The Development of an English-Maltese Assessment of Speed of Handwriting

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Abstract

The aim of this study is to modify the *Detailed Assessment of Speed of Handwriting* (DASH) (Barnett et al., 2007), a currently standardized English assessment that measures the handwriting speed of 14-15-year-old students, in order to identify students experiencing difficulties with handwriting speed, struggling writers and students who are at risk of writing disorders, namely dysgraphia. This novel assessment battery, termed the *English Maltese Assessment of Speed of Handwriting* (EMASH), can be used as a diagnostic tool by psychologists, occupational therapists, speech and language pathologists, as well as teachers. The aim is also to develop a parallel Maltese version, and to standardize both tests on Maltese students. Other research tools utilized in this study are a questionnaire to parents, and a questionnaire to form teachers, intended to determine the participants' language practices at home and at school, respectively. A cross-sectional, quantitative research methodology was employed. A sample population of 401 students, in year 10 classes, in Malta and Gozo, took part in the study. This sample is stratified by School Type (state, church and independent), Gender and Ability. The independent variables of the study are First Language, School Language, Nationality, Ability, Geographical Regions, Socio Economic Status, School Type, Gender, Age, Handedness and Writing Style. Their effect on the 12 dependent variables of the study: English *Copy Neatly,* English *Copy Quickly*, English *Copy from Board*, English *Free Writing*, Total English Score, Maltese *Copy Neatly (Ikkopja Pulit)*, Maltese *Copy Quickly (Ikkopja Malajr),* Maltese *Copy from Board (Ikkopja mill-Bord),* Maltese *Free Writing (Kitba Kreattiva),* Total Maltese Score, the Graphic Speed Test and Legibility, was studied. The variables that have an effect on writing speed in English and Maltese are Ability, First Language, SES, Geographical Regions, Gender and Writing Style. Additionaly, School Type affects writing speed in English,

and Age and Nationality affect writing speed in Maltese. This study identified the free writing subtest as the best predictor of writing speed. The study also determined if writing speed affects legibility. Results showed that in English and Maltese, legibility and speed are dependent on language, with the fastest writers in English being those participants whose written product included some words or phrases difficult to decipher. Conversely, the fastest writers in Maltese had overall clear and mature handwriting. The study helps identify areas that require attention by policy makers in order to improve literacy in schools, so that informed decisions may be made. When student performance on the English and Maltese assessment batteries were compared, it was found that students wrote faster in English than they did in Maltese. Hence the assessments batteries cannot be used interchangeably, as different norms apply. There were also some considerable differences between the standard scores of males and females, and hence separate norms for each gender were drawn. The EMASH proved to be a valid and reliable tool in measuring writing speed and identifying handwriting difficulties. The novel test helps identify struggling writers so that guided intervention can be targeted more closely to individual needs. Such intervention programmes could include activities intended to strengthen the muscles involved in handwriting and tailor-made intervention plans such as orthographic-motor integration programs that promote correct letter formation.

Abbreviation of Terms

ACTFL - American Council on the Teaching of Foreign Languages

ADHD - Attention Deficit Hyperactivity Disorder

ADD – Attention Deficit Disorder

ASD - Autism Spectrum Disorders

ASHA - American Speech-Language-Hearing Association

AQA - Assessment and Qualifications Alliance

BAS – British Ability Scales

Beery VMI - Beery-Buktenica Developmental Test of Visual-Motor Integration

CCP – Core Curriculum Programme

CDAU – Child Development Assessment Unit

CHES – Children’s Handwriting Evaluation Scale

CI – Confidence Interval

CPM – Characters Per Minute

CUP – Common Underlying Proficiency

DASH – Detailed Assessment of Speed of Handwriting

DCD - Developmental Coordination Disorder

DES - Directorate for Educational Services

DLD – Developmental Language Disorder

DQSE - Directorate for Quality and Standards in Education

EAA – Examination Access Arrangements

EEO - Equal Employment Opportunity

EF – Executive Function

EMASH – English Maltese Assessment of Speed of Handwriting

ESCS – Economic, Social and Cultural Status

ETCH - Evaluation Tool of Children's Handwriting

FREC - Faculty Research Ethics Committee

GIAHS - Group and Individual Assessment of Handwriting Speed

HST – Handwriting Speed Test

ICC – Intraclass correlation

INCOs – Inclusion Coordinators

ICT – Information and Communication Technology

IQR – Interquartile Range

ITS – Institute for Tourism Studies

KMO - Kaiser Meyer Olkin

L1 – First language

L2 – Second language

LAMC – Language Assessment for Maltese Children

LD – learning difficulties

LOF – Learning Outcomes Framework

LPM – Letters Per Minute

LPQ – Language Preference Questionnaire

LSEs – Learning Support Educators

MANOVA - Multivariate Analysis of Variance

MATSEC – Matriculation and Secondary Education Certificate

MCAST – Malta College of Arts, Science and Technology

MESA – Maltese-English Speech Assessment

MHA - Minnesota Handwriting Assessment

MLU – Mean Length Utterance

MQF - Malta Qualifications Framework

NAEP - National Assessment of Educational Progress

NCF – National Curriculum Framework

NMC – National Minimum Curriculum

NSO – National Statistics Office

NUTS – Nomenclature des Unites Territoriales Statistiques

OT – Occupational Therapist

PA – Public Address

PATOSS - Professional Association of Teachers of Students with Specific Learning Difficulties

PCERT - Perceived Children’s Effort Rating Table

PIRLS - Progress in International Reading Literacy Study

PISA - Programme for International Student Assessment

PLS – Preschool Language Scales

PSCD – Personal, Social and Career Development

PSD – Personal and Social Development

PSLT - Picture Story Language Test

SD – Standard Deviation

SEBD - Social and Emotional Behavioural Difficulties

SEC - Secondary Education Certificate

SEM – Standard Error of Measurement

SES – Socio Economic Status

SOS - *Systematische Opsporing van Schrijfmotorische Problemen* (Systematic Screening for Handwriting Difficulties)

SpLD – Specific Learning Difficulties

SPSS - Statistical Package for the Social Sciences

STM – Short Term Memory

SUP - Separate Underlying Proficiency

TEGI - Test of Early Grammatical Impairment

THS-R - Test of Handwriting Skills, Revised

TIMSS - Trends in International Mathematics and Science Study

TOLH - Test of Legible Handwriting

UK – United Kingdom

UREC - University Research Ethics Committee

US – United States

VET - Vocational Education and Training

WM – Working Memory

WPM – Words per Minute

Glossary

Ability — Children with varying abilities, such as the child with physical, psychological or learning disabilities or the child without any disabilities (Adeyele & Aladejana, 2018).

Allograph — An allograph is the shape of a letter, which may vary depending on whether the letter is uppercase or lowercase, cursive or print. (Peake et al., 2016; Vuurpijl & Schomalcer, 1997).

Alphabetic Principle — The connection between the letters of the alphabet and the sounds (phonemes) they represent (Foorman, at al. 2003).

Automaticity — Legible handwriting that is produced quickly and effortlessly (Graham et al., 2006).

Categorical Variables — A categorical variable can be any one of a fixed number of categories, such as names or labels e.g. the breed of a dog - collie, shepherd, terrier. This as opposed to quantitative or numerical data e.g. scores (Statistics How To, 2013).

Code Switching — Code-switching occurs when a multilingual speaker alternates between two languages in speech (Lyn, 2008).

Confidence Interval — A 95% confidence interval means that there is a 95% possibility that the true means of the population lies within a given range of values (Sullivan, 2019).

Diphthong — A diphthong is a sound made by the combination of two vowels, such as the combination of the "o" and "i" vowels in "oil", which make the long vowel sound 'oy' (a diphthong) (Farrell, 2019).

Dyscalculia — Children with this specific learning disability have trouble understanding number-related concepts or functions needed to solve mathematical problems (Butterworth, 2003).

Fluency — The automatic and appropriate use of words to represent thoughts and ideas (Field, 2019).

Grapheme — Graphemes are the way the phonemes (sounds) are represented in writing (Hanna et al., 1967). For instance, the phoneme /ee/ in s**ea**t is denoted by the letters "ea".

Graphomotor — Graphomotor skills combine cognitive and motor abilities which result in writing. Graphomotor problems result when a person fails to

	remember how to write the shape of a particular letter. This results when there is a disconnection between memory and the finger muscle movements necessary for making a particular letter shape (Silas, 2018).
Handwriting	"Handwriting is not just about training the hand; it is about training the memory and hand to work together to generate the correct mental images and patterns of the letters, and translate these into motor patterns, automatically and without effort" (Medwell & Wray, 2007, p. 6).
Language Assimilation	Language assimilation is when the speakers of a minority language shift to speaking the majority language of the community in which they live (Oxford University Press, 2019).
Learning Ability	Learning ability reflects cognitive capacity (concentration, logical thinking and memory), for the acquisition of new skills and knowledge (Mangina, 2009).
Lexic	Related to words, such as the vocabulary of a language. Lexical ability pertains to vocabulary size and verbal fluency (Rose et al., 2015).
Metacognition	Awareness of one's thinking, planning and understanding (Vanderbilt University, 2019).
Metalanguage	The language used to talk about language, such as "adjective", "noun" and "verb" (Gutierrez, 2016).
Macrographia	Large handwriting (Johnson et al., 2013).
Morphology	This is the study of words. There are free morphemes and bound morphemes. An example of a free morpheme is 'car', whereas an example of a bound morpheme is the suffix 's', which denotes the plural 'cars' (Wagner, 2019).
Mean	The mean is the mathematical average, which is attained by summing up all the given numbers and dividing the result by the amount of numbers there are (Sarkissian, 2019).
Mean Length Utterance	Mean Length Utterances (MLUs) give the average number of morphemes in an utterance (Gabig, 2003). A morpheme is a unit of meaning that cannot be divided further (Bowen, 2019).
Orthographic-Motor Integration	The ability to automatically generate letters and group of letters to form words (Christensen, 2005).

Phoneme	A word is made up of phonemes, that is units of sounds. The word 'chair' is made up of two phonemes: 'ch' (which is a diagraph – 2 letters) and 'air' (which is a triagraph – 3 letters) (Blasius, 2017). Graphemes are the way the phonemes (sounds) are represented in writing (Hanna et al., 1967).
Phonological Awareness	Phonological awareness is the ability to hear, recognise and manipulate sounds in spoken words, in activites such as counting the number of phonemes in spoken words (Stahl & Murray, 1994).
Receptive Vocabulary	All the words that a person can understand, though not necessarily produce (Partridge, 2017).
Percentile Ranks	The percent of cases that are at or below a score. If a student's percentile rank is 75, this indicates that 75% of the other students are at or below the student's score **(**Pullen, 2010**).**
Perceptual-motor	Perceptual-motor competence involves the interaction between the senses and physical movement (Frost et al., 2001), such as eye-hand coordination.
Pseudoword	A pseudoword (or non-word) is a word that does not exist in language. However it follows the orthographic rules of the language, and can be pronounced by the speaker. e.g. vons (Santos & Bueno, 2003).
Semantics	This is the meaning of words (Cruse, 1986).
Sensory Processing Ability	The ability of the brain to respond to stimuli that are perceived by the senses. People having sensory processing disorders often respond strongly and negatively to external stimuli. For instance, they may find common sounds painful or overwhelming (Wuang & Su, 2011).
Standard Deviation	Indicates by how much the scores vary from the mean. A low standard deviation shows that the scores do not differ too much from the mean, while a high standard deviation shows that the scores are more spread out (Allen, 2017).
Syntax	Syntax is the way words and phrases are organised to form correct sentences (Rangelova, 2019).
Visual perception	Refers to the brain's ability to interpret that which is perceived by the eyes. Visual perception problems are manifested in a poor sense of direction, difficulty interpreting maps and understanding shapes, and in the reversal of words, such as *saw* and *was.* Visual perception is unrelated to how well a person sees (visual acuity) (National Educational Psychological Service, 2015).

Writing Fluency	Writing with speed and accuracy (Johnson & Street, 2013).
Writing Skills/Ability	Writing ability is synonymous to writing skills (Sharma, 2016). Writnig skills is the ability to write well in order to communicate one's ideas in the best possible way to the reader. Writing skills develop from simple phrases to elaborate writing such as lengthy narratives and argumentative writing. Developed writing skills are shown with the correct use of grammar, spelling, vocabulary and ideation (Aupperlee et al., 2002).
Writing Style	Handwriting style is the way numbers and letters are formed (Stitzer, 2019). Handwriting style may be cursive, print or a mixture of both, with a slant or tilt.

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Chapter 1: Introduction

Handwriting competence is usually defined in terms of legibility and speed (Volman, 2006). Legibility and speed develop at different rates (Graham et al., 1998). Some authors claim that handwriting automation occurs early in primary school (Overvelde & Hulstijn, 2011), while others claim that it occurs at around 12 years (Thibon et al., 2018) or 15 years (Accardo et al., 2013). Differences may be due to exposure and training (Caravolas et al, 2020). The more a child is provided training in handwriting, the quicker they attain automation in handwriting. Handwriting and creative writing are often thought to be unrelated (Christensen, 2005). However, research shows that orthographic–motor integration, which is the ability to automatically generate letters and groups of letters to form words, is directly related to the creation of well-structured and creative text (Christensen, 2005; Jones & Christensen, 1999). A child's inability to automatically produce the letters of the alphabet will not only affect their writing speed, but also their ability to express themselves in writing and produce complex text.

One way to determine a student's capacity to perform well scholastically, particularly in examinations, is to establish their speed and legibility of handwriting (Koshy, 2005). In the Maltese educational context, students with writing difficulties are identified by means of a speed of handwriting test. One of the tests recommended in the Matriculation and Secondary Education Certificate (MATSEC) (2019a) guidelines, which entitle students with learning difficulties to Examination Access Arrangements (EAAs), is the *Detailed Assessment of Speed of Handwriting* (DASH) (Barnett et al., 2007), a UK standardised test. This research study aims to develop and standardize a novel writing speed diagnostic assessment for Maltese 14-

year-old students, which as yet does not exist in Malta. This chapter presents information related to the setting of the study, discusses the Maltese linguistic context with regard to current bilingual practices, explains the need for this novel assessment battery, and presents the research aims and objectives.

The Maltese Islands

The Republic of Malta lies in the Mediterranean sea, between Sicily and North Africa. The Maltese archipelago consists of three islands: Malta, Għawdex (Gozo) and Kemmuna (Comino). It covers an area of 316 km² with a population of about 440 thousand people (United Nations, 2019). About 86% of the population is Maltese, and the remaining 14% is non-native (Macdonald, 2019). Apart from being the native (majority) language, Maltese is the national language of Malta, the official language of the country, alongside English (Constitution of Malta, 1964), and the official language of the European Union.

The Maltese Language

Spoken Maltese began with the arrival of settlers from Sicily at the beginning of the 11th century. At the time Siculo-Arabic, which is an extinct variety of Arabic, was spoken in Sicily (Lanzafame, 2011). When the Arabs were expelled from Malta, starting with the Norman conquest in 1090, till 1249, the language gradually detached itself from its Arabic source and evolved independently into a distinct language (Brincat, 2005). Though Maltese is derived from Arabic, it has no direct relationship with Classical or Standard Arabic (Hoberman, 2007). The vocabulary of the Maltese language is unique among Semitic languages since it has assimilated a large number of Romance (French, Sicilian and Italian) words, and more recently English words (Friggieri, 1994). Maltese vocabulary, especially the function words[1] and words that represent basic ideas, is 52% Italian/Sicilian, 32% Siculo-Arabic, 6% English, and some of the rest French (Brincat, 2005).

Maltese is the only standardized Semitic language written in the Latin script (Carvajal, 2018). In fact, the earliest surviving sample of Maltese text, which dates back to the late Middle Ages, has been written in Latin script (Yoda, 2009). The orthographic system developed by the *Għaqda tal-Kittieba tal-Malti* was standardised in 1934 and has been used since then, with some additions and alterations (Rosner & Joachimsen, 2011). The Maltese alphabet (see Table 1) contains 30 letters, with the characters being mostly the same as in the Latin alphabet. Of these 30 letters, there are some diagraphs (such as "għ") and letters with diacritic marks (such as ġ) to indicate a different pronunciation.

Table 1

The Maltese Alphabet

A a	B b	Ċ ċ	D d	E e	F f
Ġ ġ	G g	Għ għ	H h	Ħ ħ	I i
Ie ie	J j	K k	L l	M m	N n
O o	P p	Q q	R r	S s	T t
U u	Vv	W w	X x	Ż ż	Z z

Note. Adapted from Ager, S. (2019). *Maltese (Malti).* https://www.omniglot.com/writing/maltese.htm

[1] Examples of Maltese function words are articles (e.g. 'il-', meaning 'the'), pronouns (e.g. 'jien', meaning 'me') and conjunctions (e.g. 'u' meaning 'and') (Micallef, n.d.).

The letter (y) is not found in the Maltese alphabet, and there are six letters not found in the English alphabet (Xuereb, Grech & Dodd, 2011), these being:

(a) ċ pronounced (ch) as in church.

(b) ġ pronounced (j) as in juice.

(c) għ mostly silent, and comes before, after or between vowels. It is aspirated when it comes at the end of words.

(d) ħ aspirated (h) with a guttural sound as in hard.

(e) ż pronounced (z) as in Zorro.

(f) ie pronounced (ee) as in bee.

All other letters are pronounced like English, except for:

(a) h which is silent, and is aspirated only when it comes at the end of words.

(b) u pronounced (oo) as in book.

(c) a pronounced (u) as in under.

(d) z pronounced (ts) as in pizza.

(e) j pronounced as (y) as in yacht.

(f) x pronounced as (sh) as in shoe (Xuereb, 2009).

Language change is a natural process and no language is immune to it (Fabri, 2015). Since both Maltese and English are frequently used languages in the Maltese islands (see section *Bilingualism in Malta* in Chapter 2), certain linguistic aspects of the two languages have left an imprint on each other. During the course of a conversation, hybrid forms of Maltese and English may be used (Grixti, 2006). For instance, during a coversation in Maltese, one might say: "I mean, issa l-affarijiet ġew hekk hux? Don't worry" (I mean, events have happened this way, right? Don't worry.)

Maltese has imported a large number of English words characterised by extensive lexical borrowing from English, particularly in the areas of technology and communication (Mifsud, 1995). Some recent examples of loan words are *kompjuter* for "computer" and *mowbajl* for "mobile phone", joining older loan words such as *wajer* for "wire" and *plagg* for "plug" (Fabri, 2015). There are cases where Maltese morphology seems to be superimposed on that of English, such as when Maltese affixes are added to English words. For example, the verb *manage* becomes *immaniġjajt* (I have managed) (Calleja, 2001). The verb *ixxuttja* (kick [a ball]), from English "shoot" (as in "shoot the ball"), takes on the Maltese forms of *nixxuttja* (I kick the ball), *tixxuttja* (you kick the ball), *jixxuttja* (he kicks the ball), and so on (Fabri, 2015). *Ixxuttja* is a typical example of how a loan word goes through "semantic narrowing", as this word in Maltese stopped having the same range of meanings it had in English, as in "shoot with a gun", for example, but means only "to kick (a ball)" (Mifsud, 2000).

The local variety of English, namely Maltese-English, can be identified through characteristics that distinguish it from Standard British English, in such cases where though the language being spoken is English, the intonation is recognizably that of Maltese (Calleja, 2001). The tendency is to have an intonational rise at the end of a sentence, when, in Standard English, you would have a fall. Phonological features also play an important role, such as the substitution of dental fricatives, represented orthographically by "th" in English, as in "though" and "thought", replaced by a "d" and a "t" sound, respectively. Maltese-English takes on some features that are typical of Maltese, such as the use of resumptive pronouns[2]. For instance, "Il-ktieb xtrajt**u** il-bieraħ" becomes "The book I bought **it** yesterday". Maltese-English is often

[2] A resumptive pronoun is a pronoun appearing in a clause, which referes back to the antecedant, in this case, the noun *lady* e.g. The lady who ate the cake, **she** is sick now (Hazem, 2015).

seen as “bad” English, so that many claim that the Maltese cannot speak neither “proper” Maltese nor “proper” English (Fabri, 2015).

Language Use in the Maltese Educational Context

With the British occupation in Malta in 1800, the English language began to seep in the Maltese islands. During this time, Maltese was the language of communication of the majority of the population (Paavlova, 1987), but was seldom written or read (Scicluna, 2016). Italian was the language of education and the courts (Sciriha, 2001), and spoken by the elite, the clergy, the nobility and the professionals (Scicluna, 2016). English started being taught in schools in 1833, and Maltese was recognised as the pupils’ first language and taught alongside English (Zammit Mangion, 2000). However, Italian remained the language of education and instruction until the Second World War (Camilleri Grima, 2016). After the war, Italian became a compulsory subject at secondary level, while Maltese and English became media of instruction, as well as school subjects, up to this day (Camilleri Grima, 2016). Between 1881 and 1960 heads of primary schools started being trained in the UK (Zammit Mangion 1992), and after the war, Maltese teachers were trained by British personnel at two training colleges. This explains how English found a place in the Maltese educational system. The Faculty of Education within the University of Malta started offering teacher training courses in 1978 (Darmanin & Mayo, 2007). In 1964, Malta became independent and English and Maltese were confirmed official languages by the Constitutions of Malta of 1961 and 1964.

Today, the National Minimum Curriculum regards bilingualism as the bedrock of the educational system (Ministry for Education and Employment, 2000) (see section *Bilingual Education in Malta* in this chapter), and is to be implemented from the early years (Ministry for Education and Employment, 2016), through to the end of compulsory education (Language Policy Unit, 2015; Ministry for Education and Employment, 2014). Both English and Maltese are taught as compulsory subjects to all citizens until the age of 16 (European Commission, 2019).

The Maltese Educational System

The Maltese educational system is divided into a number of phases, as, due to Malta's past as a British colony, it is fashioned after the UK's educational system (Grima & Farrugia, 2006). It spread over six levels - pre-primary, primary (Year 1 to Year 5), middle-school (Year 6 to Year 8), secondary (Year 9 to Year 11), post-secondary and tertiary. Pre-primary education consists of two stages - child-care for under three-year-olds, and kindergarten for three to five-year-olds. Kindergarten education is non-compulsory, although approximately, 90% of three-year-olds and 95% of 4-year olds are enrolled for Kindergarten Education (Bugeja, 2012). Kindergarten centers are found in every village, attached to the local primary school. Education is compulsory in Malta from Year 1 to Year 11.

The Maltese school system is divided into three categories - state, church and independent. According to the National Statistics Office of Malta (2018), 56.8% of school-aged children attend state schools, 27.5% attend church schools and 15.7% attend independent schools. State education in Malta is managed by two distinct national directorates – the Directorate for Quality and Standards in Education (DQSE) and the Directorate for Educational Services (DES). The first regulates the education system, while the second is in charge of the related support services (Buhagiar et al., 2010). Within the DQSE there are Education Officers who appraise ongoing teaching practices and provide teachers and school managers with the necessary support (Malta Union of Teachers, 2019). State schools are free for all students and primary schools are located in every main town or village in Malta.

The Secretariat for Catholic Education, within the Archbishop's Curia, is responsible for church schools in Malta. The vast majority of church schools are run by religious orders (Bugeja, 2012). Church school teachers' wages are funded by the state. However, as resources are not state funded, parents are asked to contribute annual donations as a financial aid (Bugeja, 2012). As primary and secondary students enter church schools through a ballot system, there is a mixed-ability student poplation. Independent schools on the other hand are privately owned and parents are requested to pay annual fees to cover the teachers' wages and the schools' supplies. Classes in all sectors normally do not exceed 25 pupils. In state schools and private schools, primary students are co-ed, whereas in church schools most primary students are single-sexed. As from scholastic year 2014-2015, secondary state schools introduced a co-educational system starting from Year 7. Nearly all secondary private schools are likewise co-educational, but secondary church schools are all single sexed.

As from 2014, colleges created middle schools to separate Year 7 and 8 students from Year 9, 10 and 11. The 2005 document *For All Children to Succeed* (Ministry of Education, Youth and Employment, 2005), proposed setting up state schools into Colleges with their own feeder primary schools. These Colleges have increased curricular and administrative autonomy. The colleges became operational in 2008, and since then ten Colleges have been set up, nine in Malta and the tenth in Gozo, each headed by a College Principal. Resource centers are incorporated within the colleges. Private and church schools are stand-alone schools, with most secondary schools having a feeder primary school on the same premises.

At age 14, students select the subjects they want to specialize in. Accordingly, vocational subjects, known as Vocational Education and Training (VET) subjects, start from Year 9. The move in 2011 to introduce vocational subjects in secondary schools was made to reduce the number of school dropouts. These subjects – artisanship, construction, engineering, Information Technology, textiles and fashion, agribusiness, health and social care, retail, hospitality, hairdressing and beauty – offer numerous practical components to cater for vocational occupations (Ministry for Education and Employment, 2012), and are pegged at Level 3 on the Malta Qualifications Framework (MQF) (Ministry for Education and Employment, 2013a).

Students in secondary state schools are set to follow syllabi set at different difficulty levels in a number of subjects. These educational programmes are referred to as Track 1, Track 2 and Track 3, with Track 3 being the most challenging. Tracks are determined by the grades attained in summative assessments. A student may follow a Track 2 programme in one subject and a Track 3 programme in another. Low achievers follow the Core Curricular Programme (CCP) during their last three years of formal education. This CCP programme was introduced in seven subjects: Maltese, English, Mathematics, Italian, Religion, Science & Technology and Physical Education. The alternative form of assessment, this being mainly formative with a small percentage being summative (Department of Curriculum Management, 2013) gives learners the possibility of attaining a certificate at MQF Level 1 for each subject studied. The certificate is attained only provided the students show evidence of achieved outcomes (Ministry for Education and Employment, 2013a). These students would be those who consider themselves as having failed at school due to constant failure at summative assessment. At age 16, students have the option to either progress into employment or continue to higher education. After passing the Secondary Education Certificate (SEC), which they sit for at the end of compulsory schooling, the students are encouraged to proceed to the Matriculation Secondary Education Certificate (MATSEC), which is an entry requirement to the University of Malta. Post-secondary education is not only free, but students even receive a stipend to finance their studies (Government of Malta, 2020a). Post-secondary education in Malta is provided by a two-year programme in church and independent schools' sixth forms, at Junior College, and at Higher Secondary (age level 16 to 18). Post-secondary education is also provided by two to four-year programmes in Vocational schools, (age level 16 to 20), such as the Malta College of Arts, Science and Technology (MCAST) and the Institute for Tourism Studies (ITS) (Government of Malta, 2020b).

The university of Malta (age level 18+) provides undergraduate and postgraduate degrees in various disciplines (L-Universita' ta' Malta, n.d.-a), and runs the University of the Third Age (L-Universita' ta' Malta, n.d.-b). There are also four private universities operating on the island (Government of Malta, 2016). Evening courses cater for extended education and adult education. The Directorate for Research, Lifelong Learning and Employability is responsible for promoting lifelong learning (Ministry for Education and Employment, n.d.-a).

Learning Outcomes Framework (LOF)

The National Minimum Curriculum (Ministry for Education and Employment, 2000) which became law in 2000, advocated equity and a student-centered learning experience in compulsory education. In 2012 the National Curriculum Framework (NCF) was launched. This NCF evolved further the educational targets of the 2000 National Minimum Curriculum (Education Division, 1999). The NCF proposed a Learning Outcomes Framework as the foundation for assessment and learning from early years through to secondary education (0-16 years) (Ministry for Education and Employment, n.d.-b). A framework of 10 levels of achievement was developed (see Figure 1), which aims to move away from the one-size-fits-all syllabi, towards a more student-centered context. It is expected for students with different abilities to progress at different rates through these levels of attainment, and for teachers to cater for their different needs. In 2019 the Learning Outcomes Framework was implemented in the Kindergarten 1, Year 3 and Year 7 classes all over Malta.

Figure 1

Attainment Levels

<table>
<tr><th>Level of Attainment</th><th>Year</th><th colspan="2">Diverse Needs</th><th>School Cycle</th><th colspan="3">Educational Institution</th><th>Age</th></tr>
<tr><td rowspan="3">1 - 3</td><td>Childcare</td><td rowspan="10">Gifted and talented learners</td><td rowspan="10">Learners with Special Education Needs</td><td rowspan="4">Early Childhood Education</td><td colspan="2">Childcare Centres</td><td rowspan="10">Resource Centres</td><td rowspan="4">0 - 7</td></tr>
<tr><td>Kinder 1</td><td colspan="2" rowspan="2">Kindergarten School</td></tr>
<tr><td>Kinder 2</td></tr>
<tr><td>4</td><td>1, 2</td><td colspan="2" rowspan="3">Primary School</td></tr>
<tr><td>5</td><td>3, 4</td><td rowspan="2">Junior Years</td><td>7, 8 9</td></tr>
<tr><td>6</td><td>5, 6</td><td>9,10,11</td></tr>
<tr><td>7</td><td>7, 8 (Forms 1, 2)</td><td>Middle Years</td><td>Middle School</td><td rowspan="4">Secondary School</td><td>11,12</td></tr>
<tr><td>8</td><td>9, 10 (Forms 3, 4)</td><td rowspan="3">Secondary Years</td><td rowspan="3">Senior Secondary School</td><td>13, 14</td></tr>
<tr><td>9</td><td rowspan="2">11 (Form 5)</td><td>15,16</td></tr>
<tr><td>10</td><td>Lifelong</td></tr>
</table>

Note: Source: Ministry for Education and Employment. (n.d.-b). *About the Learning Outcomes Framework*. http://www.schoolslearningoutcomes.edu.mt/en/pages/about-the-framework

Assessment and Examination Practices

State, church and independent schools have different assessment and examination practices. Primary and secondary state schools, apply formative assessment throughout the year, and students sit for a summative exam at the end of the scholastic year, starting in year 4 (Cilia, 2019). Some church and independent schools still hold summative examinations twice a year. In State Colleges and secondary schools, examinations are college based, and in church and independent schools they are school based. At the end of their secondary education, adolescents in Malta take national examinations (see section *The Maltese Educational System* in this chapter). Syllabi for these exams were revised to align assessment with the Learning Outcomes Framework. These revised syllabi, where 40% of the final grade constitutes of continuous assessment, came into effect in scholastic year 2020-2021 (Cilia, 2019).

Access Arrangements

This research includes year 10 students (aged 14-15 years), as it is at this stage that students with learning difficulties are assessed for extra time in preparation for their national examinations in year 11. Identification of struggling students entitles them to Examination Access Arrangements (EAAs). On an international level, the access arrangements for candidates with learning difficulties for examinations such as *Assessment and Qualifications Alliance* (AQA)[3], AQA Applied General qualifications, Business and Technology Education Council (BTEC)[4] Nationals, Cambridge Nationals, City & Guilds and General Certificate of Secondary Education (GCSE)[5] qualifications, include supervised rest breaks, extra time, read aloud and/or the use of an examination reading pen, scribe, use of a word processor, coloured overlays, low vision aid magnifiers, braille transcript, prompter, and alternative sites for the conduct of examinations (Joint Council for Qualifications, 2019). Most of these access arrangements are provided locally. However instead of providing coloured overlays, examination papers locally are printed on coloured paper, to make them accessible to all

[3] AQA offers examinations in the UK at various subjects, such as accounting, chemistry and economics, at GCSE, and A Level. It also offers vocational qualifications and teacher training (AQA, 2020).
[4] BTEC Nationals are the most acknowledged qualifications for acceptance to Higher Education alongside A levels (Pearson Education, 2020a).
[5]GCSE are exams taken by students between 15-16 in the UK and other British territories. There are about 40 subjects on offer at this level (Pearson Education, 2020b).

students, irrespective of ability. Likewise, vision aid magnifiers and braille are not provided locally. Instead, the examination paper is enlarged for visually impaired students (Matriculation and Secondary Education Certificate, 2019a).

Following referral, the assessment of speed of handwriting is carried out in educational institutions locally and abroad, to identify students with slow writing speeds in order to entitle them to special provisions in examinations, such as extra time (up to 25%), or the use of a word processor (Matriculation and Secondary Education Certificate**,** 2019a; Joint Council for Qualifications, 2019). The writing speed tests recommended by the 2019 MATSEC guidelines are the *Group and Individual Assessment of Handwriting Speed* (GIAHS) (Allcock, 2001), and Hedderly's (1995) *Test of Sentence Completion*. This GIAHS is distributed by the Professional Association of Teachers of Students with Specific Learning Difficulties (PATOSS) and requires testees to write freely for 20 minutes about a topic of their own choice. On the other hand, Hedderly's (1995) *Sentence Completion* test only requires the association of ideas, the cognitive load of the task is quite light, and hence does not reflect the cognitive load imposed by the long and complex free writing tasks required in examinations. According to a PATOSS advisor (PATOSS, 2016), the GIAHS norms for the 20-minute free writing task are unfortunately outdated. Their recommendation was to use the *Detailed Assessment of Speed of Handwriting* (DASH) (Barnett at al., 2007), if requiring a test of free writing to support extra time. MATSEC also recommends the DASH (Barnett et al., 2007) for a comprehensive evaluation of speed of handwriting, in order to support examination access arrangements in case of students with handwriting difficulties. The DASH aims to identify slow writers and children with handwriting difficulties (such as dysgraphia), and provide writing speed norms for children aged nine to sixteen. The DASH offers measures of handwriting speed by means of various writing tasks that typically take place in an educational setting. It also monitors the effectiveness of intervention programmes (Barnett et al., 2007). It was for these reasons that the DASH was the chosen assessment tool for this research.

In the case of the DASH, EAAs for extra time and a word processor are granted locally when the student attains:

1. below average scores (2 SD below the mean when the total standard score is below 70)

or

2. below average scores (1 SD below the mean when the total standard score is below 85), together with below average scores (1 SD below the mean) on a motor proficiency test.

Additionally, the result at the Graphic Speed Test should be below the standard score of 7 (Matriculation and Secondary Education Certificate, 2019a). Despite these access arrangements, the Matriculation and Secondary Education Certificate (MATSEC) guidelines stipulate that candidates are not entitled to access arrangements for skills that are being assessed. For instance, if in a non-language examination candidates are entitled to a reader, they cannot have the paper read to them in language examinations that test reading skills. Further detail about current local educational and assessment practices is given in the section *Assessment and Examination Practices* in this chapter.

Administering and interpreting DASH locally, and taking decisions based on this, is not scientifically appropriate given that it is not standardized on the local population, and it is based only on the English language.

Research Aim and Objectives

This research study aims to develop and standardize a diagnostic bilingual handwriting speed assessment battery to measure the handwriting speed of 14-year-old Maltese pupils, in order to identify students who are at risk of writing difficulties (for example, dysgraphia). This novel handwriting speed assessment battery, termed the *English-Maltese Assessment of Speed of Handwriting* (EMASH), is based on the *Detailed Assessment of Speed of Handwriting* (DASH) (Barnett et al., 2007).

To meet this aim, the following objectives have been identified:

a) To modify the five English handwriting speed subtests in the DASH to suit the Maltese students.

b) To develop four[6] parallel subtests in Maltese.

c) To obtain writing speed norms for Maltese 14-year-old students, and standardize the scores.

d) To evaluate the effect of First Language, School Language, Nationality, Ability, Geographical Regions, Socio Economic Status, School Type, Gender, Age, Handedness and Writing Style, on writing speed.

e) To evaluate the effect of writing speed on Legibility.

f) To measure the assessment's validity and reliability.

g) To identify which of the 11 independent variables (First Language, School Language, Nationality, Ability, Geographical Regions, Socio Economic Status, School Type, Gender, Age, Handedness and Writing Style) predict the 12 dependent variables of the study (English *Copy Neatly,* English *Copy Quickly,* English *Copy from Board,* English *Free Writing*, Total English Score, Maltese *Copy Neatly (Ikkopja Pulit)*, Maltese *Copy Quickly*

[6] The Graphic Speed Test is excluded from the Maltese assessment battery, as it is not constrained by language.

(Ikkopja Malajr), Maltese *Copy from Board (Ikkopja mill-Bord)*, Maltese *Free Writing (Kitba Kreattiva)*, Total Maltese Score, the Graphic Speed Test, Legibility).

h) To compare the performance of the students on the modified English assessment tasks with their performance on the novel Maltese assessment tasks.

i) To compare the performance on writing speed of students with different abilities.

j) To compare the writing speed on the English and Maltese assessment batteries.

This chapter has introduced the research setting, and explained the need for a novel assessment battery to identify students experiencing difficulties with handwriting speed, struggling writers and students who are at risk of writing disorders. Screening children with handwriting difficulties is important since these usually occur with other developmental disorders, such as Developmental Coordination Disorder (DCD**)**, Attention Deficit Hyperactive Disorder **(**ADHD**)**, autism, and dyslexia (Van Waelvelde et al., 2012). A valid and reliable handwriting assessment battery is also useful to guide intervention that is targeted more closely to individual needs. The research aim and objectives have also been presented. The following chapter provides a critical review of the relevant literature, identifies the research gaps and states the research questions.

Chapter 2: Literature Review

Language is a system of spoken or written communication, used by a particular country or community (Perin, 2015). Signing, speaking and language comprehension are innate (Chomsky, 2002) and are learnt without instruction. Young infants acquire language through exposure and use their cognitive abilities to process what they hear so that eventually they start expressing themselves in the language/s that they are exposed to. These early speech and language skills help master the literacy skills of reading and writing (American Speech-Language-Hearing Association (ASHA) (2018). Reading and writing are not innate (Erdogan & Erdogan, 2012) and are learnt with much conscious effort and repetition, usually at school (Sakai, 2005).

Writing represents language with visible marks, and in the majority of languages, writing complements speech, as letters, or combination of letters, stand for sounds. According to Alston and Taylor (1987), handwriting is the process of producing physical movement, using the muscles of the fingers and hands, to form letter shapes. Hence it necessitates skill in physical movement and knowledge of letter names and shapes (Datchuk,2015). Berninger and Graham (1998) refer to handwriting as "language by hand". This means that "handwriting is not just about training the hand; it is about training the memory and hand to work together to generate the correct mental images and patterns of the letters, and translate these into motor patterns, automatically and without effort" (Medwell & Wray, 2017, p. 6). Handwriting involves different activities, such as fine-motor movement, perceptual-motor coordination, and orthographic coding. Fine-motor movements are the precise maneuvers of the fingers, hand and arm during writing. Perceptual-motor coordination is the use of the eyesight to help guide the writing tool while writing. Orthographic coding is the commitment to memory of the individual letter names and letters shapes (Datchuk, 2015).

O'Connor & Jenkins (1995) state that reading is reinforced when children practise word spelling phonetically. James and Engelhardt (2012) studied brain activation in four and five-year-olds as they wrote letters by hand, typed letters and traced letters. Magnetic resonance imaging technology showed that the brain area related to reading - the so-called "reading circuit" – was more engaged when children wrote by hand. Their findings indicated that writing by hand aids reading development in children (Medwell & Wray, 2007). Writing by hand impacts not only reading acquisition, but also recall of information. Mueller and Oppenheimer's (2014) study showed that university students who took notes manually performed better academically than those that utilized a laptop, because note taking helped the students understand the concepts better. When students type lecture notes, they do so mindlessly, typing out almost everything they hear. However, when students handwrite their own notes, since they cannot write every word they hear, they listen, process and write only the key points. When students process and comprehend the information being imparted, they retain it more (Goodwin, 2018).

Some children write slowly either because they process information slowly or because they have spelling or motor coordination difficulties (Mason, 2016). Holding the writing instrument too tightly, or exerting too much pressure on the writing surface, may lead to physical pain and fatigue, requiring frequent rest breaks, which again results in slow writing speed (Mason, 2016). This chapter defines writing speed and reviews available writing speed assessments. It also evaluates local and international research related to writing speed and considers whether writing speed can be effected by factors such as age, gender, writing style, handedness, bilingualism, ability and socio-economic status. This chapter also considers whether writing speed affects legibility. The research questions specified at the end of the chapter derive from identified gaps in knowledge that this research study attempted to address.

Bilingualism

Malta is a bilingual nation, with the main languages of communication being Maltese and English. Mittal and Rathore (2015) define bilingualism as the ability of an individual to speak a second language, by following the rules of that language rather than paraphrasing his own. For Hornby (1977) there are varying degrees of bilingualism, ranging from limited proficiency to complete mastery of multiple languages. Baker (2002) defines four language components which make a person bilingual - listening, speaking, reading and writing. Within this method, bilingualism is treated as a series of continua which may vary for each individual (Ramaine, 1995), as for example, a person may be able to read a language but not speak it. There are two models for bilingual language acquisition – the Separate Underlying Proficiency (SUP) and the Common Underlying Proficiency (CUP) (Cummins, 1981). The SUP supports the idea that there is no connection between languages, and that these function separately in the central processing system. According to this model, exposure to one language only improves that particular language, and has no influence on the second language (Dunn Davison, 2011). The SUP model was criticised by Cummins (1981) who found no support for this model in research carried out globally over a span of 20 years (Cummins,1980). The CUP, contrary to the SUP, supports the notion that the language skills acquired in one language aid in the acquisition of a second or additional languages (Cummins,1981) (see section *The Bilingual Advantage* in this chapter). According to Paradis (2011) L1 transfer aids the acquisition of a second language. However it is not the only source of language acquisition. Other sources are the quantity and quality of second language (L2) exposure (Paradis, 2011). The quality of exposure is related to maternal education (Paradis, 2011). Children of mothers with post-secondary education have larger vocabularies than children of mothers with secondary only education. The quantity of exposure – how much an L2 learner is exposed to the second language – includes reading books in that language, conversing in that language, and exposure time in school.

Bilingualism in Malta

According to the Culture Participation Survey of 2011 (National Statistics Office, 2012), 90.8% of the respondents (16+) indicated Maltese as their first language. Most families speak Maltese at home, while a few speak English or mix the two languages (Sciriha & Vassallo, 2001, 2006). In most cases, English speaking families are inclined to be less proficient in Maltese, while Maltese speaking families are likely to be proficient in English to some degree, depending on their educational level (Fabri, 2015). In fact, the census of population and housing of 2011 shows that the 48,430 participants[7] aged ten to nineteen speak Maltese (45,521) and English (37,864) well (see Table 1) (National Statistics Office, 2014). While Maltese is preferred as the spoken medium, the written medium speaks a different story. When it comes to writing, 44.5% of the population prefer English to Maltese (43.1%)[8]. With regard to reading, 46.3% prefer to read English text and 38.6 % prefer Maltese[9] (National Statistics Office, 2012).

[7] All the people residing on the island took part in the study (National Statistics Office, 2014).
[8] The other options were Italian, another foreign language, or no specific language preference.
[9] The other options were Italian, another foreign language, no specific language preference, or do not read.

Table 1

Population by Age Group and Languages Spoken

Maltese	10-19	English	10-19
Well	45,521	Well	37,864
Average	1,357	Average	7,205
A little	852	A little	2,105
Not at all	700	Not at all	1,256
Total	48,430	Total	48,430

Thake Vassallo (2009) comments that though Maltese has taken center stage, bilingualism in Malta is integrated in everyday life, and hence it is impossible to be Maltese and be strictly monolingual. Many Maltese are, to some extent or other, bilingual, i.e., they speak English as well as Maltese, but to varying extents and at different levels of proficiency. A Maltese person would speak mostly Maltese at home and listen to the radio in Maltese, but read books and watch movies in English, and study mostly in English at school (Scicluna, n.d.). A study carried out by Sultana in 2014 supports this notion. Sultana (2014) observed, over a period of ten months, the language used by four working class Maltese children (two boys and two girls) (age range four to six), living in the Northern Harbour Region. The children's parents, spoke Standard Maltese, but had a good grasp of English. The researcher failed to specify the parents' level of proficiency in English as their level of education was not considered. Sultana (2014) collected data by observing, and noting down, the participants' home routine, such as examples of websites accessed, games played, television programmes being watched, short dialogues, and occurrences of code-switching. Sultana (2014) also asked the parents to take note of the language used while their children dressed up, had breakfast, watched television or used the computer. At the end of the observation, the researcher carried out interviews with the parents to seek clarification and gain further information about aspects of bilingualism at home. From her observations, Sultana (2014) concluded that all the children in the study were mainly exposed to spoken Maltese, but watched television, used ICT resources, and read books in English. All the families communicated bilingually.

Most Maltese individuals therefore can be said to be bilingual to differing degrees (Vella, 2012). For this reason, it is important that when tests are administered on Maltese children, both languages are to be considered. In this study, participants who reported speaking Maltese or English most of the time were termed *Dominant Maltese* or *Dominant English* respectively. Participants who reported speaking Maltese and English, or who reported speaking Maltese or English, together with a non-native language, were termed *Mixed* language speakers. The *Non-native* group refers to those who reported speaking only a non-native language, which is not English or Maltese (see section *First Language* in Chapter 3).

Bilingual Education in Malta. As from 2000, the National Minimum Curriculum (NMC) considers bilingualism as the basis of the educational system (Ministry for Education and Employment, 2000). Before 2000, the National Minimum Curriculum had recommended that all subjects were to be taught in English, except for Maltese, Religious Studies, Social Studies, History and Personal and Social Development (PSD) (Education Division, 1999). Maltese and English are introduced to Maltese school children as early as Kindergarten. Teachers have the possibility to use either Maltese or English as the means of instruction in their classrooms. Schools or teachers are not legally obliged to use either language for any subject (Camilleri Grima, 2000). The language policy for early years in Malta and Gozo (Ministry for Education and Employment, 2016a), recommends parents to expose their children to both Maltese and English, to facilitate their children's grasp of the subject content in school, since locally these two languages are the languages of schooling.

There is societal bilingualism in Malta, mirrored in the different school sectors in Malta. Maltese is the first language spoken by most students in state schools (Ministry for Education and Employment, 2016b). The language situation in church schools is more varied, with the first language of some students in some schools being English, and the first language of some students in other schools being Maltese. In independent schools, the spoken language is predominantly English (Ministry for Education and Employment, 2016b).

When the first language is the same as the test language, this might determine student performance on the test (Ministry for Education and Employment, 2016b; Agius, 2012). This was evident in the *Progress in International Reading Literacy Study* (PIRLS) **(**Ministry for Education and Employment, 2016b) results, where Maltese was the test language. Students in church schools performed worse than students in state school in Maltese reading, but the students who fared worst of all in Maltese reading, were the students in the independent schools (Ministry for Education and Employment, 2016b). Across all countries, when the students' first language was the same as the test language, their mean reading scores were significantly higher than those students who did not (Ministry for Education and Employment, 2016b). Similar conclusions were drawn by Agius (2012) and Mifsud et al. (2004), as the students who performed the best at the English reading test in their study were those whose first language was English. Likewise, the students who performed the best at their Maltese reading test were those whose first language was Maltese. The results of the *Trends in International Mathematics and Science Study* (TIMMS) (2015) showed a relationship between attainment in Mathematics and Science, and students speaking predominantly the test language, both in Malta and abroad. Locally, schools with more than 50% English-speaking students fared better in Mathematics and Science than schools with a lower percentages of English-speaking students (Directorate for Learning and Assessment Programmes, 2015). This could be so as in Malta, the language of examination of Mathematics and Science is English, so students who are not so proficient in English, are less likely to comprehend the questions, and hence less likely to do well.

According to Camilleri Grima (2016), the distinction between the use of Maltese and English in the classroom lies in the spoken/written medium. English is used almost exclusively in reading and writing, as English is the language of most textbooks and examinations on the island. Only the Maltese language is taught and examined in Maltese. The textbooks of other subjects such as Religious Studies, Social Studies and Maltese History are in Maltese in state schools, but in church and independent schools they may be in English too. National examination questions of these subjects are in English and Maltese, and may be answered in either language (Camilleri Grima, 2013). In state, and most church schools, Maltese is used almost exclusively to explain concepts, elicit answers and make sure the learners can follow the lesson. Learners are allowed to answer and ask questions in Maltese. Maltese is also used by the teachers for classroom management. The only exceptions are independent schools, where the medium of instruction is generally English, though for a second explanation Maltese may be used (G. Pace, personal correspondence, August, 21, 2020). This is in line with the *National Literacy Strategy for All in Malta and Gozo* (Ministry for Education and Employment, 2014) which promotes bilingualism in Maltese schools, and recommends Maltese and English as the languages of instruction of non-language subjects.

In Maltese state, and in most church schools, the content of textbooks in English is mediated bilingually, so that the text is more digestible for students, and the content is adjusted to their pace and learning style (Camilleri Grima, 2013). This is called “translanguaging” (Camilleri Grima, 2016) and is the process whereby individuals infer meaning, shape experiences and gain knowledge and understanding by using two languages (Baker, 2011). Through translanguaging, participants interpret the written text, analyse problems and figure out solutions, using both Maltese and English. Although much work is being conducted in education with regard to translanguaging, this is being resisted with regard to writing (Velasco & García, 2014). Bilingual students, even if asked to produce text in one language, resort to their entire linguistic repertoire to manage the text (Velasco & García, 2014). One strategy is “postponing” (Velasco & García, 2014). When a writer has difficulty remembering a word in the target language, he writes the word down in another language, and goes on writing not to disrupt the flow of thought. The writer then revises that word at the end. Teachers are wary of permitting bilingual writers to resort to their entire linguistic resources (Velasco & García, 2014), because of the possibility of interference or transference (Marin, 2013) of one language on another. An example of interference is when, for lack of appropriate vocabulary, children writing in English might literally translate an expression from Maltese into English, during writing. For instance, the phrase “I’ve got cut of the meat”, which is the Maltese equivalent to “*Għandi qtugħ ta’ laħam”*, used when the muscles ache after intensive exercise. The writing sytems of biliterates are activated simultaneoulsy, even when reading or writing in just one language (Bassetti, 2012). Hence, biliterates can mispronounce or misspell words read or written in the one language, following the orthographic-phonologic correspondence of the other language (Bassetti, 2012). This is an example of transference

(Martin, 2013). For instance, the “u” sound in the English word “umbrella”, corresponds to the “a” sound in the Maltese word “arblu” (pole). The “u” sound in the Maltese word “uviera” [eggcup] corresponds the “oo” sound in the English word “zoo”. Hence, until both languages are well mastered, Maltese and English biliterates may make spelling and prounciation errors in both languages.

Translanguaging is different to code-switching, which regards the two languages as separate codes that are switched to facilitate communication (Velasco & García, 2014). Code-switching occurs when a multilingual speaker alternates between two languages (Lyn, 2008). Code-switiching is possible only when the two speakers understand and are capable of communicating in both languages (Sultana, 2014). Locally, certain concepts are often expressed in English even by speakers who do not speak English regularly. These include numbers (especially telephone numbers and age), money, letters of the alphabet (including initials and abbreviations), days of the week and child directed speech (e.g., *Ejja ħa nagħmlu blow in-nosie!* – Come let's blow your little nose!) (Fabri, 2015). Instances of code-switching in Maltese classrooms are given by Farrugia (2013). The use of English in an otherwise Maltese spoken context involves technical or subject-specific terms, such as the Mathematical terms “square root”, “line”, “shape” and “square”. According to Camilleri (1991), two-thirds of all the codeswitching that takes place in the classroom are technical terms in English used during Maltese discourse. Farrugia (2013, p. 577) explains how loan words (see Chapter 1) may be used to link written English to spoken Maltese in the classroom. In everyday discourse it is common to use the word “qasam” for “share”, but in class, teachers and students often use the loan word *ixxerja* (derived from “share”) (pronounced ish-share-ya) instead. For instance, teachers trying to explain the mathematical concept of dividing a number of sweets equally amongst a number of children, would say "*Kemm jieħdu ħelu kull wieħed jekk jixxerjaw il-ħelu bejniehom*?" (How many sweets would each take if they shared the sweets amongst them?)

In submersion bilingual education, the home, minority language is replaced by the dominant, majority language. This is the case of students speaking minority languages in Maltese schools. The minority language is submerged in the majority languages, in this case, Maltese and English. This is so as local teachers are not proficient in these minority languages, and so are unable to improve their students' minority languages. Furthermore, this facilitates the integration of the children in the new country. For example, the Migrant Learners' Unit, that deals with migrant children in Maltese state schools, supports newly arrived migrant children and adolescents, particularly through language teaching (English and Maltese), to prepare them for successful enrolment as learners in local schools (Human Rights and Integration Directorate, 2017). The presence of migrant children in Maltese classroom is resulting in a greater diversity in students' language backgrounds (Language Policy Unit, 2015). The National Minimum Curriculum therefore believes that schools must develop their own linguistic strategies to meet the diverse linguistic needs of their student population (Ministry for Education and Employment, 2000).

Multilingualism is the ability to communicate successfully in three or more languages (Nordquist, 2018). The definition of multilingualism is subject to debate. Multilingualism may be defined as complete mastery of another language so as to sound native, or else as just knowing enough phrases to get by. Locally, when students start secondary school, they are obliged to take on another foreign language, this usually being French, Italian, Spanish or German. Foreign languages are to be taught in the language of instruction.

Biliteracy

Biliteracy links bilingualism and literacy (Hornberger, 2004). Whilst bilingualism is linked to oracy (speaking and listening), biliteracy is associated with literacy and is defined as the ability to read and write in two languages. A study by Hopewell and Butvilofsky (2016) studied how bilingual instruction affected the literacy development of students in *Paired Biliteracy* (English and Spanish) classrooms, when compared to students instructed only in English. The *Literacy Squared Paired Biliteracy* programme (Escamilla et al., 2014), promotes cross-language connections. Cross-language connections are different from translanguaging, in that students transfer what they know in one language to what they are learning in another language. This includes the use of punctuation marks, upper and lower case letters, as well as word spacing (Gort, 2006). Another instance of cross-language connection is the use of cognates, which are words in both L1 and L2 that are similar in meaning and spelling (García, et al., 2020). Examples of cognates in the local context are words such as "ġografija" in Maltese and "geography" in English; as well as "distanza" in Maltese and "distance" in English. In Hopewell and Butvilofsky's (2016) study, a total of 108 students in Grades 1–5 attending biliteracy classrooms, were matched with 92 students in English only classrooms. Students in *Paired Biliteracy* classrooms (Grades 1–5) were asked to write for 30 minutes about two writing prompts – one in English and another one in Spanish. Students in the monolingual English classrooms (Grades 1 –5) wrote only about the English writing prompt. The rationale behind the 30-minute writing period was not explained, and one cannot but question if this is way too long, especially for the younger pupils, even though the Spanish writing prompt was administered two weeks prior to the English one for the *Paired Biliteracy* classroom. A biliterate writing rubric was designed to assess the English and Spanish writing.

This consisted of three components: content (0–10), structural elements (0–5), and spelling (0–6) (Hopewell & Butvilofsky, 2016). Results showed that students in the *Paired Biliteracy* programme were equally skilled in English and Spanish, and that their writing abilities in English matched those of the students instructed in English only (Hopewell & Butvilofsky, 2016). The outcomes of this study support similar studies that students in biliteracy programmes do equally well in English, or even better, than students in English monolingual programmes (August & Shanahan, 2006; Rolstad et al., 2008). These studies invoke Cummins's (1981) interdependence hypothesis (see section *Bilingualism* in this chapter) which posits that the second language of bilingual students is developed with the support of their first language skills (Howard & Neugebauer, 2015).

Caswell's (2002) and Howard's (2003) studies in the US likewise found evidence of cross-linguistic transfer in text written in L1 and L2. During her three-year study, Caswell (2002) collected written samples of 67 third grade (aged eight years) to fifth grade (aged ten years), Spanish-English bilingual students. The researcher followed a writing rubric (range one to five), to determine text composition (if students were able to write a story following a sequence, with an appropriate introduction, conclusion and title); sentence length; the use of descriptive language (such as adjectives and reported speech); the use of tenses; agreement (e.g. subject and verb); the correct placement of adverbs, adjectives and pronouns in a sentence; the use of prepositions; correct spelling and punctuation; and the use of paragraphs. Caswell (2002) concluded that, if supported by instruction, there is improvement in both languages over time. The researcher also found a strong positive relationship between Spanish and English writing, concluding that students who wrote well in one language also wrote well in the other language. This supports Cummins's (1981) theory of transfer of skills across languages, which states that students with developed literacy skills in their L1 are also likely to have developed literacy skills in their L2. In a similar study, Howard (2003) collected, over three years, written samples of 343 Spanish-English bilinguals from third (eight years) to fifth (ten years) grades. Samples were scored using a rubric (range one to five) that analysed if the sentences written were related to the topic; if the sentences varied in length; if descriptive language (such as adjectives and reported speech) was used; if the tenses were correct; agreement (subject-verb, number), spelling and punctuation errors; and the use of paragraphs. As in Caswell's (2002) study, results revealed a growth in writing ability over time in both languages, as well as cross-linguistic transfer.

The Bilingual Advantage

A sensitive period is a stage in life during which learning is most favourable (Finn, 2010). Language learning in humans has sensitive periods that occur at different ages. The sensitive period for phonology (speech sounds) lasts from the sixth months up to a year after birth. The sensitive period for syntax (sentence structure) lasts up to age four, and that for semantics (the meaning of words) lasts up to age 15 or 16 (Ruben, 1999).

With early second language acquisition, the first language is already in place when the child is exposed to the second language (Pinter, 2011). Cummins (1981) proposed a Common Underlying Proficiency (CUP) model that permits transfer of skill between languages. The model, represented as a "dual-iceberg", states that although all languages have distinct features, there are proficiencies in common (Bilash May, 2009). The model states that linguistic proficiencies acquired in the first language are transferred to the second language, which makes learning the second language more efficient. A study by Kenner et al., (2004) involved six case studies of five to six-year-old children residing in London, who were learning to write in Arabic, Chinese or Spanish, apart from English. These children were asked to explain to their classmates how to write in Arabic, Chinese or Spanish. They explained how to write Chinese logographs, the directionality of the Arabic writing system, or the different sounds of the Spanish alphabet, by drawing comparisons to English. The study by Kenner at al. (2004) is a clear example of transfer of skill between languages, even though the language systems may be dissimilar. Similar results were attained by Agius (2012) who found that reading and writing in English are predicted by the reading and writing skills in Maltese, and vice versa, even though the orthographic depth of the two languages is dissimilar (see section *The Orthographic Depth Hypothesis* in this chapter). The transfer of writing skills between languages has been termed as "cross-orthographic influences", which is easier when the writing systems of the two languages are alike (Bassetti, 2012).

Learning a second language is believed to be more challenging for bilingual children with a profile of dyslexia than for typically developing bilingual children (Firman, 2009), due to the language difficulties faced by children with a profile of dyslexia (see section *Handwriting Difficulties* in this chapter). However skills learnt in the dominant language may support the development of the second language (Firman, 2009). This transfer of skill facilitates the acquisition of bilingual educational practices for children with learning difficulties.

The CUP model (Cummins, 1981) states that cognitively demanding tasks, such as problem-solving, abstract thought and literacy, are common across languages (Lazar, 2018) and that knowledge acquired in one language can be transferred to the second language (Cummins, 2001). For instance, if a student is familiar with the scientific concepts of gravity, floating and sinking, in the native language, they simply need to learn the labels for these concepts in the target language. This puts bilinguals at an advantage over monolinguals. The reported cognitive advantages of bilinguals include heightened metalinguistic awareness, a greater predisposition to learning a third language and enhanced executive function (Adesope et al., 2010; Bialystok, 2011; Lazar, 2018). Furthermore, multilinguals have more grey matter in the brain, in the region known as the inferior parietal cortex, thought to lead to greater cognitive plasticity, which enhances learning (Ferrari, 2018).

Meta-linguistic awareness is the ability to analyse language by focusing on phonemes, words and syntax (Ang, 2011). Since bilinguals are exposed to two sound units, they are more sensitive to speech sounds and this places them at an advantage when compared to monolinguals (Ang, 2011). The CUP (Cummins, 1981) permits the transfer of phonological knowledge from one language to the other (Wahyudi, 2012). The expansion of the CUP eases the acquisition of additional languages (Lazar, 2018), which requires more effort to reach native-like language proficiency, once the sensitive period for language learning ends. Monolinguals who have learnt a second language, have developed strategies to master that second language, which they can transfer to the acquisition of a third language. Hence bilingual language learners learning a third language are more experienced language learners than monolinguals who are still learning their second language (Cenoz, 2013).

The study by Sanz (2000) shows that the heightened metalinguistic awareness of bilinguals renders the acquisition of a third language faster. Sanz (2000) attributes this to the heightened meta-linguistic awareness of bilinguals over monolinguals as they have a greater ability to examine and handle language. Sanz (2000) administered the vocabulary and structure sections of the *CELT English Proficiency Test* (Harris & Palmer, 1970) to 124 Spanish-Catalan bilinguals and 77 Spanish monolinguals. Participants selected the correct answer to each question from the multiple responses given. The vocabulary section tested lexical knowledge. The structure section tested the learner's grammatical knowledge in English, such as choice of nouns, pronouns, propositions, adjectives, verbs and adverbs. Results show bilingual students to be at an advantage over monolingual students in third language acquisition.

The two languages in bilinguals are active all the time, but bilinguals learn to select their target language and suppress the non-target language. This leads to enhanced Executive Function (EF) in bilinguals (Olulade et al., 2016). EF is the ability to ignore distractions and manage one's resources to attain a goal (Cooper-Kahn & Dietzel, 2019) and contributes to academic success (Best et al., 2011).

The Orthographic Depth Hypothesis

Alphabetic systems represent speech in writing through sound-symbol correspondence (Ellis et al., 2004). Languages, such as French and English, that do not have a direct phoneme-to-grapheme correspondence, are considered to have deep or opaque orthographies. Languages, such as Italian and Spanish, with a direct phoneme-to-grapheme correspondence, are considered to have shallow or transparent orthographies (Zammit et al., 2018). According to Agius (2012), Maltese is a semitransparent language, because it is easily decodable, but with exceptions (see section *The Maltese Language* in Chapter 1). Children learn to read and spell a transparent language faster than an opaque language (Ellis et al., 2004).

Seymour et al., (2003) studied children from 14 different European countries learning to read phonetically. Children from Finland and Spain, with highly transparent languages read the words and non-words assigned to them very accurately. Children with less transparent languages, such French, Portugese and Danish, were less accurate. The least accurate readers were the English speaking children. Ziegler and Goswami (2005, 2006) attribute these differences to psycholinguistic grain size, that is, the size of the orthographic units of the language. Children reading a language with a shallow orthography have to contend with a small psycholinguistic grain size, that is a single letter corresponding to a phoneme. Children reading a language with a deep orthography have to contend with a large psycholinguistic grain size, that is phonemes correspond to syllables or whole words, such as the word “queue” in English. Readers reading a language with a shallow orthography retrieve phonology directly from print, whereas readers reading a language with a deep orthography retrieve phonology from memory (Richlan, 2014). Goswami et al. (2003) have shown that switching between the small and large units in languages with a deep orthography lead to reading inaccuracies. Paulesu et al. (2000) conducted a brain imagining study on skilled adult English and Italian readers while reading various words and non-words. It was noted that the same regions of the brain were activated, but to different degrees. In Italian readers, the area of the brain associated with phonological processing was activated, while in English readers the area of the brain that was activated was linked to visual word recognition. Writing (spelling) is said to follow similar processes (Babayigit, 2009). Studies that have compared reading and spelling scores in Turkish (Aro, 2006), Norwegian (Hagtvet, et al., 2006), and English (Gough, et al., 1992), found high correlation in performance. Exposure to print helps children understand that speech is represented by the letters of the alphabet (symbol-sound mapping). They start using semi phonetic spelling to spell words – for instance, writing ‘e’ to represent the ‘ai’ sound in ‘chair’ (Babayigit, 2009). Transparent languages are easier to spell because of a direct grapheme to phoneme correspondence. With regard to opaque languages, correct spelling is attained with the acquisition of higher-order grapheme-phoneme relationships (Babayigit, 2009). A study by Viise et al., (2011) concluded that spelling progress depends on the ortographic depth of the target language. Word lists of increasing complexity, dictated in English (an opaque language), and Estonian (a transparent language), to children from kindergarten to sixth grade, revealed that children writing a language with a transparent orthography achieve spelling accuracy faster than children writing a language with an opaque orthography.

According to Richlan (2014), students with a profile of dyslexia have the same “core dysfunction” (p. 4) (see section *Dyslexia* in this chapter), with differences laying in the orthographic depth of the language. Students with a profile of dyslexia experience more literacy difficulties when the language is deep or opaque (Everatt & Ocampo, 2001). Dyslexic and non-dyslexic children reading a language with a shallow orthography, such as Italian, German, Greek and Spanish, read more accurately, albeit still slowly, than children reading a language with a deep orthography, such as English (Wimmer, 1993). This is in line with a study by Lallier et al. (2014) where nine typically developing French-Spanish bilingual children, and nine matched French-Spanish bilingual children with a profile of dyslexia, were administered very similar reading batteries in French and Spanish, to assess their reading abilities. The children had to read a list of words and nonwords, and a passage in French, which was translated to Spanish. The children with a profile of dyslexia lacked speed in both the transparent (Spanish) and the opaque (French) language. However they lacked accuracy only in the opaque (French) language.

With regard to the local context, Xuereb (2009) conducted a study on 50 typically developing Maltese-English bilingual children aged between eight to ten years. The children were administered the *British Ability Scale* (BAS II; Elliot, 1996) to assess reading and spelling skills in English. Nonword reading ability was tested using *The Graded Nonword Reading Test* (Snowling et al., 1996). The children's performance at word and nonword reading outperformed that of British monolingual children. Grapheme-to-phoneme decoding employed to read the transparent Maltese language may have facilitated the reading of the less transparent English language. This study shows that the orthographic depth of the English and Maltese languages have to be considered when quoting results.

Theoretical Models of Handwriting

Roston et al., (2008), defined handwriting as a "multimodal activity that involves aspects of gross motor, fine motor, visual-perceptual, and cognitive skills" (p. 111), that produces text, which is learnt through practice. Despite the increased use of technology in society today, with keyboard typing becoming more and more customary in everyday life (Hurschler Lichtsteiner et al., 2018), handwriting remains the most accessible form of graphic communication, and a life necessity, needed when writing, for example, a cheque or taking down a message during a telephone conversation (Feder & Majnemer, 2007).

Several researchers, (Rosenblum et al., 2013; Graham et al., 2006; Van Galen, 1991; Ellis, 1982), have developed handwriting models which state that handwriting occurs because of specific processes where "the output from an earlier stage forms the input for the next stage" (Rosenblum, 2013, p. 1). The distinct processing activities are as follows. A word (the lexeme) is broken down into sounds (phonemes) which are translated into letter shapes (the allographic code). The different motor programs necessary for writing letters are set into motion. These specify which muscles are required for producing the letters. Since these models describe adult writers' performance, Graham et al. (2006) proposed a partial model of handwriting for children because young children write more slowly than adults, and rely more on visual feedback (Weintraub & Graham, 2000). Graham et al.'s (2006) model involves three stages. The first is the motor program stage, which accesses the motor program for each selected letter. The second is the visual spatial parameter setting stage. This is when the child decides where the letter should go on the page. Finally, there is the letter production stage.

Van Galen's (1991) model of adult handwriting, explains the cognitive and motor processes in handwriting, as a series of hierarchical modules. The more complex cognitive processes include attention, and the linguistic aspects, such as ideation, planning, vocabulary and grammar, which are higher in the hierarchy. Spelling, (either though phoneme-to-grapheme correspondence, or spelling words from memory), the choice of script (cursive, script, capital or small letters), as well as the activation of neuromuscular networks, and the subsequent execution of fine-motor movements, are lower in the hierarchy. Despite these hierarchies, processes are executed simultaneously in a cascading manner. A writer is planning what to write next while still executing a grapheme. Unsurprisingly, Levine et al., (1981) state that no other school task requires as much synchronization as handwriting.

Another writing model is the Composing Process Model presented by Hayes and Flower (1980). Their model split writing into three parts, these being the task environment, the writer's long-term memory, and the writing process (Hayes & Flower, 1980). The task environment comprises everything external to the writer, such as the audience and writing prompt. The writer's long-term memory is the bank of data from where the writer derives the necessary information to perform the writing task. For instance, for narrative writing, the writer knows that characters, a setting and the narration of events, which might climax into a problem, and resolved by means of a solution, are required. The writing process within this model is composed of three processes, these being *planning*, *translating*, and *reviewing*. *Planning* is again subdivided into three strategies: generating ideas, organizing information and goal setting. To generate ideas, information is retrieved from long-term memory. This information is then organised in writing. Goal setting are criteria by means of which the writer judges if the writing has met the established goal. During *translating*, the writer puts ideas into writing, using correct language and complete sentences. *Reviewing* means correcting the grammatical and spelling mistakes of the written work. This is different from editing, which is changing the written content. During writing, reviewing may disturb any of the other sub processes (Hayes & Flower, 1980). According to Hayes and Flower (1980), these sub processes may be embedded within each other. Monitoring is the ability to shift the focus among the afore mentioned processes to ensure quality writing.

The Simple View of Writing, developed by Berninger et al. (2002), is a writing model that emerged from Hayes and Flower's (1980) work. This model comprises only the basic mechanisms of idea generation and spelling (Juel et al., 1986). Idea generation corresponds to Hayes and Flower's ability to generate ideas and organised these into writing. The principle behind the Simple View of Writing is that the more a student focuses on the lower-ordered skill of spelling, because of lack of automaticity, the more difficult it is to direct attention to the higher-order skill of idea generation. According to this model, a poor writer is a poor speller, who struggles with ideation.

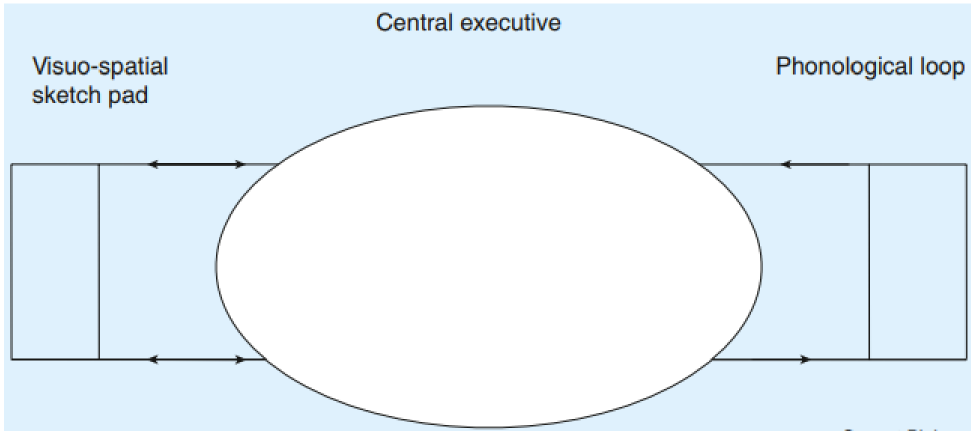
The Not-So-Simple View of Internal Functional Writing System was developed by Berninger and Winn (2006) from the Simple View of Writing model. The Not-So-Simple View added long-term memory to the model. Brain technology has shown that long term memory is triggered during planning and reviewing.

Kellogg (2001; 1999; 1996) and Hayes (1996) have both placed a lot of importance on working memory in their model of the writing process. Long-term memory can store huge amounts of information for a long time, but working memory can store a little information for a limited time period (Medwell & Wray, 2007). When different writing processes contend with working memory, these processes may interfere with each other, which results in an increase in "movement duration" (Barrientos, 2017, p. 552) and slow writing speeds. The solution to freeing up working memory resources is to automatize the lower-level skills (Medwell & Wray, 2007), such the automaticity of letter formation (see section *Handwriting Skills in Young Adults* in this chapter).

Baddeley's (2010) model of Working Memory has also been used to examine how working memory influences writing. However, in this model working memory is made up of three components – a central executive that controls attention, aided by two short-term storage systems, one for visual material, the visuo-spatial sketchpad, and one for verbal acoustic material, the phonological loop (see Figure 2). The visuo-spatial sketchpad and the phonological loop are related to writing. The former manipulates visual images and the latter stores vocabulary acquired verbally.

Figure 2

Baddeley's Model of Working Memory



Note: Source: Current Biology, 2010

Apart from the cognitive elements, in order to fully understand a student's writing performance, motivational aspects have also to be considered (Zimmerman & Risemberg, 1997). According to Zimmerman and Risemberg's (1997) Social Cognitive Model of Writing, cognitive aspects, such as ideation, planning, revision and editing are connected to motivation and self-efficacy. Self-efficacy is one's belief in succeeding at a task. High perceived self-efficacy is the belief that one will succeed at a task, despite the fact that the task itself may be quite challenging. Low perceived self-efficacy is one's belief of failing at, and hence avoiding, a task, even though the task may not be so challenging (Bandura, 1990). Self-efficacy for writing is one's beliefs about one's writing abilities (Zimmerman & Bandura, 1994). Self-efficacy in writing is related to motivation and writing performance, as it predicts the time and effort devoted to writing. Writing performance is self-regulated, as students set the writing standards with which they would be satisfied (Zimmerman & Bandura, 1994).

Handwriting Difficulties

Handwriting difficulties are recognised by poor legibility and slow writing speeds (Rosenblum et al., 2003b). Legibility is related to readability, which is determined by letter formation, letter size, spacing (Amundson & Weil, 2005; Bonney, 1992; Rosenblum et al., 2003b), word shape, confusion of upper and lower case letters and inconsistent slant (Barnett, at al., 2001). The model of handwriting sustained by Kellogg (2001; 1999; 1996) and Hayes (1996), states that slower writing speeds occur when working memory is constrained. Freeing up working memory through letter automaticity improves writing quality. Automated handwriting to increase writing speed is important to improve overall academic performance. Speed is fundamental in examinations/tests as a student needs to keep up with his flow of thoughts while trying to transfer these on paper in real time (Prunty et al., 2013), thus achieving higher academic grades (Barnett et al., 2001).

Handwriting difficulties are associated with Attention Deficit Hyperactivity Disorder (ADHD) (Racine et al., 2008), Autism Spectrum Disorders (ASD)[10] (Kushki et al., 2011), Developmental Coordination Disorder (DCD) (Prunty et al., 2013), dysgraphia (Döhla & Heim, 2015), and developmental language disorder (DLD) (Connelly & Dockrell, 2015). Van Galen's (1991), model of handwriting describes the cognitive and motor processes of handwriting, with attention and language processes being at the top of the hierarchy, and the motoric act of putting letters on paper being at the bottom of the hierarchy. According to Graham et al. (2006), handwriting difficulties can be manifest at any stage. Van Galen's (1991)

[10] Children with autism display poor letter formation but do not space, align and size the letters differently than age- and intelligence-matched controls. Training at correct letter formation may improve handwriting performance in children with autism (Fuentes et al., 2009).

model explains how children with attention (Attention Deficit Hyperactive Disorder), language (developmental language disorder and dysgraphia), spelling (dyslexia), or motoric difficulties (dyspraxia) may experience handwriting difficulties (Prunty & Barnett, 2017). All these conditions may bring graphomotor execution to a halt, and generate writing pauses (McCutchen, 1996), which reduce writing speed.

Attention Deficit Hyperactive Disorder (ADHD) is a chronic condition characterised by inattention, hyperactivity, and sometimes impulsivity (American Psychiatric Association, 2013). Children with ADHD often display poor handwriting performance, which affects their academic achievement, and consequently, their self-esteem. Their poor handwriting is characterized by illegible text, which, given their short attention span, makes it difficult for them to practise their letters (Lerer et al., 1979). Klein et al., (2011), also attribute their poor handwriting to their distractibility to external stimuli. The short attention span of children with ADHD may also be the result of the higher than average pencil-in-air time, that Rosenblum et al., (2008) have observed in children with ADHD. Children with ADHD often display below average writing speeds (Racine et al., 2008).

Autism Spectrum Disorder (ASD) is a “spectrum” condition as symptoms range from mild to severe. It is characterized by difficulties in social interaction, communication and repetitive behaviours (ICF, 2017). The handwriting of adults and children with Autism Spectrum Disorder (Beversdorf et al., 2001, Johnson et al., 2013) and children with ADHD (Frings et al., 2010), both exhibit macrographia (Johnson et al., 2013) and poor letter formation (Kushki et al., 2011), due to fine motor control deficits (Johnson et al., 2013; Kushki et al., 2011). Cartmill (2009) also found that the 8-year-old children with ASD in her study to be slower writers than their typically developing controls (Cartmill et al., 2009). In Cartmill et al.'s (2009) study, the faster the students with ASD wrote, the less regular letters they produced.

Developmental Coordination Disorder (DCD) (or dyspraxia) occurs when motor skills are delayed in developing, or when there are difficulties coordinating movements, which make it difficult for a child to perform common, daily tasks, such as buttoning, pouring liquid and zipping (Rosenblum, 2013), using a pair of scissors, drawing and painting (Biotteau et al., 2019). Standardized assessment tools, such as the *Movement Assessment Battery for Children - 2nd Edition* (MABC-2) (Henderson et al., 2007), are used to assess gross motor skills such as catching a ball; eye-hand coordination; balancing skills; and manual dexterity, to determine the speed and accuracy of each hand. Children with DCD are faced with writing difficulties, as their developmental coordination deficits make the mechanical production of letters and words challenging (American Psychiatric Association, 1994). This results in poor letter formation and untidy handwriting (Rosen, 2020). In fact, poor handwriting is a common indicator of DCD (Di Brina et al., 2008; Rosenblum & Livneh-Zirinski, 2008). However, Prunty et al, (2013), in a study with 28 children with DCD and 28 typically developing controls, attribute the slow writing production of children with DCD to increased pen-in-the-air time rather than to difficulties with the mechanical production of letters which result in slow execution speed. This study, conducted by means of a digitizing tablet, suggests that children with DCD do have some endurance for handwriting tasks, and that their lower DASH scores are not due to slower execution speeds, but rather to frequent pauses which are attributed to short breaks (Prunty et al., 2013).

Dysgraphia is defined as a neurological disorder that affects fine-motor ability and writing (Rosen, 2020). Individuals with dysgraphia are incapable of producing culturally acceptable writing in spite of average intelligence, no intellectual deficits, and receiving the relevant tuition for writing attainment throughout their academic years (Rosenblum et al., 2010). Dysgraphia can co-occur with other learning disabilities or difficulties such as dyslexia, ADHD and dyspraxia (Biotteau et al., 2019; Rosen, 2020). In fact, children regarded as clumsy by their educators are often diagnosed with dysgraphia (Laszlo, 1990) and dyspraxia (Peters et al., 2001). Students with dysgraphia have language problems, but with additional motor difficulties that interfere with learning (Alston, 1994; Rosen, 2020). When writing, students with dysgraphia write slower than peers, and are unable to speed up when instructed (Weintraub & Graham, 1998). Thus, these students require extra time to complete written classwork. They are reported to have difficulty planning their writing, putting their thoughts on paper, and make poor use of punctuation, resulting in run-on sentences without paragraphs (Rosen, 2020). The writing performance of children with dysgraphia is manifested in the quality of their written products (Rosenblum et al., 2004). Signs of dysgraphia include poor spatial planning (trouble positioning things on the paper or inside margins); a cramped grip, which may result in hand pain; poor spelling, including missing letters and unfinished or missing words; frequent erasing; and sudden changes in the size and directionality of letter writing (Hamstra-Bletz & Blote, 1993). Biotteau et al., (2019) add macrographia (larger than typical writing) to the list. According to Feder et al., (2000) macrographia is the reason why children with a profile of dysgraphia have slower writing speeds. If more than 25% of the written words are illegible (Francis, 2016), then the occupational therapist or educational psychologist will likely diagnose the child with dysgraphia. This diagnosis would usually be sustained by testing instruments such as the *Beery-Buktenica Developmental Test of Visual-Motor Integration* (Beery VMI) (Beery et al., 2010). To help plan their writing, students with dysgraphia can use graphic organisers (Rosen, 2020), such as the web used in this study for the planning of the free writing task. A child with dysgraphia spends a lot of time, energy and attention considering how to write words, and erasing that which has not been properly formed. Repeated erasure is a sign of difficulty in the production of letters (Rosenblum et al., 2004). Studies using a digitizing tablet, revealed that the longer the child's writing instrument remained in the air (In Air time), the poorer the child's legibility (Rosenblum et al., 2004; Wann, 1987; Wann & Kardirkamanathan, 1991). This is an indication of the discontinuity and inefficiency of the writing movements of children with dysgraphic handwriting.

Developmental Language Disorder (DLD) is lack of language development which cannot be attributed to other conditions such as brain injury, autism, Down's syndrome or hearing loss (Bishop et al, 2017). Children with DLD experience difficulties with aspects of language such as phonology and syntax (Norbury, 2021). Hence they find it hard to learn reading and spelling, as well as to produce written text (Connelly & Dockrell, 2015). Children with DLD talk late, and children as old as 3 or 4 may communicate verbally using short sentences, with limited vocabulary (Ervin, 2001). They also find certain aspects of language, such as the past tense, or the third person singular, hard to acquire (Ervin, 2001, Kuiack & Archibal, 2019). Thus, child observation and targeted tests, such as the *Test of Early Grammatical Impairment* (TEGI, Rice & Wexler, 2001), are used to diagnose DLD. The TEGI analyses utterances for grammatical structures such as the 's' in the third person singular, regular and irregular past tenses, auxiliary forms of the verb To Be and auxiliary forms of the verb To Do. Children with DLD have slower writing speeds as they pause for longer during the writing period (Connelly & Dockrell, 2015).

Dyslexia is the result of deficits in the phonological element of a language (Zettler-Greeley, 2020). People with a profile of dyslexia have difficulty recognizing the different speech sounds within words, such as the sounds for the phonemes '*ch'* and '*ou*', leading to reading difficulties (International Dyslexia Association, 2020). People with a profile of dyslexia also have trouble learning which letters represent the different speech sounds, leading to spelling and writing problems. With regard to writing, students with a profile of dyslexia often spell words the way they sound, because they have trouble forming memories for words (International Dyslexia Association, 2020). This is due to working memory deficits of people with a profile of dyslexia (Smith-Spark and Fisk, 2007). Mnemonics help transfer spelling from the working memory into the long-term memory (Cicerchia, 2020). Letters and numbers are omitted or reversed when writing. Teaching cursive writing may be one way of preventing letter reversals (Montgomery, 2012). For diagnosis, the condition has to be present for at least six months, despite intervention (Cardoso et al., 2014), such as the direct teaching of phonics (Montgomery, 2012). Dyslexia assessments may include: phonological awareness skills, such as identifying the middle sounds in words; the decoding of pseudo words; reading comprehension skills; the rapid naming of letters, numbers, pictures and colours displayed on a page (Kelly, 2020); and word spelling (Firman, 2009). The pencil grip is unusual, the handwriting is illegible or varies (not consistent) (Davis, 1992).

The Social Cognitive Model of Writing (Zimmerman & Risemberg, 1997) ascribes writing success to motivation and self-efficacy. Children with handwriting difficulties might get discouraged when trying to communicate their thoughts on paper, leading to loss of motivation and lower perceived self-efficacy, and avoidance of writing altogether, which reflects negatively on writing development, as increased writing may help improve writing skills (Graham, 1992). This writing failure may possibly result in a lack of motivation for learning, which may lead to lower self-esteem (Feder & Majnemer, 2007) and behavioural problems. These in turn may negatively affect the personal relationships of the child (Sassoon, 1997). When children with handwriting problems are asked to copy from the board, the notes they take are usually incomplete and illegible (Roaf, 1998). Rather than trying to understand their handwriting difficulties, teachers often label these children as uncooperative, unmotivated and lazy, which triggers further frustration in the children (Sandler et al., 1992).

Handwriting Skills in Young Adults

Handwriting develops during the first four years of life, starting with scribbles, which evolve into vertical and horizontal lines at the age of two, moving on to circles at the age of three, and crosses at the age of four, the later being a sign of writing readiness in children (Weil & Amundson, 1994) (see Appendix A). Handwriting proficiency permits students to produce legible text, with minimum effort, and within a reasonable time period (Rosenblum et al., 2003b). It is the students' tool to demonstrate their understanding, and convey their progress in school (Ziviani & Watson-Will, 1998), through written tasks, such as completing worksheets, answering end-of-chapter questions, and adding titles and labels to art work. It is a means of recording and communicating ideas**,** when making journal entries or writing narrative stories.

A study by Overvelde and Hulstijn (2011b) with typically developing elementary school children, determined that handwriting develops rapidly at around 6-7 years, evolves further at around 7-8 years, and becomes automatised by around 8-9 years. Despite technological progress, 30% to 60% of a child's school day consists primarily of handwriting tasks (McHale & Cermak, 1992), some of which are restricted by time limits. According to

Weintraub and Graham (1998) poor hand writers take twice as much time to copy the same written text as good hand writers. The quality of handwriting affects academic performance. If students are unable write at an age-appropriate speed, they will not manage to complete the examination paper in time, and their grades will not reflect their true academic abilities (O'Mahony, Dempsey & Killeen, 2008). In fact, students with poor handwriting speed are often referred to psychologists and occupational therapists in order to be granted extra time during examinations (Summers & Catarro, 2003).

Practicing handwriting is indispensable in freeing up working memory. According to Berninger and Swanson (1994) during the first three elementary school years, the working memory is constrained by transcription (spelling and handwriting), which limit writing abilities. In the subsequent three years, when transcription becomes automatic, more planning and revision are possible. In junior high school, the demands on working memory are mostly due to planning. Findings by Olive et al. (2009) state that the influence of transcription on the writing process diminishes as children grow older. The French participants in their study were 44 students, of which 23 (13 girls, 10 boys) were fifth graders (mean age 10.7 years), and 21 (9 girls, 12 boys) were ninth graders (mean age 14.10 years). Students were required to compose a narrative and an argumentative text. For the narrative text, they had to describe how they spent their Christmas holidays. For the argumentative text, they were asked to explain why some students might prefer to lunch at home while others might prefer to have school lunches. Each writing task lasted 20 minutes. To assess the cognitive effort in writing, students were asked to press the space bar of a computer keyboard whenever they heard beeps at intervals of between 15 and 45 seconds (ScriptKell program; Piolat et al., 1999). They were asked to do so as quickly as possible, using their non-dominant hand. The time the participants took to respond was an indication of the cognitive effort required in writing. The more time the participants needed, the greater the cognitive effort required. Olive et al. (2004) found that as grade increased, the cognitive effort in text writing lessened. Olive et al. (2004) presume that this is so as with age, planning and handwriting become automatized. Though the influence of transcription on the writing process declines with age, this may still effect writing speed and quality, across junior high school and adulthood.

Christensen (2005) states that handwriting is often seen as removed from the production of complex writing. However, research (Christensen, 2005; Jones & Christensen, 1999) shows that orthographic-motor integration, which is the ability to automatically generate letters and groups of letters to form words, is directly related to the creation of well-structured and creative text. A child's inability to automatically produce the letters of the alphabet will not only affect their writing speed, but also their ability to express themselves in writing and produce complex text. Jones and Christensen (1999) implemented a handwriting intervention programme on nineteen year one children identified with orthographic-motor integration difficulties (problems with letter formation). These 19 students were matched on age, gender and reading with 19 other children in the same classroom (the control group), who showed no sign of handwriting difficulties. At the beginning, the control group was better at written expression. They received instruction in handwriting as would normally receive a year one class. The intervention group were taught correct letter formation of lowercase letters with activities consisting, for example, of visual association strategies to help remember letter formations (e.g. *s* is like a snake). After seven months, the differences between the intervention group and control group in orthographic-motor integration and written expression, disappeared, indicating that handwriting difficulties are rectifiable (Jones & Christensen, 1999). This study shows that written expression improves once handwriting difficulties have been tackled. This is so as children, rather than focusing on letter formation, focus on the cognitive aspects of writing (Jones & Christensen, 1999), such as planning, organizing ideas and proofreading.

Jones and Christensen's (1999) study shows that once handwriting is in place, young children can generate creative and well-structured writing. However, will handwriting intervention likewise improve the writing of older children and adolescents? According to Barnett et al., (2001), as children grow older, their handwriting difficulties do not automatically disappear, and that some problems, such as word/letter formation, actually become more acute with age, and that boys exhibit more problems than girls. In fact, in an earlier study, Roaf (1998), examined 1,273 scripts at a 10-minute free writing task about a subject of the students' (age range 11 to 16) choice with a 2½ minute period for correction. The scripts support the idea that mature handwriting is not developed before mid-teens, and therefore attention to handwriting is equally important in secondary school as it is in primary.

Research indicates that automaticity is the best predictor of long, creative and well-structured written text not only in the primary years (Graham et al., 1997; Jones & Christensen, 1999), but also in secondary school (Christensen, 2005), and even in post secondary education (Connelly et al., 2006). Students who have been exposed to a structured handwriting programme are better spellers, have more legible handwriting, and are faster at note taking and other written classroom tasks (Weintraub & Graham, 1998) than those who have not. Christensen (2005) set out to determine if handwriting intervention improves adolescents' writing as it does for young children, despite their apparent lack of motivation. A group of 50 13-year-old students in Australia were identified as having orthographic–motor integration related to handwriting, which was assessed by the *Writing Speed and Accuracy Measure*

(Berninger et al., 1991). To assess written language, the students were asked to write for 20 minutes about the topic “My Greatest Challenge”. Quality of written text was scored on correct spelling and grammar, creativity, originality and organization of ideas, and awareness and sensitivity to the audience. The students’ word count determined the length of their writing. Students met their tutors daily, for 20 minutes, in small groups of five or six. The control group worked daily at a journal, but were provided with no direct handwriting intervention. The experimental group was presented with a handwriting program that taught the letters of the alphabet. Post testing was identical to pre-testing, with the difference that this time the topic was “A Great Adventure”. After eight weeks, the writing task of the handwriting intervention group was approximately twice as long, more original and creative, more organized and technically accurate, and showed a greater sensitivity to the audience. The study reported by Christensen (2005) demonstrated that despite their many years of writing failure, a handwriting intervention programme with secondary school students, can still be beneficial as it enhances their writing skills. Handwriting difficulties of struggling writers can still be diagnosed even in teenage years (Roaf, 1998), and handwriting is still amenable to instruction, even if the students attend secondary school. Identified struggling writers in secondary schools can still receive and benefit from handwriting intervention programmes, for improved literacy skills.

It has been suggested that older students, who have repeatedly failed at writing, may use computers to write text, as they may lack motivation to initiate a handwriting programme to amend their orthographic-motor integration difficulties (Christense, 2004). Furthermore, typing lacks the degree of fine motor control required when forming letters during writing (Christense, 2004). The 35 students (17 students in the control group and 18 students in the intervention group, matched by gender and and typing scores), who took part in Christense’s

(2004) study, at pre-test were asked to type text about the topic “My Best Friend”. The experimental group were specifically taught typing skills. The control group typed journal entries on their computers, but were not specially taught how to type. All students were reassessed after eight weeks. This time the topic was “A Surprise”. The intervention group typed longer, better sequenced and more organised, creative and original texts, with a greater awareness to the audience, than did the control group. By teaching the students typing skills, the cognitive load associated with orthographic-motor integration related to typing was minimised, so they performed better at their typed texts. Christensen (2004) noted however that improvements in orthographic-motor integration in typing did not automatically improve the quality of handwritten text. This designates the importance of automaticity in orthographic-motor integration of handwritten text, for the improvement in the quality and the length of handwritten text.

School leaving age does not bring an end to the difficulties that result from handwriting problems. With regard to adult writing, the postgraduate student experiencing writing difficulties, presented in Peverly’s (2006) case study, indicated that her verbal Short Term Memory (STM) (digits forward) and Working Memory (WM) (digits backward), as measured by the Digit Span in *Wechsler Adult Intelligence Scale* (WAIS-R) (Wechsler, 1981), were in the average range of functioning. This data suggests that STM-WM capacity was not the cause of her writing difficulty. Given the poor quality and slow speed of this student’s handwriting, Peverly (2006) argues that the student’s handwriting difficulties were likely due to poorly developed transcription (handwriting automaticity) and spelling skills. Hence, if the handwriting difficulties are not addressed during school years, the demands of higher education or the work place aggravate an already difficult situation (Rosenblum et al., 2003b). In a separate study, Connelly et al., (2006) researched about 21 adult students with dyslexia, attending a UK university. In the study, it likewise transpired that even at university level, the ability to write letters and words quickly and efficiently is still important. Connelly et al., (2006) found that students with dyslexia wrote on average as fast as 11-12-year-old children in the UK. Both studies, however, fail to present effective intervention programmes to increase adults' transcription speed. Connelly et al., (2006), limit themselves to suggesting schemes that have worked for children, that could potentially be adapted to adults. However, the researchers in both studies fail to discuss the extent to which adults' transcription speed may be achieved. Appropriate handwriting intervention programmes, tried and tested on adults, are needed as intervention for adults might need to be different from that for children, since adults would have already developed a mature hand and reached maximum handwriting speeds. These two studies are a clear example of how handwriting difficulties, which are not addressed at a young age, persist even in adulthood.

It is fortunate that recent curricula reforms in Malta have emphasized the importance for students to gain orthographic-motor skills. The new year 3 English syllabus which came into effect in 2019, expects the child to "write well-formed letters that are legible" and "write with speed, precision and legibility" (Learning Outcome Framework, 2020, p. 9). This emphasis on handwriting skills is however not reflected in the new Maltese syllabus for year 3 (Directorate for Learning and Assessment Programmes, 2020).

Mean Length Utterances

Mean Length Utterances (MLUs) give the average number of morphemes in an utterance (Gabig, 2003). A morpheme is a unit of meaning that cannot be divided further (Bowen, 2019). MLUs were first proposed by Brown (1973) as a better indication of a child's language development than chronological age. For English and Maltese, MLUs are calculated by dividing 100 utterances spoken by a child by the number of morphemes (Brown, 1973, Portelli, 2005). Brown (1973) proposed a set of guidelines for defining morphemes, presented below:

- Compound words count as a single morpheme - railroad, baseball.
- Proper names count as a single morpheme – John.
- Irregular past tense verbs and irregular plurals count as a single morpheme - took, went, geese, men.
- Catenatives count as a single morpheme - wanna, gonna.
- “s” plural counts as a separate morpheme - cats = 2 morphemes.
- Even if over-irregularised - mouses = 2 morphemes, mice = 1.
- Do not count the plural as a separate morpheme if the word never occurs as a singular - pants, clothes.
- “ed” past tense is a separate morpheme - walked, counted, goes = 2 morphemes.
- “ing” counts as a separate morpheme.
- “s” third person counts as a separate morpheme - he likes you = 4 morphemes.
- Contractions count as 2 morphemes - she'll, he'll, can't.
- Bound morphemes are counted separately – unhappily = 3 morphemes: “un”, “happy” and “ly”.

According to Bishop and Adams (1990) an MLU of 4.5 is a good predictor of reading ability in English for an 8-year-old child. Locally, Portelli (2005) carried out a research to determine the MLUs for the local population. Appendix CJ presents the MLU index proposed by this researcher. MLUs may also be used in research to calculate sentence length (J, Portelli, personal communication, December, 23, 2020).

Writing Speed Tests

Writing speed is usually recorded by taking note of the number of letters or words written in a specified amount of time, or by keeping record of the time taken to execute a specific number of words (Ferrier et al., 2013). According to Barnett et al. (2001), educational psychologists regard writing speeds of 12 words per minute (WPM) as extremely slow. What, then, are fast writing speeds? When should students be given extra time in examinations to compensate for their slow writing speeds?

Handwriting speed has been assessed in various ways. Three principal methods adopted have been copying, writing to dictation and free writing, which include expository (informative) or narrative writing. Free writing tasks produce lower writing speeds than repetitive writing tasks or copying (Horne et al., 2011). Overall, the time allocated for repetitive writing or copying tasks is relatively short. For example, the *Handwriting Performance Test* (HPT) (Ziviani & Elkins, 1984) allocates two minutes to the repeated copying of the phrase “cats and dogs”. Such simple writing tasks are ideal for young children, and they have shown an increase in handwriting speed with age (Ziviani & Watson-Will, 1998; Graham et al., 1998). In a study by Ziviani (1984), on a group of Australian school children, handwriting speed was shown to be 33, 34, 38, 46 and 52 WPM for students between 8 to 9 years, 9 to 10 years, 10 to 11 years, 11 to 12 years and 12 to 13 years, respectively. Findings showed that letter size and word spacing decreased with age. Similar results were found in the four-year longitudinal study by Duiser et al., (1999), on 83 Dutch boys and 90 Dutch girls, with an average age of seven years five months. Handwriting quality and speed were assessed using the *Concise Assessment Scale for Children’s Handwriting* (BHK) (Hamstra-Bletz et al., 1987). This required participants to copy the provided text, on unlined paper, in five minutes.

Speed was measured by counting the number of words written during the allocated time period. Handwriting quality was measured by assessing aspects of handwriting such as letter size, collision of letters and word spacing. Results showed improvement in writing quality and speed over the four-year period of writing instruction. The children whose handwriting quality and speed did not improve over the course of the study were those with handwriting difficulties, such as dysgraphia. The increase in writing speed with age, and the improvement in writing quality, is an indication for educators, that attention still needs to be given to handwriting, even when students enter secondary school (Roaf, 1998).

The first handwriting speed test dates back to 1912, when Ayres required children to copy a passage until they became familiar with it, after which the time taken to copy the passage was noted. Later in 1961, Groff asked 4834 children to read a passage until they became familiar with it, and measured their speed of handwriting by noting the time taken to copy it. Groff (1961) compared his results with those of Ayres (1912), and found that the writing speeds of his participants were slower. However, he concluded that his methods of assessment were more natural and hence more correct, as his participants were asked to read rather than copy the passage in question, hence reducing practice effects.

In order not to interfere with the natural speed of writing, which is possible when copying or dictating, Starch (1915) advocated for a phrase that can be reproduced from memory, such as “Mary had a little lamb”. In his research, students were asked to write this line rapidly and neatly for two minutes without stopping to make any corrections. Starch (1915) proclaimed that the chosen sentence must not contain more than five to seven words, and that the words must all be familiar to the children. Summers and Catarro (2003) have questioned the validity of short duration speed tests when making inferences about handwriting speed in examinations. This is because writing tasks in examinations, being much longer, may be affected by physiological factors such as muscle fatigue, do not usually involve copying simple, short sentences, and may be affected by various cognitive and motivational factors. Problems that may arise when assessing writing speed for extra time in examinations using a short writing task can be eliminated by using long duration copying tasks or writing to dictation, although the writing speed results are slower. Horne et al. (2011) studied writing to dictation using a computer-based dictation task that made use of digitized speech to dictate four to six words at a time, which the students had to write by hand. Their test was seven minutes long, and the students controlled the rate of dictation by pressing the "page down" key to hear the next phrase. Participants were allowed to hear the phrase again, by pressing the "control" key. Eleven-twelve-year-old students wrote on average 16 WPM, which for this test, corresponded to 62 letters per minute (LPM). Dictation tasks such as this, removes the time spent thinking about a topic in free writing tasks (Horne et al., 2011).

The *Handwriting Speed Test* (HST) (Wallen et al., 1996) is another copying task that assesses handwriting speed in LPM. The HST was designed and standardized on 1,292 Australian children (age range 8 - 18 years). Participants were required to read, remember and write on a test sheet the pangram[11] "The quick brown fox jumps over the lazy dog" as many times as possible in three minutes. Though correct letter formation is important, the test does not assess neatness or the ability to produce letters. All letters are counted, including the ones that have been crossed out. The youngest participants (8 to 9-year-olds) wrote 54 LPM (13.88 WPM), whereas the oldest participants (17-18-year-olds) wrote 133 LPM (34.19 WPM), indicating an almost linear growth between the ages of 8 and 18 years. The resulting writing

[11] A pangram is a sentence that contains all the letters of the alphabet.

rates of this test are faster than those presented by Phelps et al. (1985), in which 1,365 US children were required to copy a story of 197 words. A near linear growth, from 25 LPM at age 8 to 9 years, to 72 LPM at age 13 to 14 years, was recorded in this study. The participants in the study by Wallen et al. (1996) were faster than those in the study by Phelps and colleagues (1985). This is because repeatedly copying the same phrase is easier than copying a story, where there is the additional cognitive load of reading. However, the developmental writing rates in both studies are relatively equal, suggesting parallel growth rates.

O'Mahony et al. (2008) tried to simulate longer examination writing tasks by adding another nine-minute to the three-minute test of the *Handwriting Speed Test* (Wallen et al., 1996). Students wrote the pangram "The quick brown fox jumps over the lazy dog" as "quickly" and as "neatly" as possible for three minutes, stop for 30 seconds, skip two lines, and continue writing the same pangram for a further nine minutes. The authors detected a number of false positives, that is, students who wrote slowly during the first three minutes, but who then increased their writing speeds to normal writing rates during the succeeding nine minutes, once they had settled down to the writing task. The implication of the study was that the HST is more accurate with the addition of a further nine minutes.

The *Iranian Handwriting Speed Test* (Araghi et al., 2015) was developed to reflect the culture and language of Farsi, the official language in Iran. This writing system includes 32 letters of the alphabet and moves from right to left. The test was standardized in Tehran on 400 Iranians students aged eight to twelve. Text containing all the 32 letters of the alphabet was created, and passed on to 30 primary teachers, in grades two to five. The teachers were asked to comment on the chosen words that might be unfamiliar to the children, and on repeated words. After numerous amendments, the teachers agreed on the appropriateness of the final version of the text by considering reliability and validity measures. Participants were allocated five minutes to copy the text printed at the top of the paper on the lines below. The number of letters written were counted. For inter-rater reliability, raters rescored half of the scripts, chosen at random, which were scored by other raters. For discriminative validity purposes, the teachers were asked to classify the children as slow writers, normal writers or fast writers. No scientific method was utilized for this classification – just the teachers' familiarity with the students. The study concluded that the *Iranian Handwriting Speed Test* had adequate inter-rater reliability ($r = 1$, $p = 0.0001$) and discriminative validity ($r = 0.798$, $p = 0.0001$).

If tests are to replicate examination conditions, a free writing task has to be included. However, free writing places an extensive range of cognitive demands on the pupil, far more than those required for copying or writing to dictation. When writing narrative, descriptive, argumentative or expository text, logical thinking, the generation and structuring of ideas, their translation into written form, and finally self-monitoring, are required, apart from the linguistic process itself (Berninger, 1994). As a result, writing speeds for free writing tasks are slower than those for copying or writing to dictation. Hence the importance of including a free writing task in writing speed tests. If writing speed norms are derived only from copying tasks or dictation, resultant writing speeds may be faster than those obtained by students during free writing activities. If norms derived from copying tasks or diction are applied to free writing activities, students may needlessly be granted extra time during examinations.

Moseley (1997) established that the average writing speed for 15-year-olds is 15.5 WPM. He did this by calculating the average speed of tests including those by Alston (1985), Hunter-Grundin and Grundin (1980) and Myklebust (1973). Hunter-Grundin and Grundin (1980) had asked participants to write about the topic "*On my way to school"* for 10 minutes.

Myklebust (1973) had asked participants to write about a given photograph, and Alston (1985) had asked participants to write about one of these titles: "*My favourite person (or personality)*", "*Someone I know very well"* or *"Something in which I am very interested*", for a period of 20 minutes.

The average free writing speed is determined by the cognitive load imposed by the task. For instance, Hedderly (1995) asked participants to finish 40 given sentences with the first thing they could think of, as long as this made sense. Examples from Hedderly's *Sentence Completion Test* are: "A mother…"; "My greatest fear…", "Most girls…." and "Writing is…". As the task demanded just the association of ideas, the cognitive load of the task was quite light, with an average writing speed of 13 WPM for 11–12-year-olds (Hedderly, 1995). By comparison, Christensen (2004) asked participants to write for 20 minutes about the title *"Three Wishes"*, following a three-minute period for planning. As this task required the generation of more complex ideas, the average handwriting speed was 8.5 WPM, which is slower than that for Hedderly's (1995), despite the students being older (average age 13 years and 3 months). In order to help young writers cope with the cognitive load imposed by long and complex free writing tasks, a number of writing programmes may be employed. These help writers break down the writing task into stages, rather than attempt to write it all at one go. Hence, writers first plan and draft a piece of writing, and then revise the content by rewriting parts of it, as necessary. At the editing stage, the writers check their writing for grammatical mistakes.

Another free writing test is the *Group and Individual Assessment of Handwriting Speed* (GIAHS; Allcock, 2001). This 20-minute free writing test was used in the UK to grant students access arrangements in public examinations. This test provides norms in WPM from ages 11 (average 13.9 WPM) to 16 (average 16.9 WPM). However, the scores attained by students at free writing tests may not actually represent their true handwriting speeds, as students may stop writing to consider the spelling of a word, or think about what to write next (Ashton, 1997). Furthermore, free writing tasks are highly dependent on topic. In Allcock's test, students can write about a topic of their choice as students find it easier to write about topics with which they are familiar "that allow them to draw on their own history and experiences" (Barnett et al., 2007, p. 67). In the study by Ferrier et al., (2013) using Allcock's (2001) GIAHS, the fastest mean writing speed of the 11-year-old participants was 10.81 WPM, which is significantly below Allcock's (2001) average, and the slowest mean writing speed attained in their study was 7.44 WPM, almost half the writing speed affirmed by Allcock (2001). What these results imply is that if Allcock's (2001) criteria were to be applied to the data obtained in Ferrier et al.'s (2013) study, "70.2% of the students would be eligible for extra time, and 48.3% would be eligible for a scribe" (p. 75). Ferrier and colleagues (2013) attributed the huge disparities in the results to "teacher effects" (p. 73). At the time of the study, the students were being instructed in essay planning, so that the student might have spent more time planning the essay than required, with the result that they produced more structured, though shorter, pieces of writing. It has been noted in the literature that the free writing of students in secondary schools is affected by teacher effects (Christensen & Jones, 2000; Graham, 1990). The researchers therefore concluded that "the GIAHS is too vulnerable to teacher effects to be regarded as a reliable measure of writing speed" (p. 75).

Alston (1994) assessed 68 pupils (mean age of 15 years 11 months) attending a Secondary School in the UK. The pupils had to write for 20 minutes about one of the following titles: *My favourite person/personality; A person I know very well; Something in which I am* *very interested*. The titles were chosen in order for participants to have plenty of information to write about. Pupils were asked to write as much as they were able to, for 20 minutes. After 20 minutes they were instructed to put a cross after the word they were completing, but were allowed to continue. Only the words written in the first 20 minutes were counted. Alston (1994) reported an average rate of 14 WPM.

The test used by Barnett et al. (2001) for their study with British secondary school students was initially used by Barnett herself, working as an educational psychologist, to determine what access arrangements students with learning difficulties were entitled to, during national examinations. The researchers assessed 1,273 scripts (80% of the whole school secondary population). During testing, participants wrote for ten minutes about a topic of their choice. They were allowed to choose the topic to write about, to avoid presenting them with unfamiliar topics, since struggling writers have difficulty writing even about familiar topics. On average students in each age group wrote between 15 to 25 WPM. According to Barnett et al., (2011), students unable to write more than 15 WPM struggle during lessons that require a lot of writing. During assessment students were allowed 2.5 minutes for correction at the end. Correction is essential, as students who are unable to read what they have written, cannot improve their own writing (Barnett et al., 2001), or their spelling either, as it is difficult to decipher and correct misshapen letters. The researchers found a correlation between handwriting and achievement, with an increased writing speed of three to four WPM and an average increase in reading/spelling age of three to four months. This correlation was true for 11/12-year-old boys and girls. Hence, legible and fluent writing seems to improve spelling and reading (Barnett et al., 2001), general comprehension of lessons (Amundson & Weil, 2005; Graham et al., 2000; Wolf, 2005), and academic achievemnt (Barnett et al, 2001).

The *Detailed Assessment of Speed of Handwriting* (DASH) (Barnett et al., 2007) includes varied handwriting speed tasks which makes it ideal to assess different types of learning disabilities. Some of the main difficulties exhibited by students with dyslexia and dysgraphia are information retention, language processing and spelling difficulties (Zettler-Greeley, 2020). Hence, a free writing task is probably appropriate to assess the writing difficulties of these students. Students with a profile of dyspraxia will almost inevitably have handwriting difficulties because of motor coordination deficits, but may not experience difficulties with language processing or memory retention (Alston,1994). Hence, a mechanical writing speed test, perhaps copying a repetitive sentence, is suitable to assess the handwriting difficulties of children with dyspraxia. The DASH was developed by Barnett and colleagues (2007) in the UK, and was standardized on a representative sample of 546 students from England, Scotland and Wales, using data from the 2001 census. The data was stratified by age (9-16 years), ethnic groups, parental educational level and geographic region. Normal distributions were obtained from raw scores for each age group. From these scores the standard scores for each task were derived (Barnett et al., 2007).

Barnett et al., (2007) did not monitor their students' performance across the 10-minute free writing period, but Dutton (1990) did. His study at a Scottish Comprehensive School, included a presentation and a standard writing paper, to reflect examination conditions. The study's limitation was that only 10 girls and 10 boys in each of the five senior year groups (ages 12 to 16) took part. Participants, randomly selected from the school, had to write about *My Life History* for half an hour. The teacher discussed a few ideas, such as family, interests and life events. Pupils were instructed to insert a time mark // every three minutes. The teacher said "Time Mark", the pupils made the mark, and continued writing. Dutton (1990) concluded that a typical senior pupil is capable of writing at a relatively constant rate for at least 30 minutes, even during the last three minutes. Hence the importance of monitoring the students' rate of writing performance during the 10-minute free writing task in this study, to determine if a similar conclusion is possible given that the writing period is shorter.

The development of kinesthetic awareness through multisensory activities and exercises has been found to speed up the handwriting of children (Addy, 2004). Exercises that require students to draw the same patterns on both sides of a blackboard, repeat with their eyes closed a series of arm movements they have just witnessed, and paint a large sheet of paper completely with a tick paintbrush, first slowly then quickly, to help free up the wrist and hands, have been found to improve slow and/or illegible handwriting (Addy, 2004). Two probable causes of handwriting difficulties are lack of automaticity in orthographic-motor integration and perceptual-motor difficulties. Lack of automaticity in letter formation may be determined through a pangram since this contains all the letters of the alphabet. An assessor may observe the way an individual forms the letters of the alphabet as they write down the pangram. According to Karlsdottir & Stefansson (2002), for handwriting to be easily legible, 50% of the letters must be mastered. Hence children who do not master one out of every two letters should be given handwriting support. Perceptual-motor difficulties may be determined by means of the Graphic Speed Test since fine motor skills come into play (see section *The Graphic Speed Test* in Chapter 3).

Adaptation Studies of the DASH

Other countries have adapted the DASH to suit their individual and specific population. In 2014, Precup and Barnett translated sections of the manual and test instructions into

Romanian. For the *Copy Best* and *Copy Fast* subtests, the pangram in the DASH (*The quick brown fox jumps over the lazy dog*) was not substituted with another pangram, but with a sentence that contained most of the letters of the alphabet (*He/She laid cucumbers and a kilogram of cheese in a basket*). No apparent consultations with language experts were made by the researchers to determine the sentence choice. Nor was a rationale for not substituting a pangram with another pangram provided. For these copying tasks, the same timings were kept (Precup & Barnett, 2014). For the *Alphabet Writing* subtest, the same administrative procedures were kept. Participants were instructed to write out the alphabet in sequence for a minute. For the Graphic Speed Test, only the instructions were translated to Romanian. Participants were still requested to draw Xs, in circles like doughnuts, for a minute. For the *Free Writing* subtests, the prompts in the spider diagram were translated into Romanian. The sentence copying tasks (*Copy Best* and *Copy Fast*) were pilot tested on two children and two adults. It is not clear why two adults were included as participants in their pilot study when the test was intended for children. Neither was it clear why only two children piloted the test, as this figure falls below the 10% sample required for a pilot study (Connelly, 2008). Furthermore, it is not clear why the researchers did not pilot the test in its entirety, since instructions, and the *Free Writing* prompts, had also been translated into Romanian. The researchers reported that the tasks of the pilot were executed without any issues. One hundred children, 49 boys and 51 girls between the ages of 9 and 11, took part in Precup and Barnett's (2014) study. They represented diverse socio-economic backgrounds, and attended four different schools. Researchers followed the administrative and scoring procedures of the DASH for all tasks. The test was administered in classrooms. The validity of the adapted DASH was examined by testing differences in age and gender. Results of the study revealed that age influences written performance as for each task the older children wrote at least two more words. Results also showed that girls wrote faster than boys. Therefore, the Romanian version of the DASH is as good at differentiating between groups, as the UK DASH. The researchers concluded that the adapted DASH is suitable for use with children in Romania. However, other tests of reliability and validity, which were carried out in the UK DASH, such as inter-rater agreement or discriminative validity were not carried out in the Romanian study. The latter was not possible because there were no students with learning difficulties included in their study. Furthermore, writing speed norms for children between 9 and 11 were not established.

Francis et al., (2016) attempted to standardize the DASH for the Australian population, as well as revise the *Handwriting Speed Test* (HST) (Wallen et al., 1996) norms to today's Australian population. The HST was developed over 20 years ago. During this time, access to technology, both for instruction and leisure, as well as differences in handwriting instruction, may have changed children's fine motor development and handwriting speed (Francis et al., 2016). Hence the need to restandardise the norms of the HST. In all, 171 students (32 students with handwriting difficulties), between seven and eighteen years, took part in Francis et al.'s, (2016) study. The following tests were administered: HST, Graphic Speed Test, Copy Best, Alphabet Writing, Copy Fast and Free Writing. Results show that the current DASH and the HST norms are valid for today's Australian population. However, for certain year groups and ages, the sample sizes were too small to confirm this with certainty.

Cardoso et al., (2014) carried out a translation and cultural adaptation of the DASH on the Brazilian population in 2014. The translation of the test from English to Portuguese was carried out by two professionals, both specialists in English, and one specialized in translations.

These two individuals were aware of the purpose of the study and worked independently, producing two translated tests, which were combined into one. This test was then given to two other translators, who back-translated it into Portuguese. All versions of the test, including the original DASH test, were analyzed by a Committee of Judges in order to evaluate the items for "semantic equivalence (meaning of words), idiomatic (formulation of colloquial expressions equivalent to the origin language), cultural (terms and everyday situations different between cultures) and conceptual (words that have different cultural meanings)" (p. 323). According to the literature, the judges should be authorities in that domain (Reichenheim & Moraes, 2007). These judges – professionals who address handwriting performance – were composed of educators, occupational therapists and speech therapists. They created the adapted version of the DASH, which was then subjected to pre-test. This phase intended to pinpoint errors, evaluate the quality of the translation, evaluate the practicality of test administration, and assure that the adapted DASH was as equivalent as possible to the original DASH (Cardoso et al., 2014).

When performing the translation, an adjustment was made for the pangram to be in Portuguese – *One day Max played soccer with his neighbor Pedro.* For the alphabet writing task, the letters of the alphabet were to be written for a minute in alphabetical order, using cursive and lower case letters. Cursive writing, being joined, is faster, as participants do not lift their pens between letters, thus reducing letter spacing, and hence increasing the rhythm and writing speed (Almeida et al., 2013). Furthermore, a study in France (Thomas, 1997), showed that cursive writing is a physical skill that improves the flow of thought, spelling, grammar and punctuation. Once cursive writing becomes automatic, children express more creative ideas and plan their work more efficiently (Thomas, 1997). The Portuguese version of the DASH was piloted on 32 students, (16 females and 16 males), with four participants in each age group (from 9 to 16 years old). The age groups of the participants corresponded to the original procedure in order to ensure that all items of the test are comprehended by a representative sample of the population for which they are intended. A sample of 30 participants was deemed sufficient, as in the literature this number is considered adequate when pilot testing adapted and translated tests (Reichenheim & Moraes, 2007). The *Raven Progressive Matrices* (Raven, 1936), which is a cognitive assessment test, was used to exclude cases of intellectual impairment. Students with developmental disabilities, such as ADHD, those with autism or learning disabilities were also excluded. Students were randomly selected for the pilot project, with the first two girls and the first two boys on the class list being called. During the pilot, students were asked if they had any difficulties understanding or executing the tasks. Since no difficulties were apparent, no adjustments were made to the test. The researchers concluded that the subtests were equivalent to both the Brazilian and British cultures. The study showed that the translation was valid. An internal consistency value of 0.701 was reached (Cardoso et al., 2014).

In their study, Simons and Probst (2014) recruited 1163 children (650 boys and 513 girls), aged 9 to 16 years, from 11 different primary and secondary schools in Flanders. Participants had to be proficient in cursive writing, attend school regularly, and speak Dutch as their first language. Ethnic and socio-economic data was not collected, so the effect of these variables on writing speed could not be measured. From the total sample of 1163 participants, a test-retest group (n=266) and an interrater group (n=61) were obtained. The DASH was maintained in its original form. The only difference was that participants wrote the free writing task in Dutch rather than English, to avoid slow writing speeds due to participants' potential difficulties when writing in a foreign language (English). The scoring procedures proposed in the DASH were also maintained. Raw scores were converted into standard scores for each age group and subtest (mean = 10; SD = 3), and a total standard score (mean = 100; SD = 15) was calculated. Results comparing the performance of the Flemish participants to that of UK participants, showed that Flemish children aged 9, 10 and 11 wrote slower at the pangram copying task than same aged UK participants. This could be due to the fact that the Flemish children were asked to copy the pangram in English, and they only start learning English at age 12. No differences in writing speed were found for the 12, 13 and 15-year-olds between Flemish and UK participants. For the 14- and 16-year-olds, it was found that the Flemish children performed better at the pangram copying task. According to Simons & Probst (2014), this could be because, since Flemish participants knew multiple languages, it was easier for them to memorise the short pangram. Another possibility could be that the pangram used in the DASH - *The quick brown fox jumped over the lazy dog* - is well known to participants, as it is commonly used on computer to display various font styles. Despite these differences, the authors concluded that the UK norms could be applied to the Dutch population, as no significant differences were found between scores. However, these results are to be treated with caution. The authors assumed that the output of the Dutch free writing task was comparable to the output of the UK free writing task, since both nationalities wrote about the same topic (My Life) in their own language. Yet they failed to take into consideration cross-cutural adaptations. Furthermore, the *Copy Best* and *Copy Fast* subtests were in English. A Dutch pangram should replace the English one, to increase the internal reliability of the test, and to better compare Dutch and English norms. Moreover, Flemish students were required to use cursive script, whereas the DASH does not request the participants to use any particular writing style.

The Effect of Writing Speed on Legibility

A balance of both legibility and speed is vital for effective written communication. Hurschler Lichtsteiner et al. (2018) state that legible handwriting is the result of training. Writing speed may vary, depending on whether the child is writing to dictation, copying or free writing (Bonney, 1992). It also depends on the given instructions (Bonney, 1992), whether the child is asked to write as neatly as possible or as fast as possible. Speed is fundamental in tests and examinations because students need to transmit their thoughts on paper while trying to keep up with the flow of their ideas (Prunty et al., 2013). However, when students write quickly, they might produce illegible text; whereas if they try writing slowly in their best hand, they might produce fewer words (Burger & McCluskey, 2011). Legibility may also suffer if a child is asked to write for a long time, due to fatigue.

Assessment batteries that measure writing speed need to consider legibility, as writing speed may affect legibility. The literature presents a number of legibility scales that measure the legibility of handwriting. As early as 1912 a legibility scale was created to measure handwriting legibility (Ayres, 1912). The scale was a sheet of paper with eight divisions from end to end. In each division were samples of handwriting. The samples improved from left to right. In order to measure the legibility of any sample of writing, the user had to slide it along the scale until a writing of the same quality was found. The number at the top of the scale represented the legibility value of the writing. However, other researchers (Starch, 1919), deemed such an evaluation impractical for classroom use, and too subjective to be reliable.

A similar legibility test is the *Test of Legible Handwriting* (TOLH) (Larsen & Hammill, 1989). This tool intended to determine the overall legibility of print and cursive writing of children from 7 to 17 years. The authors created a scale of writing samples graded from 1 (least readable) to 9 (most readable). The ratings were then converted to standard scores and percentiles (M = 10, SD = 3). When more than one score was available, a combined score could be calculated (M = 100, SD = 15). The writing samples were stories about pictures, or other written passages, created by the children themselves, in class. The evaluator had to match a written text with one of the handwriting samples of the test (Rosenblum et al., 2003b). One drawback of the TOLH is that evaluators simply provide a holistic legibility rating to the student's written text, and disregard characteristics such as letter formation, letter spacing and inconsistent slant (Cizek, 2004). In addition, because the TOLH has only nine legibility levels, it is not sensitive enough to identify gradual improvements in handwriting quality (Artemis Bradfield, 2009).

In the "transparent overlays" methods (Collins et al., 1980; Helwing et al., 1976; Jones et al., 1977), the writing samples that determine standards of performance are printed on transparencies. These transparences are then placed on top of the written passage, and the examiner compares every letter of the written text to the writing samples. If a letter fits within 1 to 3 mms from the standard, it is considered correct (Graham, 1982). If it is slightly larger, or ends with a flourish, it is considered incorrect. Though this method is highly reliable, with inter-rater reliability coefficients ranging from 0.86 - 0.97 (Graham, 1982), the "transparent overlays" methods is criticized as it does not take into account personal style (Graham & Weintraub, 1996). Hence the validity of such an instrument is questioned (Graham & Weintraub, 1996).

Rubin and Henderson (1982) developed a scale to help teachers identify children experiencing difficulties with legibility. Six assessment criteria were identified: how accurate the letters were formed; how straight the line was written; spaces between letters and words; unity of letters; size of letters and their tilt (word shape); and readability. The six criteria were each further subdivided into a four-point scale. A paragraph 57 words long was given to the children, to be copied within five minutes, on unlined paper. Writing speed was calculated as the number of letters written per minute. Despite test-retest and inter-rater reliability of the scale being extremely high (Rosenblum et al., 2003b), research shows that when children are asked to write on unlined paper, the quality of their handwriting is affected negatively (Burnhill et al., 1983; Daniel & Froude, 1998), so the viability of this scale is questionable.

The *Handwriting Performance Test* (HPT; Ziviani & Elkins, 1984) targets children aged 7-14 years, to assess their print writing ability. In this test, handwriting ability is determined by writing speed and legibility. Writing speed is established by the number of times participants manage to write the phrase "cats and dogs" in two minutes. Legibility is defined by the readability components of letter formation, spacing, size and line straightness. Size and spacing are measured to the nearest millimeter by means of a transparent overlay with straight lines on it, and a ruler. These are used to measure the size of the letters, the spaces between the words, and line straightness. However, the authors failed to justify how their criteria are indeed those that influence readability (Stott et al., 1987).

The *Evaluation Tool of Children's Handwriting* (ETCH) (Amundson, 1995) assesses the overall legibility of handwriting of children in grades one to six, and considers illegibile those words that are not easily read. ETCH–M assesses manuscript (print) writing whereas ETCH–C assesses cursive writing. The ETCH includes the following tasks: writing the first 12 numbers, and the letters of the alphabet, from memory; a far-point copying task (five sentences); writing pseudo words to dictation; and free writing (a sentence with a minimum of five words). The test manual provides the user with illegible and legible samples, to aid in the scoring process. Nonetheless, the ETCH provides the user with the possibility of analysing letter formation, spacing and size of words. Writing speed is the total time taken to complete each task. The ETCH is useful as it identifies the student's handwriting problems, and helps map out intervention that is targeted to their needs.

Dennis and Swinth's (2001) examined the effects of pencil grasp (the tripod grasp and other atypical grasps) upon task length and legibility. They found no difference in performance between either. These findings are similar to earlier research (Ziviani & Elkin, 1986), which established that neither speed nor legibility were affected by an atypical pencil grasp. In a similar study, Jaffe (1987), asked 40 adult participants to write three paragraphs, to examine if their different pencil grasps affected fatigue, legibility and speed. The researcher found no significant differences between participants with a tripod grasp and those with atypical grasps.

In the study by Dennis and Swinth (2001), only task length influenced legibility. Forty-six fourth-grade students (18 boys and 28 girls, with a mean age of 10.2 years) from two western Washington school districts, participated in their study. Participants with a tripod grasp (n = 23) were matched with participants of the same age, gender and hand dominance, but with an atypical grasp (n = 23). Matched students were in the same classrooms. Samples were assessed for legibility following the letter and word legibility criteria of the *Evaluation Tool of Children's Handwriting* (ETCH) scale (Amundson, 1995), which evaluates letter formation, spacing, size, and alignment[12]. Dennis and Swinth (2001) found that children's writing was

[12] Alignment is the consistent use of the bottom handwriting line as the baseline for each letter (Heffron, 2016).

more legible on the short writing task than on the long task. The authors did not offer a plausible explanation for the higher illegible scores attained at the longer writing tasks. Given that the children took frequent pauses while writing, it is difficult to attribute this to muscle fatigue. Rather this could be due to lack of writing endurance, or lack of motivation, since several students passed comments about the length of the task while writing. The results of this study are to be interpreted with caution as the writing tasks were dissimilar for the two schools. Some children had two free writing tasks, whereas other children had two copying tasks. The different tasks gave rise to greater error variability when scoring for legibility, than if the same writing tasks had been used. Moreover, the test was not piloted to determine which writing task best suited the purpose of the study.

In a study by Greifeneder et al., (2012), it seems clear that, despite the content being exactly the same, legible text is graded more favourably than less legible text. In their study, each essay was handwritten both in highly legible handwriting and in less legible handwriting. Each version was given to different participants, who were asked to grade it. From the results it was evident that reading fluency due to highly legible text, positively influenced an assessor's opinion about the author's ability and the written content. Consequently, legible essays were graded higher than less legible ones. Greifeneder et al.'s (2012) study is corroborated by a study by Graham et al., (2000), who advocated that their teachers are inclined to give neatly handwritten essays higher marks than essays written in a sloppy hand. This may be so as neatness may condition a teacher's perception of the child's ability as a writer. Handwriting is often perceived as the mirror to an individual's intelligence. Likewise, five of the seven teachers who took part in the study by Roston et al. (2008) commented that when presented with sloppy or illegible handwritten work, they tend to get a generally bad impression of it than they do for more legible work. Connelly et al. (2006), carried out a study on 21 university students with dyslexia. Before being assessed, the assays they wrote were typed, in order to minimise preconception from poor handwriting. The original spelling errors and all crossed-out words were preserved. Though this is probably a very fair method of assessment, one cannot but question the practicality of this procedure in the educational setting.

Berninger et al. (1997) confirm that handwriting quality influences the valuation of handwritten essays. However, these researchers give a different interpretation to why this happens. Students with legible handwriting actually produce better compositions because legible handwriting frees the brain to focus on ideation and vocabulary, instead of letter shapes. In fact, Ferrier et al., (2013), devised a 4-point scale to describe legibility. In this study, “a rating of one was given to work that was rated ‘unacceptable for an 11-year-old’, in which overall legibility was poor and considerable portions of the text remained difficult or impossible to decipher. A rating of two was given to work in which legibility was ‘acceptable for an 11-year-old’, although it may include some words or phrases that were difficult to decipher. A rating of three was given to work that was regarded as ‘good’ for an 11-year-old, with generally clear legibility but immature appearance. The top rating of four was given to work that was judged as being of ‘good’ standard for an adult, with overall clear legibility and mature appearance” (p. 69). In the study by Ferrier et al. (2013), speed and legibility were correlated. A low but significant positive correlation of 0.21 was found. Students whose handwriting was more legible tended to write faster than those whose handwriting was less legible. A balance between speed and accuracy is an indication of mastered handwriting skills (Biotteau et al., 2019). Other studies (Sovik et al., 1993) have found that legibility tends to be sacrificed for speed, while others (Graham et al., 1998) have found little association between the two variables. It is problematic to compare studies that address legibility, as researchers use different criteria and different tools to assess legibility.

Daniel and Froude (1998) aimed to study inter-rater reliability between assessors of handwriting. They used a five-point Likert type scale to rate handwriting quality, this being: “1, very poor; 2, poor; 3, satisfactory; 4, good; 5, very good”. Handwriting samples were collected from 61 students in grade five and six classes. These samples were assessed by primary school teachers and occupational therapists. When the authors compared the way teachers and occupational therapists assessed handwriting, they found poor to fair inter-rater reliability. Thus they questioned the reliability of current methods of handwriting evaluation. Teachers and occupational therapists seem to assess legibility in different ways. For teachers it is more important that their students master the subject content delivered to them. As long as they can read the assignments, unlike occupational therapists, teachers are not concerned with formalized tests of handwriting, that heed the distance of the eyes from the paper, posture, the position of the wrist, the position of the paper on the writing surface, pencil grip as well as pressure on the writing surface (Roston et al., 2008). Occupational therapists also evaluate letter size, letter spacing, legibility of form and alignment when assessing handwriting, and so their legibility criteria differ from that of teachers.

A study by Weintraub and Graham (2000) in America, concluded that legibility is affected by perceptual-motor integration. Participants were 10-year-old students, 33 of which had legible handwriting, whereas 32 students had poor handwriting. For the study, participants were asked to write a letter to another person, asking them to go with them to another place. They had to describe this place and also explain what they would do there. The task was 15 minutes long, and was taken from the Written Expression subtest of the *Wechsler Individual*

Achievement Test (WIAT) (The Psychological Corporation, 1992). The written samples were scored for legibility, using the *Test of Legible Handwriting* (TOLH) (Larsen & Hammill, 1989), by comparing them to nine graded specimens of legibility. Perceptual-motor integration was assessed using the *Test of Visual-Motor Integration* (VMI) (Beery et al., 2010), which asked participants to copy at their own pace 24 geometric shapes of increasing difficulty. Regression analyses showed that perceptual-motor integration significantly predicted handwriting legibility.

The Effect of Writing Style on Writing Speed

The question of handwriting style is a matter of educational practices in the respective countries and schools. As far back as 1946, Freeman reported that out of the 727 public schools, representing 48 states in the USA, that took part in his survey of handwriting practices, the majority of the schools (84%) (p. 394) used print writing up to third grade. The transition to cursive writing took place in the fourth grade. Likewise, in a separate survey of laboratory schools, public schools and private schools in the USA, the 44 states that took part in Polkinghorne's (1946) study of handwriting practices showed that in 66% of the schools, the shift from print to cursive writing typically occurs in Grade 3 or above. What Polkinghorne's (1946) study also brought to light was that 17.6% of these schools taught solely print writing in all grades. This could have been due to the selective nature of the sector. Handwriting is initially taught with print, as the letter forms are so simple that they can be mastered even by very young children. Furthermore, it is easier for children to learn print writing while learning to read (Wolfe, 2020). Cursive instruction starts in fourth grade, and by fifth grade they would have developed their personal writing style, which persist throughout later school years. The idea of developing the students' personal writing styles dates back to 1946. Polkinghorne (1946) found that five of the schools that took part in the survey of handwriting practices, allowed their students to develop their personal writing style. Thirty-three schools even assisted the students to refine their individual writing style. The type of script, whether print or cursive, children should be taught at school during handwriting instruction, is a common issue for debate (Graham et al., 2010). Print was found to be more legible than cursive (Suen, 1983), yet cursive was found to be faster (Barnett et al., 2001; Sovik, 1993). Failure to join up correctly is correlated to an average drop of half a grade in the English GCSE examination for boys, and a whole grade for girls (Barnett et al., 2001).

Hamstra-Bletz & Blote (1990) claim that many children start personalizing their handwriting style by using mixed print and cursive writing, once formal handwriting training ends in primary school. This is supported by evidence gathered by Blote and Hamstra-Bletz (1991), who reported that the handwriting style of Dutch school children changed from exclusively joined cursive script to a mixed print and cursive style as they grew older. In fact, by grade 6 (11 years), only 40% of the girls in their study used solely cursive letters. In the German-speaking part of Switzerland, students are assisted to develop their personal handwriting style (Betschart & Hurschler Lichtsteiner, 2017), after research has shown that children with an adapted handwriting style are more motivated, fluent and legible writers (Wicki & Hurschler Lichtsteiner, 2014). This may be so, as writers with a mixed print and cursive handwriting, select the allographic form of the letter they are able to retrieve and execute the fastest (Graham & Weintraub, 1996). In a separate study by Graham et al. (1998), participants were asked to copy the copying subset of the *Group Diagnostic Reading Aptitude and Achievement Tests* (Monroe & Sherman, 1966). Those writing using a mixed-mostly cursive writing style wrote faster than those who used just print (10 LPM faster) or cursive script (13 letters per minute faster).

In Malta, the recommendation is to initiate formal cursive instruction when the children reach level five in their learning, which corresponds to a Maltese year three class (Ministry for Education and Employment, 2018). This recommendation is found in the primary English syllabus. The literature shows that it is not enough to classify writing style as cursive or print, as children personalize their writing style and may mix cursive and print in their writing. This understanding was taken into consideration when attempting to come up with a set of criteria to determine writing style in this study (see section *Writing Style and Legibility* in Chapter 3)

The Effect of Age and Gender on Writing Speed

Studies indicate that age and gender affect writing speed. Generally, girls are faster writers than boys (Vlachos & Bonoti, 2006). Reilly et al., (2019) examined the *National Assessment of Educational Progress* (NAEP) reports, from 1988 to 2011, to gauge gender dissimilarities in writing attainment. The NAEP is a national report conducted in all the 50 states of the US, targeting students aged 9-10, 13-14, and 17-18, attending both public and private schools. Apart from writing, the NAEP assesses a variety of subjects including reading, mathematics and science. Reilly et al. (2019) noted that girls outperformed boys in writing attainment at all ages. These results support Hartley's (1991) research which established that 7 and 8-year-old girls write at greater length and use more varied vocabulary than boys.

The 2011 PIRLS report shows a similar trend in literacy for Malta (Ministry for Education and Employment, 2013b). The 9/10-year-old girls taking part in the study outperformed the age matched boys in both the English and Maltese reading tests. Similar results were attained by older students (15/16-year-olds) in secondary schools (Ministry for Education and Employment, 2018). The 2018 PISA report also shows that girls outperformed boys in English reading[13] (Ministry for Education and Employment, 2018). This gender difference in reading was attributed to differences in outlook toward reading by the two genders (Ministry for Education and Employment, 2018), with girls reading more, and enjoying reading more than boys (Logan & Johnston, 2009).

A study by Simons and Probst (2014) evaluated the handwriting speed of children aged 9 to 16 years, using a modified form of the DASH (see section *Adaptation Studies of the Dash* in this chapter). Findings show that girls wrote significantly faster than boys in every age group. Similar results were reported by Van Waelvelde et al., (2012) who conducted a study on 862 Flemish children, aged between 7 to 11 years. Six hundred and three participants (302 males and 301 females) attended mainstream schools, while 259 (153 males and 106 females) attended schools for children with special educational needs. Participants were administered the *Systematische Opsporing van Schrijfmotorische problemen*[14] (SOS) test, which consisted of a story, written out in sentences of increasing complexity. Participants had five minutes to copy the story, as quickly and neatly as possible, on unlined paper. Writing speed was measured by counting the number of letters written in these five minutes. Results found girls to be faster writers than boys.

Despite the fact that girls and boys have the same cognitive resources (working memory functioning) (Bourke & Adams, 2012), boys find it harder to express their ideas in writing (Olinghouse, 2008), and to plan and revise their writing (Berninger et al., 1992). Hanlon et al. (1999) examined the brain development, by means of sophisticated

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[13] Maltese reading was not assessed.
[14] Systematic Screening for Handwriting Difficulties

electrophysiological imaging, of 284 boys and 224 girls, as young as two months, up to 16 years. They found that the various regions of the brain develop at different rates in boys and girls. In fact, from two months up to age six, girls experience an earlier left hemispheric maturation which might contribute to their superiority in writing (Hanlon et al., 1999) and speech (Voyer, 1996). During the same time, boys experience faster right hemispheric maturation, which is the area of the brain related to geometry and mathematics (Vlachos & Bonoti, 2006). This earlier left hemispheric maturation could contribute to girls' having more developed language production skills, to their greater ability to detect different sounds and intonations (Arnold, 1996). This could also explain why girls outdo boys at letter formation (Hamstra-Bletz & Blote, 1990), copying writing, writing to dictation (Gaddes & Crockett, 1975), compositional fluency (the ease of producing words to express ideas), and compositional micro-organization (the ability to translate ideas into properly formed sentences) (Aitken & Martinussen, 2013).

The language and fine motor skills (such as handwriting) areas of the brain, mature earlier in girls than in boys. Indeed, in Vlachos and Bonoti's (2006) study, they found a ratio of 4.67 boys to 1 girl with severe writing problems. However, according to Vlachos and Bonoti (2006), while some boys may have difficulty reading and writing at the age of six, most boys catch up with the expected literacy levels by the time they are 11. From a neurophysiological perspective, improvement in writing could be due to maturation and increased organization of the brain hemispheres. At age 10, integrated cortical activity, that involves both hemispheres, starts taking place (Vlachos & Bonoti, 2006), which results in improved writing performance. As a result, development in written production at this age occurs in all children, irrespective of their gender (Vlachos & Bonoti, 2006).

Pajares and Valiente (2001) question if gender differences in writing actually lie in gender itself, or in the stereotypical belief girls and boys hold about writing, which is that girls are better at languages than boys. The researchers examined the motivation, beliefs and achievements of 497 (250 girls; 247 boys), 11-14-year-olds attending the same school in the US. Gender orientation beliefs were determined by administering a questionnaire expressing typical gender stereotypical beliefs in American society. The students were asked to express how strongly they identified with these beliefs. The students were then classified as having a strong masculine or feminine outlook, irrespective of their gender. Pajares and Valiente (2001) concluded that girls outperform boys in writing because their outlook is generally feminine, and writing excellence is stereotypically a feminine ability.

However other studies found no difference between gender in text production or speed. In 2016, Woods administered the essay subtest from the *Wechsler Individual Achievement Test*, *Third Edition* (WIAT-III) (Wechsler, 2010) to 309, nine and ten-year-old participants from North America. Participants were asked to write for 10 minutes about their favourite game, giving three reasons for this. To attain a good score, and therefore measure writing quality, participants were required to present their idea, support their idea with clear statements, end the essay well, and use link words. Writing speed was measured using a subtest of the *Woodcock-Johnson III Tests of Achievement* (WJ-III) (Woodcock et al., 2001). Participants were asked to generate sentences using words presented to them (for instance, “good”, “cake” and “is”), and to generate as many sentences as possible in seven minutes. Legibility and accurate syntax were also scored. The study could not identify gender differences in these writing tasks. The researchers attributed this to the fact that in the first task, both genders were knowledgeable about the topic, since they had to write about their favourite game. Furthermore, text production in the second task could not have varied much between gender, since the stimuli words had been provided. Likewise, a study by Ziviani and Watson-Will (1998), carried out on 372 students, aged 7 to 14, in Queensland Australia, found no differences in writing speed between girls and boys. These were asked to perform the speed subtest of the *Handwriting Performance Test* (see section *The Effect of Writing Speed on Legibility* in this chapter).

Alston (1995) found that the maximum writing speed of teenage girls (14.7 WPM), is achieved prior to that of teenage boys (13.8 WPM), parallel to their earlier physical maturity and different types of muscular development. Although by the time children are 12/13, the majority write at a reasonable speed, their handwriting is still developing (Barnett et al., 2001). If they are asked to write too often, too fast or too much before their handwriting has matured, bad habits become engrained and their handwriting is likely to decline (Barnett et al., 2001). Graham et al. (1998) affirm that writing speed reaches a plateau at age 14-15, as children start to approximate adult writing speeds. Writing speeds between 10 and 20 WPM are within the norms for typically developing 15-year-olds (Nilukshika et al., 2012). Addy (2004) and Hedderly (1996) consider teenagers with average speeds of around 15 WPM as fast writers. Hedderly (1996) considers those with writing speeds of 8 WPM or less to have serious writing problems. According to Dutton (1990) a writing rate of less than 12 WPM is considered abnormally slow, and warrants further investigation.

Gender and Legibility

The study by Weintraub and Graham (2000) (see section *The Effect of Writing Speed on Legibility* in this chapter), did not find any differences between the legibility of girls and boys. However, the study by Graham et al. (1998), (see section *The Effect of Handedness on*

Writing Speed in this chapter), stated that the handwriting of girls was more legible in the three subtests of the research – a copying task and two free writing tasks – than that of boys. Similar results were obtained by Ziviani and Watson-Will (1998), in their Australian study. The speed subtest of the *The Handwriting Performance Test* (HPT) (Ziviani & Elkins, 1984) was utilised for the study. Legibility of the phrase "cats and dogs" was judged by experienced teachers, on a scale from one to seven, with one representing poor legibility and seven representing good legibility. Girls' handwriting was rated as being more legible than that of boys. In Ziviani and Watson-Will's (1998) study, the writing speeds of girls and boys were found to be the same (see section *The Effect of Age and Gender on Writing Speed* in this chapter). The researchers concluded that this could have been because girls chose not to speed up not to compromise legibility. Research (Armenta, 2016; Burr, 2002) attributes females' superior legibility to social stereotypes. According to Armenta (2016), handwriting is a "social identifier" (pg. 5). This means that society expects females' handwriting to be neat and consistent, and males' handwriting to be hurried and irregular. In Hartley's (1991) study, when boys were asked to imitate the handwriting of girls, they wrote smaller and neater. When girls were asked to imitate the handwriting of boys, they wrote bigger and scruffier. In a study conducted by Burr (2002), 88 handwritten samples (44 from males and 44 from females), were judged for gender by 88 college and university students (44 males and 44 females), between the ages of 17 and 25. In a separate study, ten teachers in tertiary education, well versed in reading handwritten scripts, also judged for gender 20 of these handwritten samples. The samples were viewed for four seconds. Participants had also to explain why they had judged each individual script as having either a male or female author. Participants explained that female handwriting was neat, consistent, small, even, symmetrical and rounded, and that male handwriting was scruffy, uneven, messy, hurried and spiky. From these two experiments, Burr (2002) concluded that carefully executed handwriting was judged as being female, whereas sloping and spiky handwriting was judged as being male. Armenta (2016) conducted a similar study online. Participants had to determine the gender of the person who wrote the pangram *The quick brown fox jumped over the lazy dog.* This phrase was selected as it is gender neutral, and contains all the letters of the alphabet. Participants were also asked to establish the legibility of the phrase on a scale from one to five, with one being very messy and five very neat. Whereas less legible handwriting was attributed to males, more legible handwriting was attributed to females.

The Effect of Writing Speed Across Nationalities

The literature does not indicate any one nation to be faster at writing than any other nation. Variations in writing speed between languages could be due to whether text is being written in the participants' first or second language, with slower writing speeds usually resulting for second language writing (Piolat et al., 2008). Other variations could be due to differences in the instructions imparted, and to the tasks performed (Ziviani & Watson-Will, 2010). These variations may lie in the type of writing speed tasks, which could either be copying tasks, writing from memory, writing to dictation or free writing tasks. Other differences may be due to the task duration, which may range from 1 to 30 minutes, and whether participants are to write quickly, at a normal speed or in their best handwriting. The writing accessories used, whether pens and papers or digitized tablets, also contribute to writing speeds differences between different tests (Rosenblum et al., 2003a).

For instance, as early as 1915, Starch asked US participants to write from memory for two minutes and at natural speed, the phrase “Mary had a little lamb”. Different instructions could be similar to the ones by Ziviani and Elkins (1984) in Australia, who asked the children to copy 1) the phrase “cats and dogs” 2) as quickly as possible 3) on lined paper 4) for two minutes. In contrast, Phelps et al. (1985) asked children in the US to copy 1) a passage 2) on unlined paper, 3) at their own usual pace 4) for two minutes. Wallen et al. (1996) asked children in Australia to copy 1) a sentence (The quick brown fox jumps over the lazy dog) 2) “as quickly as you can, but as organized as you can” 3) on a lined page 4) for three minutes. O’Mahony et al. (2008) asked students in Ireland to write the sentence “The quick brown fox jumps over the lazy dog” as “quickly” and as “neatly” as they could for a three-minute period, stop for 30 seconds, skip two lines, and continue writing the sentence for a further nine minutes. A study by Horne et al. (2011) in the UK asked participants to write by hand for seven minutes a computer dictated short story. Also in the UK, Allcock (2001) asked participants to write freely about a topic of their own choice for 20 minutes. Finally, Barnett et al., 2007 gave participants in the UK different sets of instructions. One instruction was to copy the pangram *The quick brown fox jumps over the lazy dog* in their best handwriting. Another was to write the same pangram as fast as possible. Finally, they asked participants to free write about the topic *My Life* for 10 minutes. The different tests and subtests trigger different senses. Copying relies on the sense of sight, whereas dictation, relies on the sense of hearing (Fryburg, 1997). In view of all these differences, it has been impossible to compare age expected handwriting speeds of students in different countries or those having different first languages. The only clear pattern that emerged from all results is that writing speed increases with age (Rosenblum et al., 2003b).

The Effect of Learning Difficulties on Writing Speed

Handwriting difficulties in the early years are generally predictors of learning difficulties (LD) at a later stage (Harvey & Henderson, 1997; Simner, 1996). In this study the label learning difficulties (LD) encompasses a variety of special educational needs, such as learning disabilities, as well as other learning problems resulting from hearing and visual impairments, motor difficulties, and social, emotional and behavioural difficulties (SEBD) (Lipkin & Okamoto, 2015). Learning disabilities result from neurological dysfunction that hinder learning (Learning Disabilities Association, n.d.). Learning disabilities are life-long (Lagae, 2008), and can be general or specific. People with general learning disabilities usually have problems learning and understanding due to lower intellectual ability (Lowth, 2016). In this study, the term learning difficulties (LD) also includes students with mild general learning disabilities, denoted by slower learning rates and lower academic success (Bosson, et al., 2010). People with specific learning disabilities have problems with particular areas of the curriculum, such as mathematics, reading or writing (Lyon et al., 2003). Specific learning disabilities, such as dyslexia, do not affect intellectual ability (Lowth, 2016).

Researchers (Barnett et al., 2001; Waber & Bernstein, 1994) found that the proportion of students with LD who were slow writers, was higher than for other pupils. About 10% to 34% of school aged children seem to have handwriting difficulties (Feder & Majnemer, 2007; Smits-Engelsman et al., 2001). About 90%–98% of children with LD experience slow and laboured handwriting, and hence have problems developing age-related handwriting (McHale & Cermak, 1992). Handwriting problems are evident when handwriting speed is slow, writing is illegible, or when physical pain is reported without somatic pathology. Students with LD have problems with writing productivity (Koutsoftas & Graya, 2012), which is usually measured by counting the number of written words produced within a time limit. Studies show that children with LD are less productive than age–matched typically developing peers in both narrative (Mackie & Dockrell, 2004), and expository (Scott & Windsor, 2000) writing. In Mackie and Dockrell's (2004) study, a group of 33 mixed-ability children with an average age of 11 years, were asked to write, for 30 minutes, a story about a picture presented to them. The picture was taken from the *Picture Story Language Test* (PSLT) (Myklebust, 1965). The researchers took note of the time each child took to complete the task. Writing productivity was measured by counting the words written during that time. In Mackie and Dockrell's (2004) study, children with LD produced significantly less WPM than their age-matched peers at narrative writing. Similarly, the 20 children with LD (mean age 11.5 years), in Scott and Windsor's (2000) study, produced significantly fewer words in narrative and expository writing than their age matched peers. Slow writers struggle in those lessons that require a great deal of written work. They find it difficult to keep up with the amount of writing required of them at school, which may hinder their academic achievement (Bamidele, 2017).

Barnett et al. (2011) also examined the differences in writing speed between typically developing students and students with LD. Their study involved 12 students with LD between 11 and 13 years, attending a mainstream school in the UK. These were age matched with typically developing students from their sample. Findings show that the students with LD wrote at a significantly slower pace than their typically developing peers. Similar results were reported by Koutsoftas and Graya (2012). Their LD group included eight fourth grade (9-10 years) and eighteen fifth grade (10-11 years) students. The typically developing group of children included 18 fourth grade and 12 fifth grade students. Participants were required to produce a narrative and an expository piece of writing because both these genres were taught and tested in these grades. Results showed that the LD group wrote less words than the typically developing group in the narrative task. However, for the expository task there were no significant difference in productivity between the LD group and the typically developing group. The researchers concluded that given the right prompt, children with LD are capable of producing sentences as complex as those of their typically developing peers. This conclusion questions if an analytic assessment of writing, such as the measure of writing speed, is enough to plan writing intervention. It also suggests that a more qualitative assessment, that takes into consideration sentence complexity, spelling, and lexical accuracy and diversity, is also needed. The study suggests that an analysis of narrative and expository text demands is needed, as the differences between these two genre place different requirements on the children. Nonetheless, these results are to be interpreted with caution as the study needs to be replicated on a larger sample of children before results can be generalized.

The study by Sumner et al. (2013), shows that children with dyslexia have slow writing execution speeds due to spelling difficulties resulting from poor-working memory, rather than due to poor motor skills. In their study, Sumner et al. (2013) found that children with a profile of dyslexia write as fast as typically developing peers, but are slower as they pause more. The researchers used a digital writing tablet to measure the distance the pen covered while writing, and divided that by the time on task (excluding pauses made while writing). Sumner et al. (2013) showed that when the pauses taken while writing to consider spelling were eliminated, children with dyslexia can write at the same speed as chronological aged peers. The study by Sumner et al. (2014) was in a language with an opaque orthography (English). However similar results were attained in a language with a transparent orthography (Spanish) (Afonso et al., 2020). In Afonso et al.'s (2020) study, participants had to write 32 words on a lined paper placed over a tablet, using an inking pen. Results showed that children with a profile of dyslexia took longer to write the words due to more frequent and longer pauses, rather than to slower writing movements. The children in both tablet studies had the same mean age (9 years).

The Effect of Handedness on Writing Speed

Some studies investigated the impact of handedness upon writing speed. Handedness is a person's preference for using a particular hand (the dominant hand) (Holder, 2005). This is innate, as neurologically the cerebral hemispheres are crossed. O'Mahony et al. (2008) found no difference in writing speed between their Irish left-handed and right-handed participants. These were 607 male and 617 female students (ages ranging between 7.7 and 19.6 years), attending the last four years of primary education and all the six years of secondary education. Handedness was decided by noting the dominant hand of the student. The HST (Wallen et al., 1996) was administered, but with an additional nine minutes. Though no writing speed differences resulted between left and right handed participants, it is worth nothing that only students of average ability were included in the study. Results might have been different had there been a cohort of students with LD among the left or right handed students.

Clark (1953) carried out a study in Glasgow on 162 and 168, 11-12-year-old boys and girls respectively. Eighteen of them were left-handed writers. The children were classified as below average, average, and above average, according to their academic scores in English and Mathematics, and their intelligence test scores. Writing speed was assessed by *The American Handwriting Scale* (West, 1929), which required the children to memorise a short passage, and write it as neatly and as quickly as possible, from memory, for two minutes. The passage read:

Teacher gave us writing tests, and found quite a few very poor. Even lazy boys like the drills, and will improve the next time. Writing speed was measured as the number of letters written per minute. When the writing speed of the 18 left-handed writers were matched by gender and ability with right-handed writers, no writing speed difference was found between the left-handed and write-handed writers. Likewise, in a more recent study, Vlachos and Bonoti (2004) found no differences in the writing speeds of 91 left-handed and 91 right-handed Greek children aged between 7 to 12 years. The sample of students also included students with learning difficulties. Handedness was determined by the *Edinburgh Handedness Inventory* (Oldfield, 1971), which among other things, asked questions about the participants' hand preference when writing, using a pair of scissors, using a toothbrush, striking a match and opening a box. Handwriting speed was determined by counting the number of times the students managed to write the word "excursion" in Greek, in the space of 20 seconds.

Conversly, Graham et al. (1998) found that right-handed students were faster writers than left-handed students. The 900 participants in grades one to nine (6 to 15 years) from North America were required to copy as quickly as possible, and without mistakes, a paragraph printed at the top of the page. The task lasted one and a half minutes. Their handwriting sample was obtained from the *Group Diagnostic Reading Aptitude and Achievement Tests* (Monroe & Sherman, 1966). They also had two free writing tasks about familiar topics. For the first, they had to write a story starting "One day (choose person) had the (choose best or worst) day at school" (Graham et al., 1998, p. 44) for five minutes. For the second, they had to write for five minutes, explaining: "I like (choose person, place, or thing) because …" (Graham et al., 1998, p. 45).

Bonoti et al., (2005) found that there were many poor writers among their left handed participants. Their 91 left-handed and 91 right-handed Greek participants, aged 8 to 12 years, were asked to complete a set of writing and drawing tasks. For writing, the children were assessed in three writing tasks: the spontaneous writing of their name and that of their mother; the copying of letters, phonemes, words and sentences; and writing letters, words and sentences to dictation, using the Greek version of the *Luria-Nebraska Neuropsychological Battery* (Golden, 1981). Handedness was again determined by the *Edinburgh Handedness Inventory* (Oldfield, 1971). Poor handwriters were classified as those with poor or inverted letter forms and inappropriate spacing. Peachey (2004) states that the writing difficulties faced by left-handlers are due to directionality. Research shows that left and right-handers draw horizontal lines differently. Left-handers draw these lines from left to right. Right-handers draw them from right to left (Glenn et al., 1995). This might affect writing performance as right handed people write from right to left, away from the body, and thus are able to see what they write. Left handed people write from right to left too, but towards the body, which makes it difficult for them to see what they write. Hence they adapt their penhold to overcome this difficulty. They curve their hand above the writing line to be able to see what they are writing. Peachey (2004) terms this as an inverted penhold, which can compromise speed and neatness, as the hand tires easily (Peachey, 2004).

Lohman (1993) found no difference in the legibility of the 138 left and right-handed undergraduate university students in his sample. The students were asked to copy two paragraphs which contained all the letters of the alphabet, and the digits from zero to nine. These samples were compared to the *Handwriting Scale of the Test of Written Language* (TOWL) (Hammill & Larsen, 1983). Each sample was compared to the five sample paragraphs of the TOWL, and given a value from zero to ten. Results showed no legibility differences between left and right handers. However, the participants who angled their paper when writing, and who did not invert their hand when writing, had higher legibility scores than those who did not angle their paper and who inverted their hand when writing.

Whilst there is no available local literature with regard to handedness and its effect on writing speed, a study by Farrugia (2011) conducted on 11 left-handed 10-year-old girls and a control group of 11 right-handed age-matched girls, revealed no differences in the effect of handedness on reading skills. Farrugia (2011) used a handedness questionnaire to determine handedness, and the *Differential Ability Scales Single Word Reading Test* (Elliot, 1990) was used to assess reading.

The literature shows contradictory results derived from studies concerning the writing speed of left and right handed people (Vlachos & Bonoti, 2004). Hence the importance of investigating in this study if handedness affects writing speed, and whether this is related to directionality.

The Effect of Socio-economic Status on Writing Speed

Socio-economic status (SES) is the social position of an individual or family, measured as a combination of income, occupation and education (American Psychology Association, 2019; Sirin, 2005). In the past, research considered the father's occupation to determine SES (Mifsud, 1997; Wagner et al., 1989; Micallef, 1981). However, Graham et al. (1998), in their study about cursive handwriting, speed and legibility, stipulated SES by the mother's level of education. In the international *Programme for International Student Assessment* (PISA) (Ministry for Education and Employment, 2009) study, which measures the performance in mathematics, reading and science of 15-year-olds worldwide, the pupils' SES was defined by both "parents' level of education, their qualifications and their main occupations" (p. vii). More information about the participants' socio-economic status in the PISA study was obtained by questions about the families' possessions.

Intelligence and ability are supposed to be the two main criteria for academic success. However critical investigations suggest that reality is not so straightforward, and that socio-economic status (SES) plays an important role (Directorate for Learning and Assessment Programmes, 2015; Ministry for Education and Employment, 2015). "Parental support for learning at home, parental emotional support and parental education in years of schooling are all positively and significantly related to students' socio-economic status, which implies that parents with a higher level of education and higher socio-economic status tend to support their children more both academically and emotionally" (Ministry for Education and Employment, 2015, p. xii). There is a significant positive relationship between SES and performance in Science, Reading and Mathematics (Ministry for Education and Employment, 2015). The TIMSS (2015) study (Directorate for Learning and Assessment Programmes, 2015), states that the number of students with high SES attending independent schools (87.5%), is significantly larger than those attending church (25.0%), and state schools (15.8%). Economical affluence predicts academic achievement in Mathematics and Science, and this could explain why students attending independent schools achieve better grades in these subjects than other students (Directorate for Learning and Assessment Programmes, 2015).

The Malta Primary Literacy Value Added study (Mifsud et al., 2004), matched the results attained at a national literacy survey study completed by pupils aged 9-10 with their previous scores attained when tested at ages 6–7 (see section *Local Research* in this chapter). In their study, the mothers' and fathers' occupations and educational levels were the variables that were considered as having possible influence on literacy development. Mifsud et al. (2004) concluded that the higher the parents' level of education, the greater the child's academic progress. Parental occupation was taken as an indication of the material and cultural resources available in the home to promote a child's education. The social status of the father's occupation was strongly related to academic progress, in this order: "professional, managerial and administrative, skilled craftsmen and higher clerical, skilled manual workers, semi- and unskilled workers, not employed (mainly unemployed)" (p. 96). When mother's occupation was considered in exclusion of all other factors, such as level of education and school type, it was found that the amount of progress made academically by the child increased with the increasing occupational scale.

The study by Cachia (2001) found a positive correlation between social class and English language proficiency. Students from an upper or middle class background are more proficient in English than their peers from a working class background. However, students from a middle class background, rather than an upper class background, were found to be the most proficient in English. This conflicts with the regression analysis results of the PISA (Ministry for Education and Employment, 2018) study, which predicted that for every unit increase in SES, scores are expected to increase by 32 in Reading, and 35 in Science and Mathematics, respectively. The study by Cauchi (1990), on the other hand, supports the PISA (Ministry for Education and Employment, 2018) study, in that a lineal relationship was found between socio-economic status (SES) (parental occupational status and education), and achievement. According to Cauchi (1990), the higher the parents' occupational status and levels of education, the higher the grades the students achieved in essay achievement (content, arrangement and correct English grammar).

According to Gatt's (2012) study, the largest percentage of manual labourers resides in the south of the island; whereas the largest percentage of those with administrative occupations reside in the north. This is confirmed by the Census of Population and Housing of 2011 (National Statistics Office, 2014), which states that the highest number of managerial positions (3,820) are to the found in the Northern Region, compared to the 1,791 managerial occupations in the Southern Harbour Region, resulting in a north-south divide in occupational patterns. Gatt's (2012) and Martinelli's (2016) studies identified a high correlation between socio-economic status and early school leavers, with the highest percentages of early school leavers residing in the Southern Harbour region (Gatt, 2012) (see section *The Effect of Different Geographical Regions on Writing Speed* in this chapter).

The socio-economic status of the Irish participants in O'Mahony et al.'s (2008) study, was determined by whether they attended a regular or disadvantaged school. The majority of the pupils attending disadvantaged schools hailed from marginalized, socio-economically deprived communities. O'Mahony et al.'s (2008) study examined whether attendance at either regular or disadvantaged schools affected writing speed. They found significant differences in writing speed, all through the secondary school years, between students attending regular schools and those attending disadvantaged schools. Students in their sixth year at disadvantaged schools had the equivalent writing speed of students in the fourth year at regular schools, and wrote ten letters per minute less than students in the sixth grade at regular schools. The researchers concluded that students attending disadvantaged schools are at a drawback in written examinations due to their slow writing speeds.

According to Lee-Corbin and Evans (1996) handwriting and socio-economic status are directly related. Due to the stressors of poverty, Lindmark (1993) proposes that needy families may not give letter formation and reading their due importance. Poverty and low literacy fuel one another. This is so as the labour market keeps requiring even more advanced qualifications and literacy skills, as time goes by (Bartolo, 2012). Hence illiterate people find it hard to find gainful employment, often resulting in poverty (Busuttil, 2017). Though lower-class parents value education immensly, they don’t consider it as a means for their children of acquiring future employment, since they foresee it to be an uphill stuggle for them (Brimmer, 1997). The PISA (Ministry for Education and Employment, 2018) study affirms that a student’s birth place, first language and parents’ occupations often strongly predict academic achievement. A student’s aspirations may be restricted by a lack of role models, which often influence the selected educational path.

Sirin (2005) examined studies about socio-economic status and academic achievement carried out and published in journals between 1990 and 2000. The sample size was 101,157 students attending kindergarten up to high school, from 6,871 US schools. Overall, all studies indicate that the family SES impacts students’ academic achievement, as it provides the necessary social capital for success. The necessary education tools are supplied at home, and allow children access to well-resourced schools. However, according to the PISA (Ministry for Education and Employment, 2018) report, schools permit a fairer access to learning opportunities when their resources are directed towards their disadvantaged students. In fact, a study by D’Angiulli et al., (2004) showed that high quality instruction can reduce the impact of SES on academic achievement. Participants in their study were 1,108 kindergarten to grade five students, from all the 30 schools of the North Vancouver (Canada) district. The literacy program offered at school included instructional activities emphasizing the sound-symbol relationship of words, cooperative story writing and journal writing, and guided, shared, independent and home reading. SES was determined on income, employment, education and immigration background. The *Wide Range Achievement Test - 3* (Wilkinson, 1993) was used to assess the word reading level of the children. Children had to read a list of letters and words of increasing difficulty. Words in the list were “cat”, “book”, “horizon” and “itinerary”. The test was discontinued once the child read ten words incorrectly. Whereas in kindergarten the effect of SES on academic performance was evident, owing to the quality school instruction imparted to the children, this gradually disappeared by the time the children reached fifth grade. Similar results were obtained by Howard et al., (2014). Participants were 447 children (kindergarten, aged 5-6; third grade, aged 8-9; fifth grade, aged 10-11), from various regions of the US. The *Woodcock Language Proficiency Battery-Revised* (Woodcock, 1991) was administered to assess reading skills. At kindergarten level, SES had an impact on academic performance, but this was no longer the case by fifth grade. The researchers attribute this to the effects of school instruction.

These studies make it necessary to examine the influence of SES on writing speed in this study, since this impacts academic achievement and examination success. If SES still impacts academic achievement by the time the students are 14-15-year old, this might indicate that local educational institutions are not catering for socially disadvantaged students by offering them high quality education. This is essential in order to decrease the rate of early school leavers in Malta, which in 2019 recorded the highest rates of early leavers compared to other European countries (Eurostat, 2020).

Research also shows that socio-economic status has an effect on fine and gross motor proficiency. Morley, et al.’s (2015) study in the UK used the *Bruininks-Oseretsky Test of Motor Proficiency, Second Edition Brief Form* (BOT-2 BF, Bruininks & Bruininks, 2005), to assess the fine and gross motor proficiency of 4 to 7-year olds. Fine motor skills were assessed through tasks such as drawing, writing and threading blocks. Gross motor skills were assessed through tasks such as jumping, hopping, running, balance and ball skills (Lucas et al., 2013), Results showed that high SE children significantly outperformed middle and low SE children in fine and gross motor proficiency (Morley, et al.’s, 2015). Gottschling-Lang, et al. (3012) also found socio-economic status to significantly affect the motor skills of 3 to 6 years old preschoolers in Germany. However, in their study, gross motor development was not effected by socio-economic status. This could be due to the different assessment tools used, which in the case of Gottschling-Lang, et al.’s (3012) study, was the *Dortmund Developmental Screening for the Kindergarten* (Tröster, et al., 2004).

The Effect of School Type on Writing Speed

Cilia and Borg (1997) interviewed a number of Maltese parents about their choice of sending their children to either state or non-state (church and independent) schools. Many of the parents justified their choice in terms of their belief that their children would achieve more, in academic terms, in a church or independent school, than in a state school. The PISA study of 2009 reported that this is because “families of students attending private schools tend to have significantly higher economic, social and cultural status than other students. Families of students attending state schools tend to score lower than average on the Economic, Social and Cultural Status (ESCS) index for Malta; whereas, families of students attending church schools tend to score higher than the average ESCS” (p. 56). This situation supports the positive relationship between socio-economic status and academic attainment discussed in the previous section. In fact, in the 2009 PISA study, attainment was found to be positively and significantly related with all items of the ESCS index, these being father's and mother's occupation, father's and mother's level of education, educational resources at home, and family wealth (Ministry for Education and Employment, 2009). This indicates that all aspects of social, economic and cultural status impact academic achievement at Secondary level[15]. This conclusion is supported by the PISA (Ministry for Education and Employment, 2018) study, which shows that the reading, science and mathematics scores of the students in state, church and independent schools are positively and significantly related to ESCS scores.

The study by Mifsud et al. (2004) (see section *Local Research* in this chapter) corroborates the finding that higher SES impacts literacy and academic achievement positivity. Children attending church and independent schools attained up to three marks more in an English reading test, and up to eight marks more in a Maltese reading test, than children attending state schools. The positive relationship between academic attainment and SES seems to be true even for the primary level. Children whose parents had the highest levels of education and held professional or managerial posts, attained higher raw scores than those children whose parents had lower levels of education or were in semi-skilled or unskilled professions. The difference in scores between church and independent schools when compared to state schools is a reflection of the children's SES, as children from affluent homes usually attend church or independent schools, whereas children from less affluent homes usually attend state schools (Ministry for Education and Employment, 2009).

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[15] Research was carried out in Science, Mathematics and Reading.

A study by Cachia (2001), studied English literacy levels among fifth formers in Maltese schools. This study was conducted when state schools were still single sexed and differentiated by ability. The more able students sat for and passed the Junior Lyceum exam[16] in year six, and hence were able to attend state Junior Lyceums. The less able students, who failed the Junior Lyceum exam, were compelled to attend state area secondary schools. Students could attend secondary church schools only upon passing the Common Entrance exam in year six. Cachia's (2001) study therefore included three school types (church, independent and state schools) and assessed the literacy levels of 245 participants (128 males and 117 females) via questionnaires meant to determine the students' abilities and aptitudes towards English. Structured interviews in the form of a reading comprehension, meant to assess the students' reading levels, comprehension and speaking skills, were administered to two students from each class. The students were required to read the comprehension passage and answer the questions verbally, in order to be audio recorded. Results indicated that, overall, students attending independent schools and church schools performed better than those attending state schools. Although writing skills were not assessed in this study, findings point at school differences in literacy levels.

Similar results were reported by the MATSEC Statistical Report of 2018 (Matriculation and Secondary Education Certificate, 2019b), which shows remarkable differences between school types. While church (75%) and independent school (65%) candidates sat for at least nine exams in different subjects, only 42.6% of state school candidates did so. Furthermore, candidates from independent schools (53.1%) and church schools (51.5%) on average outperformed state school candidates (25.2%), passing in at least nine subjects or more, at

[16] The Junior Lyceeum exam was an exam held at the end of year 6, which streamed students by ability.

Grades 1-7[17]. Independent school students obtained Grades 1, 2, and 3 in most subjects. These reports show that school type has a substantial effect on academic achievement, since this is linked to socio-economic status (see section *The Effect of Socio-economic Status on Writing Speed* in this chapter).

From the literature, it is evident that children from different school systems perform differently in literacy tests. In her study, Agius (2012) (see section *The Effect of Bilingualism on Writing Speed* in this chapter) showed that church schools students performed at a par, or better, than children in state and independent schools in the speed and accuracy of the English and Maltese free writing tasks. The author attributed this to the fact that children in church schools were taught to read both phonetically and by sight, as opposed to children in state and independent schools, who were taught to read only by sight. Spelling improves when children acquire the alphabetic principle (Berninger et al., 2002), which improves writing fluency.

The Effect of Different Geographical Regions on Writing Speed

In the Malta Primary Literacy Value Added study (Mifsud et al., 2004), the geographical regions were those defined by the National Statistics Office (2002) (see Appendix B). In their study, a participant's geographical region was determined by their school's location, rather than by the participant's home town. As a result, in Mifsud et al. (2004)'s study, analysis was confined to state schools only, since the catchment areas of church and independent schools include students coming from all over the island. The catchment area of pupils of state schools includes mostly students residing in that, and nearby areas. Mifsud et al.

[17] Paper I is common to all students. Paper II comprises a choice, with paper IIA having more demanding questions than Paper IIB. Candidates opting for Paper I and Paper IIA may qualify for Grades 1 to 5, or fail. Candidates opting for Paper I and Paper IIB qualify for Grades 4 to 7, or fail. (L-Universita' ta' Malta, 2020).

(2004) found that pupils from the inner-harbour regions made less progress in reading attainment than the pupils in Gozo.

The sons and daughters of parents with tertiary or University education are more likely to attain university degrees themselves than those without (Brownstein, 2014; Lloyd. 2020; Schembri, 1991). As far back as 1999, Baldacchino reported that the working class area of the Southern Harbour Region had a graduate density which was a staggering 20 times less than that in the "fashionable, upper middle class areas of Attard, Balzan and Lija" (p. 210), situated in the Western Region. In her study, Gatt (2012), focused on socio-economic inequalities in Malta and early school leavers. The latter are defined as people between 18 and 24 years, who left school when they were still in early secondary, and who have not progressed any further with their education or training (Eurostat, 2010). According to Gatt's (2012) study, the Southern Harbour region showed high numbers of early school leavers, low educational levels and high unemployment rates. The Western and Northern regions showed the lowest rates of early school leavers. The study identified a high correlation between early school leavers and socio-economic status (see section *The Effect of Socio-economic Status on Writing Speed* in this chapter). The results of the 2011 census endorse the connection between SES and educational achievement (National Statistics Office, 2014). According to Debono (2014), the high illiteracy levels in some Maltese towns are the result of the lack of educational resources in schools in the past. Zahra Sacco (2003) comments how teachers teaching in an area secondary school (see section *The Effect of Socio-economic Status on Writing Speed* in this chapter), in the Southern Harbour Region, felt disadvantaged due to lack of resources and an unattractive environment.

The Effect of Bilingualism on Writing Speed

It is quite demanding to write in one's native language, since this draws upon several language and metacognitive abilities. It may be even more demanding to write in a second language due to inadequate linguistic knowledge (Schoonen et al., 2003). The benefits of bilingualism to one's metalinguistic awareness are evident in the longitudinal study by Merisuo-Storm and Soininen (2014), who investigated the first language proficiency of students who had been in bilingual education for six years. It resulted that the reading, writing and spelling skills of the first language of bilingual students were better than that of their peers in monolingual classes. Soltero-González et al., (2012) confirm this research by concluding from their studies that bilingual students are resourceful learners who employ a number of bilingual strategies at the word and sentence level when writing in the target language (see section *Bilingual Education in Malta* in this chapter). Talbot et al., (2014) in a study they carried out in the UK with 20 self-reported bilingual children, confirm that bilingual children are "likely to have two linguistic reference points, from at least two languages, for the same information" (p. 119). However, this does not mean that bilingual children are capable of writing more. In the study, both groups wrote an equal number of words, and had similar lexical diversities. With regard to writing speed, as a writer's proficiency in L2 increases, their writing speed increases too, as more words are written between pauses (burst length), and there are less revision episodes (Chenoweth & Hayes, 2001).

Howard (2003) studied the effect of home language on the writing performance of 474 US bilingual Spanish and English students. In her longitudinal study, the researcher collected data each year, starting when the children were in third grade (8 years) until they were in fifth grade (10 years). The researcher found a positive correlation between home language and writing performance in that language. In her study, Howard (2003) studied the higher-order skills of composition (Howard, 2003). Similar results for home language and lower order transcription skills[18] were attained in another longitudinal study on 185 US bilingual Spanish and English students, starting when the students were in second grade (7 years) until they were in fifth grade (10 years) (Howard & Neugebauer, 2015).

Brimmer (1997) gave a questionnaire to 200, 12-13-year-old students in state, church and independent schools. Questions five and six of the questionnaire determined the language the students spoke at home and with their friends. The categories were Maltese only, English only, Maltese with a little English and English with a little Maltese. Brimmer (1997) did not define what is to be understood by "a little English" or "little Maltese", which can be very subjective from student to student. The students' academic achievement in English was determined by the grades they attained in their English mid-yearly examinations. As students in different schools sat for different papers, the raw scores were converted to percentiles, so that comparisons could be made. Brimmer (1997) concluded that neither home language, nor the language spoken by the students with their friends, affected achievement in English. This is similar to Agius (2012) who also found that home language had no significant effect on the participants' performance in reading and writing.

The *Maltese-English Speech Assessment* (MESA), was developed by Grech et al., (2011a) to assess speech disorders. Two hundred and forty-one bilingual (Maltese-English) children aged two to six years took part in the study. These were divided into two groups, based on their home language, that is, those that were bilingual as reported by the parents and those that were monolingual (either Maltese or English as their home language). The children

[18] Such as spelling and handwriting.

were asked to name a set of pictures. The words elicited all the Maltese and English consonants and vowels. Participants could reply in either Maltese or English, their responses were written down, and their phonetic inventory[19] was noted. It was noted that the children who were exposed to both languages at home stopped their speech developmental error patterns earlier[20]. The study indicated that the rate of phonological acquisition may vary depending on whether a child is brought up in a monolingual or bilingual environment.

Conversely, in Cauchi's (1990) study, students whose parents spoke to them only in English during their childhood, and who used English when young and at the time of the study, achieved the highest essay grades in English at Form four. The students whose parents addressed them in both English and Maltese in their childhood scored the second highest. Those students whose parents spoke to them only in Maltese achieved the lowest essay grades in English[21]. Cauchi's (1990) study was carried out on 343 state (Junior Lyceum and Area Secondary) and church (boys' and girls') schools in Malta. Participants were allowed an hour to write about a person they hoped never to meet again. Fifteen marks were allotted for content and arrangement, 15 for expression and 15 for correct English grammar. Cauchi (1990) found a strong association between SES, the language the parents used to address the students during their childhood, and the language the students spoke when young and at the time of the study. The higher the parents' SES, the more inclined the parents were to speak English with their

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[19] A set of speech sounds that are distinctive, such as in words like *pork* p**o**:k and *poke* p**ou**k, distinguishable by their different vowel sounds. Accordingly, the phoneme inventory of English will include both o: and ou.
[20] An example of a speech developmental error pattern is omitting the weak syllables in words, such as the "um" in "umbrella". Another is making those sounds normally generated by the tongue at the back of the mouth, with the tongue positioned at the front of the mouth. An example would be "teep" instead of "keep", replacing the "k" sound produced at the back of the mouth, with the "t" sound produced at the front of the mouth (Kinnane, 2015).
[21] Essay writing took place only in English.

children when young, and the more inclined to speak English were the students at the time of the study. This resulted in the latter achieving higher essay grades in English[22] in Form four.

Briffa (1980) compared the literacy performance of a year five class from a mixed Maltese-English speaking church school, whose first language was mixed Maltese-English, to that of another year five class, attending a state school where the children were exposed mainly to Maltese, and whose first language was mainly Maltese. The children were administered two linguistic tests, one in English and one in Maltese, developed by Falzon (1972a, b, c, d). These tests assessed reading comprehension and reading abilities. For the comprehension test, the children were required to complete sentences by choosing the correct word from the ones provided. For the reading test, the children had to read a number of words correctly. The number of correct words determined the score. They were also administered the *Goodenough-Harris Draw-A-Man Test* (Harris, 1963), which asked participants to draw a man, a woman and themselves, from head to foot. The drawings the children produce give an indication of their cognitive development. Findings show that children attending the church school performed better in all tests. However, it is worth noting that the church school children had higher levels of parental education than the state school children, which would have helped create an academic climate at home. There are many contributing factors to the superior scores of the church school's children, two of which might be bilingual advantage and SES.

The study by Mifsud and Agius (2018) investigated the word blending skills of 100 monolingual or bilingual mixed-gender Maltese children, aged between six and seven years. Monolinguals were those whose first language was either Maltese or English. Bilinguals were those who spoke both Maltese and English at home. Participants attended either state, church

[22] Only Essays written in English were examined in the study.

or independent schools. The “Blending Words” subtest of the second edition of the *Comprehensive Test of Phonological Processing* (CTOPP-2) (Wagner et al., 2013) was used to assess the participants’ word blending skills in English. The Maltese word blending test was developed for the purpose of the research. The Maltese test was created from words found in the children’s readers, used by local state, church and independent schools. The children listened to the individual sounds making up a word, and they had to blend the sounds together to form that word. Results showed that children attending state schools performed better in Maltese word blending, whereas children attending church and independent schools did better in English word blending. The authors state that this could possibly be due to the influence of school language. However, the study does not specify which language is spoken by which school system.

The study by Zammit et al., (2018) investigated Maltese word and non-word spelling abilities of Maltese children in grades four, five and six. Spelling abilities were assessed using a standardized Maltese spelling test, which formed part of the TORPAM test battery (Agius, 2012), and a non-word spelling test developed for the purpose of the study. Non-word reading requires the child to recognize the letter units, and cannot be performed by sight reading. Therefore, asking the child to read non-words provides a test of phonological decoding (Elbeheri et al., 2011). Poor decoding is one of the best predictors of reading failure and dyslexia (Norton & Wolf, 2012). The Maltese Spelling Test of the TORPAM includes 60 test items divided into groups of 20, corresponding to each of grade four, five and six. The non-word spelling test paralleled the number of items of the Maltese Spelling Test of the TORPAM. Results showed that school language significantly affected spelling rate, with bilingual participants being slower spellers than Maltese-dominant participants. This may be because the linguistic codes in bilinguals are active simultaneously (Olulade et al., 2016), leading to more strained cognitive loads (Zammit et al., 2018). Results also showed that grade effected spelling, with the older students attaining better scores than the younger students. This may be due to the longer exposure of the elder students to the curriculum (Zammit et al., 2018).

Locally there is less research conducted on writing. According to an occupational therapist working at Malta's Child Development Assessment Unit, whenever a student is assessed for literacy difficulties locally, it is common practice to administer assessment batteries that have been standardized in the UK or US, either on their own, or in combination with tests that have been standardized on the local population, (R. Bondin, personal correspondence, September 19, 2018.) The only literacy assessment that included writing, developed locally, was the *Test of Reading, Phonological Awareness and Memory* (TORPAM) (Agius, 2012). The research conducted by Agius (2012) focused on the development and standardization of a bilingual (Maltese and English) Literacy Assessment Battery, for the diagnosis of Maltese children in grades four, five and six, with specific learning disabilities. Another aim of Agius's (2012) study was to develop reading norms for typically developing children. The Maltese and English subtests included word and non-word recognition, word and nonword segmentation, rapid naming, digit memory (forward and backwards), reading comprehension, spelling and free writing. For the free writing tasks, the TORPAM asked participants to write a short paragraph in Maltese and English about any topic of their choice, about school, or about a hobby. Sentences were scored according to four characteristics: motor skills (e.g. handwriting); writing conventions (e.g. capital letters and punctuation marks); ideas (e.g. sequencing); and spelling. Points were assigned according to the mistakes made: (0 errors

= 3 points; 1 error = 2 points; 2-3 errors = 1 point and 4+ errors = 0 points). It also measured the time taken by the children to write the paragraph. Results showed that the English and Maltese free writing tasks were not significantly affected by home language. With regard to school language, results showed that children attending all school types (state, church and independent) were equally accurate in both the English and Maltese free writing tasks, irrespective of the degree of exposure to the English language, the Maltese language or both languages concurrently. With regard to writing speed, again there were no significant differences between the children's performance, irrespective of the degree of exposure at school to English and Maltese. Yet with regard to the Maltese free writing task, children exposed mainly to Maltese at school were 50 seconds faster at the free writing task than children exposed mainly to English, and 40 seconds faster than children exposed to both Maltese and English. The participants in Agius's (2012) study were aged between 8 and 12. The development of a new test is justified since the norms developed by Agius's (2012) study target a younger age group than the ones in this study.

A number of local researchers standardised UK or US literacy assessment batteries on the local population. These include assessment batteries that analysed word reading skills, such as the ones by Martinelli (2009), who standardised the *British Ability Scales* (BAS) (Elliot, 1979), and Vella (2012), who standardised the *British Ability Scales* (BAS) II (Elliot, 1997). Another test that was standardised on the local population was the *Suffolk Reading Scale II* (Hagley, 1987), that diagnoses reading difficulties (Pace, 2012). Other researchers developed and standardised novel assessment batteries on the local population. These include the *Maltese Word-Reading Test* (Bartolo, 1988), developed to assess reading ability in Maltese. Grech et al. (2011b), developed the *Language Assessment for Maltese Children* (LAMC), to measure children's language development and to assess their improvement following speech and language therapy. Depasquale (2003), developed a receptive assessment tool for children aged between three to five entitled *Kemm Tifhem?* (How much do you understand?). The researcher intended to attain a measure of receptive language through grammatical categories, such as, instructions (e.g. Uri l-platt [Show the plate]); possessives (e.g. Urini ħalqu [Show me his mouth]); and comparatives (e.g. Min hu itwal, il-mama jew il-papa? [Who is taller, mum or dad?]). A study by Grech et al., (2017), was conducted on reading comprehension skills in Maltese. The *Manual of Standardized Tests for Dyslexia*, drawn up in 2010 by the University of Malta and the MATSEC Board, includes standardized English and Maltese spelling and reading tests for Maltese students aged 6 to 16 (Camilleri et al., 2010). Camilleri et al. (2010) compiled a bilingual *Standardised Tests for Dyslexia*, comprising 87 graded words to be spelt in English and Maltese, respectively. This list of studies and assessment batteries discussed may not be exhaustive. However, with the exception of the *Test of Reading, Phonological Awareness and Memory* (TORPAM), (Agius, 2012), all the literacy assessment batteries standardized on the local population focus on reading skills. Only the TORPAM assessed spelling, free writing and writing speed.

Even though several international studies investigate writing speed and socio-ecomomics levels, in Malta these studies are limited, making it difficult to investigate the problems related to handwriting. The available data indicates that handwriting speed is measurable, and to reach this end, an objective assessment battery involving a standardized test of handwriting is necessary (Summers & Catarro, 2003; Barnett & Henderson, 2005). Up till now the evaluation instrument used in Malta to assess writing speed was the *Detailed Assessment of Speed of Handwriting* (DASH). It is crucial that an adaptation of an English test, such as the DASH, is considered locally for the Maltese population. This is required as the DASH is standardized on a British population and hence is not scientifically suitable to administer and score on a Maltese population. According to Van Waelvelde et al. (2012), it is necessary for tests to have culturally adapted norms, because of cultural differences in alphabet, orthographic depth and educational systems, such as the age when formal handwriting is commenced in schools and different teaching methods.

To date, writing speed assessment has been used solely by educational psychologists and occupational therapists to determine whether students referred to them by the educational authorities should be entitled to extra time in public examinations. Timely identification of writing disorders then leads to the development of tailor-made intervention writing programmes for the students at risk. Interven.tion programs are crucial as handwriting difficulties are not sorted without intervention (Feder & Majnemer, 2007).

Conclusion

Criteria for the identification of writing difficulties include poor legibility (letter formation, spacing, size and line straightness), and below age writing speed (Feder & Majnemer, 2007). Educational psychologists and occupational therapists make use of writing speed assessments to decide if students should be granted extra time and other access arrangements in national examinations. Such access arrangements may determine the grades awarded, and hence the importance of a concise measuring tool and standardized scores. However, writing speed assessment is not so clear cut, as it may be influenced by various other factors such as gender, age, socio-economic status, handedness, writing style, school type and bilingualism. There is also an important relationship between the quality (legibility) and quantity (writing speed) of written text.

Research Questions

The following research questions, were derived following a review of the literature in which the gaps in local and international research were identified. To date, there is no available bilingual writing speed assessment for Maltese students. There is a need to adapt the DASH to the local population, with two writing speed assessment batteries being created, one in English and one in Maltese. Given this gap, the following questions were set to be addressed in this study.

RQ 1. Is the *English-Maltese Assessment of Speed of Handwriting* (EMASH) a valid and reliable tool to identify handwriting difficulties in Maltese 14-15-year-old students?

RQ2 . Do factors such as First Language, School Language, Ability, Socio-economic Status, Geographical Regions, School Type, Handedness, Writing Style, Age, Nationality and Gender, affect writing speed?

RQ 3. Does writing speed affect Legibility?

This chapter has discussed various writing speed tests and the effects of variables such as Gender, Writing Style, Ability and Socio-economic Status upon writing speed. It has also presented a review of local literature, which, together with the literature review, have given rise to the research questions. The following chapter (Chapter 3) will discuss the method applied in this research.

Chapter 3: Method

This chapter discusses the method employed for the pilot test and the main study. It describes the participants' selection, the research tools, administration of the research tools, and coding and scoring the variables.

Participant Selection

A convenience sample population of 70 students took part in the pilot study, and 401 students took part in the main study. Fourteen-fifteen-year-old students were selected for this study, as it is at this age that writing approximates the speeds typically obtained by adults (Graham et al., 1998), and hence determine the maximum writing speeds reached by secondary school students. It is also at this age that students in Malta are usually tested when granted access arrangements for their national examinations. The samples were stratified by School Type (state, church and independent), Gender and Ability. The ratio of the participants for both the pilot and the main study was 10 (state): 3 (church): 1 (independent), respectively. This reflects the Maltese student population attending state, church and independent schools, with the ratio being 10:3:1 respectively. A cross-sectional research methodology was employed to attain a representative sample of Year 10 students in Malta. In order for the sample to represent the population sample of the schools being tested, the assessment battery was also administered to both Maltese and non-native students attending the selected schools; as well as to typically developing students, and to students with learning difficulties. The students with learning difficulties attended main-stream schools not resource centres. Only non-native students who were not proficient enough in Maltese were excluded from the study. Participants were selected from all the geographical regions of Malta. A quantitative research methodology was employed to create writing speed norms for 14-year-old students that may be generalized to the wider population. This was so to determine if any of these variables (School Type, Gender, Ability, Nationality and Geographical Regions) influence writing speed. Below is a summary of the inclusion and exclusion criteria of the participants.

Inclusion Criteria

- 14-15-year old students in Year 10 classes
- males and females
- Maltese and non-native students
- students from state, church and independent schools
-
- typically developing students and students with learning difficulties
- students from all geographical regions of Malta

Exclusion criteria

- Non-native students not proficient in Maltese
- students in resource centres

Data Protection and Ethical Clearance

Prior to the data collection, ethical approval was sought and obtained from the Faculty Research Ethics Committee (FREC) and the University Research Ethics Committee (UREC) (see Appendix Q) at the University of Malta. Once obtained, consent of the Ministry of Education (see Appendix R) and that of the Secretariat for Catholic Education (see Appendix S), the college principals (see Appendix T), as well as that of the heads of schools (See Appendix U), was also sought and obtained. Consent was also sought from the participants' parents by means of an informative letter provided by the researcher (see Appendix N), which was passed on to them through the school. Once consent was obtained, a date for test administration was agreed upon with the head of the individual schools. When the scripts were passed on to the research assistants for processing, the participants' names were blotted out beforehand. The participants' identity was protected by creating a coding system to keep the students' identity undisclosed (see section *Data Coding System* in this chapter).

Pilot Study

Sample Population and Recruitment

The participants selected to take part in the pilot study were secondary school students (age range 14 to 15 years) in Year 10 classes, attending two state schools (a boys' and a girls' school), two church schools (a boys' and a girls' school) and a co-ed independent school. Ability was a student selection criterion, to reflect the various academic abilities of the Maltese student population. A request for high ability, average and low ability students was made to the head of school, according to the students' academic performance. Information about the participants' academic performance was gathered from the assistant heads of schools. In state schools, students are streamed, with students in the 10.1 class being the high ability students, and those in the last class of the form, being the low-ability students, those usually following the Core Curriculum Progremme (CCP) (see section *The Maltese Educational System* in Chapter 2). The placement of a student in a particular class is determined by their examination reports. In state schools, consent forms were given at random to three students in each class of the form, in order to recruit students of different abilities. More consent forms were given in the girls' state school, as there were more classes in the form. For more detail about the recruitment process in state schools, see sections *Boys' State School* and *Girls' State School*, in Appendix V).

In total, the parental consent form (see Appendix N) was distributed to 105 students (48 boys and 57 girls), the parents of 88 students consented to their child's participation in the pilot study. Table 2 displays the number of students to whom the consent form was given, those who returned it, the students who sat for both sessions, those who missed a session, and the students who did not assent to the pilot study. The students who missed a session, or did not assent to the research, were excluded from the pilot study. The remaining 70 students (34 boys and 36 girls), sat for both tests, and hence were the ones included in the pilot study. A sample size of 70 students is sufficient for a pilot study since specialized literature in translation and adaptation of procedures, requests between 30 to 40 students for this stage of pre-test (Reichenheim & Moraes, 2007). Furthermore, 70 students represent 18% of the sample of the total population of participants recruited for standardization (401 participants), which is considered to be adequate since a 10% sample is sufficient for a pilot study (Connelly, 2008).

Table 2

Participants Included in the Pilot Study

	State		Church		Independent		
	Boys	Girls	Boys	Girls	Boys	Girls	TOTAL
Consent form given	18	27	15	15	15	15	105
Did not return consent form	4	4	0	3	4	3	19
Did not assent to sit for the test	2	1	0	1	2	5	11
Sat for both sessions	12	20	15	10	7	6	70
Missed a session	0	2	0	1	2	1	6

Eighteen students out of the sample population of 70 students (26% of the sample population) were reported to have a learning difficulty (LD) (see Table 3). The students' LD would have previously been diagnosed by a school psychologist, who would have produced a report for the Statementing Moderating Panel to allocate an Learning Support Educator (LSE). In the case of the girls' church school, the participants selected for the pilot study by the school's administration did not present with any LD. Information about the participants' LD was gathered either from the assistant head or the school's Inclusion Coordinator (INCO), who was presented, after attaining permission from the parents and the head of school, with an information letter (see Appendix W) explaining the purpose and nature of the research.

Table 3

Number of Participants with LD Participating in the Pilot Study

	School Type					
	Girls' state	Boys' state	Independent	Boys' church	Girls' church	Total
Typically developing	15	9	11	10	10	55
LD	5	4	2	5	0	16
Total	20	13	13	15	10	71

Research Tools

The chosen tools for this research are: (1) a speed of writing assessment battery (see Appendix C for the English test, and Appendix D for the Maltese test) (2) a parent questionnaire (see Appendix E) and (3) a teacher questionnaire (see Appendix F).

The Writing Speed Assessment Battery

The aim of this study was to develop a writing speed test. The standardized English assessment selected for this study was the *Detailed Assessment of Speed of Handwriting* (DASH) developed by Barnett, Henderson, Scheib and Schulz in 2007 in the UK. Before the DASH was selected, various other assessments were considered (see section *Writing Speed Tests* in Chapter 2). The DASH was standardized on UK children aged between 9-16 years. The DASH includes four core tasks that characterize different aspects of handwriting speed, and an optional graphic speed test. The four core tasks are two sentence copying tasks, an alphabet writing task, and a free writing task. The sentence copying tasks - *Copy Fast* and *Copy Best* - require testees to copy similar pangrams for two minutes. The alphabet writing task assesses handwriting quality. The free writing task measures speed of composition.

The bilingual test battery developed during this research was termed the *English-Maltese Assessment of Speed of Handwriting* (EMASH). The EMASH is based on findings from the literature showing that the specific subtests are well suited to the aim of identifying struggling writers. This novel assessment battery is meant to simulate classroom writing activities and examination conditions. It is in line with Feder and Majnemer's (2003) recommendations to use a wide range of tasks for handwriting evaluation that are essential for performing well in class. Hence, short copying tasks involving the copying of short repeated phrases such as "Mary had a little lamb" (Starch, 1915), and writing to dictation, were not included in this novel assessment battery, as these are not current educational practices for this age group. The EMASH pangrams - *Copy Neatly* and *Copy Quickly* - assess the student's letter formation when administered on an individual basis. They also require the participants to speed up, and an inability to do so indicates writing disorders such as dysgraphia (Weintraub &

Graham, 1998). The DASH (Barnett et al., 2007) was adapted by including a copying from the board task to simulate note taking in class. These copying tasks identify motor coordination deficits, since they are motoric tasks. The graphic speed test identifies perceptual-motor integration difficulties, since fine motor skills come into play. The free writing task identifies language processing and spelling difficulties. This also helps monitor the student's writing rate over time, to distinguish between the student who is initially fast but then slows down on running out of ideas, and the student who is constantly slow throughout the entire writing task. The *Free Writing* task also permits an assessor to examine the text in order to identify learning difficulties such as dyslexia and dysgraphia. This is so as "to identify handwriting dysfunction it is usually sufficient to analyze the quality of the handwriting" (Karlsdottir & Stefansson, 2002, p. 660). In the writing sample presented in Figure 3, produced by a student with dyslexia, phonetic spelling is very evident in words such as "werking" (working), "osim" (awesome) and "expirins" (experience). With regard to dysgraphia, global poor legibility is a sign of this writing difficulty. If a great many letters are unrecognizable, erased or overwritten, and if there is poor spatial planning, then that's a sign of dysgraphic handwriting (Rosenblum et al., 2004). None of the participants, neither in the pilot study, nor in the main study, had been diagnosed with a profile of dysgraphia. However two students, one in the pilot study and another in the main study, had been diagnosed with dyspraxia. The participant with dyspraxia in the pilot study also had a profile of ADHD. The *Copy from the Board* writing sample of the student with dysgraphia in the main study is presented in Figure 4. The ill-defined and illegible characters placed irregular on the baseline, are easily discernible.

Figure 3

Writing Sample of a Student Participating in the Main Study with a Profile of Dyslexia

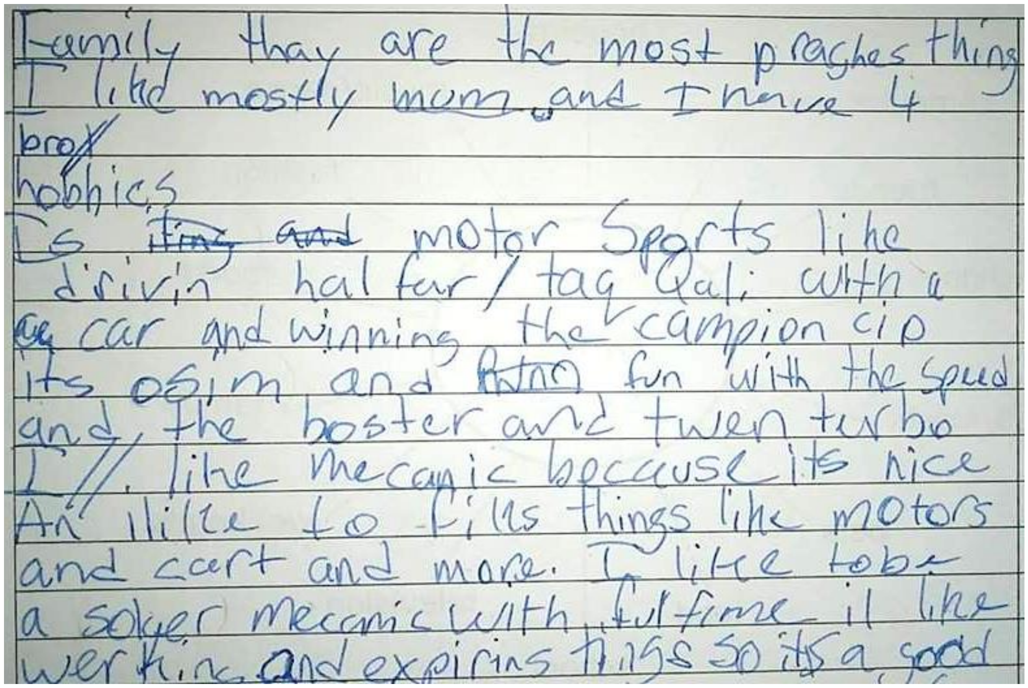
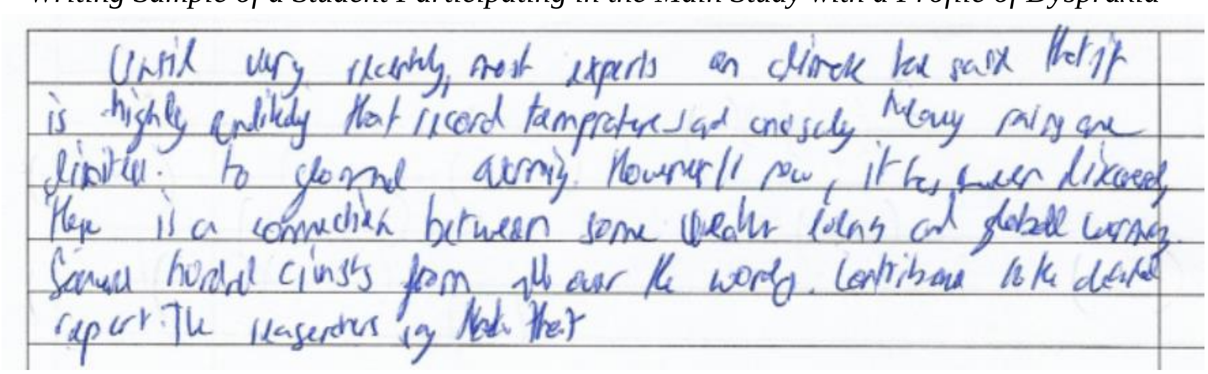


Figure 4

Writing Sample of a Student Participating in the Main Study with a Profile of Dyspraxia



The DASH also includes an optional Graphic Speed Test that evaluates perceptual-motor competence (Barnett et al., 2007). All five tasks can be administered individually or in groups, in about half an hour. Administering the test individually permits the tester to identify any difficulties a student might have in forming the individual letters of the alphabet, as the pangram in the *Copy Neatly* and *Copy Quickly* subtests contains all the letters of the alphabet. Individual administration of the test also permits the tester to note the testee's pen grasp. Since no significant differences in the speed and legibility of participants with a tripod grasp, and those with atypical grasps (see section *The Effect of Writing Speed on Legibility* in Chapter 2) were observed, pen grasp was not one of the independent variables that was studied.

Permission to adapt the test was obtained from the authors (see Appendix G). In the process of adaptation of the DASH, some of the test items were modified. Other subtests, such as the inclusion of a *Copy from the Board* subtest, as well as the methods of administration, were changed or removed (see Table 4). The subtests that were adapted to suit the local population were the *Copy Best* and *Copy Fast* subtests, which were called *Copy Neatly* and *Copy Quickly*, respectively. The names of these subtests were changed as the sentence to be copied by the participants is different from the one proposed by the DASH. Also, the alphabet writing task was replaced by a *Copy from the Board* writing task. The *Free Writing* subtest in English was slightly modified as the spider diagram provided was not exactly the same as in the DASH. Modifications to the test are explained in more detail in following sections.

Table 4

Modifications to the DASH Subtest Names During the Development of the EMASH

DASH Barnett et al. (2007)	EMASH	
	English	Maltese
Copy Best	Copy Neatly	Ikkopja Pulit
Copy Fast	Copy Quickly	Ikkopja Malajr
Alphabet Writing	Copy from the Board	Ikkopja mill-Bord
Graphic Speed Test	Graphic Speed Test	Test ta' Veloċita' Grafika
Free Writing	Free Writing	Kitba Kreattiva

Two versions of the writing speed test battery were administered to the participants: an adaptation of a previously standardized English assessment (see Appendix C) and a Maltese version of the test developed for the purpose of this study (see Appendix D).

The EMASH - English subtests

The *Copy Neatly* Subtest. This subtest requires the participants to copy a pangram, which is a phrase that contains all 26 letters of the alphabet. The pangram used in the DASH is *The quick brown fox jumped over the lazy dog*. This pangram was not used in this research as it is well-known, and participants could write it down from memory rather than copy it, thus defeating the purpose of the activity. Writing a phrase committed to memory might be faster than actually copying it, as participants do not need to raise their heads to read the next word. The pangram used in the EMASH, *A mad boxer shot a quick, gloved jab to the jaw of his dizzy opponent*, was selected from the site Fun with Words (n.d.) because it makes grammatical sense, avoids complex words, avoids complex spelling, and has simple punctuation. Furthermore, its letter count (54 letters), is as close as possible to the letter count in the Maltese pangram (55 letters) (*Kien liebes gozz ħwejjeġ u ċraret vera qodma u m'għażluhx fil-pront*).

In the DASH, students are required to copy the chosen pangram by writing the sentence repeatedly for two minutes in their best handwriting. This practice was also adopted in the administration of the *Copy Neatly* subtest of the EMASH. The rationale for asking the participants to copy the pangram for two minutes rather than one, is to give them enough time to get used to the sentence's pattern in order to get the writing flow going. For these copying tasks, the memory demands are minimised because the sentence is always present in printed form on the test paper (Barnett et al., 2009). The practice proposed by the DASH to call “time mark” after the first minute, was also kept. The time mark (//) is inserted even in mid-word, in order to keep track of changes in the speed of writing between the first minute and the following minute.

The *Copy Quickly* Subtest. In the second subtest, the DASH requires students to copy the same sentence “as quickly as possible, but legibly, for the same length of time” (Barnett et al., 2007, p. 15). In the EMASH, the students were also asked to speed up by copying out the same sentence as fast as possible, but legibly, for two minutes, as in the previous subtest. For this test, the “time mark”, was also kept. The rationale for including two tasks with similar content and time limits, was to make viable direct comparisons in writing speed (Barnett et al., 2007).

Apart from changes to the content of these subtests, minor changes were also made to the test administration. For these two subtests, the pangram the students were asked to copy was printed on the first and second pages of the test, with lines below for the students to write on. Lined papers with the pangram printed on them were preferred to distributing this phrase on strips of paper, as is recommended in the DASH manual. This makes test administration quicker and more practical, since strips of paper do not have to be collected at the end of the testing session.

The Copy from the Board Subtest. The far-point copying subtest *Copy from the Board* simulates copying from the white board during lessons. The participants were asked to copy the projected text, presented in font size 30, as fast as possible, but legibly, as they would be asked to do in a classroom setting. This activity was timed for two minutes. At the end of the first minute, the students were to denote the time mark // on their test paper. The rationale for timing the students for two minutes was to allow them enough time for the task, as according to the literature, gaze movements hamper motor execution during copying tasks (Barrientos, 2017). Participants needed time to repeatedly lift up their heads from the test paper, read the text from the board, memorise this text and lower their heads to write it down. The text chosen for this task was one taken from the 2014 state annual past paper, pitched at Track 3[23] of the Year 10 Syllabus, addressing Attainment Level 8 (Ministry for Education and Employment, n.d.-b) (see Appendix H), which is the level Year 10 students are expected to reach at this stage. The chosen text is the following:

> "Until very recently, most experts on climate have said that it is highly unlikely that record temperatures and unusually heavy rains are linked to global warming. However now, it has been discovered, that there is a connection between some weather events and global warming. Several hundred scientists from all over the world contributed to the detailed report. According to the report, climate change makes extreme weather events more probable. The researchers say that a drought may be twenty times more likely because of man-made climate change. However, not all the weather events the scientists studied in their report were linked to climate change."
>
> (Adapted from the comprehension text of the 2014 English Annual State Past Paper for Year 10 Secondary – Track 3)

For this study, black text over a creamy coloured background was selected for the projected text. This is because some students can be sensitive to the brightness that high contrast colours

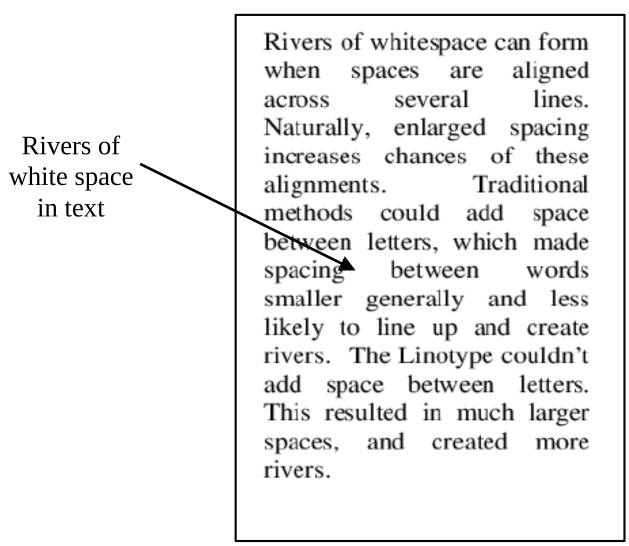
[23] Students in secondary schools may be following programmes of learning at different levels of difficulty in a number of subjects. These educational programmes may be referred to as Track 3, Track 2 and Track 1, Track 3 being the most demanding.

cause, such as word swirling or blurred words. Colours with lower contrasts help reduce the glare and visual distortion effects. A study by Rello (2012) shows that the colour pair to be read the fastest by participants with dyslexia was black text over a cream background, with a fixation duration mean of 0.214 seconds. The largest fixation duration mean, that of 0.239 seconds, resulted from the high contrast colour pairs of black text on a yellow background.

The projected texts were not justified, as justified text might pose difficulties for some students with learning difficulties (LD). This is because justified text at times creates large gaps between words, which, if lined on top of each other, create white rivers of space (Lake & Bean, 2008) (see Figure 5). Double spacing following a full stop at the end of the sentence also create white rivers of space. When these appear in text, students with LD easily lose their place when reading. To avoid the white gaps in the text, the text was left aligned rather than justified, and double spacing was avoided.

Figure 5

Rivers of White Space That Appear Between Words When the Text is Justified



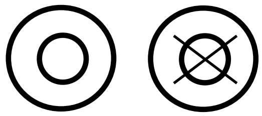
Note: Source: Quora

A sans serif font, Verdana, was used for the projected texts, and for both test papers. Serif fonts have lines attached to the ends of the characters, that tend to make the letters run into each other, and hence make reading more difficult for students with LD. A sans serif font lacks these lines, which increases the spacing between the letters, thus making them more distinguishable, and easier to read. The Verdana font was selected since a MATSEC study has shown that this font is viewed as the most readable font, and was chosen as the preferred font for MATSEC papers (MATSEC Support Unit, 2017).

The Graphic Speed Test. The graphic speed test was used to measure perceptual-motor competence, that results from "the interaction between sensory perception and motor actions" (Frost et al., 2001, p. 164). This test was also used to determine if perceptual-motor integration affects legibility, since fine motor-skills come into play. This subtest contains rows of printed circles (like doughnuts) (see Figure 6). Participants were instructed to draw an [X] not a [+], and to intercept the two lines within the inner circle. The lines could not go beyond the outer circle. Participants were instructed to lift their pens when drawing the two lines to avoid these type of crosses , which were considered invalid. It was made clear to the participants that while speed was important, precision was equally important, and that they had to work quickly but accurately. The students were first shown how the task was to be carried out on the board, and were allowed to practice on a few circles before commencing the task. As in the DASH, they were then timed for one minute.

Figure 6

The Graphic Speed Test



The *Free Writing* Subtest. The free writing subtest of the DASH requires the students to write about the topic *My Life*. According to Barnett et al. (2007), this topic enables participants to produce written material without too much effort by readily drawing on their own history and experiences, thereby providing ample material to write about. In a pilot study, Barnett and colleagues (2007) asked 51 students aged 10-11 years, to write about two different topics, these being *My Life* and *My Favourite Person.* Findings showed that more words were produced under the title *My Life* than under the title *My Favourite Person* (Barnett et al., 2007). The DASH pilot tests were carried out over a duration of a week, and the students had to write for ten minutes in each case. (For the DASH's *Free Writing* spider diagram, see Appendix I).

In the EMASH's pilot study (see Appendices J and K), though the participants also wrote about *My Life*, the prompt "clubs" that is given in the DASH, was replaced with "weekends" to make it more culturally appropriate (see Figure 7) (see section *Content Validity* in Chapter 4). Also, "computer" was added to the spider diagram to give participants ideas to write about, that are more relevant to their age. These additions were reflected in the Maltese free writing spider diagram (see Figure 8). Both spider diagrams were provided on the test paper, with lines below to write on. Given the large number of participants, this way of administering the free writing subtest was considered more practical than what is recommended in the DASH, which suggests distributing a page large spider diagram (see Appendix I) prior to testing, and collecting it afterwards.

Figure 7

The Spider Diagram of the English Free Writing Subtest

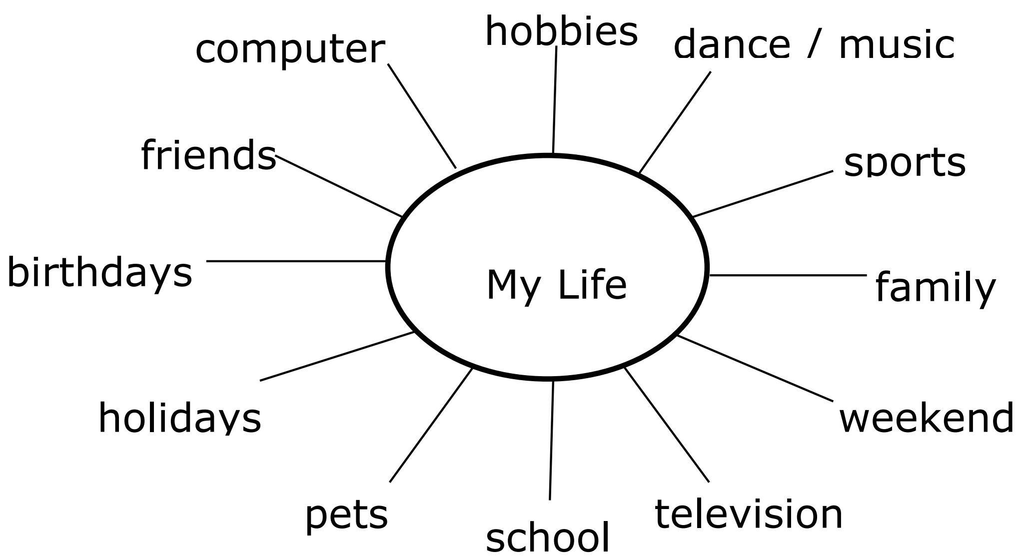
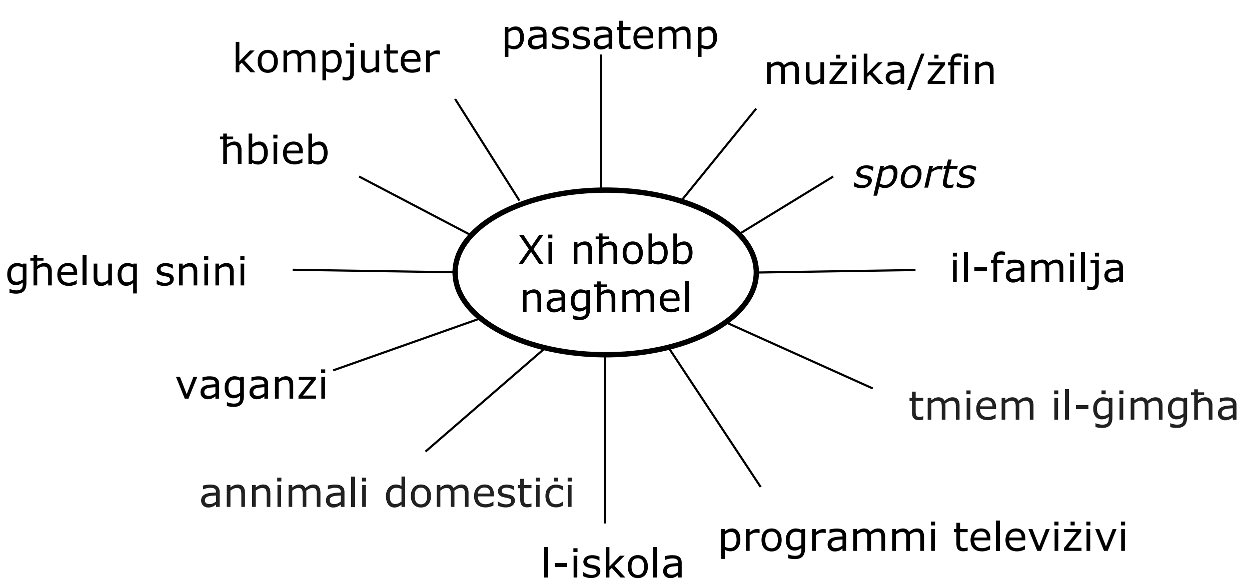


Figure 8

The Spider Diagram of the Maltese Free Writing (Kitba Kreattiva) Subtest.



One minute was allocated to discussing the spider diagram in each language. During this time, the participants were allowed to take down their own notes. The students were instructed that they could write about just one topic, several topics, or all of the topics. They could also write about anything of interest to them, which might not be related directly to the title, and were encouraged to write continuously without producing lists. Just like in the DASH, the students marked // every two minutes when the test administrator called "time mark". This exercise aids the tester to keep track of a testee's writing speed rate over time (Barnett et al., 2007, p. 16). It helps distinguish between the constantly slow writer, and the writer who is quite fast at first, but who slows down towards the end out of fatigue, or upon running out of ideas (Barnett et al., 2007). The two students could have written the same number of words in the ten-minute period, but at different writing rates.

The EMASH - Maltese Subtests

The Maltese assessment battery (see Appendix D) mirrors the English test battery in structure, scoring and test administration albeit the content is different as the text is in Maltese. The page layout, graphic style and typeface are identical to those of the English battery.

The Maltese *Copy Neatly (Ikkopja Pulit)* Subtest. Since there was no existing pangram in Maltese, one was created for the purpose of this research following consultation with academics with expertise in the Maltese language, within the Faculty of Arts at the University of Malta (see section *Content Validity* in Chapter 4). The Maltese pangram *Kien liebes gozz ħwejjeġ u ċraret vera qodma u m'għażluhx fil-pront* (He was wearing a pile of very old clothes and cloths and he was not chosen promptly) includes 55 letters. Like the English parallel subtest, participants were again instructed to copy the given pangram in their best handwriting for two minutes and to denote the time mark // when the researcher called "time mark" after the first minute, even if this happened in mid-word.

The Maltese *Copy Quickly (Ikkopja Malajr)* Subtest. For the second subtest, the students were asked to copy the same pangram as in the first task (*Kien liebes gozz ħwejjeg u ċraret vera qodma u m'għażluhx fil-pront)*. The same administrative procedures were applied. This time, however, the students were asked to write as fast as possible, but legibly, for two minutes.

The Maltese *Copy from the Board (Ikkopja mill-Bord)* Subtest. The third subtest required the students to copy text from the whiteboard, as fast as possible but legibly. The text chosen for this task was one taken from the 2013 state annual past paper, pitched at Track 3 of the Year 10 Syllabus, addressing Attainment Level 8 (Ministry for Education and Employment, n.d.-b) (see Appendix L), which is the level Year 10 students are expected to reach at this stage. The chosen text is the following:

> "Siġra indiġena Maltija hija s-siġra nazzjonali, is-siġra tal-Għargħar, li tħaddar is-sena kollha. Il-weraq tagħha huma rqaq, fuq zkuk kannella fl-aħmar, u huma dawn li jagħmlu s-siġra tiflaħ ħafna għan-nixfa u l-melħ. Il-frotta ta' din is-siġra tissejjaħ prinjola. Ġo fiha issib iż-żerriegħa li tinxtered mar-riħ. Kull żerriegħa ssibilha par ġwienaħ wesgħin, qishom tal-karta, biex ittir, u għalhekk is-siġra l-ġdida ma tikbirx tmiss m'oħra. L-Għargħar hija siġra rari li fl-Ewropa u tinstab biss f'Malta u Spanja. Fil-gżejjer Maltin tikber fis-selvaġġ f'xi ħames postijiet biss, u f'uħud minn dawn l-inħawi tikber ma' xi blat minkejja li jkun hemm nuqqas ta' ħamrija.[24]"

[24] A Maltese indigenous tree is the national tree, the Għargħar tree, which is an evergreen tree. Its leaves are narrow, on reddish brown branches, and it is these that make this tree resitant to drought and salt. The fruit of this tree is called prinjola. Inside there is a seed that gets disseminated by the wind. Each seed has a pair of wide wings, that seem to be made of paper, that enables it to fly, so that the new tree does not grow touching another. The

(Adapted from the 2013 Maltese Listening Comprehension Teacher's Paper for Year 10 – Track 3 in turn adapted from an article by Zach Engerer, published in the December issue of 2009, volume 306, of *Sagħtar*)

The same text-background colour combination and formatting that were used for the English projected text were used for the Maltese projected text.

The texts for both *Copy from the Board* tasks were selected for two reasons. First, both texts are pitched at the level which students are expected to have reached at this stage and therefore they should be familiar with the diction. Second, the texts do not have many punctuation marks (e.g. direct speech or question marks), making it less demanding for students to copy. The same method of administration and scoring procedures were adhered to for both language versions of the test.

The Maltese *Graphic Speed Test (Test ta' Veloċita' Grafika)*[25]. For this subtest, the same scoring and administrative procedures were applied as those outlined in the English subtest of the test.

The Maltese *Free Writing (Kitba Kreattiva)* Subtest. The selected title of the ten minute Maltese *Free Writing* (*Kitba Kreattiva*) subtest was *Xi Nħobb Nagħmel* (What I like to Do), because it allows for the use of the same prompts used in the English free writing subtest. This permits testers to administer only one version of the test should they choose to do so. The

għargħar tree is rare in Europe and is found only in Malta and Spain. In the Maltese islands, it grows in the wild in only five places, and in some of these places it grows amongst the rocks despite lack of soil.

[25] Carried out in the pilot study only.

use of correction fluid was not permitted during the test. Any mistakes were to be crossed out neatly with a single line, so that the crossed out words could be counted too.

In cases where participants started writing before the researcher said “Start”, the extra words were crossed out and omitted from the final word count. For the *Copy from Board* and *Free Writing* tasks, the participants were instructed not to write beyond the right margins, as these were used by the researcher for scoring. For detailed test instructions see Appendix M.

Questionnaires

Assessment batteries are often used in combination with information obtained from questionnaires, to comprehend better the effects of the home and school environment on literacy performance (Ministry for Education and Employment, 2016b), and to provide further information about the teaching and learning practices in local schools (Directorate for Learning and Assessment Programmes, 2015). In view of the available literature (see section *Bilingual Education in Malta* in Chapter 2) (Agius, 2012; Directorate for Learning and Assessment Programmes, 2015; Ministry for Education and Employment, 2018; Ministry for Education and Employment, 2016b), it was considered necessary to include a language and literacy questionnaire to the parents (see Appendix E), and teachers (see Appendix F) of the participants. For this reason, a parent questionnaire to determine the participants’ first language, and a teacher questionnaire to establish language practices in the classroom, were used in this study.

During the design stage of the questionnaires, care was taken to ask only questions that directly addressed the research aims (Lietz, 2010). Instructions were clear and concise, and the questions were kept simple, in order to avoid having respondents interpreting the questions in ways other than intended. This is possible when not having anyone to explain the questions to the respondents (Debois, 2019). Furthermore, a questionnaire that is simple to complete increases the response rate (Covington Smith & Williams Bost, 2007). To maximize the response rate, the questionnaires were kept short (Lindemann, 2016), so that it took respondents only a few minutes to complete. For this purpose, checkboxes and multiple choice questions were mostly used. In the case of the teachers' questionnaire, respondents had the option to add an alternative answer to some questions. However, this required respondents to write just one word or a short phrase (see section *Teachers' Questionnaire* in this chapter).

Response rate increases when the aims of the study are clearly explained (Jaykaran, 2011). In this case, together with the questionnaires, respondents were given an information letter (see Appendix N) explaining the purpose of the study and why their contributions were valued. If respondents have their queries answered, the chances that they will fill out the questionnaire increases. The contact details of the researcher were also provided on the informative letter. A few parents called the researcher to have their queries answered. Issues dealt mainly with concerns about having their children missing lessons, to which the researcher replied that it was not going to be the case, since arrangements had been made with the school to ensure that this would not be the case.

Given the societal bilingualism in Malta, questions were provided in both Maltese and English. Care was also taken to maintain objectivity by avoiding leading the respondents into giving the desired response. This was done by avoiding questions written in the negative. Furthermore, questions dependent on previous responses were avoided, as were questions that asked respondents to rank a series of statements. This was so to increase the reliability of the answers (Walonick, 2004).

Parents' Questionnaire

A questionnaire (see Appendix E) was given to the participants' parents to identify and categorise independent variables such as the family's SES, Nationality, the participants' First Language[26], and Ability. This questionnaire was adapted from the Language Preference Questionnaire (LPQ) developed by Agius (2012). Permission from the author was obtained (Appendix O). The LPQ was also modified to suit the purposes of this research. For example, those questions in the parents' questionnaire that were unlikely to be relevant to the lifestyles of 14/15-year-olds, such as questions about the language in which they received catechism lessons, were removed. The two questions in the LPQ related to the child's language use with friends during school recess and in class, were brought together into one question in the modified questionnaire. This question enquired about the student's language use with friends in general, since at age 14-15, students start socialising even beyond school hours. The participants' parents had to provide demographic information such as their child's and the school's name. The participants' socio economic status was determined by the mother's and father's level of education and occupations (Mifsud et al., 2004; Ministry for Education and Employment, 2009). The final questionnaire included eleven closed-ended questions. The first eight questions required the respondent to tick boxes marked Maltese, English or Other, depending on the language practices of the child. Respondents had the option to tick more than one box, in cases were the child was exposed to and/or spoke multiple languages. Multiple choice answers were preferred because they are generally the easiest to answer and the easiest to analyse (Ohlson, 2020). One disadvantage of this method of asking questions is that it

[26] Four consent forms from different state schools had to be discarded, as though the parents had filled in the questionnaires, they had omitted to sign the consent forms. Two other consent forms were signed but the parents failed to fill in the questionnaire. Hence for first language, data analysis was obtained from 399 participants.

allows little possibility for respondents to comment, though some respondents commented anyway. A further three questions were added to the LPQ for the purpose of this research to determine whether speech delay, hearing imapirment or other learning difficulties were present. The students' statementing reports confirmed the information obtained from the parents' questionnaire with regard to ability. These reports were accessed by the Learning Support Educators (LSEs) or Inclusion Coordinators (INCOs), with the permission of the head of school, for the purpose of providing the required information about the students' ability profile to the tester.

During the pilot study the parents' questionnaire, together with the consent form, was distributed to all the parents of the participants who were invited to take part in the pilot study, to determine, prior to data collection, any difficulties the respondents might have had in understanding, or replying, to any of the questions. None of the parents who returned the questionnaire - these being the 70 parents of the students who participated in the pilot study - expressed any concerns with any part of the questionnaire, so the format was kept.

Teachers' Questionnaire

The responses to the teachers' questionnaire helped derive the four independent variables (school type, subject, class language, corridor language), and three dependent variables (time spent copying, time spend writing, the most time consuming writing task), which were meant to determine language practices in the classroom. Appendix AD presents the levels for each of these variables.

This questionnaire was adapted from the *Teaching Practices* questionnaire developed by Agius (2012). As the questionnaire by Agius (2012) is mainly about language and reading practices in the classroom, the questions related to reading were replaced by ones related to writing. For instance, the question “Which method do you use in the classroom when teaching children how to read?” (Agius, 2012) was replaced with “Approximately how much time do students spend copying from the board?” An approximation, in multiple choice format, of the time the children spend doing the activity, was offered to the teachers, from which they had to choose their answer. For instance, for this question, the teachers had to decide whether the children spend 5%, 25%, 50%, 75% or 95% of the time copying from the board per lesson.

The form teachers were informed about the study via an information letter (see Appendix P), which was passed on to them through the school. They were asked to complete the questionnaire (see Appendix F) to determine their language practices in class and at school, the language they use to address their pupils in class and outside, for instance, in the corridors and playground, the time spent by their students writing in class, and how this writing time is utilized. The questionnaire was only given to the form teachers, as they have the most frequent contact with the students of that year group. The questions were mostly closed-ended with respondents being asked to select the best answer from the ones provided. The only open-ended question was the first one, where respondents were asked to name the subject they teach. The second and last question offered the possibility of an open-ended answer in the case the options provided did not suit the teachers’ responses. One disadvantage of this type of self-reporting questionnaire is that respondents might not be always truthful. This may happen because of social desirability bias that is, when respondents give the answers they think they are expected to give, to avoid being criticised or to gain approval (Van de Mortel, 2008). In an attempt to overcome this problem, the importance that the respondents take the questionnaire anonymously, and likewise return the questionnaire to the researcher anonymously, was emphasised. The teachers' questionnaire was given to 88 teachers during the main study, of whom 55 completed and returned it (see Table 5).

Table 5

Number of Form Teachers Who Participated in the Teachers' Questionnaire

	Given	Returned
Boys' church school 1	3	2
Boys' church school 1	2	2
Boys' church school 1	2	2
Girls' church school 1	4	4
Girls' church school 2	2	2
Private school	4	2
State school 1	9	2
State school 2	9	9
State school 3	10	2
State school 4	12	3
State school 5	10	8
State school 6	11	9
State school 7	10	8
Total	88	55

Test Administration – Pilot Study

On the day of testing, a few minutes were dedicated to allow the students to settle down between lessons and to explain the purpose of the research and what the test entails. Before the actual test was administered, the students' assent form (see Appendix X) was read out to them. An emphasis was placed on confidentiality, and their right to withdraw from the test anytime they wanted to without giving any reason.

The students who did not consent either stayed in class doing alternative work assigned to them by the class teacher while the test was being administered, or else continued with their lessons as usual while those who consented were pulled out of class to sit for the test. The decision whether to keep the students in class or pull them out for testing was taken by the school administration, depending on the number of students who consented to sit for the test. When this number was small, the students were pulled out of different classes to sit for the test together. When the majority of the students consented to testing, these stayed in class with alternative work being given to those who did not consent. When pulling students out of class, administration took care not to do so during core subject lessons, such as Mathematics, Maltese or English, or during option classes. All instructions regarding test administration were communicated to the students prior to the commencement of each individual task. Instructions were given in Maltese on the day of the Maltese tests, and in English when administering the English assessment. However, in cases where students found it hard to understand the language of test instruction, the instructions were also explained in the students' first language. Before the test commenced, the students were given time to fill in the personal information on the front page, such as name, gender, school and handedness. Students determined handedness by defining the dominant hand used for writing. The students were also instructed to stop writing and to put their pens down when the time was up, even in mid-word. They were instructed not to use correction fluid, and to cross out any mistakes by drawing a line down the middle of the word.

The order of test administration was reversed for half of the total sample. Half of the students were administered the English version of the test on the first day of testing, and proceeded with the Maltese assessment battery the following week, and vice versa. Alternating the order of test administration in this way reduces practice and order effect and increases the validity of the test (Mifsud et al., 2004) (see section *Internal Validity* in Chapter 4).

Furthermore, the order of administration of the individual subtests was reversed for most schools (see Table 6). A week was allowed between tests to avoid test fatigue. This time frame was determined following personal communication with a statistician, who stressed the importance of allowing sufficient time (normally a week) between the first and second administration of the test to eliminate test fatigue (Cefai & Camilleri, 2009; L. Camilleri, personal communication, January 15, 2017). Data collection for the pilot study lasted about a month.

Table 6

Order of Subtest Administration, by School, for the Pilot Study

School Type	Order of Subtest Administration for Maltese and English	First Test Administered	Second Test Administered
Independent	Copy Neatly Graphic Speed Test Free Writing Copy Quickly Copy from the Board	English	Maltese
Boys' State	Copy Quickly Free Writing Copy Neatly Copy from the Board Graphic Speed Test	Maltese	English
Boys' church	Free Writing Copy Quickly Graphic Speed Test Copy Neatly Copy from the Board	English	Maltese
Girls' state	Copy Neatly Copy Quickly Copy from the Board Graphic Speed Test Free Writing	English	Maltese

Girls' church	Graphic Speed Test Copy from the Board Copy Neatly Free Writing Copy Quickly	Maltese	English

Changes Made to the Test Papers Following Pilot Testing

Following an analysis of the data collected during the pilot study (see Appendix Y for details), the following modifications were made to the assessment batteries:

1. Instructions to participants to use only black or blue ink but no pencils, were added to the test manual. This was because one student in the boy's state school used a pencil, instead of a pen, for the Graphic Speed Test. However, during local national examinations, only blue or black ink is permitted during language examinations (MATSEC unit, personal correspondence, May 9, 2017). Since the EMASH can be used as a measure of writing speed to grant extra time during national examinations, it is important to simulate examination conditions.
2. More prompts were added to the Maltese *Free Writing* spider diagram following testing at the Independent co-ed school. This was done in order to assist participants in the Maltese Free Writing (*Kitba Kreattiva*) task (see section *Independent Co-Ed School* in Appendix Y). "Food" was added to the spider diagram, as well as "fashion". "Feasts" was added to make it more culturally acceptable. When a research instrument, which has been developed in one culture is applied to another, cross-cutural adaptations are necessary, so that the instrument is understood by the target population (Cardoso et al., 2014) (see

section *Content Validity* in Chapter 4). Furthermore, "computer games" replaced "computer". These changes were reflected in the English spider diagram.

3. The size of the *Free Writing* spider diagrams was enlarged, following testing at the girls' state school, as it was noticed that the participants had little space where to add their own notes (see Figure 9 for the English spider diagram, and Figure 10 for the Maltese spider diagram).

Figure 9

The Final Version of the Spider Diagram of the English Free Writing Subtest

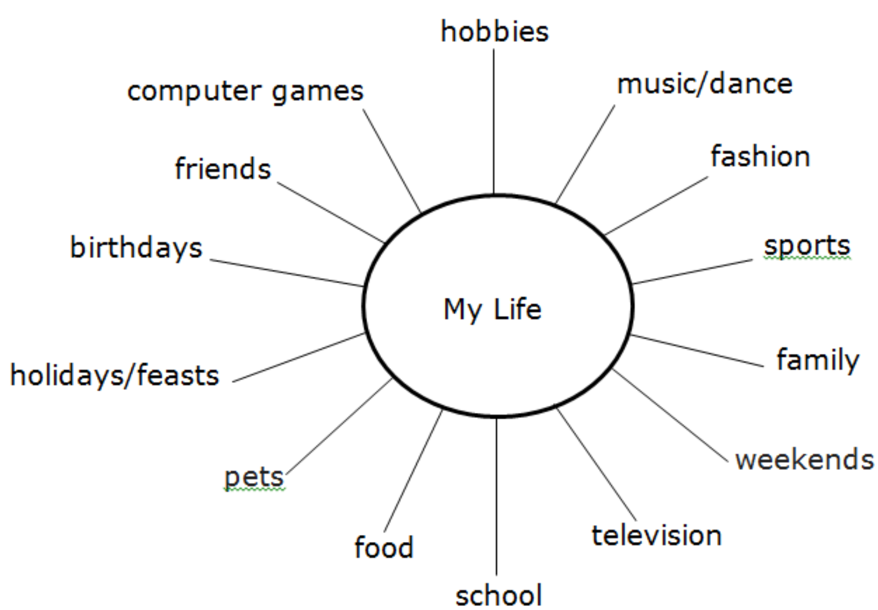
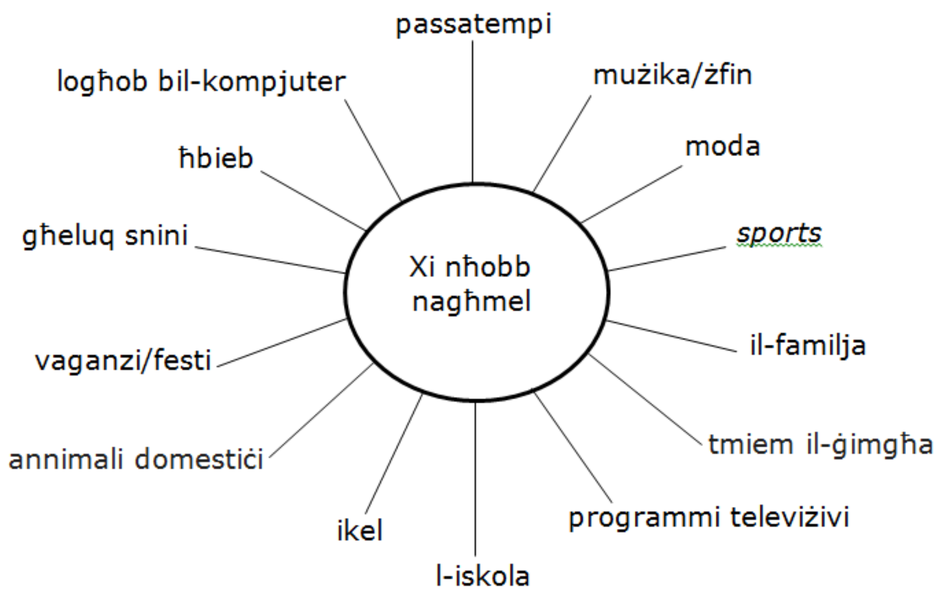


Figure 10

The Final Version of the Spider Diagram of the Maltese Free Writing (Kitba Kreattiva) Subtest.



4. *Age* was replaced with *Date of Birth* to have a month of birth profile since research shows that the youngest members of each cohort (even 14 and 15-year-olds) overall score lower academically than the oldest members (Bedard & Dhuey, 2006).

5. It was noticed that a few students had not lifted their pens when drawing crosses for the Graphic Speed Test subtest, making these type of crosses , which were considered invalid. Hence instructions were added to the test manual for participants to lift their pens when drawing the two lines of the cross. It was made clear that for this subtest, speed and precision were equally important, and hence, while the students had to work quickly, they also had to be precise.

6. As some of the time marks (//) on the test papers were difficult to spot, (especially if these had been inserted in the middle of words, due to their small size), a

recommendation was added to the test manual asking participants to draw clear and well visible time marks on their tests papers.

7. During the pilot study, the subtests were administered in a different order to reduce order effects. However, the test papers the participants were given all had the same layout (see Appendix J for English and Appendix K for Maltese). When the subtests were not administered in chronological order, the participants had to flip through the pages to find the subtests in question. Though this did not prove difficult for the students since they were old enough to follow the instructions easily, test administration for main data collection was simplified even further, by presenting the participants with two versions of the same test paper. The order of the subtests of the first version of test papers (see Appendix C for English and Appendix D for Maltese) was very similar to the one used in the pilot study (see Table 6). The subtests of the second version of the test papers (see Appendix Z) alternated fast paced subtests with slow paced ones (see Table 7). This decision was reached following comments of fatigue by participants in the boys' state school, when two fast paced activities followed in sequence.

Table 7

Order of Subtests of Test Papers used for Main Study Data Collection

Test Paper Version 1	Test Paper Version 2
Copy Neatly subtest	*Copy from the Board* subtest (fast paced)
Copy Quickly subtest	Graphic Speed Test
Copy from the Board subtest	*Copy Neatly* subtest (slow paced)
Graphic Speed Test	*Copy Quickly* subtest (fast paced)
Free Writing subtest	*Free Writing* subtest (slow paced)

This new test paper placed the *Copy Neatly* and *Copy Quickly* exercises on the same page. Participants were instructed to skip two lines between the two tasks.

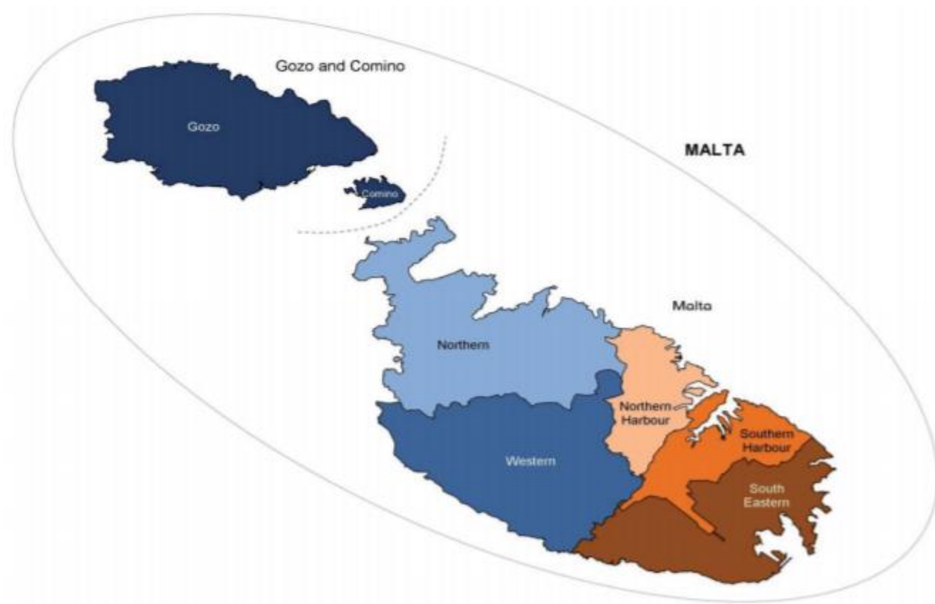
Main Study

Sample Population and Recruitment

Since the Year 10 school population was too large for all its members to be surveyed, the parental consent form (see Appendix N) was distributed to a representative sample of students. Selection of schools for the main study was determined by type (state, church and independent). By the time data collection was initiated for the main study, Year 10 classes in state schools had become co-ed. Hence selection of state schools was determined according to the six geographical regions (five in Malta and one in Gozo) of the Nomenclature des Unites Territoriales Statistiques (NUTS; 2009) (see Figure 11). Schools in the respective geographical regions were selected randomly.

Figure 11

Geographical Regions



Note: Source: NSO (2019)

Southern Harbour Region: Valletta, Floriana, Senglea, Vittoriosa, Cospicua, Kalkara, Fgura, Ħal Luqa, Ħal Farruġ, il-Marsa, Paola, Santa Luċija, Ħal Tarxien, ix-Xgħajra, Ħaż-Żabbar

Northern Harbour Region: Ħal Qormi, Birkirkara, Fleur-de-Lys, is-Swatar, il-Gżira, il-Ħamrun, l-Imsida, Pembroke, tal-Pietà, Guardamangia, San Ġiljan, Paceville, Balluta, San Ġwann, il-Kappara, Santa Venera, tas-Sliema, is-Swieqi, Madliena, Ta' Xbiex

South Eastern Region: Birżebbuġa, Ħal Għaxaq, il-Gudja, Ħal Kirkop, Marsaskala, Marsaxlokk, l-Imqabba, il-Qrendi, Ħal Safi, iż-Żejtun, iż-Żurrieq, Bubaqra

Western Region: Ħ'Attard, Ħal Balzan, Ħad-Dingli, l-Iklin, Ħal Lija, l-Imdina, l-Imtarfa, ir-Rabat, Baħrija, tal-Virtù, is-Siġġiewi, Ħaż-Żebbuġ

Northern Region: Ħal Għargħur, il-Mellieħa, Manikata, l-Imġarr, il-Mosta, in-Naxxar, Baħar iċ-Ċagħaq, San Pawl, il-Baħar, Burmarrad, Qawra, Wardija, Madliena, Buġibba

Gozo Region: Ir-Rabat, il-Fontana, Għajnsielem, Comino, l-Għarb, l-Għasri, Ta' Kerċem, il-Munxar, in-Nadur, il-Qala, San Lawrenz, Ta' Sannat, ix-Xagħra, ix-Xewkija, iż-Żebbuġ

Due to the low participant response rate from the Southern Harbour District, a second college was recruited (see section *Test-Retest Reliability* in Chapter 4). The selected state schools in the final count included seven colleges, (six in Malta and one in Gozo), all with a co-ed student population. Since students attending church and independent schools come from various geographical regions in Malta, this selection was not applied. The church schools were selected according to gender – two girls' schools and two boys' school in Malta, and one boys' school in Gozo. The only girls' church school in Gozo did not consent to take part in the research. The independent co-ed school that participated in the study was the only Independent school that consented to be part of the research.

The informative letter and parental consent form (see Appendix N) was distributed to the 1,438 students attending the Year 10 classes of the 13 selected schools. It was imperative to recruit participants from all classes since students were set by ability in different classes. Of these 1,438 students, 404 parents consented to the research[27]. Three participants from the same state school withdrew their participation from the main study before the first test. Hence data analysis was carried out on the performance of the remaining 401 students. The local school population of Year 10 students in 2016 was 4,086 (National Statistics Office, 2018). A sample size of 401 students, out of a population of 4,086, is 9.8%. This figure was confirmed to be an adequate sample size for statistical analysis by a statistician, since a sample size of 10% is deemed sufficient to attain meaningful results (L. Camilleri, personal communication, July 30, 2016). Contrary to the pilot study, when participants missed a testing session due to illness, the data collected during the other testing session was kept and analysed. This was possible since

[27] Four consent forms from different state schools had to be discarded, as though the parents had filled in the questionnaires, they had omitted to sign the consent forms. Two other consent forms were signed but the parents failed to fill in the questionnaire. Hence for first language, data analysis was obtained from 399 participants.

the English and Maltese tests were standardised separately, and hence it was not imperative for the same students to sit for both tests. Three hundred and sixty students sat for the English test and 342 students sat for the Maltese test. In the literature, Francis et al. (2016) standardised the DASH in Australia on 171 students, aged seven to eighteen years. Araghi et al., (2015) standardised the *Iranian Handwriting Speed Test* on 400 Iranians students aged eight to twelve. The DASH itself was standardised on 546 students aged nine to sixteen. Hence the standardisation sample of the EMASH (360 for English and 342 for Maltese), for a single age group (14 years), was deemed sufficient.

In state schools, most of the participants who consented to the study were from the middle and lower streams (years 10.4 to 10.7). There were very few participants from the higher streams (10.1 to 10.3), or the Core Curriculum Programme (CCP) classes, possibly because of the parents' and students' concern of missing out on any lesson. Another possible reason for a low turnout of students from the CCP classes could be because, being low ability students, they might have been reluctant to take part in a study that involved writing. Table 8 presents the number of male and female participants from the various school types.

Table 8

Male and Female Participants from the Various School Types

		School Type				
		State	Independent	Boys' church	Girls' church	Total
Gender	Male	111	22	73	0	206
	Female	133	21	0	41	195
Total		244	43	73	41	401

Table 9 presents the distribution of participants by geographical regions.

Of the 401 participants:

— 176 were born between January and June 2003, and 221 were born between July and December. The 19 students born in 2002 were included in the January – June cohort. They were excluded from the standardisation of scores process, which was carried out on 14-year-olds only, since the standardisation of writing speed scores for 15-year-olds cannot be carried out on a sample size of just 19 students.

— 336 participants were typically developing. Of the 65 participants with LD (16.2 % of the total poulation), the majority (24 participants) had general learning disabilities, followed by ADHD/ADD (17 particiapnts) and dyslexia (13 participants). One student was diagnosed with dyspraxia (see Table 10)

Table 9

Distribution of Participants by Geographical Region

Geographical Regions	Sample size	Percent
Southern Harbour	58	14.5
Northern Harbour	55	13.7
South Eastern	86	21.4
Western District	72	18.0
Northern District	64	16.0
Gozo	66	16.5
Total	401	100.0

Table 10

Types of Learning Difficulties

Learning Difficulty	Sample size	Percent
Dyslexia	13	3.2
Dyspraxia	1	0.2
Global developmental delay	1	0.2
ADHD/ADD	17	4.2
General Learning Disabilities	24	6.0
Autism	5	1.2
Hearing impairment	3	0.7
SEBD	1	0.2
Total	65	100.0

Non-native Participants. Due to the influx of non-native students in Maltese schools, a decision was taken to include students of non-native nationality in the study, in order to have a realistic representation of the local school population. In Malta, during 2017/2018 non-native people accounted for 11.1% of the total school-age population, with the majority being Italian (Sansone, 2020). Of the 401 participants who took part in this research, 358 were Maltese and 38 (9.47%) had non-native citizenship. Five (1.2%) had dual nationality (Maltese and home nationality). In all, 10.7% of the research sample had non-native citizenship. Participants with a dual nationality were mainly from America, the UK and Australia. Non-native participants in state schools were mainly from Eastern European countries, such as Bosnia, Hungary, Macedonia, Serbia and Romania. Non-native participants in the Independent school were mainly from Italy. Table 11 presents a breakdown of the non-native participants and the schools they attended.

Table 11

Local and Non-native Participants in the Main Study

School Type		Nationality			Total
		Maltese	Non-native	Dual	
State	Count	216	26	3	245
	% within School Type	88.2%	10.6%	1.2%	100.0%
Independent	Count	30	12	1	43
	% within School Type	69.8%	27.9%	2.3%	100.0%
Boys' church	Count	71	0	1	72
	% within School Type	98.6%	0.0%	1.4%	100.0%
Girls' church	Count	41	0	0	41
	% within School Type	100.0%	0.0%	0.0%	100.0%
Total	Count	358	38	5	401
	% within School Type	89.3%	9.5%	1.2%	100.0%

Some non-native students were excluded from sitting for the Maltese test, after consultation with administrative staff or teachers, who, guided by the students' academic performance, identified those students who had not yet reached the desired level of proficiency in Maltese, by the time of the study. Non-native students who did not learn Maltese[28], or who had just started learning Maltese, were exempt from sitting for the Maltese test. This was so to minimize low writing speed scores that were due to language barriers, rather than to writing difficulties. All were proficient in English at the time of testing.

One widely recognized framework to understand proficiency in a language is the *American Council on the Teaching of Foreign Languages* (ACTFL) (2012). Proficiency Guidelines describe levels of proficiency in the language skills of speaking, writing, reading, and listening. With regard to writing, there are five major levels of proficiency on the ACTFL scale:

[28] In the private school.

1) Novice: Writing is very limited and is expressed using short messages, notes and lists.
2) Intermediate: Writing is simple but can describe common events and daily routines, and request information.
3) Advanced: Writing is more detailed and lengthy, and discusses numerous topics in different time frames.
4) Superior: Writers are able to produce research papers and reports about various topics, dealing with academic and social issues.
5) Distinguished**:** Writing is analytical and may express a point of view which is not necessary the writer's own.

One way to view writing is the ability to transfer ideas into a language which can be understood by someone else in a difference space and time. The concern that good writing ability includes good spelling may be contested at this day and age, especially in the new technological world. However, with regard to writing proficiency in our schools, students are expected to know the spelling rules of the language they write in, as well as the exceptions to these rules (Ministry for Education and Employment, n.d.-b). With regard to technology, national examinations are still in pen and paper format, and hence online dictionaries and thesauruses cannot be used to amend spelling during examinations. The level of language proficiency and academic achievement of the participants taking part in the study are described in Appendix H for English and L for Maltese (Ministry for Education and Employment, n.d.-b). These describe the attainment levels of students attending Year 10 classes in grammar, language awareness and writing. These are the expected writing abilities in English and Maltese of students in Year 10. With regard to writing, this would correspond to an advanced level as defined by ACTFL (2012).

With regard to English language awareness, according to the Learning Outcomes Framework (Ministry for Education and Employment, n.d.-b), students should be aware of language rules and their exceptions, be able to use various tenses, including conditionals for presumed scenarios, the passive voice for scientific report writing, and direct and indirect speech. With regard to Maltese language awareness, students should be aware of and correctly use grammatical rules, such as the article, the negative, the passive, suffixes, prefixes, collective nouns, pronouns, possessive, plurals and prepositions. They should also be able to make correct use of tenses in the present, past and future, including loan verbs. As for writing, for both English and Maltese, students should be able to write elaborate sentences using different punctuation marks. They should engage over a number of paragraphs in different genres of writing, such as narrative and argumentative essays. Apart from appropriately planning these essays, students should be able to improve upon their first draft of writing by moving sentences around, deleting repetition and adding words where necessary to communicate the meaning better. Academic performance, usually based on summative and formative assessment, usually determines whether the desired level of language proficiency has been reached by the students.

Test Administration – Main Study

The same procedures administered in the pilot study were administered in the main study (see section *Test Administration – Pilot Study*, in this chapter). Testing took place over two consecutive weeks, to reduce test fatigue. As in the pilot study, tests were administered in a different order to reduce practice and order effects (see Table 12). There were two (parallel) versions of the same test paper (see section *Changes Made to the Test Papers Following Pilot Testing* in this chapter). The English version of the first test paper (see Appendix C) will be referred to as "English Version 1"; and the Maltese version of the first test paper (see Appendix D) will be referred to as "Maltese Version 1". The English version of second test paper will be referred to as "English Version 2"; whereas the Maltese version of the second test paper will be called "Maltese Version 2" (see Appendix Z for these test papers). Data collection lasted about five months. A little token of appreciation was given to the heads and assistant heads of the schools for their participation.

Table 12

Order of Subtest Administration, by School

School	Maltese Version 1	English Version 1	Maltese Version 2	English Version 2
Girls' church school 1	1^{st} session	2^{nd} session		
Girls' church school 2	1^{st} session	2^{nd} session		
Boys' church school 1			2^{nd} session	1^{st} session
Boys' church school 2			2^{nd} session	1^{st} session
Boys' church school 3	2^{nd} session	1^{st} session		
State school 1			1^{st} session	2^{nd} session
State school 2	2^{nd} session	1^{st} session		
State school 3			2^{nd} session	1^{st} session
State school 4			1^{st} session	2^{nd} session
State school 5	1^{st} session	2^{nd} session		
State school 6			2^{nd} session	1^{st} session
State school 6	2^{nd} session	1^{st} session		
Independent school	1^{st} session	2^{nd} session		

Independent and Dependent Variables

The 11 independent variables are listed below. The number of levels, and the name of each independent variable, are presented in Table 13.

Table 13

Levels for Each Independent Variable

Independent Variables	Number of levels	Levels
First Language	4	dominant Maltese, dominant English, mixed, foreign
School Language	3	dominant Maltese, dominant English, mixed
Socio Economic Status	3	low, middle, high
Handedness	2	left, right
Gender	2	male, female
Geographical Regions	6	southern harbour region, northern harbour region, south eastern region, western region, northern region, Gozo region
Nationality	3	Maltese, foreign, dual
Age	2	January to June, July to December[29]
School Type	4	state, independent, boys' church, girls' church
Ability	2	typically developing, learning disabilities
Writing Style	4	cursive, print, mixed mostly cursive, mixed mostly print

[29] Participants were stratified by age to have a month of birth profile since research shows that the youngest members of each cohort (even 14 and 15-year-olds) overall score lower academically than the oldest members (Bedard, & Dhuey, 2006).

The 12 dependent variables of the study are English *Copy Neatly,* English *Copy Quickly,* English *Copy from Board,* English *Free Writing,* Total English Score, Maltese *Copy Neatly (Ikkopja Pulit),* Maltese *Copy Quickly (Ikkopja Malajr),* Maltese *Copy from Board (Ikkopja mill-Bord),* Maltese *Free Writing (Kitba Kreattiva),* the Graphic Speed Test and Legibility.

The second research question: Do factors such as First Language, School Language, Ability, Socio Economic Status, Geographical Regions, School Type, Handedness, Writing Style, Age, Nationality and Gender, affect writing speed?, investigates the effect of these independent variables on writing speed. Here, writing speed is the dependent variable and is equivalent the 'Total English Score' and 'Total Maltese Score'. It also considers the writing speed obtained in each subtest. In the third research question: Does writing speed affect Legibility?, writing speed is considered to be an independent variable, and its effect upon legibility is examined.

Data Coding System

The participants who took part in the study were assigned a code to ensure pseudonymity. The code comprised letters and digits composed of the initials of the name of the school (e.g. Rose School would be 'RS') and a number. So the 45th participant in the study would have the code RS45. The letters "E" or "M", depending on whether the test was in English or Maltese, were added to this code (e.g. RS45E for English and RS45M for Maltese), and recorded at the top of the English and Maltese assessment batteries respectively. This code was inputted into IBM SPSS (Statistical Package for the Social Sciences, 2017).

The participants' learning or physical disabilities that might hinder schooling, if any, were noted down by after consultation with the LSE or INCO after the test papers were collected (see section *Parents' Questionnaire*). The values assigned to the independent variable Learning Difficulties are presented in Appendix AA, under the *Ability* section. Typically developing students were assigned the value 1 (see Appendix AA).

Coding the Variables

The EMASH. The coding of the variables of the EMASH are given in Appendix AA. Ability was classified in two ways, as explained below.

Ability. Ability was determined by whether the participants were typically developing or whether they were reported to have a learning difficulty.

The first manner of classification is presented in Table 14, which gives a code to each learning difficulty, including a code (1) to typically developing students. The second manner of classification is presented in Table 15. This groups all LDs together under the same code (2), with code 1 being assigned to typically developing students. The first way of classifying Ability permitted comparisons to be made between the performance of students with learning difficulties, such as dyslexia, and typically developing students. The second way of classifying Ability permitted the comparison of the writing speeds of typically developing students and students presenting an LD. This was important to determine if the EMASH is a valid tool in identifying struggling writers.

Table 14

First Method of Categorising the Variable Ability

Learning Difficulties	Value assigned
None	1
Dyslexia	2
Dyspraxia	3
Global Developmental Delay	4
ADHD/ADD	5
General Learning Disabilities	6
Literacy Challenges	7
Asperger’s	8
Autism	9
Hearing impairment	10
Visual impairment	11
SEBD	12

Table 15

Second Method of Categorising the Variable Ability

Learning Difficulties	Value assigned
None	1
Dyslexia	2
Dyspraxia	2
Global Developmental Delay	2
ADHD/ADD	2
General Learning Disabilities	2
Literacy Challenges	2
Asperger’s	2
Autism	2
Hearing impairment	2
Visual impairment	2
SEBD	2

Students with LD were included in the sample for three reasons. First, students with LD are included in the normative sample because a normative sample represents the population for whom the test is targeted (L. Camilleri, personal correspondence, March 15, 2019; DiMaria, 2020). As most students with LD attend main stream schools[30], these students were included in order to have a true representative sample of the Maltese student population. Second, since authors of the DASH also included children with LD who were receiving remedial support at school (Barnett et al., 2007, p. 70), this enabled direct comparisons between the DASH and EMASH. Third, there is a substantial amount of research that includes children with LD as part of their normative sample. For example, Zimmerman et al., (2002) administered the *Preschool Language Scales, Fourth Edition* (PLS-4) to a sample of 1,534 children, included children from various regions, with different socio economic backgrounds, ability and race. The University of Alberta (2020) rightly states that a normative sample should include both typically developing children and children with learning difficulties. This is because if children with learning difficulties are excluded from the normative sample of a test, it will be difficult to interpret the data obtained by these children from the results of the test (Schneider et al., 2003).

Age. Participants were stratified by birth month since research shows that the youngest members of each cohort (even 14 and 15-year-olds) overall score lower academically than the oldest members, due to maturity differences (Bedard & Dhuey, 2006). Dhuey et al. (2019) state that the gap persists throughout secondary and post-secondary education. Hence, for the purpose of this research, participants born between January to June 2003 were grouped together (and coded 1); whereas those born between July and December 2003 formed the

[30] Excluding those with severe intellectual impairment, who attend resource centers.

second group (and coded 2). Students born in 2002 (a year before) were placed with the January – June group. Four participants in the main study did not specify their date of birth.

Parents' Questionnaire. Appendix AB presents the levels for each of the 17 independent variables of the parents' questionnaire.

Occupation. The coding for Maternal Occupation (Maternal_Occ) and Paternal Occupation (Paternal_Occ) are outlined in Appendix AC. Some types of jobs straddle two categories, but for the purpose of this study, jobs were classified according to an adaptation of the Equal Employment Opportunity (EEO) Guidelines for Classification of Employees (HudsonMann, 2015).

Socio Economic Status (SES). In the current study, socio-economic status was measured by establishing parental education (to determine the level of education), and occupation (to determine income) (Mifsud et al., 2004; Ministry for Education and Employment, 2015). Parental occupation (see Appendix AC) was recategorised into five values as explained in Table 16 (L. Camilleri, personal correspondence, July 22, 2018). The category "self-employed" was placed with the categories "professionals" and "officials and managers", as although examples from literature tend to define self-employed as the skilled craftsman and the small shopkeeper (Bechhofer et al., 1974), in recent studies (Schembri Bianchi, 2017), the participants have linked self-employment with a better income.

Table 16

Categorising the Variable Occupation

Occupation	Education	Value assigned
Unskilled (labourer) / Unemployed	Primary	0
Semi-Skilled (operative)	Secondary	1
Skilled (craft worker) / Technicians / Service Workers	post-secondary	2
Office and Clerical Workers / Sales Workers	Vocational	3
Professionals / Officials and Managers / Self employed	Tertiary	4

In cases where participants failed to denote their level of education or occupation, the missing values were replaced by the respective column average, which was two in each case (see Table 17), in order to be able to get an SES estimate for these cases (L. Camilleri, personal correspondence, July 22, 2018). Computations were executed in Excel.

Table 17

Column Averages

Variable	Column average	Missing value
Maternal occupation	2.07	2
Paternal occupation	2.42	2
Maternal education	1.96	2
Paternal education	1.91	2

The categorized values for paternal and maternal occupations and education were added up to find the SES total. The SES score ranged from 0 to 16. For instance, a semi-skilled mother (value assigned 1), who has attended vocational training (value assigned 3), and a father in a managerial post (value assigned 4), having attended tertiary education (value assigned 4), would have a total of 12. Table 18 presents the cut off points for the 25th and 75th quartiles, which set the SES percentages to 25%, 50% and 25%. Normally SES is classified as Low, Middle and High (Berzofsky, et al., 2014; L. Camilleri, personal correspondence, July 22, 2018). Hence an SES ranging from 0 to 6 indicated low SES (25%), an SES ranging from 7 to 10 indicated middle SES (50%), and an SES ranging from 11 to 16 indicated high SES (25%). In the above example, as the total SES value is 12, this falls within the high SES bracket. The values assigned to SES classifications (as explained in Table 19) were used for computational purposes in SPSS.

Table 18

Percentiles for SES

Sample Size	Valid	401
	Missing	0
Percentiles	25	6.00
	50	8.00
	75	10.00

Table 19

The Values Assigned to the SES Classifications

Range	Value assigned	SES classification
0 – 6	1	Low SES
7 – 10	2	Middle SES
11 – 16	3	High SES

First Language. The participants' first language was determined from their responses to the language practices questionnaire which asked about the language(s) spoken with family members (fathers, mothers and siblings), at meal times, the language they spoke best, and the language/s they used to express anger and discuss their problems. Coding relied on the participants' responses and was classified as follows:

1. *Dominant Maltese* - *Maltese* box only is ticked

2. *Dominant English* - *English* box only is ticked

3. *Mixed* - Two or three boxes ticked (e.g. *Maltese* and *English;* or *English* and *Other;* or *Maltese* and *Other;* or *Maltese, English* and *Other*). These four options were grouped together because the number of multilingual participants was not numerous.

4. *Non-native* - *Other* box only ticked

Codes 1 and 2 were classified as *Dominant Maltese* and *Dominant English* respectively. The word *Dominant* was used due to societal bilingualism in Malta, and the local variety of English, namely Maltese-English (see section *The Maltese Language* in Chapter 1), characterized by codeswitching during speech (see section *Code-Switching* in Chapter 2), which makes it practically impossible to have a pure Maltese or English monolingual. So with regard to the example in Figure 12, the responses were coded as follows:

question 1 – *Dominant Maltese* (code 1)

question 2 – *Mixed* (code 3)

question 3 - *Dominant Maltese* (code 1)

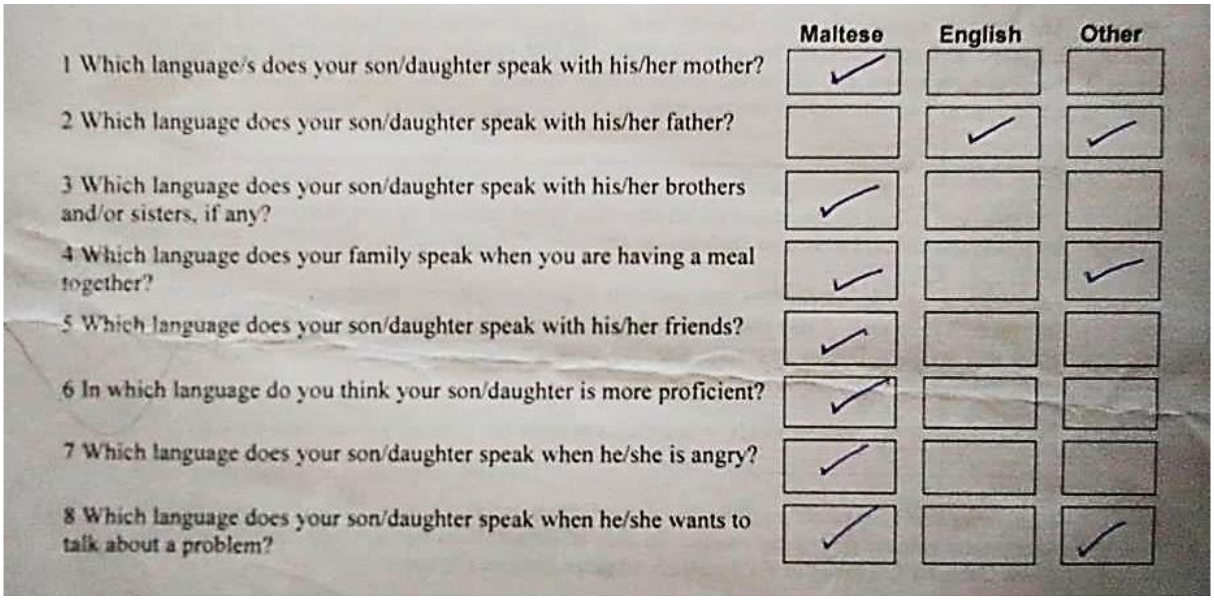
question 4 - *Mixed* (code 3)

questions 5 to 7 – *Dominant Maltese* (code 1)

question 8 - *Mixed* (code 3)

Figure 12

Sample of a Parent's Responses for the First Eight Questions of the Parents' Questionnaire



	Maltese	English	Other
1 Which language/s does your son/daughter speak with his/her mother?	✓		
2 Which language does your son/daughter speak with his/her father?		✓	✓
3 Which language does your son/daughter speak with his/her brothers and/or sisters, if any?	✓		
4 Which language does your family speak when you are having a meal together?	✓		✓
5 Which language does your son/daughter speak with his/her friends?	✓		
6 In which language do you think your son/daughter is more proficient?	✓		
7 Which language does your son/daughter speak when he/she is angry?	✓		
8 Which language does your son/daughter speak when he/she wants to talk about a problem?	✓		✓

The first language was hence determined by the dominant language, that is, the language that was most frequently used. Hence in the example above (Figure 12), the first language of this participant would be classified as *Dominant Maltese*. This was decided since there were more code 1s than code 3s – five code 1s (*Dominant Maltese*) and three code 3s (*Mixed*).

Teachers' Questionnaire

School Language. School language was determined by the language of instruction, the language spoken by administration to the students, and the language spoken by the students among themselves. This data was derived from the responses to the form teachers' questionnaire (see Appendix F), and from questions asked verbally, or by email, to the schools' administrating staff, such as heads and assistant heads. The questions asked were:

1. What language is used during assemblies?
2. What language is used by administration with students at the office?
3. What language is mostly spoken in class by students to ask questions or to speak between themselves?
4. What language is spoken during break time between students?

These questions were categorized as *Dominant Maltese*, *Dominant English* and *Mixed* - a mixture of both Maltese and English. Non-native students who spoke their native language at schools with peers who spoke the same language, were still included in the study. This decision was reached, as in schools, the language of communication of non-native students is English, since the schools' administrative staff, educators and local students are not familiar with the native tongue of these students. School Language was defined in this study as that language the students were mostly exposed to at school. Table 20 replicates part of the SPSS database to demonstrate the way School Language was determined for each school. In the case of student number seven (Table 19), where there were an equal number of *Dominant Maltese* and *Mixed* responses, *Mixed* was opted for. This was so as *Dominant Maltese* still implies a certain degree of code switching to English, so that, taken together with the remaining *Mixed* responses, it can safely be said for the school's language to be mixed.

Table 20

Defining the School's Language

Student code	Lang of instruction	Lang used in corridors	Lang used in assemblies	Lang used by Admin	Lang students speak in class	Lang students speak during break	**School Language**
5	Dominant Maltese	Dominant Maltese	Dominant Maltese	Dominant Maltese	Dominant Maltese	Dominant Maltese	**Dominant Maltese**
6	Mixed	Dominant Maltese	Mixed	Mixed	Mixed	Mixed	**Mixed**
7	Mixed	Dominant Maltese	Mixed	Mixed	Dominant Maltese	Dominant Maltese	**Mixed**
8	Mixed	Mixed	Mixed	Mixed	Mixed	Mixed	**Mixed**
9	Dominant English	Mixed	Dominant English	Dominant English	Dominant English	Dominant English	**Dominant English**
10	Dominant Maltese	Dominant Maltese	Dominant Maltese	Dominant Maltese	Dominant Maltese	Dominant Maltese	**Dominant Maltese**

Dominant Maltese was coded as 1; Dominant English was coded as 2; and Mixed was coded as 3. Once the school language was determined for each school, this was inputted for each individual participant, depending on the school they attended. So for example, in the case of participant number seven in Table 19, if the school was Rose School, this was assigned code 3 (*Mixed*). All participants attending Rose School were hence assigned 3 (*Mixed*) as the school language.

Scoring System

Three research assistants were recruited to help with scoring of the test results obtained during the pilot study, and five for scoring of data obtained during the main study. All were speech and language pathology graduates of the University of Malta. Speech and language pathologists were chosen as their programme of studies include assessment and intervention of written language difficulties. The participants were contacted via email by the research supervisor (who acted as mediator) inviting them to participate in the data analysis and inputting stages of the research. Upon being informed about the research study, a consent form (see Appendix AE) was given to the research assistants, which was signed and duly returned to the researcher. Separate appointments, lasting approximatly two hours, were set with the research assistants for training purposes. Test developers emphasize the importance of having experienced evaluators who have scored at least ten writing samples before scoring research samples (Rosenblum et al., 2003b). This approach was adopted for this research, and the scoring of the writing samples took place during the two-hour training period. The scoring criteria (see Appendix AF) were sent by email to the research assistants prior to training. They were requested to read them carefully before the meeting. The EMASH scoring criteria for the copying subtests and the Graphic Speed Test, were the same as those adopted by the authors of the DASH (Barnett et al., 2007). The changes that were made were as follows:

1. Letter strings. The DASH excludes letter strings, such as “laaaa”, from the word count of the free writing task as they are considered “inappropriate writing” (Barnett et al., 2007, p. 41). This test considers these letter strings as pseudo words, and hence contribute to the word count of this test.
2. In the free writing task, the DASH considers the time, e.g. ‘12.30am’ (Barnett et al., 2007, p. 40) as one word. The abbreviated word ‘am’[31] is not considered as a word on its own, despite the fact that it is an abbreviation. Yet the DASH considers abbreviations, such as TV and DVD as words that are to be counted separately. To eliminate this disparity, the

[31] *a.m.* and *p.m.* (also written ‘am’ and ‘pm’, ‘AM’ and ‘PM’, or ‘A.M.’ and ‘P.M.’) are abbreviations of the Latin phrases “ante meridiem” and “post meridiem”, meaing “before noon” and “after noon” respectively (Merriam-Webster, 2019a, 2019b).

EMASH considers all abbreviations (including a.m. and p.m., as individual words, and to be counted separately.

3. For the *Free Writing* subtest, the first eight criteria for English, and the first seven criteria for Maltese (see Appendix AF), were similar to those proposed by the DASH. The remaining criteria were further examples given to test administrators by the researcher, or criteria developed for the purpose of the research, as was the case for Maltese. According to Farrugia (personal communication, August 11, 2016) there are no existing criteria about what defines a word in Maltese, or which criteria are necessary to determine the word count (and hence the writing speed) of the participants. The writing conventions (presented in the points below) were developed by the researcher in consultation with the Institute of Linguistics at the University of Malta.

a. Maltese words with an article e.g. "il-mama" [the mother], "ix-xemx" [the sun], "l-għaġin" [the pasta] are counted as two words. This decision was taken following personal correspondence with a linguistic expert from the Maltese department at the University of Malta. "From a linguistic perspective, the article is usually thought of as part of the word that hosts it (evidence for this is the fact that it changes in some contexts, as in the case of "d"). However, from a computational perspective, we have usually gone for a split. So, "id-dar" [the house] is split into "id-" [the] and "dar" [house]. Same for cases involving prepositions ("mid-dar" [from the house] etc.): we think of "mid-" [from the] as a separate word. The reason for this is that it becomes easier to process at the lexical level." (A. Gatt, personal correspondence, November 14, 2016).

b. Bound morphemes are considered as one word, e.g. "fil-ħanut" [in the shop] ("fi" is the preposition and "l-" is the article) and "lill-Isqof" [to the bishop] ("lil" is the preposition and “l-” is the article), “mid-dar” [from home], “sal-belt” [to the city], “fil-ħarifa” [in autumn], “bl-irkotta” [with ricotta], are to be counted as two words (A. Gatt, personal correspondence, November 14, 2016).

c. Prepositions, followed by apostrophies, such as “f’Malta” [in Malta], “f’uħud” [in some], “m’oħra” [with another], “f’xi”, [in some] and “f’widien” [in valleys], “b’dik” [with it] and “f’moħħu” [in his mind] are both to be counted as one word. Similarly, negatives such as “m’għandux” [he hasn’t], “m’għamilx” [he didn’t do] are to be counted as one word (A. Gatt, personal correspondence, November 15, 2016).

d. Words such as “ 'il bogħod” [far away] and “ 'l isfel” [downwards] are to be counted as two words, as “ 'il” or “ 'l” are counted separately” (A. Gatt, personal correspondence, November 15, 2016). The word “ 'il” in this case is not an article, but is a shorted form of the word “lejn” (towards), which is a word on its own (Il-Malti. n.d.).

e. Prepositions that end with an apostrophe, e.g. “ma' ” and “ta' ” are to be counted as one word.

Upon receiving the raw scores from the research assistants, a random sample from each school was taken and recounted by the researcher. No differences in scoring procedures were observed between the two raters. This was because the research assistants would constantly consult the researcher when they had doubts about scoring procedures. Results were initially inputted into Excel 2010 (see Appendix AG for English and Appendix AH for Maltese), as Excel may be exported into SPSS, and because the research assistants were more familiar and felt more comfortable with Excel. For the copying tasks, the number of legible and illegible words per minute were inputted. For the free writing task, the number of legible and illegible words written every two minutes were inputted. *Excel* worked out the total raw score for each subtest, and the percentage of legible and illegible words written per subtest. Results were then exported to SPSS for further analysis.

The pangram in the *Copy Quickly* and *Copy Neatly* subtests in English and Maltese have a different number of words (15 words in the English pangram, and 12 words in the Maltese pangram). Apart form the count in WPM, two separate counts in Characters per Minute (CPM), and Letters per Minute (LPM) were taken for the *Copy Quickly* and *Copy Neatly* subtests, in English and Maltese. The English and Maltese languages have different letters in their alphabet (see section *The Maltese Language* in Chapter 1). The diagraphs "ie" and "għ" in Maltese are each considered one letter. Hence the Maltese pangram *Kien liebes gozz ħwejjeġ u ċraret vera qodma u m'għażluhx fil-pront* has 55 letters but 52 characters. A parallel count was made for English. The diagraphs "sh", "qu", "ck" and "th" were counted as one letter in the pangram *A mad boxer shot a quick, gloved jab to the jaw of his dizzy opponent*. So this pangram has 54 letters and 50 characters.

Scoring Procedure of Writing Style and Legibility in the Free Writing Subtest

Writing Style was scored on a four-point scale: (1) Cursive, (2) Print, (3) Mixed mostly cursive, with the majority of the letters being joined, and only a few unjoined, and (4) Mixed mostly print, with the majority of the letters being unjoined, with only a few being joined (Graham et al., 2010). An example of cursive script is given in Figure 13; an example of print script is given in Figure 14; an example of mixed mostly cursive script is given in Figure 15; and an example of mixed mostly print script is given in Figure 16. For the purpose of identifying the participant' writing style, only the free writing subtest was analysed, as it is the one that mostly simulates examination conditions. Free writing, academically known as essay writing, forms part of practically every language examination on the island (Cauchi, 1990).

Figure 13

Example of Cursive Script

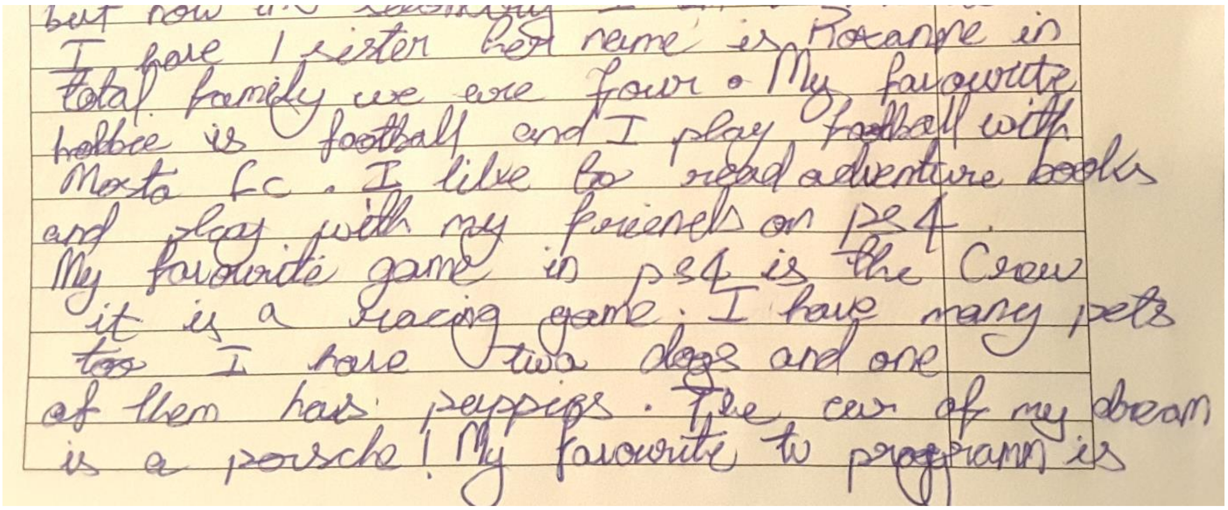

but now
I have 1 sister her name is Roxanne in
total family we are four. My favourite
hobbie is football and I play football with
Mosta FC. I like to read adventure books
and play with my friends on PS4.
My favourite game in PS4 is the Crew
it is a racing game. I have many pets
too I have two dogs and one
of them has puppies. The car of my dream
is a porsche! My favourite tv programm is

Figure 14

Example of Print Script

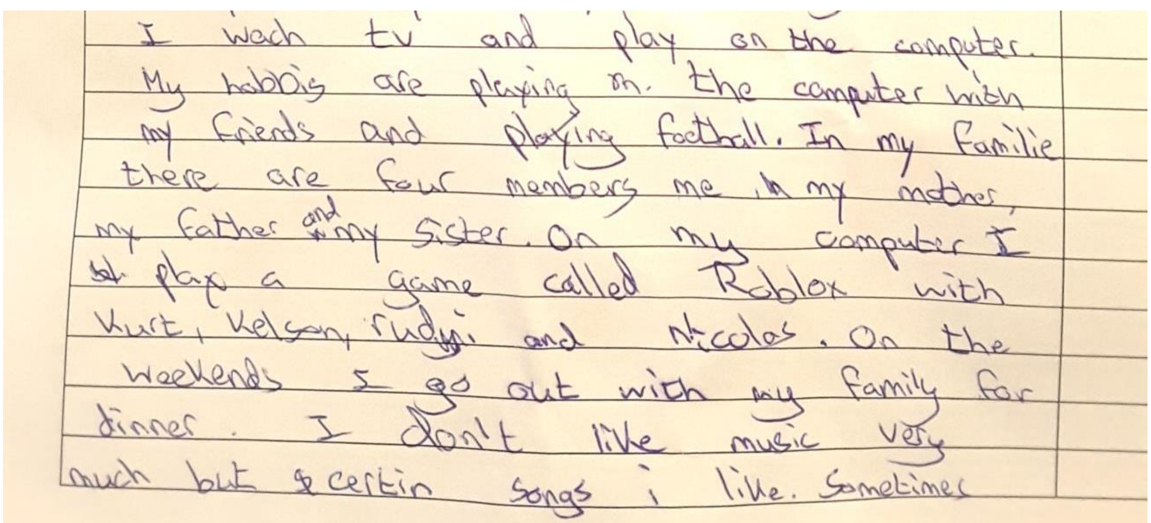

I wach tv and play on the computer.
My hobbis are playing on the computer with
my friends and playing football. In my familie
there are four members me, my mother,
my father and my sister. On my computer I
play a game called Roblox with
Kurt, Kelson, Rudgi and Nicolas. On the
weekends I go out with my family for
dinner. I don't like music very
much but certin songs i like. Sometimes

Figure 15

Example of Mixed Mostly Cursive Script

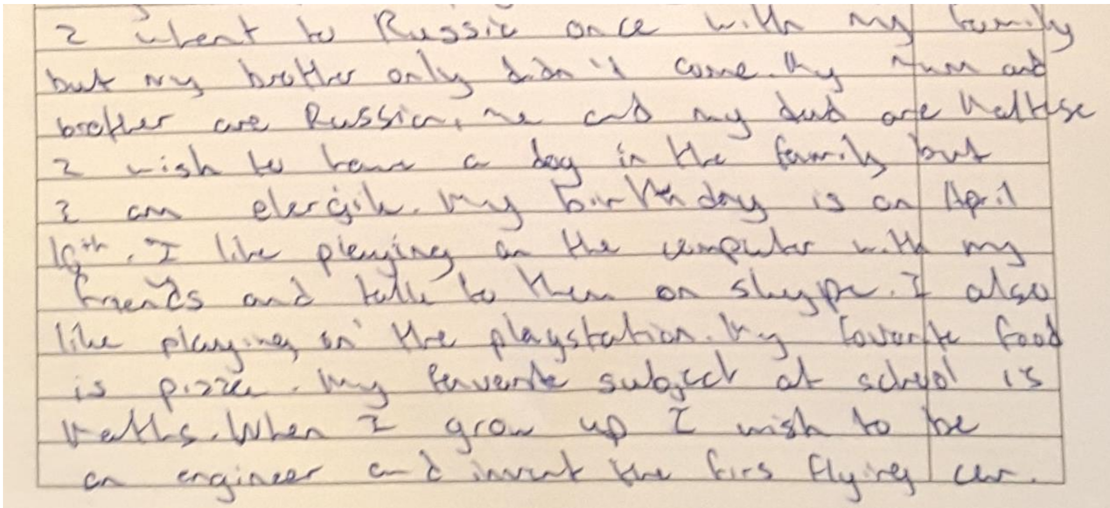
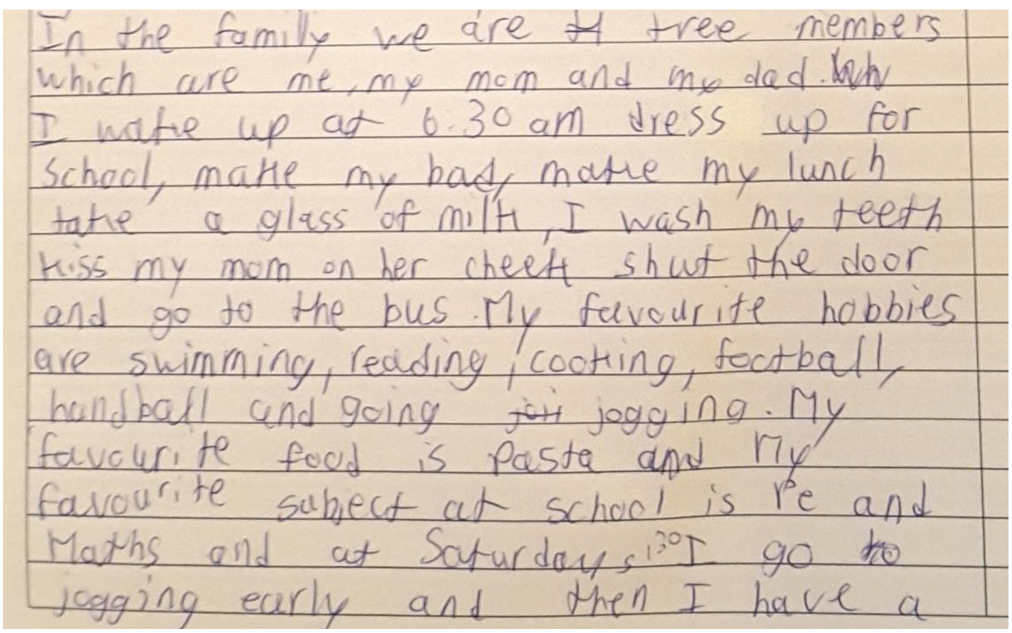


Figure 16

Example of Mixed Mostly Print Script



As a relationship exists between the general legibility of a text, and letter size, letter formation, spacing, slant and alignment of the individual letters/words (Rosenblum et al., 2003b), in the current study, an overall rating was given to the participants' written samples. Ferrier et al.'s (2013) legibility scale was adopted to determine participants' legibility. This rated (1) work in which "overall legibility was poor and considerable portions of the text remained difficult or impossible to decipher"; (2) work which included "some words or phrases that were difficult to decipher"; (3) work "with generally clear legibility but immature appearance"; and (4) work "with overall clear legibility and mature appearance" (p. 69), that is, adult-looking handwriting. Ferrier's scale was selected for this study as it had been analysed for inter-rater reliability, and an inter-rater value between Ferrier and an experienced school teacher of 0.88 was reached. Only the Free Writing subtest was analysed for legibility (either English or Maltese), as it is the one that mostly simulates examination conditions. Two separate legibility counts were drawn: one for English, when legibility was determined from the English *Free Writing* task; and another one for Maltese, when legibility was determined from the Maltese *Free Writing (Kitba Kreattiva)* subtest. This approach was used in order to be able to determine if writing speed affected legibility in either language. Specific deficits in spacing, letter formation, or slant were only considered insofar as they detracted from the legibility of a word (Feder & Majnemer, 2003).

Data Analysis

IBM SPSS (Statistical Package for the Social Sciences, 2017) version 26 and Excel 2016 were used to analyse the data. IBM SPSS statistics was selected because it is the chosen software for quantitative analysis at the University of Malta, and hence is readily available.

Training in the use of SPSS is also provided at the University of Malta. Another reason for the selection of SPSS is because of the numerous amount of statistical tests that it offers, such as descriptive (e.g. mean, median, frequencies) and bivariate statistics (e.g. correlations, t-tests). SPSS also offers inferential statistics including Analysis of Variance[32] (ANOVA), and regression analysis, that assess collectively the impact of a number of independent variables on the dependent variables. These are all statistical measures that strategically address the research questions put forward in this research (see Table 20).

Table 21

Statistical Tests used to Address the Research Questions

Research question	Statistical tests used
RQ1. Is the *English-Maltese Assessment of Speed of Handwriting* (EMASH) a valid and reliable tool to identify handwriting difficulties in Maltese 14-15-year-old students?	ANOVAs Paired samples statistics Pearson correlation Spearman correlation Cronbach Alpha Intra-class correlation
RQ 2. Do factors such as First Language, School Language, Ability, Socio Economic Status, Geographical Regions, School Type, Handedness, Writing Style, Age, Nationality and Gender, affect writing speed?	one-way ANOVAs Kruskal-Walis test Independent sample t-test Mann Whitney test two-way ANOVAS MANOVAs Bonferroni post hoc test Dunn Post hoc test

32 Analysis of Variance (ANOVA) is a statistical method used to make comparisons between three groups or more (e.g. 3 school types).

	Chi Square test Correlations Regression analysis
RQ 3. Does writing speed affect Legibility?	Descriptive statistics

Writing Speed Norms for Bilingual Maltese Students

One of the objectives of the research is to obtain writing speed norms for Maltese 14-year-old students, and standardize the scores. The process of how this was done is explained in Chapter 5 (section *Standardization of the Data*). The process of standardizing the scores, and the results, are kept together in one chapter, not to disrupt the flow of reading.

Conclusion

This chapter discussed the method employed in this research study. It described the participants' selection, the development and administration of the research tools and the scoring criteria. It also discussed the coding system of the dependent and independent variables used to input data into SPSS. The following chapter (Chapter 4) discusses the validity and reliability measures that were conducted in order to address the first research question: Is the *English-Maltese Assessment of Speed of Handwriting* (EMASH) a valid and reliable tool to identify handwriting difficulties in Maltese 14-15-year-old students? This research question is discussed in Chapter 4 not to disrupt the flow of reading.

Chapter 4: Psychometric Validation

According to Phelan and Wren (2006), test validity indicates the degree to which an instrument measures what it is meant to measure, and reliability is the degree to which an instrument generates stable and consistent results. This chapter discusses the validity and reliability measures undertaken during the research, and addresses the first research question: Is the *English-Maltese Assessment of Speed of Handwriting* (EMASH) a valid and reliable tool to identify handwriting difficulties in Maltese 14-15-year-old students?

Since the research aims to standardize the novel writing speed assessment battery, it was necessary to dedicate an entire chapter to the measurement of the validity and reliability of the research tool. The validity and reliability measures that were selected parallel the ones used by test development studies in literature (Barnett et al., 2007; Cardoso et al., 2014; Simons & Probst, 2014). The internal validity measures selected for this research were content and face. The external validity measures selected were discriminative and criterion validity (concurrent). The internal reliability measures selected were Cronbach's Alpha and Guttman Split-Half, whereas the external reliability measures were test-retest, parallel forms and inter-rater. These particular measures were selected because they were deemed appropriate measures suited to the scope of this research.

For this study, the *Detailed Assessment of Speed of Handwriting* (DASH) (Barnett at al., 2007) was adapted to the Maltese population, and a parallel test was developed in Maltese. During the development phase of the EMASH, the assessment battery underwent a series of modifications, described in this section, before it was finalised (see Appendix C for the English version and Appendix D for the Maltese version).

Unidimentionality of the Total Score

Unidimentionality means that only one variable is measured by the test items (Stage, 2003), in this case, words written per minute. Data analysis required computations using the means of the total sum of the subtests that measured writing speed (*Copy Neatly*, *Copy Quickly*, *Copy from the Board* and *Free Writing*), for English and Maltese, respectively. These subtests were initially assessed for normality. As these scores were not all normally distributed (see section *Assessing Data for Normality* in Chapter 5), both the parametric Pearson correlation test and the non-parametric Spearman correlation test were run to check for a relationship (strength and direction) between these pairs of subtests (see Table 22 for English, and Table 23 for Maltese). With large samples, parametric tests are still robust to deviations from Gaussian distributions (Motulsky, 1995). When parametric tests are used with data from a non-Gaussian population, the Central Limit Theorem states that parametric tests still work well, if the sample size is large. The Central Limit Theorem states that the larger the sample size, the more the sample distribution approaches a normal curve (Rogers, 2009; Statistics How To, 2020c). As the sample size of this research is that of 401 participants, parametric, as well as non-parametric tests, were run in cases where the data was skewed and the population was not distributed in a Gaussian manner. However, parametric tests can be significantly affected by outliers (Frost, 2019). Appendices AY and AZ present the range of participants' scores in each English and Maltese subtest, indicating that there are outliers in each case. As nonparametric tests are not seriously affected by outliers (Scibilia, 2015), non-parametric tests were used during data analysis with data from a non-Gaussian population. Results from the Pearson and Spearman correlation tests (Table 22 for English and Table 23 for Maltese) indicated a strong positive significant ($p = 0.000$) relationship for both English and Maltese.

Table 22

Correlation Between Individual English Subtests

		Pearson Correlation Correlation		Spearman's rho Correlation	
		Correlation level	p-value	Correlation level	p-value
English Copy Neatly	English Copy Quickly	0.750	0.000	0.762	0.000
	English Copy from Board	0.685	0.000	0.705	0.000
	English Free Writing	0.683	0.000		
English Copy Quickly	English Copy Neatly	0.750	0.000	0.762	0.000
	English Copy from Board	0.720	0.000	0.749	0.000
	English Free Writing	0.659	0.000	0.675	0.000
English Copy from Board	English Copy Neatly	0.658	0.000	0.705	0.000
	English Copy Quickly	0.720	0.000	0.749	0.000
	English Free Writing	0.632	0.000	0.626	0.000
English Free Writing	English Copy Neatly	0.683	0.000		
	English Copy Quickly	0.659	0.000	0.675	0.000
	English Copy from Board	0.632	0.000	0.626	0.000

Table 23

Correlation Between Individual Maltese Subtests

		Pearson Correlation		Spearman's rho Correlation	
		Correlation level	p-value	Correlation level	p-value
Maltese Copy Neatly (Ikkopja Pulit)	Maltese Copy Quickly (Ikkopja Malajr)	0.806	0.000	0.791	0.000
	Maltese Copy from Board (Ikkopja mill-Bord)	0.774	0.000		
	Maltese Free Writing (Kitba Kreattiva)	0.625	0.000	0.641	0.000
Maltese Copy Quickly (Ikkopja Malajr)	Maltese Copy Neatly (Ikkopja Pulit)	0.806	0.000	0.791	0.000
	Maltese Copy from Board (Ikkopja mill-Bord)	0.787	0.000	0.787	0.000
	Maltese Free Writing (Kitba Kreattiva)	0.643	0.000	0.667	0.000
Maltese Copy from Board (Ikkopja mill-Bord)	Maltese Copy Neatly (Ikkopja Pulit)	0.774	0.000		
	Maltese Copy Quickly (Ikkopja Malajr)	0.787	0.000	0.787	0.000
	Maltese Free Writing (Kitba Kreattiva)	0.623	0.000	0.646	0.000
Maltese Free Writing (Kitba Kreattiva)	Maltese Copy Neatly (Ikkopja Pulit)	0.625	0.000	0.641	0.000
	Maltese Copy Quickly (Ikkopja Malajr)	0.643	0.000	0.667	0.000
	Maltese Copy from Board (Ikkopja mill-Bord)	0.623	0.000	0.646	0.000

Factor analysis was conducted on the four highly correlated subtests to examine their unidimentionality (Barnett et al., 2007). Factor analysis was carried out using principal axis factoring. This was the method of extraction chosen when running the test due to the non-normal distribution of scores (F. Sammut, personal correspondence, June 15, 2018).

The *Total Variance Explained* table (Table 24 for English and Table 25 for Maltese) shows that only one substantial factor emerged with an eigenvalue ≥1. The eigenvalue is a measure of the variance, that is, the average spread of data from the mean (Rahn, 2018). This factor explains 69.041% of the variance for the English scores (highlighted in Table 24) and 72.006% of the variance for the Maltese scores (highlighted in Table 24). This single-factor solution accounting for the large proportion of the total variance, is regarded as strong evidence for the unidimentionality of a multi-task scale (Barnett et al., 2007), and hence justifies the calculation of a total score as the sum of the task scores.

Table 24

Total Variance Explained for the English Subtests

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.067	76.673	76.673	2.762	69.041	69.041
2	0.383	9.566	86.240			
3	0.313	7.816	94.055			
4	0.238	5.945	100.000			

Extraction Method: Principal Axis Factoring.

Table 25

Total Variance Explained for the Maltese Subtests

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.142	78.547	78.547	2.880	72.006	72.006
2	0.445	11.133	89.681			
3	0.229	5.722	95.403			
4	0.184	4.597	100.000			

Extraction Method: Principal Axis Factoring.

The scree plots for English (Figure 17) and for Maltese (Figure 18) show that only one factor (WPM) was above an eigenvalue of 1.

Figure 17

Scree Plot for English

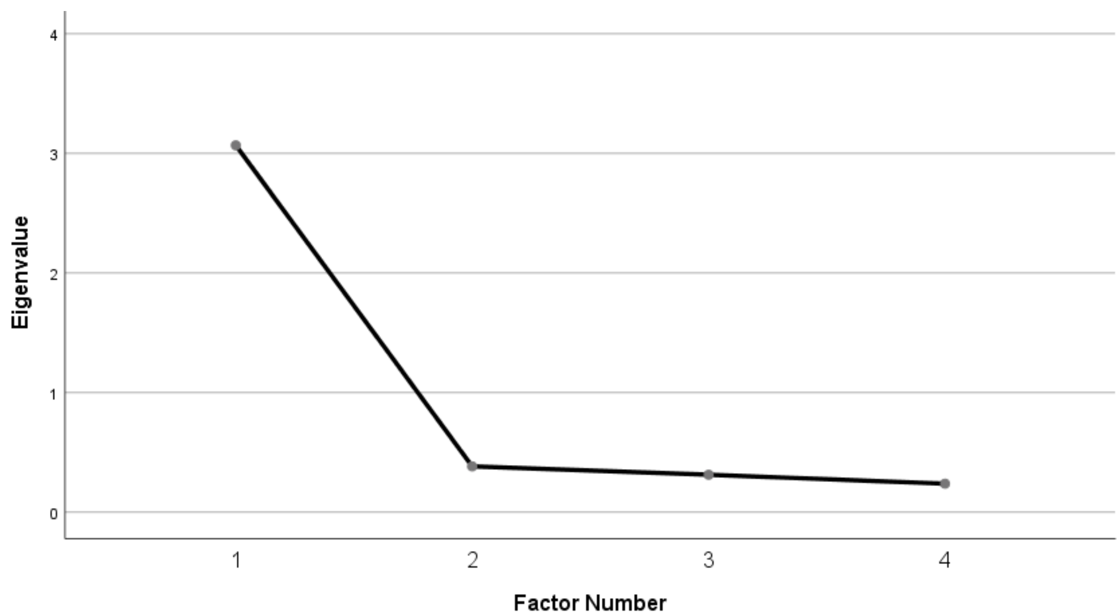
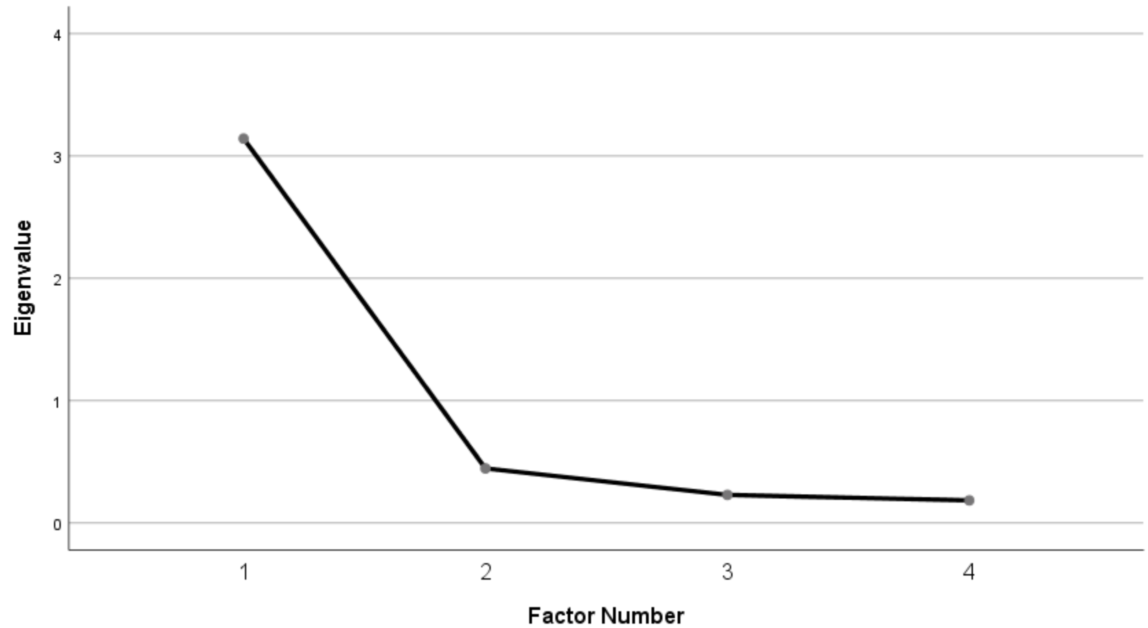


Figure 18

Scree Plot for Maltese



Factor loadings are the relationship of each variable to the underlying factor (Rahn, 2018). Factor loadings can vary from -1 to 1. The closer factors are to -1 or 1, the more they affect the variable. A correlation coefficient close to 1 indicates a very strong positive relationship; whereas a correlation coefficient close to -1 indicates a strong, negative relationship (Nickolas, 2018). A positive correlation means that as one variable increases, the other variable increases too (Hayes, 2019). In a negative correlation, when one variable increases, the other decreases in a linear manner (Picardo, 2019). A factor loading of zero would indicate no effect (Statistics How To, 2014a). A correlation above 0.5 is deemed important (The Pennsylvania State University, 2018).

Tables 26 and 27 show that all factor loadings were > 0.5 indicating that they are strongly correlated with the underlying factor. This result leads to the conclusion that these four subtests could be regarded as a homogenous set of tasks allowing the calculation of a meaningful total score for English and Maltese respectively (Barnett et al., 2007). Results were significant at the 0.05 level of significance ($p = 0.000$).

Table 26

Correlations of the English Subtests to the Extracted Factor

English subtests	Factor 1
English Copy Neatly	0.859
English Copy Quickly	0.872
English Copy from Board	0.813
English Free Writing	0.776

Table 27

Correlations of the Maltese Subtests to the Extracted Factor

Maltese subtests	WPM
Maltese Copy Neatly (Ikkopja Pulit)	0.891
Maltese Copy Quickly (Ikkopja Malajr)	0.909
Maltese Copy from the Board (Ikkopja mill-Bord)	0.872
Maltese Free Writing (Kitba Kreattiva)	0.707

Factor analysis results also present the Kaiser Meyer Olkin (KMO) and Bartlett's Test of Sphericity. These measure the strength of relationship among the variables. Table 28 gives Kaiser's (1974) description of the strength of relationship.

Table 28

Kaiser's Describtion of the Strength of Relationship

KMO	Strength of Relationship
in the 0.90s	marvellous
in the 0.80s	meritorious
in the 0.70s	middling
in the 0.60s	mediocre
in the 0.50s	miserable
below 0.50	unacceptable

The KMO measure is 0.840 for English and 0.842 for Maltese (highlighted in Table 29), indicating a 'meritorious' relationship among variables. Also in both cases, the Bartlett's Test of Sphericity is significant ($p = 0.000$), as it is less than the 0.05 criterion (Grande, 2016)[33]. This is another indication that there is a relationship between the four subtests, and that they can therefore be regarded as a homogenous set of tasks, allowing the calculation of a meaningful total score for English and Maltese.

Table 29

Kaiser Meyer Olkin (KMO) and Bartlett's Test of Sphericity for English

		English	Maltese
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.840	0.842
Bartlett's Test of Sphericity	Approx. Chi-Square	841.069	936.939
	df	6	6
	p-value	0.000	0.000

[33] Null Hypothesis H_0: There is no relationship between the variables.
Alternate Hypothesis H_1: There is a relationship between the variables.
Taking a level of significance of 0.05, if $p > 0.05$, then H_0; if $p < 0.05$, then H_1.

Validity Measures

Internal Validity

Research is said to have internal validity if all confounding variables have been eliminated (Wright & Lake, n.d.). Confounding variables are "extra" variables that were not accounted for, such as pre-testing or test fatigue. They can suggest there is correlation between the dependent and independent variables, when in fact there is none. To ensure high internal validity, the following confounding variables were avoided (Statistics How To, 2018b):

- Pre-testing subjects - participants were not pre-tested in this study, so that they do not get clues about the test from the pre-test.
- Testing different participants. In this research the same participants were tested each time. If the test is administered on different students, external variables, such as teaching instruction, could be introduced that may skew results,
- Practice effects. This is when a participant's score on a test may improve simply from repeating the same test material (Duff et al., 2011). In order to avoid this happening, participants were asked to retake the test, for purposes of test-retest reliability, after two weeks. Test-retest studies have shown that practice effects are not evident beyond a two-week period (e.g. Barnett et al., 2007).
- Order effects. Participants' performance may be affected by the order in which the test material is presented to them (Strack, 1992). Participants may perform better as they become more familiar with the test. To minimize order effects, during data collection, the subtests were administered in a different sequence for some of the participants. Furthermore, some students sat for the English test first, whereas others sat first for the Maltese test.

- Test fatigue – leaving too little time between one test and the other may alternate the results of the test. Resulting writing speed scores may be lower due to fatigue. In this study, tests were administered at an interval of a week.
- Changing the data collection tools during the study. The same assessment battery was administered throughout the study. The only instance when the instrument was changed was in order to administer concurrent validity.

Content validity. Content validity analyses the degree to which the test questions are relevant to the content they are meant to assess (Almanasreh et al., 2019). Content validity relies on the expertise of professionals who are knowledgeable about the construct being measured (Clause, 2020). In this regard, domain-related professionals, including practitioners (such as linguists, educational psychologists and occupational therapists), were invited, via a mediator, to offer their expert feedback on the content validity of the subtests, in order to determine how well the items cover the concepts they are supposed to measure. Feedback offered during personal discussions with these professionals determined content validity by considering the appropriateness of the test items, their duration, the overall duration of the test, the scoring procedure, the layout of the test paper, and the font style and font size.

For the purpose of this research, it was necessary to develop a pangram in Maltese. A pangram is a sentence containing all the letters of the alphabet. Translating the English pangram (provided in the DASH) to Maltese would not have obtained the same end since the letters of the alphabet are different (see section *The Maltese Language* in Chapter 1). The expertise of two academics from the Maltese Department within the Faculty of Arts at the University of Malta, was sought with regard to the creation of a syntactically and grammatically correct Maltese pangram. At the start of the consultation process, three possible pangrams were proposed:

1. M'għażluhx fil-pront bil-gozz ħwejjeg veru ċari u qodma li kien liebes (57 letters). *(He was not chosen at once because of the pile of faded and shabby clothes he was wearing.)*

2. Kien liebes gozz ħwejjeg u ċraret vera qodma u m'għażluhx fil-pront (55 letters). *(He was wearing a pile of very old clothes and cloths and was not chosen promptly.)*

3. Hi sejħet u deheret tiekol cagħaq mixwi f'važun bil-pizz go gaġġa. (53 letters). (*She called and was seen eating roasted pebbles in a decorative vase inside a cage.)*

The first two options were proposed by one of the academics of Maltese (M, Mifsud, personal correspondence, March, 25, 2016). The third option, proposed by the researcher, was discussed and later discarded after consultation with the second Professor of Maltese (B, Micallef, personal correspondence, August 14, 2016). He pointed out that "*sejħet*" (called) is a transitive verb, which needs to be followed by a noun or pronoun e.g. "*sejħet lil ħuha*" (called her brother). In the end, the pangram *Kien liebes gozz ħwejjeg u ċraret vera qodma u m'għażluhx fil-pront* was selected as it is the shortest, grammatically correct phrase of all three that fits the criteria of a pangram.

Following the consultation process about the development of the pangram, the initial drafts of the English and Maltese assessment batteries (see Appendices AI and AJ respectively), were submitted for content validation to the relevant professionals. The research supervisor acted as mediator and contacted these professionals by e-mail. Those who consented were contacted by the researcher and an appointment was scheduled at the validator's convenience. The content of the meetings and topics discussed are further explained in Appendix AK. All meetings were face-to-face interviews, and started with the researcher providing an overview of purpose of the research and the content of the assessment battery. Below is a list of the professionals who were involved in the process used to determine content validity, together with their specific roles.

Professionals Consulted	Reason
1. A senior lecturer of English within the Faculty of Arts at the University of Malta.	To validate the content of the English test version.
2. Two professionals in the Occupational Therapy (OT) field. These individuals were chosen because occupational therapists are often consulted about handwriting problems.	To validate the usefulness of the test to Occupational Therapists (OTs) for awarding access arrangements.
3. An academic specialised in Maltese within the Faculty of Arts at the University of Malta.	To validate the Maltese component of the test.
4. An academic specialised in learning disabilities from the Faculty of Social Wellbeing at the University of Malta.	To validate the usefulness of the test in identifying students with handwriting difficulties.
5. An educational psychologist at the Secretariat of Catholic Education.	To validate the usefulness of the test to educational psychologists for awarding access arrangements.

The modifications made to the EMASH following consultation with experts, are presented in Tables 30 and 31. Table 30 discusses the layout of the test papers, and Table 31 discusses scoring and administrative procedures. The versions of the tests that were used for Pilot testing are in Appendices J and K, for English and Maltese, respectively.

Table 30

Modifications Made to the Layout of the EMASH Following Consultation with Validators

ints discussed with validators	Prior to discussion	Following discussion	Reason
Graphic Speed: diameter of circles	Outer circle diameter: 2.3cm	Outer circle diameter: 1.95cm	To parallel the inner and outer circle diameter provided by the *Graphic Speed* subtest in the DASH (Barnett et al, 2007).
	Inner circle diameter: 1.7cm	Inner circle diameter: 1.45cm	
Line spacing	Line spacing: 1.6 cm	Line spacing increased to 1.8 cm	To parallel the line spacing used in the DASH and line spacing of foolscaps used in exams.
Borders	Fancy borders were used.	Plain borders were used.	To keep the formatting simple in order for the test paper to be dyslexia friendly.
Headings, instructions and/or titles	To be found at the start of each subtest.	Removed.	To keep the formatting simple in order for the test paper to be dyslexia friendly.
The title on the front page of the Maltese assessment battery	*Assessjar tal-Kitba* (Writing Assessment).	Changed to *Ħiliet fil-Kitba* (Writing Skills).	To avoid using complicated language that might confuse students.
Free Writing subtest title	The title of the English free writing subtest was *My Life*. The title of the Maltese writing subtest was *Il-Familja Tieghi* (My Family).	The title of the English free writing subtest remained the same. The title of the Maltese free writing subtest was changed to *Xi Nħobb Nagħmel* (What I like to Do).	The English and Maltese free writing tasks have different titles but similar prompts. This makes it possible for testers to choose whether to use one or both tests, as students would be writing similar content. Yet if the tests are administered apart from each other, different titles reduce the chances of students reproducing exactly the same content in both tests.

Test items	The *Copy Neatly* pangram was written between the first two writing lines on the first page.	The pangram was placed above the first writing line on first the page.	To parallel the layout of the DASH.
Font style	*Andika*	Changed to *Verdana*.	The *Verdana* font was the preferred option because that this font is considered to be the most readable font and is used in MATSEC papers (MATSEC Support Unit (2017).
Font size	Size 12	Increased to size 15.	So that font sizes matched each other throughout the test paper.

Table 31

Modifications Made to the Administration of the EMASH Following Consultation with Validators

Points discussed with validators	Prior to discussion	Following discussion	Reason
Copy from the Board: subtest duration	1 minute	2 minutes	To allow participants enough time to visualize, memorise and write the text.
Illegible words	Illegible words were to be counted separately only in the *Free Writing* subtest.	Illegible words should be counted separately in *all* writing tasks, using two counts: one for legible words only, and one for legible *and* illegible words. For the free writing task, a percentage of illegible words was calculated, using the formula (illegible words / by legible words) * 100.	The decision to include two counts for all writing tasks (one for legible words only, and one for legible and illegible words) was taken following recommendations by Prunty et al. (2013) who showed that omitting illegible words could lead to abnormally low scores in cases of participants with a coordination disorder. This allows a comparison to be drawn between the two counts: between the raw score for legible words only, and the raw score for legible *and* illegible words.
Coding system	"Student number" on front page.	"Student number" to be replaced with "Student code" and to be inserted into an empty box (see Appendix J for English and Appendix K for Maltese).	So that the test does not feel like a school exam, thus putting added pressure on the students.
Scoring practices	Scoring table on front page.	Scoring table removed.	To keep the test paper as simple and plain as possible, and hence dyslexia friendly.

When the research instrument is developed in one culture, but is then applied to another, cross-cutural adaptations are necessary so that the instrument can be adopted by the target population (Cardoso et al., 2014). In order to make the test more culturally acceptable, "feasts" was added to the free writing spider diagram, and "weekends" replaced "clubs" in the final draft of the assessment battery used for data collection (see Appendix C for English and Appendix D for Maltese).

Face validity. Face validity determines how relevant the test is to test takers (Holden, 2010), and whether it measures what it is meant to measure. During the pilot study, the class teachers in charge of the class on the day of the testing were informed about the study via an information letter (Appendix AL). Eleven teachers were contacted, out of which six (three from state schools; one from a boys' church school; one from a girls' church school; and one from an independent school) consented to a meeting. During this meeting the research aim was explained and the assessment battery was shown and explained to them. Teachers were asked to provide feedback about how effective the test items were in measuring writing speed, by considering the following questions:

Is the test able to:

- determine letter formation?
- determine pen grip?
- determine a student's best handwriting?
- determine if a student is able to speed up their writing?
- identify writing difficulties due to motoric deficiencies (such as dyspraxia)?
- identify writing difficulties due to language disorders (such as dyslexia and dysgraphia)?

- simulate writing in a classroom environment?
- simulate writing under examination conditions?

Discussion took place verbally, and the researcher took note of the teachers' responses in a notebook. According to the teachers interviewed, the assessment batteries were appropriate, so no modifications to the test papers were made.

External Validity

External validity determines the degree to which the result of a study can be generalized to groups of people, settings and time (Steckler & McLeroy, 2008). The external validity measures adopted in this study were discriminative and criterion validity (concurrent).

Discriminative. This type of validity exists when variables are weakly associated, or not associated with each other (Engellant et al., 2016). In the pilot study (see Chapter 2), discriminative validity was established by administering the EMASH to a group of typically developing students and another group of students who presented with, or where previously diagnosed with learning difficulties (see Table 32).

Table 32

Pilot Study Participants, Grouped by Ability

Learning difficulties	Sample size	Percent
Typically developing	52	31.7
Dyslexia	5	3.0
Dyspraxia	1	0.6
ADHD/ADD	1	0.6
General Learning Disabilities	11	6.7
Total	70	42.7

In Malta, students with LD receive a diagnosis and a report by an educational psychologist earlier on in their school life. The report is passed on to the Statementing Moderating Panel[34] whose function is to allocate Learning Support Educators (LSE) to students with LD. For the purpose of this part of the study, the parental consent form was modified to ask permission to have access to these reports and personal files (see Appendix AM). However, the same administration and testing procedures were applied as with the typically developing group.

Students with learning difficulties are expected to have handwriting difficulties when compared to a typically developing group (Barnett et al., 2007). Findings show that students with learning difficulties (five students diagnosed dyslexia, and one diagnosed with dyspraxia) in the pilot study were significantly slower to write than typically developing students (see Table 33).

[34] The functions and role of the Statementing Moderating Panel are discussed within the Inclusive Education Policy regarding students with a disability. Online reference: https://education.gov.mt/en/resources/Documents/Policy%20Documents/inclusion_of_students_with_disability.pdf accessed on 18/08/2016.

Table 33

Writing Speed Performance of Students with Varying Abilities

Ability		Total English Score	Total Maltese Score
None	Mean	28.11	22.92
	Sample Size	52	52
General Learning Disabilities	Mean	22.63	17.94
	Sample Size	18	18
Dyslexia and dyspraxia	Mean	21.46	14.79
	Sample Size	6	6

The F ratio generated by the ANOVA test (Table 34) is the ratio of how much variability there is *between* the groups relative to how much there is *within* the groups (Pezullo, 2019). Between-group differences show how two or more groups are different (in this case, students with LD and typically developing students, in English and Maltese respectively), whereas within-group differences show differences among subjects who are in the same group. When the F ratio is close to 1, no true difference exists. In this case, since the F ratio is larger than 1 (see Table 34), there is a significant (p = 0.000) difference between the scores attained by students with LD and typically developing students.

Table 34

ANOVA Test in English and Maltese for Students with LD and Typically Developing Students

		Sum of Squares	df	Mean Square	F	p-value
Total English Score	Between Groups	401.388	1	401.388	13.448	0.000
	Within Groups	2029.651	68	29.848		
	Total	2431.039	69			
Total Maltese Score	Between Groups	331.108	1	331.108	13.956	0.000
	Within Groups	1613.298	68	23.725		
	Total	1944.406	69			

Similar results were attained in the main study. Table 35 presents the mean number of words written per minute by students with LD, and typically developing students, in the English and Maltese tests. Appendices AN and AO present graphical representations of these results, for English and Maltese, respectively. Overall, students with LD were significantly slower to write than typically developing children.

Table 35

Mean Number of Words Written by Students with LD and Typically Developing Students, in English and Maltese

Subtest/Test	Ability	WPM
English Copy Neatly	Typically Developing	27.73
	Students with LD	25.11
English Copy Quickly	Typically Developing	32.99
	Students with LD	29.73
English Copy from Board	Typically Developing	20.53
	Students with LD	17.79
English Free Writing	Typically Developing	21.42
	Students with LD	18.76
Total English Score	Typically Developing	23.26
	Students with LD	19.94
Maltese Copy Neatly (Ikkopja Pulit)	Typically Developing	21.23
	Students with LD	18.54
Maltese Copy Quickly (Ikkopja Malajr)	Typically Developing	25.09
	Students with LD	21.88
Maltese Copy from the Board (Ikkopja mill-Bord)	Typically Developing	20.59
	Students with LD	17.21
Maltese Free Writing (Kitba Kreattiva)	Typically Developing	16.58
	Students with LD	14.16
Total Maltese Score	Typically Developing	18.51
	Students with LD	16.01

The F ratio derived form the ANOVA test (see Table 36), is larger than 1, which means that there is a significant (p = 0.000) difference between the scores attained by typically developing students and students with LD.

Table 36

ANOVA Test in English and Maltese for Students with LD and Typically Developing Students

		Sum of Squares	df	Mean Square	F	p-value
English Copy Neatly	Between Groups	348.012	1	348.012	10.802	0.001
	Within Groups	11502.041	357	32.219		
English Copy Quickly	Between Groups	531.068	1	531.068	17.329	0.000
	Within Groups	10940.895	357	30.647		
English Copy from Board	Between Groups	373.827	1	373.827	19.425	0.000
	Within Groups	6870.432	357	19.245		
English Free Writing	Between Groups	338.011	1	338.011	13.819	0.000
	Within Groups	8511.866	348	24.459		
Total English Score	Between Groups	560.621				
	Within Groups	8982.500	1	560.621	22.344	0.000
Maltese Copy Neatly	Between Groups	323.817	1	323.817	16.619	0.000
(Ikkopja Pulit)	Within Groups	6624.829	340	19.485		
Maltese Copy Quickly	Between Groups	461.416	1	461.416	22.654	0.000
(Ikkopja Malajr)	Within Groups	6884.437	338	20.368		
Maltese Copy from the	Between Groups	503.699	1	503.699	22.652	0.000
Board (Ikkopja mill-Bord)	Within Groups	7493.633	337	22.236		
Maltese Free Writing	Between Groups	262.266	1	262.266	13.097	0.000
(Kitba Kreattiva)	Within Groups	6708.373	335	20.025		
Total Maltese Score	Between Groups	279.164	1	279.164	15.226	0.000
	Within Groups	6233.773	340	18.335		

Criterion Validity. Criterion validity determines how well a measure is associated to an outcome. Concurrent validity and predicative validity are both types of criterion validity, differing mainly on when the outcome is measured (Statistics How to, 2020a). Concurrent validity takes places around the time of testing. Predicative validity may take place months or years after testing.

Concurrent Validity. Concurrent validity determines the validity of a novel test by comparing the results of this novel test, to the results of a well-established test (Statistics How to, 2020b). The well-established test serves as the criterion against which the novel test is measured. Concurrent validity was established in the main study by running another test, the DASH (Barnett et al., 2007), that assessed the same skills as the English version of the EMASH, to the same group of participants, over a period of time. Comparisons were then drawn between the two tests. To ascertain concurrent validity, both assessment tools contained items that tested the same concepts, skills and knowledge (Phelan & Wren, 2006).

For the purpose of this research, an English test paper was developed with the same content as the DASH (see Appendix AP), except for the alphabet writing task, which was removed (see Appendix AK, section *Fifth Validator*). The layout of the novel DASH paper was similar to the English test paper of the EMASH. This decision was taken out of the necessity to have an assessment battery that probes the same skills, and that parallels the administration of the EMASH, in order not to introduce external variables that might compromise results.

The schools that were selected for concurrent validity included a boy's church school, an independent school and three state schools: one from the Northern Harbour District, one from the Southern Harbour District and one from the Western District. The independent school and the state schools from the Northern Harbour and Southern Harbour District had also participated in the main study. The school from the Southern Harbour district that had taken part in the main study withdrew before the validation process began. A replacement school was found. The girls' church school that had consented to take part in the concurrent validity process, also withdrew from the study and a replacement could not be found.

In order to recruit participants for concurrent validity, the participants who took part in the main study were given a second consent form explaining the validity process (see Appendix AQ). This second cycle of testing was only administered to those participants who returned this consent form. In the case of the replacement school, a different consent form was given, explaining the main study and the validation process, and requesting participants to take part in both (see Appendix AR).

Twenty-seven male students and 18 female students, (30 from the state schools, eight from the boys' church school, and seven from the independent school), sat for the EMASH and the corresponding DASH paper. This number of participants was deemed adequate by the researcher since the results attained from the 45 students were satisfactory, and hence there was no need to increase the sample size (L. Camilleri, personal communication, March 6, 2018). Thirty-four of these participants were typically developing students, eight had been diagnosed with dyslexia, and three had general learning disabilities. The same administrative procedures and scoring system discussed in Chapter 3 were applied.

The interval for concurrent validity was mostly a week, with one school performing the test 15 days after the first assessment, because of time constraints. This time frame was determined following personal communication with a statistician, who stressed the importance of allowing sufficient time (normally a week) between the first and second administration of the test to eliminate test fatigue (Cefai & Camilleri, 2009; L. Camilleri, personal communication, January 15, 2017). The DASH was administered after the EMASH in every school. This was so, as the students had already sat for the EMASH test in the main study. The only exception was the replacement school, where the DASH was administered first to reduce order effects. The coding of the scripts followed the same procedure as explained in Chapter 3 (section *Coding System)*. However, the letters PF[35] were added to the DASH paper. So the code of student 200 of Rose School, sitting for the DASH paper, would be coded as RS200EPF.

Paired samples statistics (see Table 37) show that the mean number of WPM written by the same participants in all the subtests of the EMASH English paper is close to that of its DASH equivalent. The average number of WPM written overall in the EMASH test is also compared to the average number of WPM written overall in its DASH equivalent (pair 5). Results were not significant at the 0.05 level of significance, showing that there were no differences between scores.

Table 37

Paired Samples Statistics for the EMASH English Paper and that of its DASH Equivalent

		Mean	Sample size	Std. Deviation	p-value
Pair 1	English Copy Neatly	28.102	44.000	5.214	0.166
	Equivalent Test of English Copy Neatly	27.398	44.000	5.598	
Pair 2	English Copy Quickly	33.091	44.000	5.497	0.315
	Equivalent Test of English Copy Quickly	32.568	44.000	5.271	
Pair 3	Graphic Speed Test English correct no. of crosses	42.114	44.000	15.747	0.608

[35] A code used by the researcher for the DASH test paper.

	Equivalent Test of Graphic Speed Test English correct no. of crosses	42.977	44.000	13.068	
Pair 4	English Free Writing	20.946	41.000	5.032	0.315
	Equivalent Test of English Free Writing	21.385	41.000	3.987	
Pair 5	EMASH Total English Score	22.683	44.000	6.153	0.094
	Equivalent Test DASH Total English Score	23.523	44.000	4.333	

Each subtest of the English EMASH paper was correlated with its equivalent subtest of the English DASH paper, checking first for a normal distribution of scores. In order to assess the normality distribution of their scores, the Shapiro Wilk test was used. Table 38 shows that the EMASH scores of the participants were normally distributed, as the p-values were larger than the 0.05 level of significance. Table 39 shows that the DASH scores of the same participants were also normally distributed. The only exception was *Copy Quickly* ($p = 0.027$, highlighted in Table 39), indicating that the scores for this subtest were not normally distributed. Pearson correlation (r) was used to check for linearity for all parametric subtests. Spearman correlation (r_s) was used to check for linearity for the nonparametric subtests. The choice of using parametric or nonparametric tests depends on sample size (see section *Unidimentionality of the Total Score* in this chapter). As the sample size for concurrent validity was small, separate parametric and nonparametric tests were conducted.

Table 38

Normality Distribution of the EMASH Scores

	Statistic	df	p-value
EMASH English Copy Neatly	0.983	41	0.780
EMASH English Copy Quickly	0.965	41	0.230
EMASH English Copy from Board	0.978	41	0.599
EMASH Graphic Speed Test	0.983	41	0.796
EMASH English Free Writing	0.979	41	0.656
Total EMASH Sores	0.980	41	0.685

Table 39

Normality Distribution of the DASH Scores

	Statistic	df	p-value
DASH English Copy Neatly	0.972	41	0.392
DASH English Copy Quickly	0.938	41	0.027
DASH Graphic Speed Test	0.973	41	0.432
DASH English Free Writing	0.973	41	0.434
Total DASH Scores	0.972	41	0.405

Table 40 summaries the results of the Pearson and Spearman correlations for the EMASH subtests and test, and the equivalent DASH subtests and test. (See Appendix AS for these tests, and Appendix AT for a graphical representation of their results.) Pearson correlation results showed significant positive linear relationships between the English EMASH and DASH subtests and tests. This means that when participants scored low on the EMASH, they also scored low on the DASH. Likewise, when participants scored high on the EMASH, they also scored high on the DASH. The interpretation of the Spearman correlation coefficient (r_s) is similar to that of Pearson's. However, Spearman's correlation determines monotonic relationships rather than linear ones (Laerd Statistics, 2018b). If a relationship between two variables is monotonic, the rate of increase or decrease doesn't have to happen at the same time, causing a curved pattern in the data. Spearman's correlation coefficient for the EMASH and DASH *Copy Quickly* subtests shows a significant positive monotonic relationship, meaning that when participants scored low on the EMASH, they also scored low on the DASH, and when they scored high on the EMASH, they also scored high on the DASH, though the rate of increase did not happen at the same time. To conclude, the results of the Pearson and Spearman correlations show that the EMASH has high concurrent validity with the DASH.

Table 40

Correlation Coefficients for the EMASH and DASH Subtests and Test

	Pearson correlation	Spearman correlation	p-value
Copy Neatly	0.814		0.000
Copy Quickly		0.827	0.000
Graphic Speed Test	0.719		0.000
Free Writing	0.837		0.000
Total Score	0.864		0.000

Additional Validation Check

A Paired-Samples t-Test computed the copy speed difference score by subtracting the mean number of words written per minute at the *Copy Neatly* subtest (Maltese and English) from the *Copy Quickly* subtest (see Table 41). A copy speed difference check determines if participants are able to speed up when instructed. An inability to do so indicates handwriting difficulties. This computation showed that participants responded to the speed up instruction in the second subtest (Barnett et al., 2007). The mean increase in writing speed, for both Maltese and English, was significant at the 0.05 level of significance (p = 0.000), showing that there was a difference between scores.

Table 41

Mean Copy Speed difference in WPM between the Copy Neatly and Copy Quickly Subtests for English and Maltese

		Mean	Std. Deviation	p-value
Pair 1	English Copy Quickly – English Copy Neatly	5.13966	4.03331	0.000
Pair 2	Maltese Copy Quickly (Ikkopja Malajr) – Maltese Copy Neatly (Ikkopja Pulit)	3.73382	2.84903	0.000

Reliability Measures

Internal Reliability

This determines how items in a test relate to each other and to the test as a whole. It also reflects the redundancy of the items in a scale (McCrae et al., 2011).

Internal consistency. Internal consistency reliability was determined via the Cronbach's Alpha test. In general, Cronbach’s Alpha is interpreted as explained in Table 42 (Statistics How To, 2014b).

Table 42

Interpreting Cronbach's Alpha

Cronbach's Alpha	Internal Consistency
≥ 0.9	Excellent
0.89 – 0.8	Good
0.79 – 0.7	Acceptable
0.69 – 0.6	Questionable
0.59 – 0.5	Poor
0.49 >	Unacceptable

The Cronbach's Alpha test for the five English and five Maltese sub tests yielded Cronbach's Alpha values of 0.733 and 0.636 respectively (highlighted in Tables 43 and 44 respectively), showing that the internal consistency for English was acceptable, but questionable for Maltese.

Table 43

Cronbach's Alpha Value for English subtests, including the Graphic Speed Test

Cronbach's Alpha	Cronbach's Alpha based on standardized items	No. of Items
0.733	0.846	5

Table 44

Cronbach's Alpha Value for Maltese, including the Graphic Speed Test

Cronbach's Alpha	Cronbach's Alpha based on standardized items	No. of Items
0.636	0.802	5

Weaker correlations between subtests were associated with the Graphic Speed Tests for both English and Maltese (highlighted in Tables 45 and 46).

Table 45

Inter-item Correlation Table for English

	English Copy Neatly	English Copy Quickly	English Copy from the Board	English Free Writing	Graphic Speed Test English
English Copy Neatly	1.000	.863	0.715	0.697	0.242
English Copy Quickly	0.863	1.000	0.776	0.726	0.216
English Copy from the Board	0.715	0.776	1.000	0.657	0.181
English Free Writing	0.697	0.726	0.657	1.000	0.155
Graphic Speed Test English	0.242	0.216	0.181	0.155	1.000

Table 46

Inter-item Correlation Table for Maltese

	Maltese Copy Neatly (Ikkopja Pulit)	Maltese Copy Quickly (Ikkopja Malajr)	Maltese Copy from the Board (Ikkopja mill-Bord)	Maltese Free Writing (Kitba Kreattiva)	Graphic Speed Test Maltese
Maltese Copy Neatly (Ikkopja Pulit)	1.000	0.861	0.720	0.474	0.231
Maltese Copy Quickly (Ikkopja Malajr)	0.861	1.000	0.739	0.593	0.225

Maltese Copy from the Board (Ikkopja mill-Bord)	0.720	0.739	1.000	0.386	0.108
Maltese Free Writing (Kitba Kreattiva)	0.474	0.593	0.386	1.000	0.132
Graphic Speed Test Maltese	0.231	0.225	0.108	0.132	1.000

Inter-item values that are lower than 0.20 indicate that the items may not be representative of the same content domain (Wongpakaran & Wongpakaran, n.d.). This indicates that the graphic speed test does not measure the same construct as the rest of the items. In fact, it does not measure writing speed but perceptual-motor difficulties. Tables 47 and 48 show the Cronbach's Alpha value for the English and Maltese assessment batteries respectively, if each subtest were to be removed from the assessment battery. By removing the Graphic Speed subtest from the assessment battery, the Cronbach's Alpha increased to 0.914 in English (highlighted in Table 47), and 0.848 in Maltese (highlighted in Table 48) indicating an increase in reliability (Reynaldo & Santos, 1999). Removal of the Graphic Speed Test is justified because:

1. this test is not constrained by language;
2. DASH testees complete the Graphic Speed Test only once. Removing the Graphic Speed Test from the Maltese version of the test battery means that, participants will perform the Graphic Speed Test only once, and that (like the DASH), standard scores for the Graphic Speed Test for the EMASH will be derived from this single performance.

Table 47

New Cronbach's Alpha Value if Each Individual Subtest of the English Assessment Battery were to be Removed

English subtests	Cronbach's Alpha if item is removed
English Copy Neatly	0.615
English Copy Quickly	0.599
English Copy from the Board	0.666
English Free Writing	0.660
Graphic Speed Test	0.914

Table 48

New Cronbach's Alpha Value if Each Individual Subtest of the Maltese Assessment Battery Were to be Removed

Maltese subtests	Cronbach's Alpha if item is removed
Maltese Copy Neatly (Ikkopja Pulit)	0.504
Maltese Copy Quickly (Ikkopja Malajr)	0.506
Maltese Copy from the Board (Ikkopja mill-Bord)	0.526
Maltese Free Writing (Kitba Kreattiva)	0.558
Graphic Speed Test Maltese Correct no. of Crosses	0.848

Guttman Split Half. The internal consistency of a test may also be measured using the split-half method. This assesses if all parts of the test measure what they are supposed to measure in the same way (McLeod, 2013), by comparing the results of one half of the test with the results of the other half. There are numerous ways in which a test may be split in half. If there are ten items in a text, the first five items could be compared with the last five items. Alternatively, the odd-numbered items could be compared with the even-numbered. A test is said to have internal consistency if the two halves of the test produce similar results. Items on the test that have a low correlation (e.g. r = 0.20) should be rewritten or removed (McLeod, 2013). The Guttman Split-Half coefficient needs to be more than 0.80 to indicate good reliability. A value below 0.80 is considered adequate (F. Sammut, personal correspondence, December 17, 2018; L. Camilleri, personal correspondence, December 17, 2018).

The Guttman Split-Half coefficient was calculated first by comparing the *Copy Neatly* and *Copy Quickly* subtests to the *Copy from the Board* and *Free Writing* subtests in English. The resulting coefficient (0.884) indicated good reliability (see Table 49).

Table 49

Split-Half Reliability Estimates of the English Parallel Items (Test 1)

Cronbach's Alpha	Part 1	Value	0.858
		no. of Items	2[a]
	Part 2	Value	0.772
		no. of Items	2[b]
	Total no. of Items		4
Correlation Between Forms			0.811
Spearman-Brown Coefficient	Equal Length		0.896
	Unequal Length		0.896
Guttman Split-Half Coefficient			**0.884**

a. The items are: English Copy Neatly, English Copy Quickly.
b. The items are: English Copy from Board, English Free Writing.

The *Copy Neatly* and the *Copy from the Board* English subtests were then compared to the *Copy Quickly* and *Free Writing* subtests. These returned a coefficient of 0.913 (Table 50), which also indicated good reliability.

Table 50

Split-Half Reliability Estimates of the English Parallel Items (Test 2)

Cronbach's Alpha	Part 1	Value	0.796
		N of Items	2[a]
	Part 2	Value	0.791
		N of Items	2[b]
	Total no. of Items		4
Correlation Between Forms			0.840
Spearman-Brown	Equal Length		0.913
Coefficient	Unequal Length		0.913
Guttman Split-Half Coefficient			**0.913**

a. The items are: English Copy Neatly, English Copy from Board.
b. The items are: English Copy Quickly, English Free Writing.

The Guttman Split-Half coefficient was calculated in a similar manner for the Maltese tests. First the *Copy Neatly* and *Copy Quickly* subtests were compared to the *Copy from the Board* and *Free Writing* subtests. The resulting coefficient (0.906) indicated good reliability (see Table 51).

Table 51

Split-half Reliability Estimates of the Maltese Parallel Items (Test 1)

Cronbach's Alpha	Part 1	Value	0.897
		no. of Items	2[a]
	Part 2	Value	0.767
		no. of Items	2[b]
	Total no. of Items		4
Correlation Between Forms			0.828
Spearman-Brown Coefficient	Equal Length		0.906
	Unequal Length		0.906
Guttman Split-Half Coefficient			**0.906**

a. The items are: Maltese Copy Neatly (Ikkopja Pulit), Maltese Copy Quickly (Ikkopja Malajr)
b. The items are: Maltese Copy from Board (Ikkopja mill-Bord), Maltese Free Writing (Kitba Kreattiva)

The *Copy Neatly* and the *Maltese Copy from the Board (Ikkopja mill-Bord)* subtests were then compared to the *Copy Quickly* and *Free Writing* subtests. These returned a coefficient of 0.909 (Table 52), which also indicated good reliability.

Table 52

Split-half Reliability Estimates of the Maltese Parallel Items (Test 2)

Cronbach's Alpha	Part 1	Value	0.872
		no. of Items	2[a]
	Part 2	Value	0.782
		no. of Items	2[b]
	Total no. of Items		4
Correlation Between Forms			0.834
Spearman-Brown Coefficient	Equal Length		0.910
	Unequal Length		0.910
Guttman Split-Half Coefficient			**0.909**

a. The items are: Maltese Copy Neatly (Ikkopja Pulit), Maltese Copy from Board (Ikkopja mill-Bord).
b. The items are: Maltese Copy Quickly (Ikkopja Malajr), Maltese Free Writing (Kitba Kreattiva).

External Reliability

External reliability determines how much "a measure varies from one use to another" (McLeod, 2013). The external reliability measures in this study were test-retest, parallel (or alternate) forms and inter-rater reliability.

Test-Retest. Test-retest reliability is obtained by administering the same test twice, after some time, to the same testees. The test is considered stable over time if the results from the two tests are similar (Phelan & Wren, 2006).

Thirty-four participants did the English test again; whereas 56 participants did the Maltese test again. These figures were deemed appropriate (L. Camilleri, personal communication, March 30, 2018), given that in the literature sample size for test-retest reliability varies, with studies having 20 participants (Rizvi et al., 2000; Brookshire & Nicholas, 1994), and others including 384 participants (Dikmen et al., 1999).

The schools that were selected for test-retest reliability were selected accordingly:

1. Three state schools were selected, one from the Northern Harbour District, one from the Southern Harbour District and one from the Western District, in order to have a fair distribution of state school students from all over the island. The schools from the Northern and Southern Harbour Districts had also participated in the main study. The school from the Western District that had taken part in the main study withdrew before the validation process began. No replacement school could be found.
2. A boys' and a girls' church school.
3. No independent school consented to take part in the test retest reliability process.

The participants who also took part in the main study were given a second consent form explaining the reliability process (see Appendix AQ). The final number of participants who consented to take part in the retest procedure is shown in Tables 53 and 54, grouped by gender and school type, respectively. The same administrative procedures and scoring system discussed in Chapter 3 were applied.

Table 53

Test-Retest number of Participants, Grouped by Gender

Gender	English	Maltese
Male	17	27
Female	17	29
Total	34	56

Table 54

Test-Retest number of Participants, Grouped by School Type

School Type	English	Maltese
State	15	34
Boys' church	11	14
Girls' church	8	8
Total	34	56

The participant group also included a typically developing participants and students with LD (see Table 55).

Table 55

Test-Retest number of Participants, Grouped by Ability

Ability	Maltese retest	English retest
None	46	29
Dyslexia	3	0
ADHD/ADD	2	1
General Learning Disabilities	5	4
Total	56	34

The interval for test-retest assessment was approximately 15 days, with one school performing the test 22 days after the first assessment, as other school activities prevented the tester from administering the test sooner. These time frames were permissible as practice effects were not evident from test-retest studies on the DASH, that took place after two weeks (Barnett et al., 2007). Furthermore, in the DASH, the second group of participants was retested after 8 to 12 days. There does not seem to be evidence available to aid in the selection of the time interval between test and retest. In fact, this interval has varied in studies from two days (Backhaus et al., 2002; Lundy et al., 2014; Marx et al., 2003), a week (Paquet et al., 2014), two weeks (Larkey & Knight, 2002; Marx et al., 2003); to months (Safaz et al., 2015; Sharpley et al., 2015). When testing for test-retest reliability, it must be ensured that no changes occur in the participants between measurements (Marx, 2004). Hence the time between tests must not be too long for external factors, such as handwriting intervention, to take effect.

For test-retest, the scripts were coded in the same way as explained in Chapter 3 (see section *Coding System* in this chapter). However, the letter R was added for the retest paper. So the code of student 50 of Rose School, sitting for an English retest paper, would read RS50ER. Likewise, the code for student 120 of Rose School, sitting for a Maltese retest paper, would read RC120MR. For data analysis, paired samples statistics, showing the Pearson correlation, was used.

The English Test. Paired samples statistics executed using SPSS (Table 56) show the average number of WPM written by the same participants in all the English subtests and the retests (pairs 1-5 in Table 56). The average number of WPM written overall in the English test (Total English Score) is also compared to the average number of WPM written overall in the English retest (pair 6). Results are not significant at the 0.05 level of significance, showing that there are no differences between scores.

Table 56

Paired Samples Statistics for the English Test and its Retest

		Mean	Sample size	Std. deviation	p-value
Pair 1	English Copy Neatly	27.014	35.000	4.690	0.142
	Retest of English Copy Neatly	28.043	35.000	5.425	
Pair 2	English Copy Quickly	32.014	35.000	5.273	0.979
	Retest of English Copy Quickly	32.000	35.000	5.119	
Pair 3	English Copy from Board	20.114	35.000	4.084	0.159
	Retest of English Copy from Board	19.457	35.000	4.140	
Pair 4	Graphic Speed Test English	45.114	35.000	14.885	0.290
	Retest of Graphic Speed Test English	47.571	35.000	14.751	
Pair 5	English Free Writing	19.854	35.000	4.691	0.343
	Retest of English Free Writing	20.429	35.000	5.223	
Pair 6	Total English Score	22.302	35.000	4.306	0.412
	Retest Total English Score	22.705	35.000	4.583	

The performance of the participants in each subtest of the English EMASH paper was correlated with its corresponding subtest of the English retest paper. Prior to running pairwise correlations, the normality distribution of the scores was determined. The Shapiro Wilk test was used, as it considers both Skewness and Kurtosis simultaneously (see Chapter 5, section *Assessing Data for Normality*). Table 57 shows that the English EMASH scores of these participants were normally distributed, as the p-values were larger than the 0.05 level of significance. Table 57 also shows that the English retest scores of these participants were also normally distributed, as the p-values were likewise larger than the 0.05 level of significance. As both English EMASH scores and the corresponding retest scores were normally distributed, Pearson correlation (r) was used to check for linearity between the variables.

Table 57

Distribution of the English EMASH Scores

Test				Retest			
	Statistic	df	p-value		Statistic	df	p-value
English Copy Neatly	0.980	57	0.467	Retest of English Copy Neatly	0.983	30	0.895
English Copy Quickly	0.966	57	0.105	Retest of English Copy Quickly	0.987	30	0.971
English Copy from Board	0.985	57	0.716	Retest of English Copy from Board	0.973	30	0.618
Graphic Speed Test	0.978	57	0.399	Graphic Speed Test	0.971	30	0.562
English Free Writing	0.980	57	0.449	Retest of English Free Writing	0.953	30	0.199
Total English Score	0.965	57	0.094	Retest Total English Score	0.972	30	0.582

Pearson correlation tests gave significant positive correlations between the English EMASH test, all its subtests, and their retests (see Table 58). (See Appendix AU for the Pearson correlation tests, and Appendix AV for graphical representaions of these correlations).

Table 58

Pearson Correlations between the EMASH English Subtests, and English Total Score, and their Retests

	Pearson Correlation	*p-value*
Copy Neatly	0.689	0.000
Copy Quickly	0.800	0.000
Copy from the Board	0.785	0.000
Free Writing	0.751	0.000
Graphic Speed Test	0.583	0.000
Total Score	0.793	0.000

The Maltese Test. Each subtest of the Maltese test correlated with its corresponding subtest of the Maltese retest. Prior to running correlations, the normality distribution of the scores was determined. The Shapiro Wilk test was used, as it considers both Skewness and Kurtosis simultaneously. Table 59 shows a normal distribution of scores for the Maltese EMASH test and its retest (p = > 0.05). Hence Pearson correlation (r) was used to check for linearity between the variables.

Table 59

Distribution of the Maltese Scores

Test				Retest			
	Statistic	df	p-value		Statistic	df	p-value
Maltese Copy Neatly (Ikkopja Pulit)	0.971	57	0.184	Retest of Maltese Copy Neatly (Ikkopja Pulit)	0.981	30	0.839
Maltese Copy Quickly (Ikkopja Malajr)	0.975	57	0.278	Retest of Maltese Copy Quickly (Ikkopja Malajr)	0.956	30	0.245

Maltese Copy from Board (Ikkopja mill-Bord)	0.976	57	0.305	Retest of Maltese Copy from Board (Ikkopja mill-Bord)	0.967	30	0.463
Maltese Free Writing (Kitba Kreattiva)	0.977	57	0.355	Retest of Maltese Free Writing (Kitba Kreattiva)	0.953	30	0.198
Total Maltese Score	0.982	57	0.557	Retest Total Maltese Score	0.981	30	0.842

Paired samples statistics (see Table 60) show that the mean number of WPM written by the same participants in all the Maltese subtests (pairs 1-4 in Table 60), and its retest. The average number of WPM written overall in the Maltese test is also compared to the average number of WPM written overall in the Maltese retest (pair 5). Results are not significant at the 0.05 level of significance, showing that there are no differences between scores.

Table 60

Paired Samples Statistics for the Maltese Assessment Battery and its Retest

		Mean	Sample size	Std. Deviation	p-value
Pair 1	Maltese Copy Neatly (Ikkopja Pulit)	21.773	55.000	4.072	0.238
	Retest of Maltese Copy Neatly (Ikkopja Pulit)	21.318	55.000	4.148	
Pair 2	Maltese Copy Quickly (Ikkopja Malajr)	25.355	55.000	4.304	0.979
	Retest of Maltese Copy Quickly (Ikkopja Malajr)	25.364	55.000	4.577	

Pair 3	Maltese Copy from Board (Ikkopja mill-Bord)	21.255	55.000	4.380	0.668
	Retest of Maltese Copy from Board (Ikkopja mill-Bord)	21.100	55.000	4.500	
Pair 4	Maltese Free Writing (Kitba Kreattiva)	16.405	55.000	3.961	0.700
	Retest of Maltese Free Writing (Kitba Kreattiva)	16.533	55.000	3.892	
Pair 5	Total Maltese Score	18.801	55.000	3.736	0.985
	Retest Total Maltese Score	18.806	55.000	3.633	

Pearson correlation tests gave significant positive correlations between the Maltese EMASH test and its subtests, and their retests (see Table 61). (See Appendix AW for the Pearson correlation tests, and Appendix AX for graphical representaions of these correlations).

Table 61

Pearson Correlations between the EMASH Maltese Subtests, and Maltese Total Score, and their Retests

	Pearson Correlation	*p-value*
Copy Neatly	0.764	0.000
Copy Quickly	0.831	0.000
Copy from the Board	0.821	0.000
Free Writing	0.807	0.000
Total Score	0.881	0.000

The correlation coefficients for the English and Maltese tests, and their respective retests, were relatively high, meaning that the students who wrote fast in the English or Maltese EMASH test also wrote fast in its retest, and those who wrote slowly in the English or Maltese EMASH test, also wrote slowly in its retest. These results confirm the EMASH as a reliable handwriting speed tool.

Parallel Forms. Parallel or alternative forms reliability correlates two versions of the same test that have been administered to the same participants. The reliability of both tests is determined by the correlation between the tests (Hilger & Beauducel, 2017). In this study the parallel forms constitute the English version of the EMASH and the newly developed Maltese version, whose subtests were developed in parallel to the English form. Reliability was demonstrated by correlating the English subtests and Total Score to the equivalent Maltese subtests and Total Score (Table 62). The Graphic Speed Test was omittied from this computation as there was no equivalent Graphic Speed Test in the Maltese version of the test. Prior to running correlations, the normality distribution of the scores was determined (see section *Assessing Data for Normality* in Chapter 5). Pearson correlation was used when scores were normally distributed. When scores were not normally distributed, both the parametric Pearson test and its non-parametric equivalent, Spearman's rho test, were used for data analysis. Correlations results showed a positive correlation significant at the 0.01 level of significance ($p = 0.000$), meaning that when a student attained low scores in a subtest/test in one language, they also attained low scores in the equivalent subtest/test in the other language. This means that both the English and Maltese versions of the EMASH measure the same concept (writing speed).

Table 62

Correlation Between the English Subtest/Test and the Maltese Subtests/Test

		Pearson Correlation		Spearman's rho Correlation	
		Correlation level	p-value	Correlation level	p-value
English Copy Neatly	Maltese Copy Neatly (Ikkopja Pulit)	0.712	0.000		
English Copy Quickly	Maltese Copy Quickly (Ikkopja Malajr)	0.758	0.000	0.743	0.000
English Copy from Board	Maltese Copy from Board (Ikkopja mill-Bord)	0.795	0.000	0.805	0.000
English Free Writing	Maltese Free Writing (Kitba Kreattiva)	0.666	0.000	0.706	0.000
Total English Score	Total Maltese Score	0.728	0.000	0.775	0.000

Inter-Rater. A very important type of reliability concerns the degree of agreement among scorers (or raters), due to the fact that the number of words in the scripts were counted by different people. Even though the research assistants received training, and the EMASH presents precise instruction on what scorers are to count or not count as legible or illegible words, there is still an element of subjectivity. This depends on whether a scorer manages to decipher unclear words or not. Inter-rater agreement was conducted in order to determine the extent to which subjectivity influenced the final score. In inter-rater agreement, scorers rate the performance of a group of participants independently of each other. The extent to which their scores agree provides a measure of reliability. High inter-rater reliability exists when there is high agreement between scorers. Low inter-rater reliability occurs when there is low agreement between scorers (Lange, 2011). In this study, the scripts of 50 students were selected randomly as explained in Table 63.

Table 63

Student Selection for Inter-Rater Reliability

School Type	Number of students	Number of English Scripts	Number of Maltese Scripts
state	10	10	10
girls' church	5	5	5
boys' church	5	5	5
independent	5	5	5

Five of these 50 students had LD, with three having general learning disabilities, another having ADHD, and the last dyslexia. Students with LD were included in the random sample of scripts selected for inter-rater agreement, to have a more realistic representative sample of the students attending the schools being tested. A sample size of 50 participants was deemed appropriate (L, Camilleri, personal correspondence, April 18, 2018), given that in the literature inter-rater reliability was determined on sample sizes of 20 participants (Mikkelsen et al., 2015) to sample sized as large as 223 participants (Krishnasamy & Unsworth, 2011).

In the case of the EMASH, two independent scorers scored half the sample size each and entered the data in Excel sheets (see Appendix AG for English and Appendix AH for Maltese). These same scripts were then given to a third scorer, who entered the data in similar but separate Excel sheets. All the data was transferred to the SPSS database and absolute agreement was estimated using intraclass correlation coefficient (ICC). Tables 64 and 65 outline the results of the intraclass correlations for absolute agreement between the raters for each of the English and Maltese EMASH subtests respectively. The results indicate an accuracy in the scoring rules with all ICCs > 0.90. These intraclass correlations were all significant at the 0.05 criterion (p = 0.000).

Table 64

Intra-class Correlation for Absolute Agreement for all English Subtests

	Intraclass Correlation for absolute agreement	95% Confidence Interval Lower Bound	Upper Bound	p-value
English Copy Neatly	0.999	0.999	1.000	0.000
English Copy Quickly	0.999	0.997	0.999	0.000
English Copy from the Board	0.912	0.803	0.961	0.000
Graphic Speed Test	0.932	0.848	0.970	0.000
English Free Writing	0.961	0.911	0.983	0.000

Table 65

Intra-class Correlation for Absolute Agreement for all Maltese Subtests

	Intraclass Correlation for absolute agreement	95% Confidence Interval Lower Bound	Upper Bound	p-value
Maltese Copy Neatly (Ikkopja Pulit)	0.991	0.978	0.996	0.000
Maltese Copy Quickly (Ikkopja Malajr)	0.999	0.998	1.000	0.000
Maltese Copy from the Board) (Ikkopja mill-Bord)	1.000	1.000	1.000	0.000
Maltese Free Writing (Kitba Kreattiva)	0.998	0.995	0.999	0.000

Conclusion

This chapter discussed the measures of validity and reliability conducted on the EMASH assessment battery. Results have shown that the EMASH is a reliable and valid handwriting speed assessment tool. The four writing speed tasks: C*opy Quickly*, *Copy Neatly, Copy from the Board* and *Free Writing*, were found to be unidimensional, leading to the conclusion that these four subtests could be regarded as a homogeneous set of tasks, allowing for the calculation of a meaningful total score for English and Maltese. The following chapter (Chapter 5) discusses the results derived from the data analysis of the main study.

Chapter 5: Results

This chapter discusses the results obtained following data collection. Descriptive statistics present the participants' performance in each subtest, as well as their overall performance in the EMASH. It also presents the participants' performance in each subtest grouped according to each of the independent variables. Following descriptive analysis, the data was assessed for normality to get an overview of the distribution of scores. The mean, median, standard deviation (SD), skewness and kurtosis values were calculated for each of the English and Maltese subtests and Total Scores. Normality tests helped determine whether parametric or non-parametric tests were needed for inferential statistical analysis. Inferential statistics was used to determine which of the dependent variables were influenced by the independent variables. Comparisons were drawn between student performance on the English and Maltese test. Correlation and regression analyses were then conducted to determine the relationship and predictors between variables. Given the large amount of data, some of the graphs and tables are presented in the appendices so as not to disrupt the flow of reading. This chapter also outlines the standardisation process of the EMASH for the Maltese population. As a reminder, the 12 dependent variables are: English *Copy Neatly*, English *Copy Quickly*, English *Copy from the Board*, English *Free Writing*, Graphic Speed Test, Total English Score, Maltese *Copy Neatly* (*Ikkopja Pulit*), Maltese *Copy Quickly* (*Ikkopja Malajr*), Maltese *Copy from the Board* (*Ikkopja mill-Bord*), Maltese *Free Writing* (*Kitba Kreattiva*), Total Maltese Score and Legibility. The 11 independent variables of the research: First Language, School Language, Nationality, Ability, Geographical Regions, Socio Economic Status, School Type, Gender, Age, Handedness and Writing Style.

Analysis of data was based on scores obtained from 89.8% of the sample population for English and 85.3% for Maltese (Table 66). The remaining 10.2% and 14.7% for English and Maltese respectively, include participants who missed a test in either of these languages.

Table 66

Number of Participants who Participated in both the English and Maltese Tests

	Cases included		Excluded		Total	
	Sample size	Percent	Sample size	Percent	Sample size	Percent
English	360	89.8%	41	10.2%	401	100%
Maltese	342	85.3%	59	14.7%	401	100%

Table 67 gives a breakdown of the participants' First Language, grouped by School Type, and the languages they were exposed to at school. The majority (142) spoke predominantly Maltese with their family and friends, and were mostly exposed to Maltese in the state school they attended. Participants attending the independent school spoke a variety of languages, but were exposed predominantly to English at school. Boys and girls attending church schools spoke predominantly Maltese, but were exposed mainly to Maltese or to a mixture of Maltese and English.

Table 67

Participants' First Language Grouped by School Type and School Language

		First language			
School Type	School Language	Dominant Maltese	Dominant English	Mixed	Non-native
State	Dominant Maltese	142	6	14	5
	Dominant English	1	0	0	0
	Mixed	46	3	12	14
Independent	Dominant English	16	13	5	9
Boys' church	Dominant Maltese	41	2	7	0
	Mixed	17	1	4	0
Girls' church	Dominant Maltese	20	0	4	0
	Mixed	9	6	2	0

Descriptive Statistics – Overall Performance

Table 68 presents the participants' performance (mean, median, standard deviation[36], minimum score and maximum score) in each of the English and Maltese subtests (*Copy Neatly, Copy Quickly*, *Copy from the Board* and *Free Writing*) in words per minute. A graphic representation of these scores can be found in Appendices AY and AZ. The box plots presented in this section display the range of the scores, indicate the outliers and present the upper quartile and lower quartile of the score distribution. Although there is a large variation in the performance of children, the majority of the participants' scores fall within the interquartile range[37]. Table 68 also presents the participants' overall average performance in Total English Score and Total Maltese Score. Results showed that participants were able to write more words

[36] The *Standard Deviation* is a number that tells us by how much the scores are spread out from the mean. A low standard deviation indicates that the scores are clustered around mean, while a high standard deviation indicates that the scores are spread out over a wider range of values (Niles, 2019).
[37] The range of scores between the 25th and 75th percentiles.

in English (Total English Score and the individual English subtests), than in Maltese, except for the *Copy from the Board* subtest. For this subtest, participants wrote an average of 22 WPM in both English and Maltese. Results also show that students were able to increase their writing speed when requested at the *Copy Quickly* subtests. Participants increased their speed by 5.2 WPM in English and 3.8 WPM in Maltese. Table 68 shows that participants wrote less when requested to copy from the board (far point copying) than when they were asked to copy from the paper (near point copying) (*Copy Neatly* and *Copy Quickly*), and that they generated the least text during the *Free Writing* task. Table 68 also presents the scores of the Graphic Speed Test, which are the number of correct crosses participants managed to draw in one minute. Table 69 gives Characters per Minute (CPM) and Letters Per Minute (LPM) counts of the English and Maltese *Copy Neatly* and *Copy Quickly* subtests.

Table 68

Overall Students' Performance on the EMASH

Subtest		WPM	Subtest		WPM
English Copy Neatly	Mean	27.28	Maltese Copy Neatly (Ikkopja Pulit)	Mean	20.81
	Median	27.00		Median	21.00
	Std. Deviation	5.75		Std. Deviation	4.51
	Minimum	10.50		Minimum	6.50
	Maximum	41.50		Maximum	32.00
English Copy Quickly	Mean	32.44	Maltese Copy Quickly (Ikkopja Malajr)	Mean	24.59
	Median	32.00		Median	24.50
	Std. Deviation	5.66		Std. Deviation	4.66
	Minimum	12.50		Minimum	6.50
	Maximum	56.00		Maximum	36.000

English Copy from Board	Mean	20.07	Maltese Copy from Board (Ikkopja mill-Bord)	Mean	20.08
	Median	20.00		Median	20.00
	Std. Deviation	4.498		Std. Deviation	4.86
	Minimum	4.50		Minimum	4.50
	Maximum	43.50		Maximum	31.50
Graphic Speed Test	Mean	41.78			
	Median	41.00			
	Std. Deviation	13.47			
	Minimum	0.00			
	Maximum	80.00			
English Free Writing	Mean	20.99	Maltese Free Writing (Kitba Kreattiva)	Mean	16.20
	Median	21.15		Median	16.40
	Std. Deviation	5.04		Std. Deviation	4.56
	Minimum	6.80		Minimum	1.60
	Maximum	33.80		Maximum	28.50
Total English Score	Mean	22.70	Total Maltese Score	Mean	18.12
	Median	22.94		Median	18.28
	Std. Deviation	5.16		Std. Deviation	4.37
	Minimum	3.75		Minimum	3.81
	Maximum	35.75		Maximum	28.19

Table 69

CPM and LPM of the Copy Neatly and the Copy Quickly Subtests

	English Copy Neatly CPM	English Copy Quickly CPM	Maltese Copy Neatly (Ikkopja Pulit) CPM	Maltese Copy Quickly (Ikkopja Malajr) CPM
LMP	98	117	95	113
CPM	91	108	90	107

Graphical representations of the distribution of scores in WPM of Total English Score and Total Maltese Score, respectively, are given in Figure 19. Figure 20 presents a graphical representation of the distribution of scores of the Graphic Speed Test, in correct number of crosses. These box plots demonstrate that although the scores varied, the majority of the participants' scores still fell within the interquartile range.

Figure 19

Distribution of Scores on the EMASH

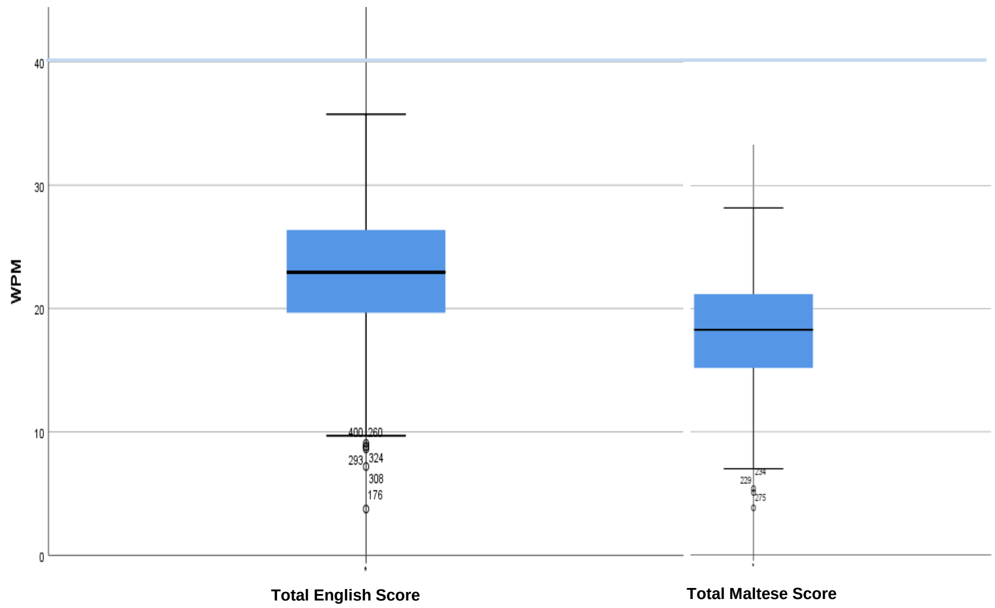
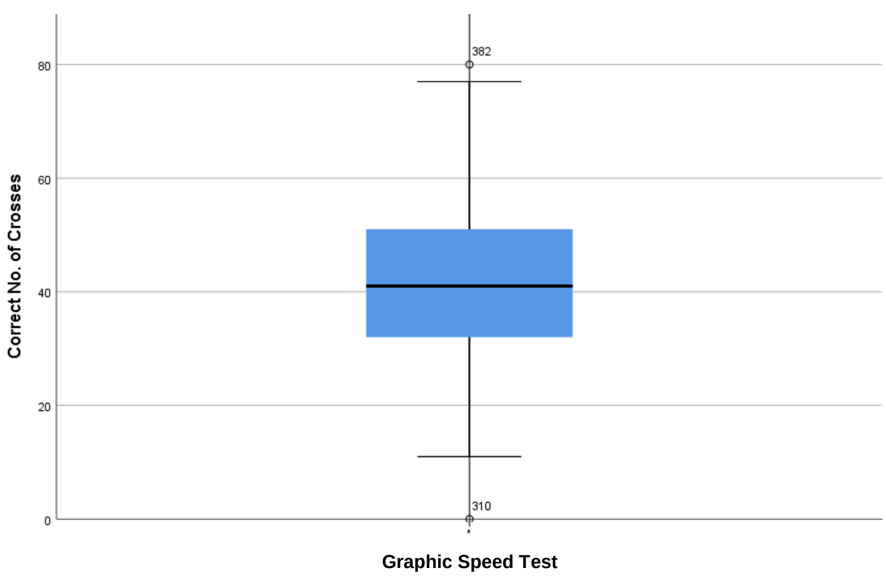


Figure 20

Distribution of Scores on the Graphic Speed Test



Descriptive Statistics - Grouped by Independent Variables

This section provides descriptive statistics in WPM (mean, median, SD, minimum and maximum), of the scores obtained by the participants, grouped by the independent variables, for the English and Maltese Total Scores, respectively. Appendices BA and BB give the same descriptive statistics in WPM of the individual English and Maltese subtests, respectively. Tables 70 to 80 display the scores in WPM attained by the participants in the English and Maltese Total Scores, grouped by Ability, Geographical Region, Gender, Student Nationality, Age, School Type, School Language, Writing Style, SES, First Language and Handedness, respectively.

Table 70

Ability

Ability		Total English Score	Total Maltese Score
Typically Developing	Mean	23.26	18.51
	Median	23.72	18.97
	Std. Deviation	4.86	4.31
	Minimum	8.63	3.81
	Maximum	35.75	28.19
Learning Difficulties	Mean	19.94	16.01
	Median	20.13	16.75
	Std. Deviation	5.68	4.14
	Minimum	3.75	5.06
	Maximum	33.56	24.31

Table 71

Geographical Regions

Region		Total English Score	Total Maltese Score
	Mean	20.86	15.78
	Median	20.88	16.56
Southern Harbour	Std. Deviation	4.33	4.09
	Minimum	8.81	7.00
	Maximum	33.56	23.19
	Mean	22.27	18.37
	Median	23.44	19.00
Northern Harbour	Std. Deviation	5.40	3.95
	Minimum	7.19	7.19
	Maximum	34.81	26.13
	Mean	22.28	18.00
	Median	23.25	18.25
South Eastern	Std. Deviation	5.45	4.81
	Minimum	9.06	5.06
	Maximum	33.25	28.19
	Mean	24.32	19.83
	Median	25.09	20.69
Western	Std. Deviation	4.74	3.59
	Minimum	13.19	11.59
	Maximum	34.63	27.31
	Mean	22.86	17.47
	Median	23.91	17.31
Northern	Std. Deviation	6.08	4.24
	Minimum	3.75	8.19
	Maximum	35.75	27.81
	Mean	23.25	18.35
	Median	23.00	18.56
Gozo	Std. Deviation	4.25	4.49
	Minimum	13.94	3.81
	Maximum	33.38	27.50

Table 72

Gender

Gender		Total English Score	Total Maltese Score
Males	Mean	22.01	17.63
	Median	22.06	17.81
	Std. Deviation	4.94	4.29
	Minimum	3.75	3.81
	Maximum	33.56	27.50
Females	Mean	23.44	18.82
	Median	24.09	19.38
	Std. Deviation	5.30	4.14
	Minimum	7.19	7.44
	Maximum	35.75	28.19

Table 73

Nationality

Nationality		Total English Score	Total Maltese Score
Maltese	Mean	22.65	18.40
	Median	22.94	18.59
	Std. Deviation	5.18	4.19
	Minimum	3.75	3.81
	Maximum	35.75	28.19
Non-native	Mean	22.60	13.31
	Median	24.00	12.75
	Std. Deviation	4.84	4.72
	Minimum	9.06	7.00
	Maximum	29.94	22.19
Dual	Mean	26.55	20.25
	Median	25.31	20.56
	Std. Deviation	5.39	2.55
	Minimum	19.69	17.56
	Maximum	33.38	22.63

Table 74

Age

Birth Range		Total English Score	Total Maltese Score
January to June	Mean	22.88	18.77
	Median	24.06	19.84
	Std. Deviation	5.57	4.52
	Minimum	3.75	3.81
	Maximum	34.81	27.31
July to December	Mean	22.54	17.66
	Median	22.44	17.63
	Std. Deviation	4.81	4.17
	Minimum	7.19	5.38
	Maximum	35.75	28.19

Table 75

School Type

School Type		Total English Score	Total Maltese Score
State	Mean	22.25	18.06
	Median	22.31	18.00
	Std. Deviation	5.08	4.39
	Minimum	3.75	5.06
	Maximum	33.38	28.19
Independent	Mean	23.16	18.70
	Median	24.75	18.72
	Std. Deviation	6.72	3.40
	Minimum	7.19	13.06
	Maximum	34.63	24.31

Boys' church	Mean	23.06	18.43
	Median	22.50	18.56
	Std. Deviation	4.42	4.16
	Minimum	12.69	9.63
	Maximum	33.56	27.50
Girls' church	Mean	24.46	19.44
	Median	24.38	19.50
	Std. Deviation	5.00	2.95
	Minimum	10.75	12.00
	Maximum	35.75	27.81

Table 76

School Language

School language		Total English Score	Total Maltese Score
Dominant Maltese	Mean	22.61	18.18
	Median	22.63	18.53
	Std. Deviation	4.66	4.59
	Minimum	8.81	3.81
	Maximum	33.38	28.19
Dominant English	Mean	23.12	18.71
	Median	24.75	18.88
	Std. Deviation	6.63	3.34
	Minimum	7.19	13.06
	Maximum	34.63	24.31
Mixed	Mean	22.73	17.81
	Median	23.31	18.13
	Std. Deviation	5.56	4.14
	Minimum	3.75	7.19
	Maximum	35.75	27.81

Table 77

Writing Style

Writing Style		Total English Score	Total Maltese Score
Cursive	Mean	24.97	20.51
	Median	25.59	21.13
	Std. Deviation	1.89	3.51
	Minimum	21.94	16.06
	Maximum	26.69	24.94
Print	Mean	21.58	17.24
	Median	21.81	17.25
	Std. Deviation	5.33	4.67
	Minimum	3.75	5.06
	Maximum	33.56	27.50
Mixed mostly cursive	Mean	24.26	18.90
	Median	24.38	18.63
	Std. Deviation	5.17	3.68
	Minimum	9.06	11.19
	Maximum	35.75	27.81
Mixed mostly print	Mean	23.23	18.61
	Median	23.66	18.88
	Std. Deviation	4.85	4.16
	Minimum	7.19	3.81
	Maximum	34.63	28.19

Table 78

Socio Economic Status

SES		Total English Score	Total Maltese Score
Low SES	Mean	22.35	18.14
	Median	22.56	18.44
	Std. Deviation	5.18	4.57
	Minimum	8.81	3.81
	Maximum	33.56	28.19
Middle SES	Mean	22.17	17.66
	Median	22.16	18.16
	Std. Deviation	4.93	4.38
	Minimum	3.75	5.06
	Maximum	33.25	26.06
High SES	Mean	24.12	19.03
	Median	24.75	19.25
	Std. Deviation	5.33	3.96
	Minimum	7.19	8.19
	Maximum	35.75	27.81

Table 79

First Language

First Language		Total English Score	Total Maltese Score
Dominant Maltese	Mean	22.41	18.31
	Median	22.75	18.44
	Std. Deviation	4.93	4.12
	Minimum	3.75	3.81
	Maximum	33.56	28.19
Dominant English	Mean	24.32	19.15
	Median	25.00	19.44
	Std. Deviation	6.63	3.76
	Minimum	7.19	9.19
	Maximum	34.81	24.75

Mixed	Mean	23.17	18.50
	Median	24.44	19.44
	Std. Deviation	5.54	4.69
	Minimum	9.07	5.06
	Maximum	35.75	27.81
Non-native	Mean	22.78	11.37
	Median	23.59	10.94
	Std. Deviation	4.63	3.62
	Minimum	13.00	7.00
	Maximum	29.94	20.94

Table 80

Handedness

Handedness		Total English Score	Total Maltese Score
Right	Mean	22.72	18.11
	Median	23.06	18.25
	Std. Deviation	5.16	4.26
	Minimum	3.75	3.81
	Maximum	35.75	27.81
Left	Mean	22.69	18.27
	Median	23.81	18.94
	Std. Deviation	5.15	5.11
	Minimum	11.06	5.06
	Maximum	31.88	28.19

Tables 70 to 80 show low standard devaitions, meaning that the data is clustered around the mean.

School Type and Writing Style

Table 81 gives descriptive statistics of the writing style used in state, church and independent schools. Results showed that only one student in the independent school wrote exclusively in Cursive, and very few used Mixed mostly cursive writing (9.3%). Similar results were obtained by the students attending state schools. In both schools, the majority of the participants used exclusively Print writing or Mixed mostly print writing. In the girls' church schools, there were no exclusive Cursive writers, and again, the majority of these students used exclusively Print or Mixed mostly print writing. The majority of exclusive Cursive writers attended the boys' church schools, yet this amounted to only five students. Boys' church schools witnessed the largest amount of Mixed mostly cursive writers (22.2%). Yet once again, the majority of the students in boys' church schools wrote exclusively in Print, or in Mixed mostly print handwriting (70.8%).

Table 81

Participants' Writing Style Grouped by School Type

		School Type				Total
Writing Style		State	Independent	Boys' church	Girls' church	
Cursive	Count	1	1	5	0	7
	Percent	0.4%	2.3%	6.9%	0.0%	1.7%
Print	Count	122	13	17	17	169
	Percent	49.8%	30.2%	23.6%	41.5%	42.1%
Mixed mostly cursive	Count	23	4	16	6	49
	Percent	9.4%	9.3%	22.2%	14.6%	12.2%
Mixed mostly print	Count	99	25	34	18	176
	Percent	40.4%	58.1%	47.2%	43.9%	43.9

Legibility and Writing Speed

This study aimed to determine whether students' handwriting becomes less legible when asked to free write quickly. Participants' legibility was determined by analysing the free writing task (see section *Writing Style and Legibility* in Chapter 3), as this task is the only subtest in the battery that requires a longer piece of text that is spontaneously generated, and which therefore mostly simulates examination conditions. Separate mean scores were calculated for writing speed and legibility, in English and Maltese (Table 82), respectively. Results showed that in English and Maltese, legibility and speed were dependent on language, with the fastest writers in English being those participants whose written product included some words or phrases difficult to decipher (highlighted). Conversely, the fastest writers in Maltese had overall clear and mature handwriting (highlighted).

Table 82

Mean Number of WPM Written in the English and Maltese Free Writing Subtests, Grouped by Legibility

Legibility	English Free Writing	Maltese Free Writing (Kitba Kreattiva)
Portions of the text difficult or impossible to decipher	21.10	
Some words or phrases difficult to decipher	23.10	15.70
Generally clear legibility but immature appearance	20.62	15.47
Overall clear legibility and mature appearance	21.32	16.88

Assessing Data for Normality

Prior to running inferential statistical analyses, the data was assessed for normality in order to look at the way the data was distributed, since running a test on data that is atypically distributed (i.e. highly skewed to the right or left) can lead to misleading results (Limpert & Stahel, 2011). This is because the mean moves in the direction of the skew, so that it loses its central location (Faridi, 2016). Skewness measures the degree of asymmetry (Čisar & Čisar, 2010). Whilst negative skewness indicates that data is skewed left, positive skewness indicates that data is skewed right (Jain, 2018). A symetrical distribution looks the same to the left as it does to the right of the mean, and hence the skewness value is zero (Kim, 2013). If the skewness is between -0.5 and 0.5, the data is considered fairly symmetrical (Jain, 2018). Typically, skewness is considered to be considerably large if data falls outside the +/- 2 range (West et al., 1996). Kurtosis looks at the outliers of a distribution (Dugar, 2018), by measuring the thickness of the tails of the distribution. A positive value indicates heavier tails than those of the normal distribution (more observations in the extremes of the distribution) and a negative value indicates lighter tails than those of the normal distribution (less observations in the extremes of the distribution). An extreme positive kurtosis (greater than 3) indicates a distribution where most of the values are in the tails of the distribution rather than around the mean (Dugar, 2018). A kurtosis value of 0 indicates a shape close to the normal distribution.

To assess the data for normality, both numerical and graphical means (histograms), were used to help understand the distribution of the scores. Table 83 presents numerical data (mean, median, standard deviation (SD), skewness and kurtosis) for the distribution of the scores for the English and Maltese subtests and Total Scores, in words per minute (WPM). Upon examining the data, the mean and median values were very close in value for all variables, indicating a relatively normal distribution of scores. When data was slightly skewed to the left or right, this was indicated by the negative and positive values respectively. As most of the Kurtosis values were within the ± 1 range (see Table 83), this was another indication of relatively normally distributed scores. Appendices BC and BD give a graphic representation (histograms) of each independent subtest. Figures 21 and 22 present the histograms of the distribution of scores for the English and Maltese Total Scores respectively. These histograms are presented here as they include the total of the scores of all the English, (excluding the Graphic Speed Test), and Maltese subtests, respectively. The Graphic Speed Test taps a different set of sub skills (perceptual-motor difficulties, see section *The Graphic Speed Test* in Chapter 3), and so its histogram is presented separately (Figure 23).

Table 83

Normality Testing: English and Maltese Subtests and Total Scores

	Mean	Median	Std. Deviation	Skewness	Kurtosis
English Copy Neatly	27.28	27.00	5.75	-0.01	-0.24
English Copy Quickly	32.44	32.00	5.66	0.10	0.72
English Copy from Board	20.07	20.00	4.50	0.49	1.84
English Free Writing	20.99	21.15	5.04	-0.10	-0.08
Total English Score	22.70	22.94	5.16	-0.41	0.57
Maltese Copy Neatly (Ikkopja Pulit)	20.81	21.00	4.51	-0.18	-0.02
Maltese Copy Quickly (Ikkopja Malajr)	24.59	24.50	4.66	-0.33	0.42
Maltese Copy from Board (Ikkopja mill-Bord)	20.08	20.00	4.86	-0.05	-0.39
Maltese Free Writing (Kitba Kreattiva)	16.20	16.40	4.55	-0.39	0.37
Total Maltese Score	18.12	18.28	4.37	-0.41	0.16

Figure 21

Score Distribution of Total English Score

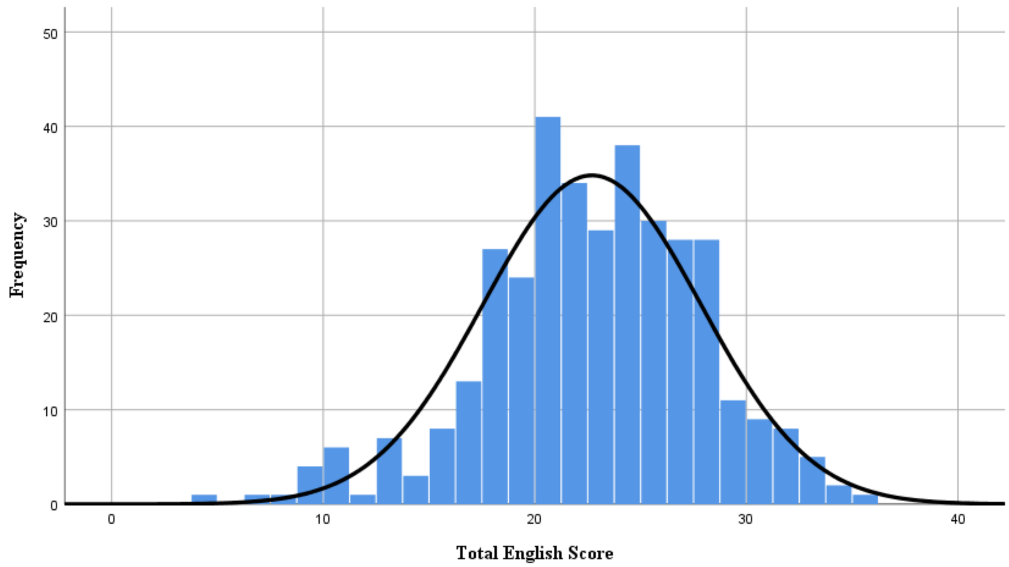


Figure 22

Score Distribution of Total Maltese Score

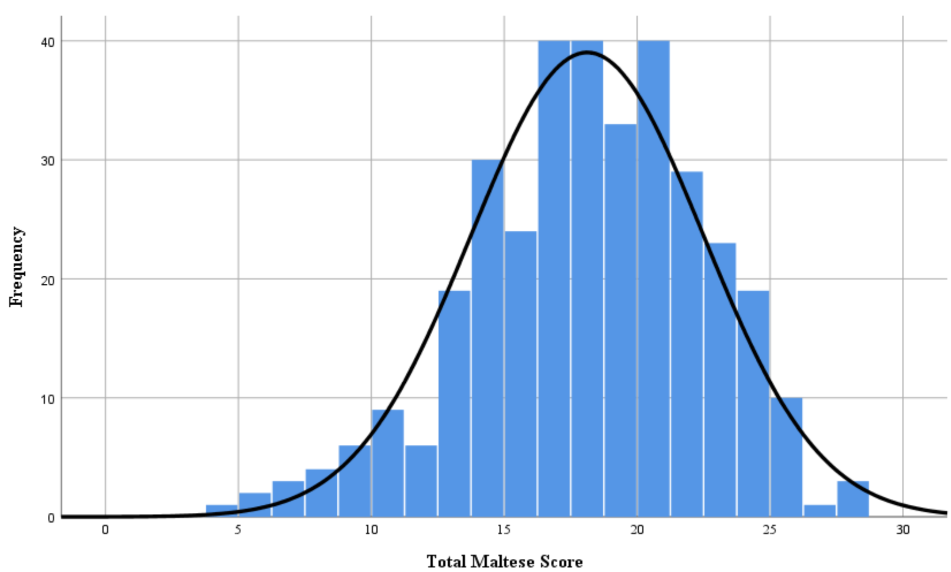
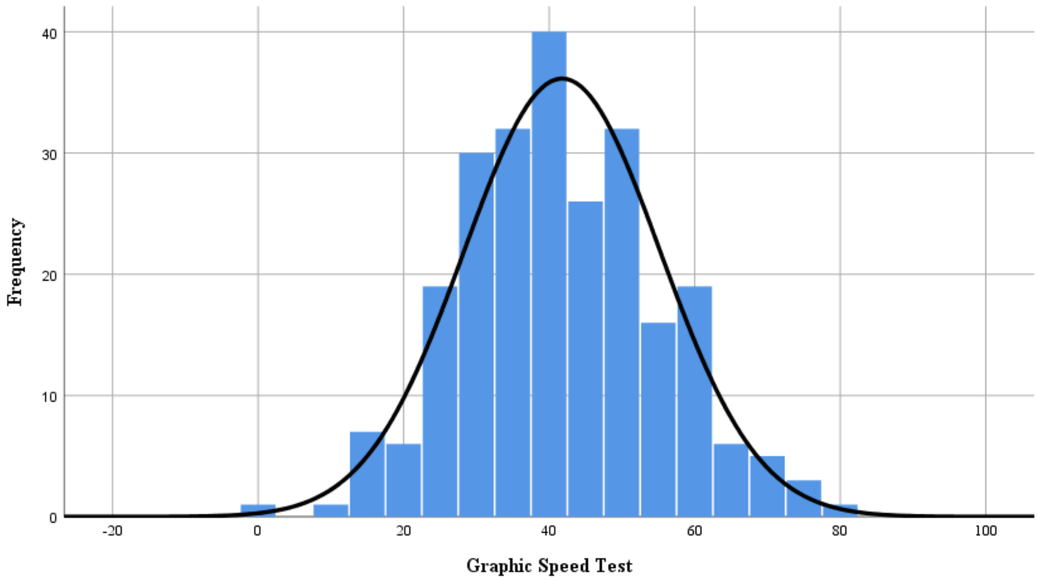


Figure 23

Score Distribution of Graphic Speed Test



To assess the normality assumption, it is best to look at established normality tests that consider both Skewness and Kurtosis simultaneously. In SPSS, such a test is the Shapiro Wilk test (Forsell & Cooper, 2014). This is because it is possible to have a distribution which is fairly symmetric, but does not satisfy the normality assumption, due to heavier or lighter tails than those of the normal distribution curve. The Shapiro Wilk Test is also ideal as it can handle sample sizes ranging from 50 up to 2000 (Laerd Statistics, 2018d).

Table 84 gives the results of the Shapiro Wilk test for the English and Maltese subtests and Total Scores in WPM. When p-values are higher than the 0.05 level of significance, the data is normally distributed and can be analysed using parametric tests. P-values lower than the 0.05 level of significance (highlighted) indicate that the data is not normally distributed and should be analysed with non-parametric tests.

Table 84

Normality Tests in WPM

	Statistic	df	p-value
English Copy Neatly	0.996	359	0.397
English Copy Quickly	0.990	359	0.017
English Copy from Board	0.978	359	0.000
English Free Writing	0.997	350	0.794
Total English Score	0.987	360	0.003
Maltese Copy Neatly (Ikkopja Pulit)	0.993	342	0.147
Maltese Copy Quickly (Ikkopja Malajr)	0.989	340	0.014
Maltese Copy from Board (Ikkopja mill-Bord)	0.992	339	0.051
Maltese Free Writing (Kitba Kreattiva)	0.990	337	0.016
Total Maltese Score	0.988	342	0.008

Following the Shapiro Wilk test of normality, normality distribution for the EMASH was as follows:

Normally Distributed	**Not Normally Distributed**
English Copy Neatly	English Copy Quickly
English Free Writing	English Copy from Board
Maltese Copy Neatly (Ikkopja Pulit)	Total English Score
Maltese Copy from Board (Ikkopja mill-Bord)	Maltese Copy Quickly (Ikkopja Malajr)
Graphic Speed Test	Maltese Free Writing (Kitba Kreattiva)
	Total Maltese Score

The process of choosing between parametric and non-paramentric tests depends on whether the data meets the assumption that it is sampled from a Gaussian (normal) distribution (Tyler, 2017). In cases where scores are normally distributed, parametric tests are used. When scores are too high/low (outliers) and the population is distributed in a non-Gaussian manner, nonparametric tests are typically selected. Whereas caution is taken by considering skewness and kurtosis values, the choice of using parametric or nonparametric tests really depends on sample size (see section *Unidimentionality of the Total Score* in Chapter 4). Since this research includes 401 participants, both parametric and non-parametric tests were run when the data was distributed in a non-Gaussian manner. For example, both the Independent Samples t-test (parametric) and the Mann Whitney test (nonparametric equivalent) were used to compare mean scores between two independent groups (e.g. males and females) when the scores where atypically distributed. To make comparisons between more than two independent groups (e.g. three school types) Analysis of Variance (ANOVA), and the Kruskal-Walis test were used. Although these tests indicate that there are differences between the groups, they do not specify which groups differ. In such cases, post hoc tests were conducted to investigate where the differences lay. The parametric Bonferroni post hoc test was run for the ANOVA test, and the nonparametric Dunn post hoc test was run for the Kruskal-Walis test. Both post hoc tests were chosen as they make adjustments for Type 1 error. The chance of making a Type 1 error increases when multiple analysis are executed on the same dependent variable. This may result in significant differences in scores, when in fact there are none (Banerjee at al., 2009). The Bonferroni method was preferred to the Tukey test, as the latter tolerates Type I errors (Lee & Lee, 2018).

Inferential Statistics

Following a descriptive analysis of the data, and testing for normality, inferential statistics were conducted. The next section presents the participants' scores in WPM, analysed by each independent variable (First Language, School Language, Nationality, Ability, Geographical Regions, Socio Economic Status, School Type, Gender, Age, Handedness and Writing Style).

Comparison of Means

First Language

As the independent variable First Language has four categories (Dominant Maltese, Dominant English, Mixed and Non-native), the one-way ANOVA (parametric) and the Kruskal-Walis test (non-parametric) were conducted. Table 85 shows the p-values derived from the one-way ANOVA and the Kruskal-Walis tests. For English *Free Writing*, Maltese *Copy from Board (Ikkopja mill-Bord)*, Maltese *Free Writing (Kitba Kreattiva)* and Total Maltese Score (highlighted), the p-values did not reach the 0.05 level of significance. This meant that First Language had an effect upon the participants' writing speed in these subtests and in their overall Maltese score. The p-values of the remaining subtests and the overall English score were larger than the 0.05 criterion, meaning that First Language did not affect the writing speed of these subtests or of Total English Score.

Table 85

EMASH Subtests, Grouped by First Language

Test	F	p-value one-way ANOVA	H	p-value Kruskal-Walis
English Copy Neatly	2.037	0.108		
English Copy Quickly	1.054	0.369	3.385	0.336
English Copy from Board	0.986	0.400	2.274	0.517
English Free Writing	3.277	0.021		
Total English Score	1.393	0.245	5.044	0.169
Maltese Copy Neatly (Ikkopja Pulit)	2.187	0.089		
Maltese Copy Quickly (Ikkopja Malajr)	1.821	0.143	6.469	0.091
Maltese Copy from Board (Ikkopja mill-Bord)	3.693	0.012		
Maltese Free Writing (Kitba Kreattiva)	19.287	0.000	27.497	0.000
Total Maltese Score	13.122	0.000	26.514	0.000

In the English assessment battery, a Bonferroni post hoc test (Table 86) revealed that the only significant difference in writing speed for the English Free Writing subtest was between Dominant Maltese and Dominant English first language speakers ($p = 0.018$). Dominant English speakers wrote about 3 WPM more than Dominant Maltese speakers.

Table 86

Bonferroni Post Hoc Test for English Free Writing, Grouped by First Language

(I) First Language	(J) First Language	Mean Difference (I-J)	Std. Error	p-value
Dominant Maltese	Dominant English	-2.967	0.992	0.018
	Mixed	-1.066	0.830	1.000
	Non-native	-0.317	1.025	1.000
Dominant English	Dominant Maltese	2.967	0.992	0.018
	Mixed	1.901	1.214	0.710
	Non-native	2.650	1.356	0.309
Mixed	Dominant Maltese	1.066	0.830	1.000
	Dominant English	-1.901	1.214	0.710
	Non-native	0.749	1.242	1.000
Non-native	Dominant Maltese	0.317	1.025	1.000
	Dominant English	-2.650	1.356	0.309
	Mixed	-0.749	1.242	1.000

In the Maltese assessment battery, a Bonferroni post hoc test (Table 87) revealed that the only significant differences in writing speed for the Maltese *Copy from Board (Ikkopja mill-Bord)* subtest, were between Non-native and Dominant Maltese first language speakers ($p = 0.008$), Non-native and Dominant English first language speakers ($p = 0.021$), and Non-native and Mixed first language speakers ($p = 0.020$). Non-native first language speakers wrote about 4 WPM less than the Maltese and English first language speakers.

Table 87

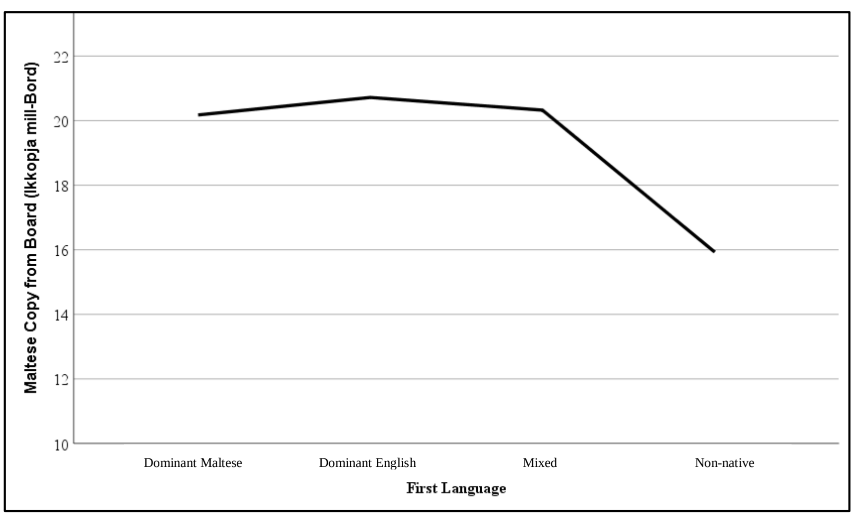
Bonferroni Post Hoc Test for Maltese *Copy from Board (Ikkopja mill-Bord), Grouped by First Language*

(I) First language	(J) First language	Mean Difference (I-J)	Std. Error	p-value
Dominant Maltese	Dominant English	-0.541	1.044	1.000
	Mixed	-0.149	0.815	1.000
	Non-native	4.248	1.317	0.008
Dominant English	Dominant Maltese	0.541	1.044	1.000
	Mixed	0.392	1.256	1.000
	Non-native	4.789	1.627	0.021
Mixed	Dominant Maltese	0.149	0.815	1.000
	Dominant English	-0.392	1.256	1.000
	Non-native	4.396	1.490	0.020
Non-native	Dominant Maltese	-4.248	1.317	0.008
	Dominant English	-4.789	1.627	0.021
	Mixed	-4.396	1.490	0.020

Figure 24 presents a line graph of the mean WPM written by different first language speakers in the Maltese *Copy from Board (Ikkopja mill-Bord)* subtest.

Figure 24

Maltese Copy from the Board (Ikkopja mill-Bord) Subtest, Grouped by First Language



The Dunn post hoc test (Table 88 for the Maltese *Free Writing (Kitba Kreattiva*) subtest, and Total Maltese Score, showed significant differences in writing speed between Non-native and Dominant Maltese first language speakers (p = 0.000), Non-native and Mixed first language speakers (p = 0.000), and Non-native and Dominant English first language speakers (p = 0.000).

Table 88

Dunn Post Hoc Test for Maltese Free Writing (Kitba Kreattiva) and Total Maltese Score, Grouped by First Language

Subtests/Test	First language	Test Statistic	Std. Error	Std. Test Statistic	p-value	Adj. p-value[38]
Maltese Free Writing (Kitba Kreattiva)	Non-native-Dominant Maltese	136.346	27.605	4.939	0.000	0.000
	Non-native-Mixed	150.569	31.010	4.855	0.000	0.000
	Non-native-Dominant English	158.334	33.704	4.698	0.000	0.000
	Dominant Maltese-Mixed	-14.223	16.497	-0.862	0.389	1.000
	Dominant Maltese-Dominant English	-21.988	21.131	-1.041	0.298	1.000
	Mixed-Dominant English	7.765	25.418	0.305	0.760	1.000
Total Maltese Score	Non-native-Dominant Maltese	132.227	27.039	4.890	0.000	0.000
	Non-native-Mixed	141.124	30.515	4.625	0.000	0.000
	Non-native-Dominant English	155.363	33.416	4.649	0.000	0.000
	Dominant Maltese-Mixed	-8.897	16.552	-0.537	0.591	1.000
	Dominant Maltese-Dominant English	-23.136	21.435	-1.079	0.280	1.000
	Mixed-Dominant English	14.240	25.682	0.554	0.579	1.000

[38] The Bonforroni correction makes adjustments for Type 1 error.

This difference in writing speed is explained in Table 89 which presents the mean number of WPM written in the Maltese *Free Writing (Kitba Kreattiva)* subtest by different first language speakers. Non-native participants whose first language was one other than English and Maltese, wrote about 9 WPM less in the Maltese *Free Writing (Kitba Kreattiva)* subtest than Dominant Maltese, Dominant English or Mixed (Maltese-English) first language speakers. The difference in writing speed in Total Maltese Score, between participants speaking different first languages, is also shown in Table 14 (in this chapter). Non-native participants whose first language was one other than English and Maltese, wrote overall about 7 WPM less than other first language speakers in Total Maltese Score.

Table 89

Maltese Free Writing (Kitba Kreattiva) Subtest, Grouped by First Language

Subtest	First Language	WPM
Maltese Free Writing (Kitba Kreattiva)	Dominant Maltese	16.43
	Dominant English	17.04
	Mixed	16.95
	Non-native	7.52

Figures 25 and 26 present line graphs of the mean WPM written by different first language speakers in the Maltese *Free Writing (Kitba Kreattiva)* subtest, and Total Maltese Score, respectively.

Figure 25

Maltese Free Writing (Kitba Kreattiva) Subtest, Grouped by First Language

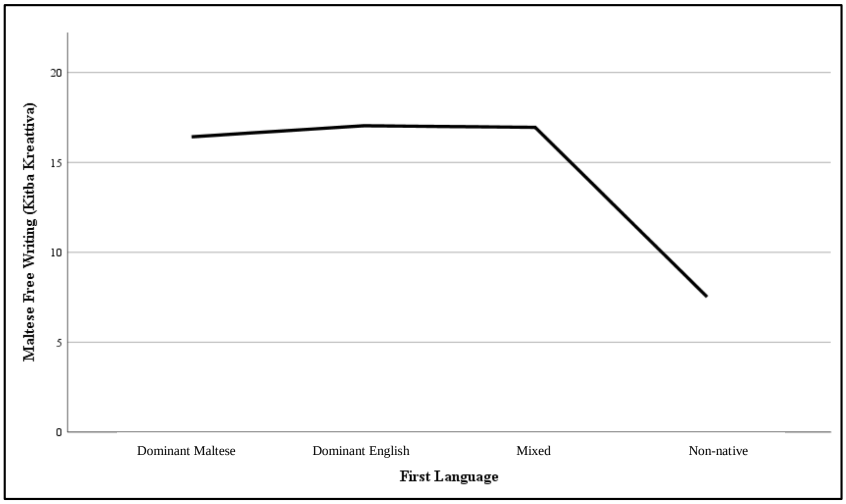
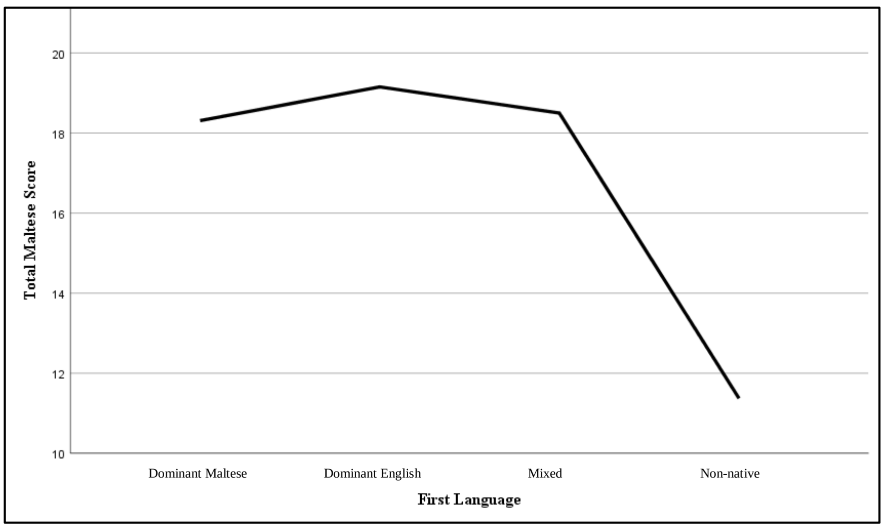


Figure 26

Total Maltese Score, Grouped by First Language



School Language

To determine if School Language affected writing speed, the one-way ANOVA test was run for typically distributed scores and its nonparametric counterpart, the Kruskal-Walis test, was used to analyse atypically distributed scores (Table 90). Results from the analysis of the English *Copy Quickly* subtest revealed that School Language has an effect upon the participants' writing speed in the English *Copy Quickly* subtest (highlighted in Table 90). For the remaining English and Maltese subtests and Total Scores, results revealed that School Language did not affect the participants' writing speed.

Table 90

EMASH Subtests and Total Scores, Grouped by School Language

Test	F	p-value one-way ANOVA	H	p-value Kruskal-Walis
English Copy Neatly	1.329	0.266		
English Copy Quickly	3.115	0.046	6.604	0.037
English Copy from Board	1.486	0.228	2.591	0.274
English Free Writing	2.051	0.130		
Total English Score	0.149	0.862	1.613	0.446
Maltese Copy Neatly (Ikkopja Pulit)	0.145	0.865		
Maltese Copy Quickly (Ikkopja Malajr)	0.538	0.584	1.269	0.530
Maltese Copy from Board (Ikkopja mill-Bord)	1.736	0.173		
Maltese Free Writing (Kitba Kreattiva)	2.172	0.116	2.477	0.290
Total Maltese Score	0.520	0.595	1.019	0.601

The Dunn post hoc test (Table 91) revealed that the only significant difference in writing speed in the English *Copy Quickly* subtest was between participants attending Dominant Maltese and Dominant English schools ($p = 0.036$).

Table 91

Dunn Post Hoc Test for English Copy Quickly, grouped by School Language

School Language	Test Statistic	Std. Error	Std. Test Statistic	p-value	Adj. p-value
Dominant Maltese-Mixed	-13.365	12.206	-1.095	0.274	0.821
Dominant Maltese-Dominant English	-46.884	18.685	-2.509	0.012	0.036
Mixed-Dominant English	33.519	19.939	1.681	0.093	0.278

Descriptive statistics in Table 92 show that participants attending Dominant English speaking schools wrote on average 2½ more WPM than participants attending Dominant Maltese speaking schools in the English *Copy Quickly* subtest. Figure 27 presents this result graphically.

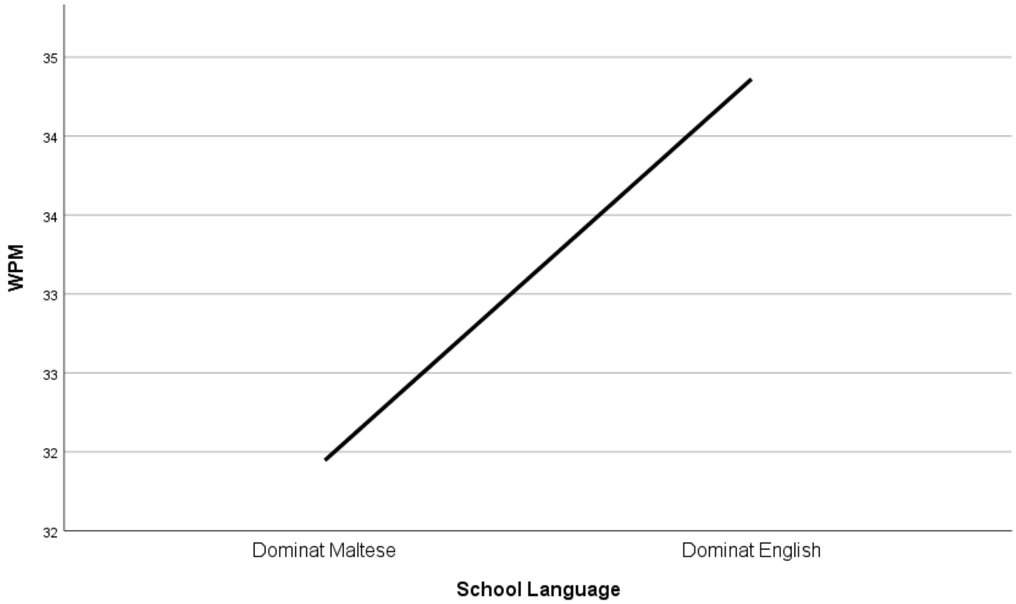
Table 92

English Copy Quickly Subtest, Grouped by School Language

Subtest	School Language	WPM
English Copy Quickly	Dominant Maltese	31.95
	Dominant English	34.36

Figure 27

English Copy Quickly Subtest, Grouped by School Language



Handedness

Since the variable Handedness has two categories (Left and Right), the Independent Samples t-test was used for typically distributed data, and the Mann Whitney test was used for atypically distributed data (Table 93). Results revealed that Handedness did not affect the participants' writing speed in any of the English or Maltese EMASH subtests or Total Scores, as the 0.05 criterion[39] was met in both the parametric and non-parametric tests.

[39] When the p-value is larger than 0.05, it means that the result is not statistically significant (LaMorte, 2019).

Table 93

EMASH Subtests and Total Scores, Grouped by Handedness

Test	t	p-value Independent Samples t-test	U	p-value Mann Whitney test
English Copy Neatly	-0.670	0.503		
English Copy Quickly	-0.231	0.818	6384.0	0.854
English Copy from Board	0.236	0.813	6326.0	0.782
English Free Writing	1.092	0.276		
Total English Score	0.044	0.965	6514.0	0.994
Maltese Copy Neatly (Ikkopja Pulit)	0.086	0.931		
Maltese Copy Quickly (Ikkopja Malajr)	0.586	0.559	6107.0	0.668
Maltese Copy from Board (Ikkopja mill-Bord)	0.116	0.908		
Maltese Free Writing (Kitba Kreattiva)	-0.482	0.630	6097.0	0.586
Total Maltese Score	-0.217	0.829	6294.0	0.694

Figures 28 and 29 confirm that there were no significant differences between the number of words written by left handed students and right handed students in each subtest and in the Total Score of the English and Maltese test respectively.

Figure 28

Total English Score, Grouped by Handedness

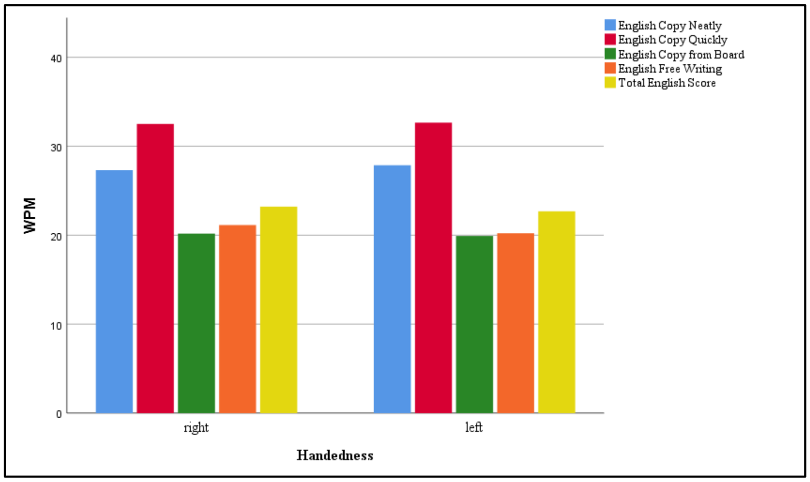
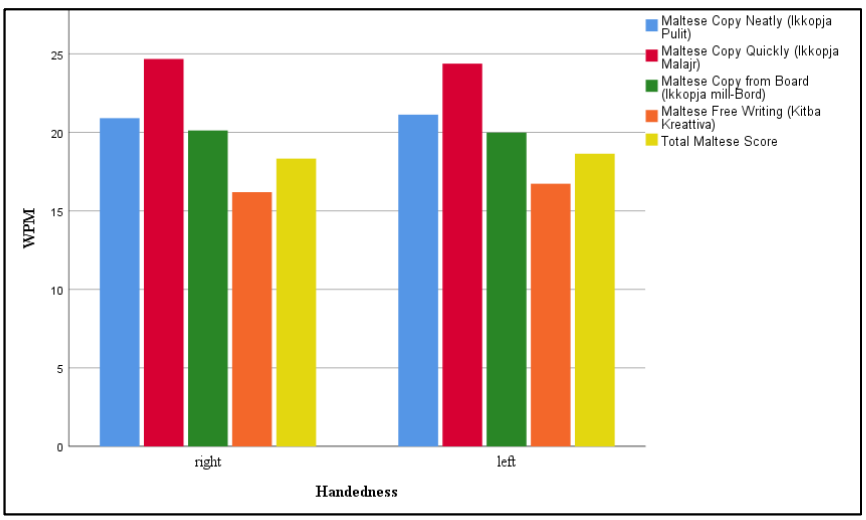


Figure 29

Total Maltese Score, Grouped by Handedness



Handedness and Ability. Univariate analysis of variance (Two-Way ANOVA) presents the combined effect of two independent variables, Handedness and Ability, on Total English Score, and Total Maltese Score, respectively (Table 94). Findings show that the combined effect of Handedness and Ability had no significant effect on Total English and Maltese Scores.

Table 94

Two-way Anova: English and Maltese Total Scores, Grouped by Handedness and Ability

	Source	Type III Sum of Squares	df	Mean Square	F	p-value
Total English Score	Handedness * Ability	16.669	1	16.669	0.664	0.416
Total Maltese Score	Handedness * Ability	0.489	1	0.489	0.027	0.871

A Multivariate analysis of variance (MANOVA) for English and Maltese together (Table 95) presents the effect of Handedness combined with Ability on writing speed. As the scores were atypically distributed, the Pillai's Trace test was used. MANOVA results showed that the interaction effect between Handedness and Ability was not statistically significant (p = 0.690), meaning that Handedness and Ability combined had no combined effect on writing speed.

Table 95

MANOVA: English and Maltese Total Scores, Grouped by Handedness and Ability

Effect		Value	F	Hypothesis df	Error df	Sig.
Handedness * Ability	Pillai's Trace	0.003	0.371[b]	2.000	296.000	0.690
	Wilks' Lambda	0.997	0.371[b]	2.000	296.000	0.690
	Hotelling's Trace	0.003	0.371[b]	2.000	296.000	0.690
	Roy's Largest Root	0.003	0.371[b]	2.000	296.000	0.690

Gender

The Independent Samples t-test was run on typically distributed scores and the Mann Whitney test was run for atypically distributed scores, to determine if Gender had an effect upon writing speed. Findings from both tests (Table 96) revealed that there were no significant differences between male and female students in the English *Copy Quickly* and English *Copy from the Board* subtests. However, there were significant differences in writing speed scores between genders for the remaining subtests and Total Scores (highlighted).

Table 96

EMASH Subtests and Total Scores, Grouped by Gender

Test	t	p-value Independent samples t-test	U	p-value Mann Whitney test
English Copy Neatly	-2.385	0.018		
English Copy Quickly	-1.371	0.171	14545.5	0.116
English Copy from Board	-1.483	0.139	14616.5	0.135
English Free Writing	-3.752	0.000		
Total English Score	-2.644	0.009	13246.0	0.003
Maltese Copy Neatly (Ikkopja Pulit)	-2.884	0.004		
Maltese Copy Quickly (Ikkopja Malajr)	-2.865	0.004	11838.0	0.004
Maltese Copy from Board (Ikkopja mill-Bord)	-2.131	0.034		
Maltese Free Writing (Kitba Kreattiva)	-2.840	0.005	11423.0	0.002
Total Maltese Score	-2.975	0.003	11932.0	0.003

The difference in mean scores (WPM), between males and females, for each subtest of the English assessment battery, is given in Table 97. In the English *Copy Neatly* subtest, the *English Free* Writing subtest and Total English Score, females wrote between 1½ and 2 WPM more than males. Figure 30 provides a graphical representation of the values presented in Table

97. Significant differences in scores between males and females were only found in the *Copy Neatly* subtest, the *Free Writing* subtest and Total English Score.

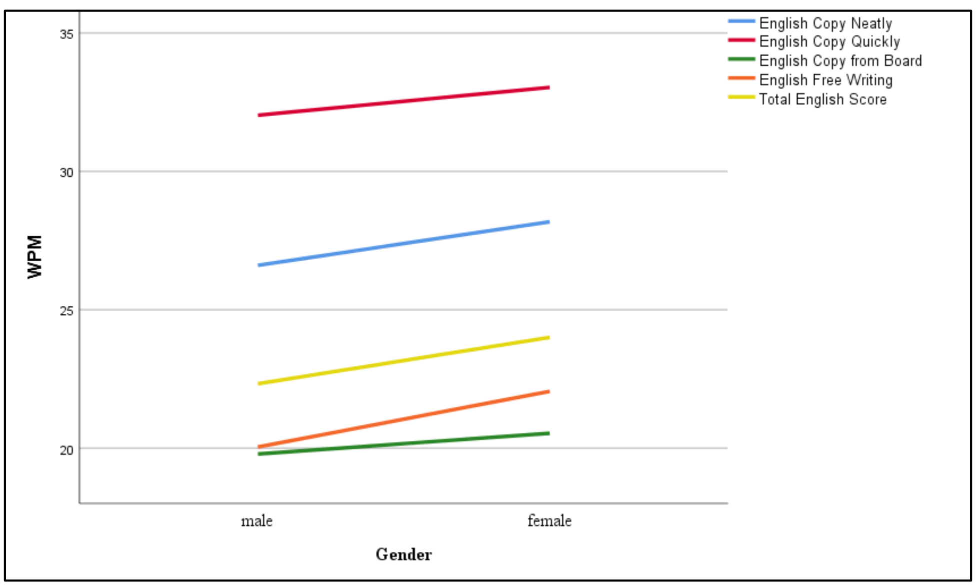
Table 97

Writing Speed in Each English Subtest, Grouped by Gender

Subtest	Gender	WPM
English Copy Neatly	Male	26.59
	Female	28.03
English Copy Quickly	Male	32.05
	Female	32.86
English Copy from Board	Male	19.79
	Female	20.44
English Free Writing	male	20.04
	female	22.03

Figure 30

Participants' Writing Speed in English, Grouped by Gender



In the Maltese assessment battery, females were significantly faster than males. Table 98, shows the difference in mean scores in WPM between females and males for each Maltese subtest. Table 72 (in this chapter) shows Gender difference for Total Maltese Score in WPM. In all the Maltese subtests and Total Maltese Score, females wrote on average 1.3 WPM more than males. Figure 31 provides a graphical representation of the participant's performance in Maltese.

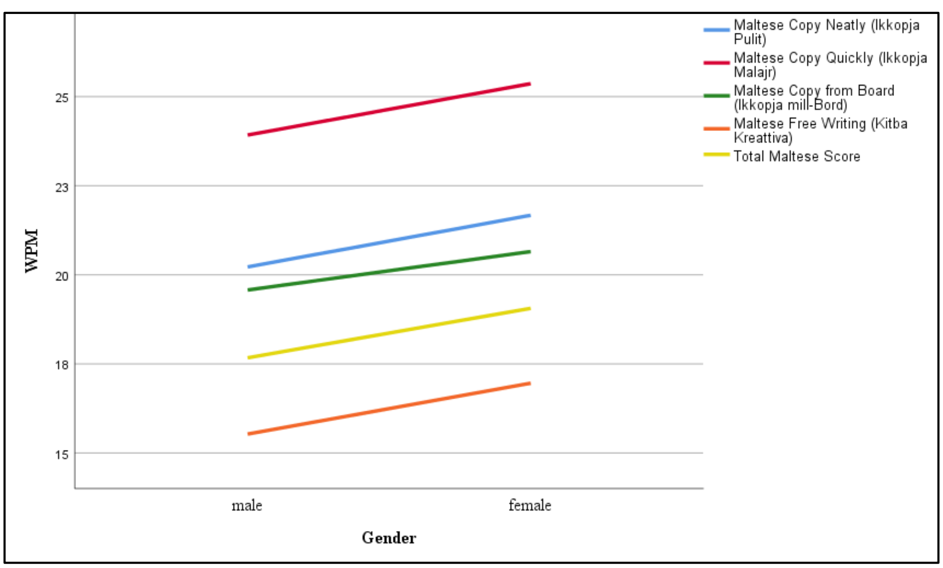
Table 98

Writing Speed in Each Maltese Subtest, Grouped by Gender

Subtest	Gender	WPM
Maltese Copy Neatly (Ikkopja Pulit)	Male	20.12
	Female	21.51
Maltese Copy Quickly (Ikkopja Malajr)	Male	23.88
	Female	25.31
Maltese Copy from Board (Ikkopja mill-Bord)	Male	19.52
	Female	20.64
Maltese Free Writing (Kitba Kreattiva)	Male	15.51
	Female	16.96

Figure 31

Participants' Writing Speed in Maltese, Grouped by Gender



Given these significant differences in writing speed scores between males and females, separate writing speed norms for males and females were drawn (see section *Standard Scores, Z-Scores and Percentile Ranks for Males and Females* in this chapter).

Geographical Regions

The one-way ANOVA and the Kruskal-Walis tests for English and Maltese (Table 99) revealed that participants from different Geographical Regions wrote at different writing speeds in the English and Maltese assessment batteries, except for the English *Copy Neatly* subtest (p = 0.065).

Table 99

EMASH Subtests and Total Scores, Grouped by Geographical Regions

Test	F	p-value one-way ANOVA	H	p-value Kruskal-Walis
English Copy Neatly	2.099	0.065		
English Copy Quickly	2.428	0.035	13.417	0.020
English Copy from Board	3.592	0.004	19.550	0.002
English Free Writing	2.675	0.022		
Total English Score	3.060	0.010	16.379	0.006
Maltese Copy Neatly (Ikkopja Pulit)	4.498	0.001		
Maltese Copy Quickly (Ikkopja Malajr)	3.132	0.009	15.129	0.010
Maltese Copy from Board (Ikkopja mill-Bord)	2.863	0.015		
Maltese Free Writing (Kitba Kreattiva)	3.815	0.002	20.226	0.001
Total Maltese Score	5.107	0.000	24.464	0.000

In the English assessment battery, a Bonferroni post hoc analysis revealed that the only significant difference in writing speed in the English *Free Writing* subtest was between participants residing in the Southern Harbour Region and those from the Western Region (p = 0.027) (Table 100). Participants from the Western Region wrote on average 3 more WPM (highlighted in Table 100) in the English *Free Writing* subtest than participants from the Southern Harbour Region.

Table 100

Bonferroni Post Hoc test for English Free Writing, Grouped by Geographical Regions

(I) Geographical Regions	(J) Geographical Regions	Mean Difference (I-J)	Std. Error	p-value
Southern Harbour	Northern Harbour	-1.698	1.002	1.000
	South Eastern	-1.138	0.920	1.000
	Western	-2.909	0.926	0.027
	Northern	-2.705	0.958	0.076
	Gozo	-2.134	0.932	0.340
Northern Harbour	Southern Harbour	1.698	1.002	1.000
	South Eastern	0.561	0.947	1.000
	Western	-1.211	0.953	1.000
	Northern	-1.006	0.984	1.000
	Gozo	-0.436	0.959	1.000
South Eastern	Southern Harbour	1.138	0.920	1.000
	Northern Harbour	-0.561	0.947	1.000
	Western	-1.771	0.866	0.625
	Northern	-1.567	0.901	1.000
	Gozo	-0.997	0.873	1.000
Western	Southern Harbour	2.909	0.926	0.027
	Northern Harbour	1.211	0.953	1.000
	South Eastern	1.771	0.866	0.625
	Northern	0.205	0.907	1.000
	Gozo	0.775	0.880	1.000
Northern	Southern Harbour	2.705	0.958	0.076
	Northern Harbour	1.006	0.984	1.000
	South Eastern	1.567	0.901	1.000
	Western	-0.205	0.907	1.000
	Gozo	0.570	0.914	1.000

Gozo	Southern Harbour	2.134	0.932	0.340
	Northern Harbour	0.436	0.959	1.000
	South Eastern	0.997	0.873	1.000
	Western	-0.775	0.880	1.000
	Northern	-0.570	0.914	1.000

A Dunn post hoc test (Table 101) revealed that significant differences in writing speed in English *Copy Quickly*, English *Copy from Board* and Total English Score, were between the Southern Harbour Region and the Western Region (highlighted).

Table 101

Dunn Post Hoc Test for English Copy Quickly, English Copy from Board and Total English Score, Grouped by Geographical Regions

Subtests/Test	Regions	Test Statistic	Std. Error	Std. Test Statistic	p-value	Adj. p-value
English Copy Quickly	Southern Harbour-Northern Harbour	-35.779	20.465	-1.748	0.080	1.000
	Southern Harbour-South Eastern	-43.876	18.846	-2.328	0.020	0.299
	Southern Harbour-Northern Region	-47.302	19.535	-2.421	0.015	0.232
	Southern Harbour-Gozo and Comino	-45.075	19.236	-2.343	0.019	0.287
	Southern Harbour-Western	-68.269	19.099	-3.574	0.000	0.005
	Northern Harbour-South Eastern	-8.096	19.378	-0.418	0.676	1.000
	Northern Harbour-Northern	-11.522	20.048	-0.575	0.565	1.000
	Northern Harbour-Gozo and Comino	-9.296	19.758	-0.470	0.638	1.000
	Northern Harbour-Western	-32.489	19.624	-1.656	0.098	1.000
	South Eastern-Northern	-3.426	18.393	-0.186	0.852	1.000
	South Eastern-Gozo and Comino	-1.200	18.075	-0.066	0.947	1.000
	South Eastern-Western	-24.393	17.929	-1.361	0.174	1.000
	Northern-Gozo and Comino	2.226	18.792	0.118	0.906	1.000
	Northern-Western	20.967	18.652	1.124	0.261	1.000
	Gozo and Comino-Western	23.193	18.339	1.265	0.206	1.000
English Copy from Board	Southern Harbour-Northern Harbour	-35.779	20.465	-1.748	0.080	1.000
	Southern Harbour-South Eastern	-43.876	18.846	-2.328	0.020	0.299
	Southern Harbour-Northern Region					
	Southern Harbour-Gozo and Comino	-45.075	19.326	-2.343	0.019	0.287

	Southern Harbour-Western	-68.269	19.099	-3.574	0.000	0.005
	Northern Harbour-South Eastern	-43.876	18.846	-2.328	0.020	0.299
	Northern Harbour-Northern	-9.779	19.965	-0.490	0.624	1.000
	Northern Harbour-Gozo and Comino	0.825	19.750	0.042	0.967	1.000
	Northern Harbour-Western	-49.979	19.683	-2.539	0.011	0.167
	South Eastern-Northern	-6.601	18.303	-0.361	0.718	1.000
	South Eastern-Gozo and Comino	4.002	18.069	0.221	0.825	1.000
	South Eastern-Western	-46.802	17.995	-2.601	0.009	0.139
	Northern-Gozo and Comino	10.603	18.704	0.567	0.571	1.000
	Northern-Western	40.201	18.633	2.157	0.031	0.465
	Gozo and Comino-Western	50.804	18.403	2.761	0.006	0.087
Total English Score	Southern Harbour-Northern Harbour	-40.961	20.532	-1.993	0.046	0.694
	Southern Harbour-South Eastern	-41.548	18.908	-2.197	0.028	0.420
	Southern Harbour-Northern Region	-48.489	19.520	-2.484	0.013	0.195
	Southern Harbour-Gozo and Comino	-50.373	19.299	-2.610	0.009	0.136
	Southern Harbour-Western	-76.391	19.161	-3.987	0.000	0.001
	Northern Harbour-South Eastern	-0.632	19.441	-0.033	0.974	1.000
	Northern Harbour-Northern	-7.573	20.038	-0.378	0.705	1.000
	Northern Harbour-Gozo and Comino	-9.457	19.882	-0.477	0.633	1.000
	Northern Harbour-Western	-35.475	19.688	-1.802	0.072	1.000
	South Eastern-Northern	-6.641	18.370	-0.378	0.706	1.000
	South Eastern-Gozo and Comino	-8.825	18.134	-0.487	0.627	1.000
	South Eastern-Western	-34.843	17.988	-1.937	0.053	0.791
	Northern-Gozo and Comino	-1.884	18.772	-0.100	0.920	1.000
	Northern-Western	27.903	18.631	1.498	0.134	1.000
	Gozo and Comino-Western	26.018	18.399	1.414	0.157	1.000

Table 102 gives the average number of WPM written in these subtests and Total English Score by participants residing in the Southern and Western Regions. Participants residing in the Southern Harbour Region wrote on average 3.4 less words in these subtests and Total English Score than participants residing in the Western Region.

Table 102

Writing Speed of Participants from Different Geographical Regions, Grouped by English Subtests and Total English Score

Subtest/Test	Geographical Regions	WPM	Difference
English Copy Quickly	Western	33.78	3.46
	Southern Harbour	30.32	
English Copy from Board	Western	21.85	3.21
	Southern Harbour	18.64	
Total English Score	Western	24.86	3.46
	Southern Harbour	20.86	

In the Maltese assessment battery, a Bonferroni post hoc test (Table 103), revealed that significant differences in writing speed in the Maltese *Copy Neatly (Ikkopja Pulit)* subtest were between the Western Region and the Southern Harbour Region (p = 0.001), the Western Region and the Gozo Region (p = 0.018), and the Western Region and the South Eastern Region (0.009). In the Maltese *Copy from Board (Ikkopja mill-Bord)* subtest, the Bonferroni post hoc test (Table 103) showed that the significant differences in writing speed were between the Western Region and Southern Harbour Region (p = 0.019). In this subtest, participants residing in the Western Region wrote about 3 more WPM than those residing in the Southern Harbour Region (highlighted).

Table 103

Bonferroni Post Hoc Test for Maltese Copy Neatly (Ikkopja Pulit), Maltese Copy from Board (Ikkopja mill-Bord), Grouped by Geographical Regions

Dependent Variable	(I) Geographical Regions	(J) Geographical Regions	Mean Difference (I-J)	Std. Error	p-value
Maltese Copy Neatly (Ikkopja Pulit)	Southern Harbour	Northern Harbour	-1.576	0.934	1.000
		South Eastern	-0.990	0.849	1.000
		Western	-3.569	0.860	0.001
		Northern	-2.266	0.920	0.214
		Gozo	-1.068	0.865	1.000
	Northern Harbour	Southern Harbour	1.576	0.934	1.000
		South Eastern	0.586	0.831	1.000
		Western	-1.992	0.843	0.280
		Northern	-0.689	0.904	1.000
		Gozo	0.508	0.848	1.000
	South Eastern	Southern Harbour	0.990	0.849	1.000
		Northern Harbour	-0.586	0.831	1.000
		Western	-2.579	0.747	0.009
		Northern	-1.276	0.815	1.000
		Gozo	-0.078	0.753	1.000
	Western	Southern Harbour	3.569	0.860	0.001
		Northern Harbour	1.992	0.843	0.280
		South Eastern	2.579	0.747	0.009
		Northern	1.303	0.828	1.000
		Gozo	2.501	0.766	0.018

	Northern	Southern Harbour	2.266	0.920	0.214
		Northern Harbour	0.689	0.904	1.000
		South Eastern	1.276	0.815	1.000
		Western	-1.303	0.828	1.000
		Gozo	1.198	0.833	1.000
	Gozo	Southern Harbour	1.068	0.865	1.000
		Northern Harbour	-0.508	0.848	1.000
		South Eastern	0.078	0.753	1.000
		Western	-2.501	0.766	0.018
		Northern	-1.198	0.833	1.000
Maltese Copy from Board (Ikkopja mill-Bord)	Southern Harbour	Northern Harbour	-1.449	1.024	1.000
		South Eastern	-0.771	0.932	1.000
		Western	-3.082	0.950	0.019
		Northern	-0.514	1.009	1.000
		Gozo	-1.128	0.950	1.000
	Northern Harbour	Southern Harbour	1.449	1.024	1.000
		South Eastern	0.678	0.906	1.000
		Western	-1.633	0.925	1.000
		Northern	0.936	0.985	1.000
		Gozo	0.321	0.925	1.000
	South Eastern Region	Southern Harbour	0.771	0.932	1.000
		Northern Harbour	-0.678	0.906	1.000
		Western	-2.311	0.821	0.077
		Northern	0.257	0.889	1.000
		Gozo	-0.357	0.821	1.000

	Western	Southern Harbour	3.082	0.950	0.019
		Northern Harbour	1.633	0.925	1.000
		South Eastern	2.311	0.821	0.077
		Northern	2.568	0.908	0.074
		Gozo	1.954	0.842	0.313
	Northern	Southern Harbour	0.514	1.009	1.000
		Northern Harbour	-0.936	0.985	1.000
		South Eastern	-0.257	0.889	1.000
		Western	-2.568	0.908	0.074
		Gozo	-0.615	0.908	1.000
	Gozo	Southern Harbour	1.128	0.950	1.000
		Northern Harbour	-0.321	0.925	1.000
		South Eastern	0.357	0.821	1.000
		Western	-1.954	0.842	0.313
		Northern	0.615	0.908	1.000

A Dunn post hoc test (Table 104) showed that significant differences in writing speed in the Maltese *Copy Quickly (Ikkopja Malajr)* subtest, Maltese *Free Writing (Kitba Kreattiva)* subtest, and Total Maltese Score, were between the Southern Harbour Region and the Western Region (highlighted in yellow Table 104). Furthermore, for the Maltese *Free Writing (Kitba Kreattiva)* subtest, and for Total Maltese Score, other significant differences in writing speed (highlighted in blue in Table 104) were between the Northern Region and the Western Region. Table 105 shows that on average participants from the Southern Harbour Region wrote 3.5 WPM less than those residing in the Western Region, and participants from the Western Region wrote on average about 2 WPM more than those from the Northern Region. Table 71 (in this chapter) shows that on average, participants from the Western Region were the fastest in Total Maltese Score.

Table 104

Dunn Post Hoc Test for Maltese Copy Quickly (Ikkopja Malajr), Maltese *Free Writing (Kitba Kreattiva)*, and Total Maltese Score, *Grouped by Geographical Regions*

	Regions	Test Statistic	Std. Error	Std. Test Statistic	p-value	Adj. p-value
Maltese Copy Quickly (Ikkopja Malajr)	Southern Harbour-Northern Harbour	-45.029	20.956	-2.149	0.032	0.475
	Southern Harbour-South Eastern	-47.604	19.065	-2.497	0.013	0.188
	Southern Harbour-Northern Region	-55.594	20.647	-2.693	0.007	0.106
	Southern Harbour-Gozo and Comino	-41.872	19.499	-2.147	0.032	0.476
	Southern Harbour-Western	-73.665	19.325	-3.812	0.000	0.002
	Northern Harbour-South Eastern	-2.575	18.534	-0.139	0.889	1.000
	Northern Harbour-Northern	-10.565	20.158	-0.524	0.600	1.000
	Northern Harbour-Gozo and Comino	3.157	18.980	0.166	0.868	1.000
	Northern Harbour-Western	-28.636	18.801	-1.523	0.128	1.000
	South Eastern-Northern	-7.989	18.184	-0.439	0.660	1.000
	South Eastern-Gozo and Comino	5.732	16.869	0.340	0.734	1.000
	South Eastern-Western	-26.061	16.667	-1.564	0.118	1.000
	Northern-Gozo and Comino	13.721	18.639	0.736	0.462	1.000
	Northern-Western	18.072	18.457	0.979	0.328	1.000
	Gozo and Comino-Western	31.793	17.162	1.852	0.064	0.959

Maltese Free Writing (Kitba Kreattiva)	Southern Harbour-Northern Harbour	-42.876	21.206	-2.022	0.043	0.648
	Southern Harbour-South Eastern	-38.786	19.370	-2.002	0.045	0.679
	Southern Harbour-Northern Region	-42.876	21.206	-2.022	0.043	0.648
	Southern Harbour-Gozo and Comino	-49.421	19.791	-2.497	0.013	0.188
	Southern Harbour-Western	-76.920	19.622	-3.920	0.000	0.001
	Northern Harbour-South Eastern	4.089	18.389	0.222	0.824	1.000
	Northern Harbour-Northern	28.570	20.001	1.428	0.153	1.000
	Northern Harbour-Gozo and Comino	-6.545	18.832	-0.348	0.728	1.000
	Northern Harbour-Western	-34.004	18.655	-1.825	0.068	1.000
	South Eastern-Northern	24.481	18.042	1.357	0.175	1.000
	South Eastern-Gozo and Comino	-10.635	16.737	-0.637	0.525	1.000
	South Eastern-Western	-38.133	16.537	-2.306	0.021	0.317
	Northern-Gozo and Comino	-35.115	18.493	-1.899	0.058	0.864
	Northern-Western	62.614	18.313	3.419	0.001	0.009
	Gozo and Comino-Western	27.499	17.028	1.615	0.106	1.000
Total Maltese Score	Southern Harbour-Northern Harbour	-57.879	20.972	-2.760	0.006	0.087
	Southern Harbour-South Eastern	-52.310	19.055	-2.745	0.006	0.091
	Southern Harbour-Northern Region	-34.854	20.659	-1.687	0.092	1.000
	Southern Harbour-Gozo and Comino	-56.392	19.435	-2.902	0.004	0.056
	Southern Harbour-Western	-91.715	19.319	-4.747	0.000	0.000
	Northern Harbour-South Eastern	5.569	18.662	0.298	0.765	1.000
	Northern Harbour-Northern	23.025	20.297	1.134	0.257	1.000
	Northern Harbour-Gozo and Comino	1.487	19.049	0.078	0.938	1.000
	Northern Harbour-Western	-33.837	18.931	-1.787	0.074	1.000
	South Eastern-Northern	17.456	18.310	0.953	0.340	1.000

	South Eastern-Gozo and Comino	-4.082	16.916	-0.241	0.809	1.000
	South Eastern-Western	-39.405	16.783	-2.348	0.019	0.283
	Northern-Gozo and Comino	-21.538	18.705	-1.151	0.250	1.000
	Northern-Western	56.861	18.585	3.060	0.002	0.033
	Gozo and Comino-Western	35.323	17.213	2.052	0.040	0.602

Table 105

Writing Speed of Participants from Different Geographical Regions, Grouped by Maltese Subtests and Total Maltese Score

Subtest/Test	Geographical Regions	WPM	Difference
Maltese Copy Quickly (Ikkopja Malajr)	Western Southern Harbour	25.81 22.40	3.41
Maltese Free Writing (Kitba Kreattiva)	Western Southern Harbour	17.77 14.73	3.04
	Northern Western Region	19.35 17.77	1.58
Total Maltese Score	Western Southern Harbour Region	19.83 15.78	4.05
	Western Northern Region	19.83 17.47	2.36

Socio Economic Status

A one-way ANOVA (parametric) and Kruskal-Walis test (non-parametric) (Table 106), revealed that participants from different socio economic backgrounds had different writing speeds in all English subtests and Total English Score. With regard to the Maltese assessment battery, participants from different socio economic backgrounds had different writing speeds in the Maltese *Copy Neatly (Ikkopja Pulit)* and Maltese *Copy from Board (Ikkopja mill-Bord)* subtests (highlighted).

Table 106

EMASH Subtests and Total Scores, Grouped by Socio Economic Status

Test	F	p-value one-way ANOVA	H	p-value Kruskal-Walis
English Copy Neatly	8.021	0.000		
English Copy Quickly	3.549	0.030	7.002	0.030
English Copy from Board	4.208	0.016	9.117	0.010
English Free Writing	4.005	0.019		
Total English Score	4.494	0.012	11.439	0.003
Maltese Copy Neatly (Ikkopja Pulit)	4.021	0.019		
Maltese Copy Quickly (Ikkopja Malajr)	2.341	0.098	3.098	0.212
Maltese Copy from Board (Ikkopja mill-Bord)	7.998	0.000		
Maltese Free Writing (Kitba Kreattiva)	0.690	0.502	1.216	0.544
Total Maltese Score	2.573	0.078	3.888	0.143

In the English assessment battery, a Bonferroni post hoc test (Table 107) showed that the only significant difference in writing speed in the English *Copy Neatly* subtest was between Middle SES and High SES (p = 0.000). For the English *Free Writing* subtest, the only significant difference in writing speed was between Low SES and High SES (p = 0.024). Table 107 shows that students with a High SES background were the fastest writers in these two subtests. Table 78 (in this chapter) shows that participants with High SES were the fastest writers in Total English Score.

Table 107

Bonferroni Post Hoc Test for English Subtests, Grouped by SES

Dependent Variable	(I) SES	(J) SES	Mean Difference (I-J)	Std. Error	p-value
English Copy Neatly	Low SES	Middle SES	1.238	0.695	0.228
		High SES	-1.766	0.807	0.088
	Middle SES	Low SES	-1.238	0.695	0.228
		High SES	-3.004	0.752	0.000
	High SES	Low SES	1.766	0.807	0.088
		Middle SES	3.004	0.752	0.000
English Free Writing	Low SES	Middle SES	-0.323	0.622	1.000
		High SES	-1.921	0.721	0.024
	Middle SES	Low SES	0.323	0.622	1.000
		High SES	-1.598	0.674	0.055
	High SES	Low SES	1.921	0.721	0.024
		Middle SES	1.598	0.674	0.055

A Dunn post hoc test (Table 108) revealed that significant differences in writing speed (highlighted in Table 108) in English *Copy Quickly*, English *Copy from Board* and Total English Score were between Middle SES and High SES. For Total English Score, other significant differences in writing speed were between Low SES and High SES ($p = 0.010$).

Table 108

Dunn Post Hoc Test for English Copy Quickly, English Copy from Board and Total English Score, Grouped by Writing Style

	SES	Test Statistic	Std. Error	Std. Test Statistic	p-value	Adj. p-value
English Copy Quickly	Middle SES-Low SES	2.237	12.763	0.175	0.861	1.000
	Middle SES-High SES	-34.661	13.833	-2.506	0.012	0.037
	Low SES-High SES	-32.425	14.795	-2.192	0.028	0.085
English Copy from Board	Middle SES-Low SES	17.197	12.758	1.348	0.178	0.533
	Middle SES-High SES	-41.650	13.828	-3.012	0.003	0.008
	Low SES-High SES	-24.453	14.789	-1.653	0.098	0.295
Total English Score	Middle SES-Low SES	-0.639	12.788	-0.050	0.960	1.000
	Middle SES-High SES	-43.063	13.862	-3.106	0.002	0.006
	Low SES-High SES	-43.701	14.843	-2.944	0.003	0.010

Table109 shows that students with High SES were the fastest writers in the English *Copy Quickly* subtest, the English *Copy from Board* subtest, and Total English Score.

Table 109

Writing Speed of Participants with Different SES, Grouped by English Subtests and Total English Score

Subtest/Test	SES	WPM	Difference
English Copy Quickly	High SES	33.82	1.94
	Middle SES	31.88	
English Copy from Board	High SES	21.05	1.68
	Middle SES	19.37	
Total English Score	High SES	24.12	1.95
	Middle SES	22.17	
	High SES	24.12	1.77
	Low SES	22.35	

In the Maltese assessment battery, a Bonferroni post hoc test (Table 110), showed that significant differences in writing speed in the Maltese *Copy Neatly (Ikkopja Pulit)* were between Middle SES and High SES (p = 0.015, highlighted). For the Maltese *Copy from Board (Ikkopja mill-Bord)* subtest, significant differences in writing speed were also between Middle SES and High SES, but also between Low SES and High SES (highlighted). Results showed that students with High SES were the fastest writers in these subtests. Table 110 also shows that upper SES students were the fastest writers in all the remaining Maltese subtests, and Total Maltese Score, though these results were not statistically significant. Table 78 (in this chapter) shows that participants with High SES were the fastest writers in Total Maltese Score.

Table 110

Bonferroni Post Hoc Test for the Maltese Subtests and Total Maltese Score, Grouped by SES

Dependent Variable	(I) SES	(J) SES	Mean Difference (I-J)	Std. Error	p-value
Maltese Copy Neatly (Ikkopja Pulit)	Low SES	Middle SES	0.693	0.559	0.647
		High SES	-1.069	0.666	0.328
	Middle SES	Low SES	-0.693	0.559	0.647
		High SES	-1.762*	0.623	0.015
	High SES	Low SES	1.069	0.666	0.328
		Middle SES	1.762*	0.623	0.015
Maltese Copy Quickly (Ikkopja Malajr)	Low SES	Middle SES	0.704	0.582	0.682
		High SES	-0.660	0.693	1.000
	Middle SES	Low SES	-0.704	0.582	0.682
		High SES	-1.364	0.646	0.106
	High SES	Low SES	0.660	0.693	1.000
		Middle SES	1.364	0.646	0.106
Maltese Copy from Board (Ikkopja mill-Bord)	Low SES	Middle SES	0.942	0.597	0.346
		High SES	-1.735*	0.716	0.048
	Middle SES	Low SES	-0.942	0.597	0.346
		High SES	-2.677*	0.670	0.000
	High SES	Low SES	1.735*	0.716	0.048

		Middle SES	2.677*	0.670	0.000
Maltese Free Writing (Kitba Kreattiva)	Low SES	Middle SES	0.163	0.574	1.000
		High SES	-0.579	0.680	1.000
	Middle SES	Low SES	-0.163	0.574	1.000
		High SES	-0.742	0.638	0.737
	High SES	Low SES	0.579	0.680	1.000
		Middle SES	0.742	0.638	0.737
Total Maltese Score	Low SES	Middle SES	0.478	0.543	1.000
		High SES	-0.896	0.648	0.502
	Middle SES	Low SES	-0.478	0.543	1.000
		High SES	-1.374	0.606	0.072
	High SES	Low SES	0.896	0.648	0.502
		Middle SES	1.374	0.606	0.072

SES and First Language. This study looks at the first language spoken by participants with different SES. Table111 shows that the Maltese language is the preferred language by participants from all SES. Table112 shows that Dominant English speakers of any SES were fastest in English (highlighted in yellow) and students from all social classes speaking a non-native language, were the slowest in Total Maltese Score (highlighted in blue). Table 112 gives no indication that any particular language is tied to any particular socio economic class, and that participants of that particular social class write faster in either language.

Table 111

First Language Preference, Grouped by Social Class

SES	First language			
	Dominant Maltese	Dominant English	Mixed	Non-native
Low SES	111	4	10	4
Middle SES	127	14	21	12
High SES	54	13	17	12

Table 112

SES and First Language

	Total English Score		Total Maltese Score	
SES	First language	Mean	First language	Mean
Low SES	Dominant Maltese	22.316	Dominant Maltese	18.257
	Dominant English	25.609	Dominant English	18.542
	Mixed	22.675	Mixed	19.141
	Non-native	18.042	Non-native	11.292
Middle SES	Dominant Maltese	22.012	Dominant Maltese	18.043
	Dominant English	22.755	Dominant English	18.875
	Mixed	22.569	Mixed	17.671
	Non-native	22.034	Non-native	10.688
High SES	Dominant Maltese	23.576	Dominant Maltese	19.039
	Dominant English	25.481	Dominant English	19.545
	Mixed	24.233	Mixed	19.254
	Non-native	24.651	Non-native	14.563

School Type

A one-way ANOVA (parametric) and Kruskal-Walis test (non-parametric), were run to determine if School Type affects writing speed. Findings show that with the exception of English *Copy Quickly* and English *Free Writing*, the distribution of mean scores for the English and Maltese subtests and Total Scores was the same across school types (see Table 113).

Table 113

EMASH Subtests and Total Scores, Grouped by School Type

Subtest/Test	F	p-value one-way ANOVA	H	p-value Kruskal-Walis
English Copy Neatly	2.384	0.069		
English Copy Quickly	3.674	0.012	9.941	0.007
English Copy from Board	1.495	0.215	4.037	0.133
English Free Writing	4.920	0.002		
Total English Score	2.082	0.102	2.997	0.223
Maltese Copy Neatly (Ikkopja Pulit)	0.062	0.980		
Maltese Copy Quickly (Ikkopja Malajr)	0.369	0.775	1.203	0.548
Maltese Copy from Board (Ikkopja mill-Bord)	1.982	0.117		
Maltese Free Writing (Kitba Kreattiva)	2.557	0.055	0.273	0.872
Total Maltese Score	2.219	0.086	1.399	0.497

In the English assessment battery, a Bonferroni post hoc test (Table 114) revealed that for the English *Free Writing* subtest, the only significant difference in writing speed was between participants attending girls' church schools and participants attending state schools (p = 0.008). Table 114 shows that state school participants were three words slower than girls' church schools' participants in this subtest.

Table 114

Bonferroni Post Hoc Test for English Free Writing, Grouped by School Type

(I) School Type	(J) School Type	Mean Difference (I-J)	Std. Error	p-value
State	Independent	-2.322	0.951	0.091
	Boys' church	-0.413	0.678	1.000
	Girls' church	-3.039	0.938	0.008
Independent	State	2.322	0.951	0.091
	Boys' church	1.908	1.066	0.446
	Girls' church	-0.717	1.248	1.000
Boys' church	State	0.413	0.678	1.000
	Independent	-1.908	1.066	0.446
	Girls' church	-2.626	1.055	0.080
Girls' church	State	3.039	0.938	0.008
	Independent	0.717	1.248	1.000
	Boys' church	2.626	1.055	0.080

A Dunn post hoc test (Table 115) revealed that the only significant differences in writing speed in the English *Copy Quickly* subtest was between participants attending state schools and those attending independent schools. Table BA7 in Appendix BA shows that the independent school's participants wrote about 2.7 more WPM than state schools' participants in this subtest.

Table 115

Dunn Post Hoc Test for English Copy Quickly, Grouped by School Type

School Type	Test Statistic	Std. Error	Std. Test Statistic	p-value	Adj. p-value
State-Boys' church	-25.665	14.158	-1.813	0.070	0.419
State-Girls' church	-35.895	19.364	-1.854	0.064	0.383
State-Independent	-53.823	18.876	-2.851	0.004	0.026
Boys' church-Girls' church	-10.230	21.854	-0.468	0.640	1.000
Boys' church-Independent	28.158	21.423	1.314	0.189	1.000
Girls' church- Independent	17.927	25.168	0.712	0.476	1.000

SES and School Type. Univariate analysis of variance (Two-Way ANOVA) presents the effect of SES, combined with School Type, on Total English Score, and Total Maltese Score, respectively (Table 116). Findings show that the combined effect of SES and School Type on Total English and Total Maltese Score was not statistically significant

Table 116

Two-way Anova: English and Maltese Total Scores, Grouped by SES and School Type

	Source	Type III Sum of Squares	df	Mean Square	F	p-value
Total English Score	SES * School Type	255.810	6	42.635	1.660	0.130
Total Maltese Score	SES * School Type	80.615	6	13.436	0.711	0.641

A Multivariate analysis of variance (MANOVA) for the combined Total English Score and Total Maltese Score (Table 117) presents the writing speed of participants, grouped by SES and School Type. As the data was not normally distributed, the Pillai's Trace test was used. MANOVA results showed that SES and School Type combined had no effect on writing speed ($p = 0.253$).

Table 117

MANOVA: English and Maltese Total Scores, Grouped by SES and School Type

Effect		Value	F	Hypothesis df	Error df	p-value
SES * School Type	Pillai's Trace	0.050	1.238	12.000	580.000	0.253
	Wilks' Lambda	0.951	1.237[b]	12.000	578.000	0.254
	Hotelling's Trace	0.051	1.236	12.000	576.000	0.254
	Roy's Largest Root	0.038	1.834[c]	6.000	290.000	0.092

SES, School Type, First Language and School Language. Descriptive statistics (Table 118) of First Language and School Language, considered together with SES and School Type, showed that overall, different first language speakers attend different language speaking schools. However, the data showed that Dominant English first language speakers attend the independent school where the school language is also Dominant English. Additionally, the majority of these participants come from middle to high socio economic backgrounds (highlighted in yellow in Table 118). The majority of Dominant Maltese first language speakers attend Dominant Maltese speaking schools, and come from low to middle socio economic backgrounds (highlighted in blue in Table 118). These descriptive statistics further show that the majority of non-native first language speakers attend state schools.

Table 118

Participants Grouped by First Language, School language, SES and School Type

First Language	School Language	SES	School Type			
			State	Independent	Boys' church	Girls' church
Dominant Maltese	Dominant Maltese	Low SES	62		11	8
		Middle SES	62		23	7
		High SES	18		7	5
		Total	**142**		**41**	**20**

	Dominant English	Low SES	1	0		
		Middle SES	0	6		
		High SES	0	10		
		Total	**1**	**16**		
	Mixed	Low SES	24		4	1
		Middle SES	16		7	6
		High SES	6		6	2
		Total	**46**		**17**	**9**
Dominant English	Dominant Maltese	Low SES	1		0	
		Middle SES	4		1	
		High SES	1		1	
		Total	**6**		**2**	
	Dominant English	Low SES		2		
		Middle SES		4		
		High SES		7		
		Total		**13**		
	Mixed	Low SES	1		0	0
		Middle SES	2		1	2
		High SES	0		0	4
		Total	**3**		**1**	**6**
Mixed	Dominant Maltese	Low SES	4		2	0
		Middle SES	5		3	3
		High SES	5		2	1
		Total	**14**		**7**	**4**
	Dominant English	Low SES		0		
		Middle SES		2		
		High SES		3		
		Total		**5**		
	Mixed	Low SES	3		1	0
		Middle SES	6		2	0
		High SES	3		1	2
		Total	**12**		**4**	**2**
Non-native	Dominant Maltese	Low SES	1			
		Middle SES	4			
		Total	**5**			
	Dominant English	Low SES		0		
		Middle SES		0		
		High SES		9		
		Total		**9**		

Mixed	SES	Low SES	3
		Middle SES	8
		High SES	3
		Total	**14**

Nationality

The one-way ANOVA test and/or Kruskal-Walis test (Table 119) revealed that nationality had a significant effect on English *Copy Neatly*, as well as on all the Maltese subtests and Total Maltese Score (highlighted in Table 119).

Table 119

EMASH Subtests and Total Scores, Grouped by Nationality

Test	F	p-value one-way ANOVA	H	p-value Kruskal-Walis
English Copy Neatly	5.159	0.006		
English Copy Quickly	0.977	0.377	2.388	0.303
English Copy from Board	1.377	0.254	2.706	0.258
English Free Writing	0.846	0.430		
Total English Score	1.419	0.243	2.213	0.331
Maltese Copy Neatly (Ikkopja Pulit)	3.599	0.028		
Maltese Copy Quickly (Ikkopja Malajr)	2.514	0.082	6.192	0.045
Maltese Copy from Board (Ikkopja mill-Bord)	4.978	0.007		
Maltese Free Writing (Kitba Kreattiva)	20.181	0.000	20.033	0.000
Total Maltese Score	14.176	0.000	19.340	0.000

In the English assessment battery, a Bonferroni post hoc test (Table 120) for the English *Copy Neatly* subtest showed significant differences in writing speed between participants with a Maltese nationality and those with a Dual nationality as well as participants with a Non-native nationality and a Dual nationality. Table 120 shows that students with a dual nationality wrote 6.6 WPM and 8.4 WPM more in the English *Copy Neatly* subtest, than Maltese and Non-native students, respectively.

Table 120

Bonferroni Post Hoc test for English Copy Neatly, Grouped by Nationality

(I) Nationality	(J) Nationality	Mean Difference (I-J)	Std. Error	p-value
Maltese	Non-native	1.802	1.000	0.217
	Dual	-6.629	2.564	0.030
Non-native	Maltese	-1.802	1.000	0.217
	Dual	-8.431	2.714	0.006
Dual	Maltese	6.629	2.564	0.030
	Non-native	8.431	2.714	0.006

The Maltese Assessment Battery. A Bonferroni post hoc test (Table 121) revealed that writing speed was the same across nationalities for Maltese *Copy Neatly (Ikkopja Pulit)*. This in spite the statistically significant result of the one-way ANOVA test, as post hoc tests are more stringent in accepting statistical significance (L. Camilleri, personal correspondence, August 28, 2019). The only significant difference in writing speed in the Maltese *Copy from Board (Ikkopja mill-Bord)* subtest was between Maltese and Non-native participants. Table 121 shows that Maltese students wrote on average 3.3 WPM more than Non-native students in this subtest.

Table 121

Bonferroni Post Hoc test for Maltese Copy Neatly (Ikkopja Pulit) and *Maltese Ikkopja mill-Bord (Copy from Board), Grouped by Nationality*

Dependent Variable	(I) Nationality	(J) Nationality	Mean Difference (I-J)	Std. Error	p-value
Maltese Copy Neatly (Ikkopja Pulit)	Maltese	Non-native	2.203	1.033	0.101
		Dual	-4.097	2.599	0.347
	Non-native	Maltese	-2.203	1.033	0.101
		Dual	-6.300	2.774	0.071
	Dual	Maltese	4.097	2.599	0.347
		Non-native	6.300	2.774	0.071
Maltese Copy from Board (Ikkopja mill-Bord)	Maltese	Non-native	3.295	1.109	0.010
		Dual	-2.755	2.789	0.972
	Non-native	Maltese	-3.295	1.109	0.010
		Dual	-6.050	2.977	0.129
	Dual	Maltese	2.755	2.789	0.972
		Non-native	6.050	2.977	0.129

A Dunn post hoc test (Table 122) showed that for the Maltese *Copy Quickly (Ikkopja Malajr)* subtest, writing speed was the same across nationalities. This inspite the statistically significant result of the Kruskal-Walis test, as post hoc tests are more stringent in accepting statistical significance (L. Camilleri, personal correspondence, August 28, 2019). For the Maltese *Free Writing (Kitba Kreattiva)* subtest and Total Maltese Score, the Dunn post hoc test (Table 122) showed that the only significant difference in writing speed was between Non-native and Maltese participants

Table 122

Dunn Post Hoc Test for Maltese Copy Quickly (Ikkopja Malajr), Maltese Free Writing (Kitba Kreattiva), and Total Maltese Score, *Grouped by Nationality*

	Nationality	Test Statistic	Std. Error	Std. Test Statistic	p-value	Adj. p-value
Maltese Copy Quickly	Non-native-Maltese	40.674	22.638	1.797	0.072	0.217
(Ikkopja Malajr)	Non-native-Dual	-136.292	60.793	-2.242	0.025	0.075
	Maltese-Dual	-95.618	56.957	-1.679	0.093	0.280
Maltese Free Writing	Non-native-Maltese	-102.732	23.015	4.464	0.000	0.000
(Kitba Kreattiva)	Non-native-Dual	-115.386	60.525	-1.906	0.057	0.170
	Maltese-Dual	-12.654	56.514	-0.224	0.823	1.000
Total Maltese Score	Non-native-Maltese	93.843	22.790	4.293	0.000	0.000
	Non-native-Dual	-146.717	61.213	-2.397	0.017	0.050
	Maltese-Dual	-48.874	57.349	-0.852	0.394	1.000

Table 123 shows that non-native participants were the slowest writers in the Maltese *Free Writing* (*Kitba Kreattiva*) subtest, and Total Maltese Score.

Table 123

Writing Speed of Participants of Different Nationalities, Grouped by Maltese Subtests and Total Maltese Score

Subtest/Test	Nationality	WPM	Difference
Maltese Free Writing (Kitba Kreattiva)	Maltese	16.56	6.47
	Non-native	10.09	
Total Maltese Score	Maltese	18.40	5.09
	Non-native	13.31	

Age

The Independent Samples t-test (parametric) and the Mann Whitney test (non-parametric) were run to determine if Age has an effect upon writing speed (Table 124).

Table 124

EMASH Subtests and Total Scores, Grouped by Age

Subtest/Test	t	p-value Independent Samples t-test	U	p-value Mann Whitney test
English Copy Neatly	1.499	0.135		
English Copy Quickly	1.179	0.239	14501.0	0.163
English Copy from Board	1.896	0.059	14097.0	0.070
English Free Writing	0.830	0.407		
Total English Score	0.622	0.534	14706.0	0.201
Maltese Copy Neatly (Ikkopja Pulit)	2.061	0.040		
Maltese Copy Quickly (Ikkopja Malajr)	2.664	0.008	11481.0	0.005
Maltese Copy from Board (Ikkopja mill-Bord)	2.823	0.005		
Maltese Free Writing (Kitba Kreattiva)	2.842	0.005	10840.0	0.001
Total Maltese Score	2.342	0.020	11512.5	0.004

With regard to the English assessment battery, Table 125 shows that Age does not affect the participants' writing speed in any of the English EMASH subtests or tests. Table125 shows that participants born between January to June wrote 1 WPM faster than those born between July to December. Figure 32 shows that participants wrote on average an equal number of words in the English subtests and Total English Score, irrespective of age.

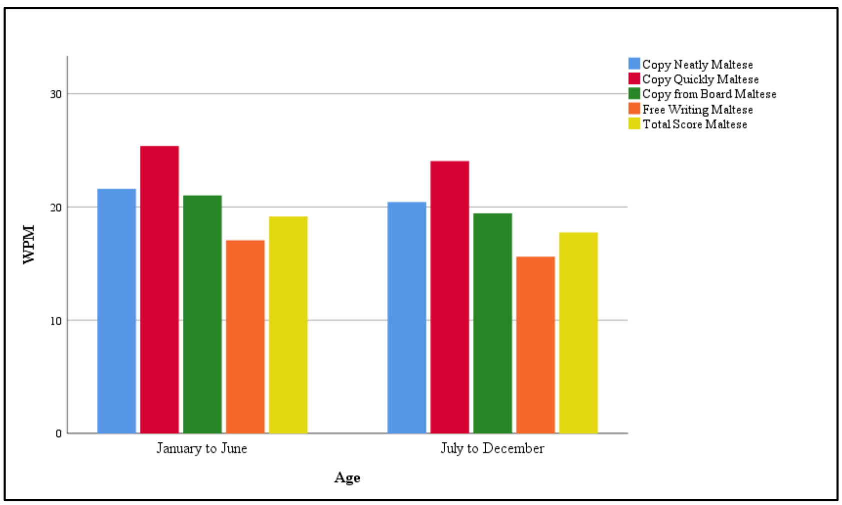
Table 125

WPM Written in English, by Participants with a Different Birth Range

Subtest	Birth Range	WPM
English Copy Neatly	January to June	27.78
	July to December	26.86
English Copy Quickly	January to June	32.83
	July to December	32.12
English Copy from Board	January to June	20.57
	July to December	19.67
English Free Writing	January to June	21.23
	July to December	20.78

Figure 32

WPM Written in English, by Participants with a Different Birth Range



In the Maltese assessment battery, Independent Samples and Mann Whitney test findings for Maltese subtests show that, unlike English, Age has a significant effect on the average number of words written in the Maltese subtests and Total Maltese Score (highlighted in Table 124). Table 126 and Figure 33 show that participants born between January to June were on average 1.3 WPM faster than those born between July to December.

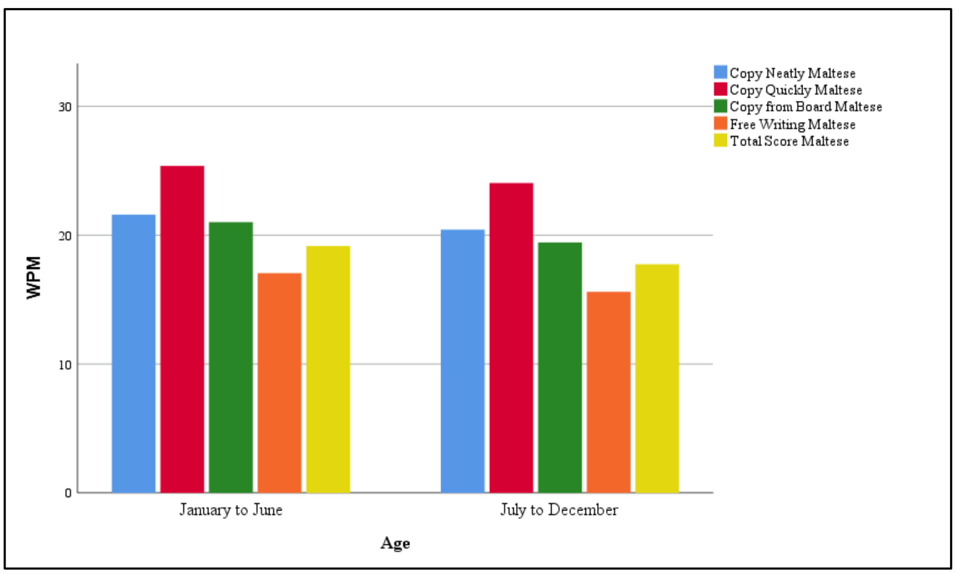
Table 126

WPM Written in Maltese, by Participants with a Different Birth Range

Subtest	Birth Range	WPM
Maltese Copy Neatly (Ikkopja Pulit)	January to June	21.41
	July to December	20.39
Maltese Copy Quickly (Ikkopja Malajr)	January to June	25.34
	July to December	23.99
Maltese Copy from Board (Ikkopja mill-Bord)	January to June	20.93
	July to December	19.43
Maltese Free Writing (Kitba Kreattiva)	January to June	17.02
	July to December	15.60

Figure 33

WPM Written in Maltese, by Participants with a Different Birth Range



Ability

Findings from the Independent Samples t-test (parametric) and the Mann Whitney tests (non-parametric) show that Ability has a significant effect on writing speed in both English and Maltese (Table 127).

Table 127

EMASH Subtests and Total Scores, Grouped by Ability

Subtest/Test	t	p-value Independent Samples t-test	U	p-value Mann Whitney test
English Copy Neatly	3.287	0.001		
English Copy Quickly	4.163	0.000	6161.000	0.000
English Copy from Board	4.407	0.000	5842.500	0.000
English Free Writing	3.717	0.000		
Total English Score	4.727	0.000	5853.000	0.000
Maltese Copy Neatly (Ikkopja Pulit)	4.077	0.000		
Maltese Copy Quickly (Ikkopja Malajr)	4.760	0.000	4702.000	0.000
Maltese Copy from Board (Ikkopja mill-Bord)	4.759	0.000		
Maltese Free Writing (Kitba Kreattiva)	3.619	0.000	5307.500	0.000
Total Maltese Score	3.902	0.000	5135.500	0.000

Typically developing participants wrote on average 2.5 more WPM than participants with learning difficulties in all the English subtests (see Table BA2, in Appendix BA), and 3.3 WPM more in Total English Score (see Table 70 in this chapter for descriptive statistics). As for the Maltese assessment battery, typically developing participants wrote on average 3 WPM more than participants with learning difficulties in all the Maltese subtests (see Table BB9, in Appendix BB), and 2.5 WPM more in Total Maltese Score (see Table 70 in this chapter for descriptive statistics).

To determine if participants with a profile of dyslexia and dyspraxia were able to speed up when instructed, the *Copy Neatly* scores were subtracted from the *Copy Quickly* scores. The copy speed difference cut-off score to flag those students who do not manage to increase their speed was set at 1.5 WPM in English, and 1 WPM in Maltese (see section *Copy Speed Difference* in this chapter). Since the copy speed difference cut-off score in this study was calculated on 14-year-old students, the 15-year-old student with a profile of dyslexia in this study was excluded from the sample before computing the Copy Speed difference check. The *Copy Neatly* score of the students with a profile of dyslexia and dyspraxia was deducted from their *Copy Quickly* score, and their writing speed difference at the 15th percentile was identified in SPSS. In this study, students with a profile of dyslexia and dyspraxia managed to speed up by 2 WPM in English, but by 0.18 WPM in Maltese. Hence, the copy speed difference was within the copy speed difference cut-off score for English, but not for Maltese. Table 128 shows that students with a profile of dyslexia and dyspraxia were about 3 WPM slower than average in English Total Score, and 2 WPM slower than average in Maltese Total Score, respectively.

Table 128

Total Score - Mean WPM Written by Typically Developing Students and Students with a Profile of Dyslexia and Dyspraxia

	Total English Score	Total Maltese Score
All participants	22.70	18.12
Dyslexia and dyspraxia	19.60	15.91

Writing Style

A one-way ANOVA (parametric) and Kruskal-Walis (non-parametric) test were run to determine if Writing Style affects writing speed in English and Maltese (Table 129). Findings show that writing style has an effect on writing speed, except in the English *Copy from Board* subtest (highlighted).

Table 129

EMASH Subtests and Total Scores, Grouped by Writing Style

Subtest/Test	F	p-value one-way ANOVA	H	p-value Kruskal-Walis
English Copy Neatly	9.753	0.000		
English Copy Quickly	7.677	0.000	19.858	0.000
English Copy from Board	1.514	0.211	6.621	0.085
English Free Writing	5.452	0.001		
Total English Score	4.901	0.002	14.808	0.002
Maltese Copy Neatly (Ikkopja Pulit)	3.377	0.019		
Maltese Copy Quickly (Ikkopja Malajr)	4.048	0.008	11.013	0.012
Maltese Copy from Board (Ikkopja mill-Bord)	2.762	0.042		
Maltese Free Writing (Kitba Kreattiva)	3.000	0.031	7.266	0.064
Total Maltese Score	3.755	0.011	9.698	0.021

In the English assessment battery, a Bonferroni post hoc test (Table 130) revealed that significant differences in writing speed in the English *Copy Neatly* and English *Free Writing* subtests, were between Print writers and Mixed mostly cursive writers, as well as Print writers and Mixed mostly print writers (highlighted in yellow in Table 130).

Table 130

Bonferroni Post Hoc Test for English Copy Neatly and English Free Writing, Grouped by Writing Style

Dependent Variable	(I) Writing Style	(J) Writing Style	Mean Difference (I-J)	Std. Error	p-value
English Copy Neatly	Cursive	Print	3.036	2.312	1.000
		Mixed mostly cursive	-0.924	2.410	1.000
		Mixed mostly print	0.135	2.310	1.000
	Print	Cursive	-3.036	2.312	1.000
		Mixed mostly cursive	-3.960	0.935	0.000
		Mixed mostly print	-2.902	0.634	0.000
	Mixed mostly cursive	Cursive	0.924	2.410	1.000
		Print	3.960	0.935	0.000
		Mixed mostly print	1.059	0.932	1.000
	Mixed mostly print	Cursive	-0.135	2.310	1.000
		Print	2.902	0.634	0.000
		Mixed mostly cursive	-1.059	0.932	1.000
English Free Writing	Cursive	Print	3.567	2.058	0.504
		Mixed mostly cursive	0.774	2.145	1.000
		Mixed mostly print	1.872	2.058	1.000
	Print	Cursive	-3.567	2.058	0.504
		Mixed mostly cursive	-2.793	0.834	0.005
		Mixed mostly print	-1.695	0.573	0.020
	Mixed mostly cursive	Cursive	-0.774	2.145	1.000
		Print	2.793	0.834	0.005
		Mixed mostly print	1.098	0.833	1.000
	Mixed mostly print	Cursive	-1.872	2.058	1.000
		Print	1.695	0.573	0.020
		Mixed mostly cursive	-1.098	0.833	1.000

A Dunn post hoc test (Table 131) showed that significant differences in writing speed in the English *Copy Quickly* subtest and Total English Score were between Print writers and Mixed mostly cursive writers, as well as Print writers and Mixed mostly print writers. The difference in English writing speed is given in Table 132.

Table 131

Dunn Post Hoc Test for English Copy Quickly *and Total English Score, Grouped by Writing Style*

	Writing Style	Test Statistic	Std. Error	Std. Test Statistic	p-value	Adj. p-value
English Copy Quickly	print-cursive	42.610	43.185	0.987	0.324	1.000
	print-mixed mostly cursive	-49.415	17.339	-2.850	0.004	0.026
	print-mixed mostly print	-49.697	11.862	-4.190	0.000	0.000
	cursive-mixed mostly cursive	-6.805	44.968	-0.151	0.880	1.000
	cursive-mixed mostly print	-7.087	43.153	-0.164	0.870	1.000
	mixed mostly cursive-mixed mostly print	-0.282	17.260	-0.016	0.987	1.000
Total English Score	print-cursive	79.859	43.320	1.843	0.065	0.392
	print-mixed mostly cursive	-52.365	17.382	-3.013	0.003	0.016
	print-mixed mostly print	-34.481	11.880	-2.902	0.004	0.022
	cursive-mixed mostly cursive	27.495	45.115	0.609	0.542	1.000
	cursive-mixed mostly print	45.378	43.294	1.048	0.295	1.000
	mixed mostly cursive-mixed mostly print	17.884	17.316	1.033	0.302	1.000

Table 132

Writing Speed of Participants using Different Writing Styles, Grouped by English Copy Quickly Subtest and Total English Score

Subtest/Test	Writing Style	WPM	Difference
English Copy Quickly	Mixed mostly cursive	33.78	2.98
	Print	30.80	
	Mixed mostly print	33.59	2.79
	Print	30.80	
Total English Score	Mixed mostly cursive	24.26	2.68
	Print	21.58	
	Mixed mostly print	23.23	1.65
	Print	21.58	

Although Table 133 shows that cursive writers are faster than print writers, these differences were not statistically significant (see tables 130 and 131, p-values highlighted in blue).

Table 133

Writing Speed Differences Between Cursive and Print Writing for English Subtests and Test

Subtest/Test	Writing Style	WPM	Difference
English Copy Neatly	Cursive	28.50	3.04
	Print	25.46	
English Copy Quickly	Cursive	33.08	2.28
	Print	30.80	
English Free Writing	Cursive	23.40	3.57
	Print	19.83	
Total English Score	Cursive	24.97	3.39
	Print	21.58	

In the Maltese assessment battery, a Bonferroni post hoc test analysis shows that in the Maltese *Copy Neatly (Ikkopja Pulit)* subtest, the only significant differences in writing speed was evident between Print writers and Mixed mostly print writers (highlighted in yellow in

Table 134. In the Maltese *Copy from Board (Ikkopja mill-Bord)* and the Maltese *Free Writing (Kitba Kreattiva)* subtests, the Bonferroni post hoc test (Table 134) showed that writing speed was the same for all Writing Styles, despite the statistically significant result of the One-Way ANOVA test, as post hoc tests are more stringent in accepting statistical significance (L. Camilleri, personal correspondence, August 28, 2019). Table 134 also shows that Cursive writers were faster than Print writers in the Maltese *Copy Neatly (Ikkopja Pulit)* subtest, the Maltese *Copy from Board (Ikkopja mill-Bord)* subtest, and the Maltese *Free Writing (Kitba Kreattiva)* subtest. These results were however not statistically significant (highlighted in blue in Table 134).

Table 134

Bonferroni Post Hoc Test for Maltese Subtests, Grouped by Writing Style

Dependent Variable	(I) Writing Style	(J) Writing Style	Mean Difference (I-J)	Std. Error	p-value
Maltese Copy Neatly (Ikkopja Pulit)	Cursive	Print	2.661	1.730	0.750
		Mixed mostly cursive	1.335	1.838	1.000
		Mixed mostly print	1.141	1.726	1.000
	Print	Cursive	-2.661	1.730	0.750
		Mixed mostly cursive	-1.326	0.817	0.633
		Mixed mostly print	-1.519	0.519	0.022
	Mixed mostly cursive	Cursive	-1.335	1.838	1.000
		Print	1.326	0.817	0.633
		Mixed mostly print	-0.193	0.808	1.000
	Mixed mostly print	Cursive	-1.141	1.726	1.000
		Print	1.519	0.519	0.022
		Mixed mostly cursive	0.193	0.808	1.000
Maltese Copy from Board (Ikkopja mill-Bord)	Cursive	Print	2.793	1.869	0.817
		Mixed mostly cursive	1.230	1.989	1.000
		Mixed mostly print	1.394	1.865	1.000
	Print	Cursive	-2.793	1.869	0.817
		mixed mostly cursive	-1.563	0.892	0.484
		mixed mostly print	-1.399	0.563	0.080

	mixed mostly cursive	Cursive	-1.230	1.989	1.000
		Print	1.563	0.892	0.484
		Mixed mostly print	0.164	0.883	1.000
	mixed mostly print	Cursive	-1.394	1.865	1.000
		Print	1.399	0.563	0.080
		Mixed mostly cursive	-0.164	0.883	1.000
Maltese Free Writing (Kitba Kreattiva)	Cursive	Print	3.199	1.749	0.410
		Mixed mostly cursive	1.692	1.857	1.000
		Mixed mostly print	1.912	1.744	1.000
	Print	Cursive	-3.199	1.749	0.410
		Mixed mostly cursive	-1.507	0.828	0.418
		Mixed mostly print	-1.287	0.529	0.093
	Mixed Mostly Cursive	Cursive	-1.692	1.857	1.000
		Print	1.507	.828	0.418
		Mixed mostly print	0.220	.817	1.000
	Mixed Mostly Print	Cursive	-1.912	1.744	1.000
		Print	1.287	0.529	0.093
		Mixed mostly cursive	-0.220	0.817	1.000

A Dunn post hoc test showed that the only significant difference in writing speed in the Maltese *Copy Quickly (Ikkopja Malajr)* subtest was between Print writers and Mixed mostly print writers (highlighted in yellow in Table 135). The Dunn post hoc test for Total Maltese Score, showed that writing speed was the same for all writing styles, as the p-values exceeded the 0.05 criterion, despite the statistically significant result generated by the Kruskal-Walis test.

Table 135

Dunn Post Hoc Test for Maltese Copy Quickly (Ikkopja Malajr) and Total Maltese Score, Grouped by Writing Style

Subtest/Test	Writing Style	Test Statistic	Std. Error	Std. Test Statistic	p-value	Adj. p-value
Maltese Copy Quickly (Ikkopja Malajr)	print-mixed mostly print	-32.781	11.448	-2.863	0.004	0.025
	print-mixed mostly cursive	-35.924	17.961	-2.000	0.045	0.273
	print-cursive	66.689	38.029	1.754	0.079	0.477
	mixed mostly print-mixed mostly cursive	3.144	17.774	0.177	0.860	1.000
	mixed mostly print-cursive	33.909	37.941	0.894	0.371	1.000
	mixed mostly cursive-cursive	30.765	40.386	0.762	0.446	1.000
Total Maltese Score	print-mixed mostly print	-29.494	11.493	-2.566	0.010	0.062
	print-mixed mostly cursive	-31.600	18.085	-1.747	0.081	0.483
	print-cursive	73.775	38.292	1.927	0.054	0.324
	mixed mostly print-mixed mostly cursive	2.106	17.874	0.118	0.906	1.000
	mixed mostly print-cursive	44.281	38.193	1.159	0.246	1.000
	mixed mostly cursive-cursive	42.175	40.665	1.037	0.300	1.000

Table 136 shows the difference in writing speed between Cursive and Print writing in the Maltese *Copy Quickly (Ikkopja Malajr)* subtest, and Total Maltese Score. Cursive writers were faster than Print writers, though this result was not statistically significant (highlighted in blue in Table 136).

Table 136

Writing Speed Difference between Cursive and Print Writers

Subtest/Test	Writing Style	WPM	Difference
Maltese Copy Quickly (Ikkopja Malajr)	Cursive	26.64	3.06
	Print	23.58	
Total Maltese Score	Cursive	20.51	3.27
	Print	17.24	

Legibility

Writing Style and Legibility. This study seeks to determine whether writing style affects legibility. A Chi-Square test (Table 137) presents the relationship between the two categorical variables Writing Style and Legibility. Table 137 shows that writing style has no significant affect upon legibility.

Table 137

Chi-Square Test for Writing Style and Legibility

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.669	9	0.378
Likelihood Ratio	6.782	9	0.660
Linear-by-Linear Association	0.713	1	0.398

Table 138 shows descriptive statistics for Legibility and Writing Style. The handwriting of the majority of the students (highlighted in Table 138) had overall clear legibility and mature appearance. The writing of these students varied, some using only Cursive, some only Print, while yet others using a mixture of both, to varying degrees.

Table 138

Legibility and Writing Style

		Writing Style				
		Cursive	Print	Mixed mostly cursive	Mixed mostly print	Total
Legibility	portions of the text difficult or impossible to decipher	0	0	1	0	1
	some words or phrases difficult to decipher	0	3	1	2	6
	generally clear legibility but immature appearance	3	52	15	66	136
	overall clear legibility and mature appearance	4	114	32	108	258
Total		7	169	49	176	401

Ability and Legibility. This study seeks to determine whether ability has an effect on legibility. A Chi-Square test (Table 139) presents the relationship between the two categorical variables Ability and Legibility. Table 139 shows that ability has a significant affect upon legibility.

Table 139

Chi-Square Test for Ability and Legibility

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	18.542	3	0.000
Likelihood Ratio	15.593	3	0.001
Linear-by-Linear Association	15.783	1	0.000

Descriptive statistics for Legibility and Ability (Table 140) in English and Maltese showed that the slowest writers with the most immature handwriting were students with LD (highlighted in yellow). However, immature handwriting was also identified amongst students without LD (highlighted in blue). Conversely, the free writing of a number of students with LD had mature handwriting (highlighted in green).

Table 140

Participants' Legibility in the English and Maltese Free Writing, Grouped by Ability

Ability	Legibility	Total English Score	Total Maltese Score
Typically Developing	some words or phrases difficult to decipher	24.30	16.35
	generally clear legibility but immature appearance	21.06	16.18
	overall clear legibility and mature appearance	21.57	16.76
Learning Difficulties	portions of the text difficult or impossible to decipher	21.10	15.40
	some words or phrases difficult to decipher	22.70	14.30
	generally clear legibility but immature appearance	18.04	13.52
	overall clear legibility and mature appearance	18.93	14.78

Age and Legibility. This study seeks to determine whether age has an effect on legibility. A Chi-Square test (Table 141) presents the relationship between the two categorical variables Age and Legibility. Table 141 shows no significant differences between the legibility of the two birth ranges, which varied only by a few months.

Table 141

Chi-Square Test for Age and Legibility

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.567	3	0.667
Likelihood Ratio	1.944	3	0.584
Linear-by-Linear Association	0.735	1	0.391

Gender and Legibility. A Chi-Square test (Table 142) presents the relationship between the two categorical variables Legibility and Gender. Table 142 shows that gender has a significant affect upon legibility.

Table 142

Chi-Square Test

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.707	3	0.002
Likelihood Ratio	17.444	3	0.001
Linear-by-Linear Association	13.441	1	0.000

Table 143 shows that the handwriting of female participants was more clear, legible and mature than that of male participants.

Table 143

Relationship between Legibility and Gender

Gender		portions of the text difficult or impossible to decipher	some words or phrases difficult to decipher	generally clear legibility but immature appearance	overall clear legibility and mature appearance
Male	Count	1	6	82	117
	% within Gender	0.5%	2.9%	39.8%	56.8%
Female	Count	0	0	54	141
	% within Gender	0.0%	0.0%	27.7%	72.3%

Handedness and Legibility. A Chi-Square test (Table 144) presents the relationship between Handedness and Legibility. Table 144 shows that being left or right handed does not affect legibility.

Table 144

Relationship between Legibility and Handedness

		Legibility			
Handedness		portions of the text difficult or impossible to decipher	some words or phrases difficult to decipher	generally clear legibility but immature appearance	overall clear legibility and mature appearance
right	Count	1	5	120	228
	% within Handedness	0.3%	1.4%	33.9%	64.4%
left	Count	0	1	16	29
	% within Handedness	0.0%	2.2%	34.8%	63.0%

Correlations

Correlations measure the strength of relationships between two variables, and their direction (Jaadi, 2019). In this study, correlations were run to determine if there was a relationship between the subtests within and across languages. When both variables were normally distributed, thus meeting all assumptions of normality, the parametric Pearson test was used for correlational analysis. When one or both of the variables were not normally distributed, the non-parametric Spearman's rho test was used as it is insensitive to the distribution of data. As a reminder, the distribution of scores, as shown by the Shapiro-Wilk test (see section *Assessing Data for Normality* in this chapter), is as follows:

Normally Distributed	**Not Normally Distributed**
English Copy Neatly	English Copy Quickly
English Free Writing	English Copy from Board
Maltese Copy Neatly (Ikkopja Pulit)	Total English Score
Maltese Copy from Board (Ikkopja mill-Bord)	Maltese Copy Quickly (Ikkopja Malajr)
Graphic Speed Test	Maltese Free Writing (Kitba Kreattiva)
	Total Maltese Score

Within Language Correlations

Correlational analyses show that the individual English subtests and Total English Score are positively and significantly correlated with one another (Table 145). This indicates that when a student obtained low scores in one subtest, they also attained low scores in the other subtest. The strongest correlation was evident between the English *Free Writing* subtest and Total English Score.

Table 145

Correlation Between Individual English Subtests and Total English Score

		Pearson Correlation Correlation		Spearman's rho Correlation	
		Correlation level	p-value	Correlation level	p-value
English Copy Neatly	English Copy Quickly	0.750	0.000	0.762	0.000
	English Copy from Board	0.685	0.000	0.705	0.000
	English Free Writing	0.683	0.000		
	Total English Score	0.752	0.000	0.798	0.000
English Copy Quickly	English Copy Neatly	0.750	0.000	0.762	0.000
	English Copy from Board	0.720	0.000	0.749	0.000
	English Free Writing	0.659	0.000	0.675	0.000
	Total English Score	0.746	0.000	0.796	0.000
English Copy from Board	English Copy Neatly	0.658	0.000	0.705	0.000
	English Copy Quickly	0.720	0.000	0.749	0.000
	English Free Writing	0.632	0.000	0.626	0.000
	Total English Score	0.726	0.000	0.757	0.000
English Free Writing	English Copy Neatly	0.683	0.000		
	English Copy Quickly	0.659	0.000	0.675	0.000
	English Copy from Board	0.632	0.000	0.626	0.000
	Total English Score	0.963	0.000	0.958	0.000
Total English Score	English Copy Neatly	0.752	0.000	0.798	0.000
	English Copy Quickly	0.746	0.000	0.796	0.000
	English Copy from Board	0.726	0.000	0.757	0.000
	English Free Writing	0.963	0.000	0.958	0.000

Correlational analyses show that the individual Maltese subtests and Total Maltese Score are positively and significantly correlated with one another (Table 146). This indicates that when a student obtained low scores in one subtest, they also attained low scores in the other subtest. The strongest correlation was evident between the Maltese *Free Writing* subtest and Total Maltese Score.

Table 146

Correlations Between Individual Maltese Subtests and Total Maltese Score

		Pearson Correlation		Spearman's rho Correlation	
		Correlation level	p-value	Correlation level	p-value
Maltese Copy Neatly (Ikkopja Pulit)	Maltese Copy Quickly (Ikkopja Malajr)	0.806	0.000	0.791	0.000
	Maltese Copy from Board (Ikkopja mill-Bord)	0.774	0.000		
	Maltese Free Writing (Kitba Kreattiva)	0.625	0.000	0.641	0.000
	Total Maltese Score	0.781	0.000	0.791	0.000
Maltese Copy Quickly (Ikkopja Malajr)	Maltese Copy Neatly (Ikkopja Pulit)	0.806	0.000	0.791	0.000
	Maltese Copy from Board (Ikkopja mill-Bord)	0.787	0.000	0.787	0.000
	Maltese Free Writing (Kitba Kreattiva)	0.643	0.000	0.667	0.000
	Total Maltese Score	0.785	0.000	0.804	0.000
Maltese Copy from Board (Ikkopja mill-Bord)	Maltese Copy Neatly (Ikkopja Pulit)	0.774	0.000		
	Maltese Copy Quickly (Ikkopja Malajr)	0.787	0.000	0.787	0.000
	Maltese Free Writing (Kitba Kreattiva)	0.623	0.000	0.646	0.000
	Total Maltese Score	0.768	0.000	0.789	0.000
Maltese Free Writing (Kitba Kreattiva)	Maltese Copy Neatly (Ikkopja Pulit)	0.625	0.000	0.641	0.000
	Maltese Copy Quickly (Ikkopja Malajr)	0.643	0.000	0.667	0.000
	Maltese Copy from Board (Ikkopja mill-Bord)	0.623	0.000	0.646	0.000
	Total Maltese Score	0.954	0.000	0.957	0.000
Total Maltese Score	Maltese Copy Neatly (Ikkopja Pulit)	0.781	0.000	0.791	0.000
	Maltese Copy Quickly (Ikkopja Malajr)	0.785	0.000	0.804	0.000
	Maltese Copy from Board (Ikkopja mill-Bord)	0.768	0.000	0.789	0.000
	Maltese Free Writing (Kitba Kreattiva)	0.954	0.000	0.957	0.000

Between Language Correlations

The English subtests and Total English Score were correlated with the parallel Maltese subtests and Total Maltese Score (Table 147). Results showed a significant positive correlation across languages, meaning that when a student attained low scores in a subtest/total score in one language, they also attained low scores in the equivalent subtest/total score in the other language.

Table 147

Correlation Between the English Subtest/Test and the Maltese Subtests/Test

		Pearson Correlation		Spearman's rho Correlation	
		Correlation level	p-value	Correlation level	p-value
English Copy Neatly	Maltese Copy Neatly (Ikkopja Pulit)	0.712	0.000		
English Copy Quickly	Maltese Copy Quickly (Ikkopja Malajr)	0.758	0.000	0.743	0.000
English Copy from Board	Maltese Copy from Board (Ikkopja mill-Bord)	0.795	0.000	0.805	0.000
English Free Writing	Maltese Free Writing (Kitba Kreattiva)	0.666	0.000	0.706	0.000
Total English Score	Total Maltese Score	0.728	0.000	0.775	0.000

Performance Across Time Within the Free Writing Task

Within the free writing task, the profile of raw scores written in each of the two-minute period was examined to see how consistently the participants wrote within the ten-minute period. Table 148 shows the number of words written every two minutes: by the whole population; by typically developing students; by students with LD; and by students diagnosed with dyslexia and dyspraxia.

Table 148

WPM Written Every Two Minutes in the English and Maltese Free Writing Subtests

	Total sample		Typically developing		Students with LD		Students with dyslexia and dyspraxia	
	WPM English	WPM Maltese	WPM English	WPM Maltese	WPM English	WPM Maltese	WPM English	WPM Maltese
1st & 2nd Minute	23.71	18.17	24.25	18.63	20.97	15.59	21.82	16.44
3rd & 4th Minute	21.33	16.90	23.48	17.14	19.25	15.54	20.57	16.94
5th & 6th Minute	20.27	15.69	20.56	15.98	18.82	14.06	19.29	14.94
7th & 8th Minute	20.16	15.87	20.64	16.21	17.74	14.94	17.40	14.69
9th & 10th Minute	19.76	15.46	20.30	15.80	17.03	13.44	18.93	16.56

Regression Analysis

A single independent variable (or predictor) could have an effect on a dependent variable (predicted), or it could have no effect at all in the presence of other predictors (L. Camilleri, personal communication, June 28, 2018). Linear regression analyses was conducted to predict the effect of the independent (predictor) variables on one or more dependent variables (or predicted). To identify the regression model, General Linear Model was computed. This regression model was selected because the predictors are categorical. The results presented here are those derived from the backward procedure model (see Appendix BE for Regression Analysis in English before backward procedure; and Appendix BF for Regression Analysis in Maltese before backward procedure). Only predictors with p-values smaller than the 0.05 level of significance were included in this model. The independent variables examined were: First Language, School Language, Nationality, Ability, Geographical Regions, Socio Economic Status, School Type, Gender, Age, Handedness and Writing Style. The following sections present the regression analyses for each subtest in the English and Maltese versions of the EMASH.

The English Assessment Battery

English *Copy Neatly* Subtest. Table 149 shows the results of regression analysis for the English *Copy Neatly* subtest against all independent variables (predictors). The five variables that emerged as significant predictors of the ability to copy neatly in English, from most to least predictive, include Writing Style, (p = 0.000), followed by Nationality (p = 0.001), Socio Economic Status (p = 0.002), Ability (p = 0.002) and Geographical Region (p = 0.040). This five predictor model explained 15.7%[40] of the total variability[41] of the number of words written per minute in the English *Copy Neatly* subtest. The remaining 84.3% of the total variation may be attributed to other predictors not accounted for in the study. The remaining predictors (e.g. Age and Gender) were eliminated from the model because they were not significant.

Table 149

Regression Analysis for English Copy Neatly Subtest

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	2120.885[a]	13	163.145	5.992	0.000
Intercept	19660.046	1	19660.046	722.078	0.000
Ability	267.577	1	267.577	9.828	0.002
Writing Style	623.134	3	207.711	7.629	0.000
Geographical Regions	321.596	5	64.319	2.362	0.040
Nationality	423.377	2	211.688	7.775	0.001
SES	346.404	2	173.202	6.361	0.002
Error	9121.058	335	27.227		
Total	272403.000	349			
Corrected Total	11241.943	348			

a. R Squared = 0.189 (Adjusted R Squared = 0.157)

[40] Derived from the adjusted R-squared value, which is a modified version of R-squared that has been adjusted for the number of predictors in the model. The R-squared value increases every time a predictor is added. The adjusted R-squared value increases only if the new predictor improves the model more than would be expected by chance. It decreases when the new predictor doesn't improve the model (Ogee et al., 2013). Hence the adjusted R-squared is a more reliable predictive value.

[41] When the independent variables are in the presence of each other.

English *Copy Quickly* Subtest. Table 150 shows the results of regression analysis for the English *Copy Quickly* subtest. The regression model identified three significant predictors that predict the ability to copy quickly, where Ability and Writing Style were the best predictors since they have the smallest p-value (p = 0.000). These were followed by School Language (p = 0.025). This three predictor model explained 8.7% of the total variability of the number of words written per minute in the English *Copy Quickly* subtest.

Table 150

Regression Analysis for English Copy Quickly Subtest

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1095.284[a]	6	182.547	6.543	0.000
Intercept	62523.711	1	62523.711	2240.917	0.000
Ability	391.030	1	391.030	14.015	0.000
School Language	207.437	2	103.719	3.717	0.025
Writing Style	543.955	3	181.318	6.499	0.000
Error	9542.123	342	27.901		
Total	381319.000	349			
Corrected Total	10637.407	348			

a. R Squared = 0.103 (Adjusted R Squared = 0.087)

English *Copy from Board.* Table 151 shows that the three significant predictors of English *Copy from Board* subtest include Ability (p = 0.000), followed by Geographical Region (p = 0.008) and SES (p = 0.012). This three predictor model explained 8.2% of the total variability of the number of words written per minute in the English *Copy from Board* subtest.

Table 151

Regression Analysis for English Copy from Board Subtest

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	702.784[a]	8	87.848	4.891	0.000
Intercept	63549.800	1	63549.800	3538.064	0.000
Ability	260.622	1	260.622	14.510	0.000
Geographical Regions	284.176	5	56.835	3.164	0.008
SES	162.298	2	81.149	4.518	0.012
Error	6106.993	340	17.962		
Total	148719.250	349			
Corrected Total	6809.777	348			

a. R Squared = 0.103 (Adjusted R Squared = 0.082)

English *Free Writing*. Table 152 shows that English *Free Writing* is significantly predicted by Gender (p = 0.001), Ability (p = 0.002), Writing Style (p = 0.002) and School Type (p = 0.036). This four predictor model explained 12.1% of the total variability of the number of words written per minute in the English *Free Writing* subtest.

Table 152

Regression Analysis for English Free Writing Subtest

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1203.037[a]	8	150.380	6.808	0.000
Intercept	27463.417	1	27463.417	1243.364	0.000
Writing Style	326.891	3	108.964	4.933	0.002
School	190.744	3	63.581	2.879	0.036
Gender	231.275	1	231.275	10.471	0.001
Ability	206.508	1	206.508	9.349	0.002
Error	7311.126	331	22.088		
Total	159000.660	340			
Corrected Total	8514.163	339			

a. R Squared = 0.141 (Adjusted R Squared = 0.121)

Total English Score. The regression model identified four significant variables that predict an effect on Total English Score (Table 153). Ability emerged as the best predictor, followed by Gender (p = 0.013), Geographical Region (p = 0.019) and Writing Style (p = 0.31). This four predictor model explained 11.6% of the total variability of the number of words written per minute in Total English Score.

Table 153

Regression Analysis for Total English Score Subtest

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1299.241[a]	10	129.924	5.586	0.000
Intercept	30950.705	1	30950.705	1330.752	0.000
Writing Style	208.373	3	69.458	2.986	0.031
Gender	145.788	1	145.788	6.268	0.013
Ability	413.709	1	413.709	17.788	0.000
Geographical Regions	318.725	5	63.745	2.741	0.019
Error	7884.480	339	23.258		
Total	190464.277	350			
Corrected Total	9183.721	349			

a. R Squared = 0.141 (Adjusted R Squared = 0.116)

The Maltese Assessment Battery

Maltese *Copy Neatly (Ikkopja Pulit)* Subtest. Table 154 shows the results of regression analysis for the Maltese *Copy Neatly (Ikkopja Pulit)* subtest. The model identified five significant predictors including Ability (p = 0.002), Geographical Region (p = 0.006), Nationality (p = 0.017), Writing Style (p = 0.035) and Gender (p = 0.037). This five model explained 11.7% of the total variability of the number of words written per minute in the Maltese *Copy Neatly* subtest.

Table 154

Regression Analysis for Maltese Copy Neatly (Ikkopja Pulit) Subtest

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	972.694[a]	12	81.058	4.645	0.000
Intercept	7590.048	1	7590.048	434.961	0.000
Writing Style	151.898	3	50.633	2.902	0.035
Gender	76.379	1	76.379	4.377	0.037
Ability	166.980	1	166.980	9.569	0.002
Geographical Regions	293.540	5	58.708	3.364	0.006
Nationality	144.420	2	72.210	4.138	0.017
Error	5549.087	318	17.450		
Total	151235.500	331			
Corrected Total	6521.781	330			

a. R Squared = 0.149 (Adjusted R Squared = 0.117)

Maltese *Copy Quickly (Ikkopja Malajr)* Subtest. The regression model identified six significant predictors that predict a student's ability to copy quickly in Maltese (Table 155). Ability (p = 0.001) and Gender (p = 0.006) were the best predictors followed by Age (p = 0.015), Geographic Region (p = 0.18), Writing Style (p = 0.040) and SES (p = 0.049). This six predictor model explained 12.9% of the total variability of the number of words written per minute in the Maltese *Copy Quickly* subtest.

Table 155

Regression Analysis for Maltese Copy Quickly (Ikkopja Malajr) Subtest

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1137.393[a]	13	87.492	4.750	0.000
Intercept	36483.006	1	36483.006	1980.504	0.000
Writing Style	154.375	3	51.458	2.793	0.040
Gender	141.491	1	141.491	7.681	0.006
Ability	221.197	1	221.197	12.008	0.001

Geographical Regions	255.796	5	51.159	2.777	0.018
Age	110.058	1	110.058	5.975	0.015
SES	112.108	2	56.054	3.043	0.049
Error	5821.059	316	18.421		
Total	207942.500	330			
Corrected Total	6958.452	329			

a. R Squared = 0.163 (Adjusted R Squared = 0.129)

Maltese *Copy From Board (Ikkopja mill-Bord)* Subtest. Table 156 shows the results of regression analysis for the Maltese *Copy from Board (Ikkopja mill-Bord)* subtest. The regression model identified four significant predictors that predict the ability to copy from the board in Maltese, where Ability (p = 0.000) and Socio Economic Status (p = 0.001) were the best predictors since they have the smallest p-values. These were followed by First Language and Age, both with a p-value of 0.018. This four predictor model explained 11.5% of the total variability of the number of words written per minute in the Maltese *Copy from the Board* subtest.

Table 156

Regression Analysis for Maltese Copy from Board (Ikkopja mill-Bord) Subtest

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1017.263[a]	7	145.323	7.083	0.000
Intercept	24487.029	1	24487.029	1193.463	0.000
Ability	279.544	1	279.544	13.625	0.000
DOB	116.499	1	116.499	5.678	0.018
SES	280.525	2	140.262	6.836	0.001
First Language	208.283	3	69.428	3.384	0.018
Error	6586.157	321	20.518		
Total	141574.000	329			
Corrected Total	7603.419	328			

a. R Squared = 0.134 (Adjusted R Squared = 0.115)

Maltese *Free Writing.* The regression model (Table 157) identified four significant predictors of Maltese free writing identified by the regression analysis. These include Geographical Region, Ability and First Language (0.000), followed by Gender ($p = 0.006$). This four predictor model explained 24.8% of the total variability of the number of words written per minute in the Maltese *Free Writing* subtest.

Table 157

Regression Analysis for Maltese Free Writing Subtest

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1808.004[a]	10	180.800	11.704	0.000
Intercept	12660.832	1	12660.832	819.594	0.000
Ability	264.200	1	264.200	17.103	0.000
First Language	970.668	3	323.556	20.945	0.000
Gender	118.839	1	118.839	7.693	0.006
Geographical Regions	382.295	5	76.459	4.950	0.000
Error	4866.024	315	15.448		
Total	93038.130	326			
Corrected Total	6674.028	325			

a. R Squared = 0.271 (Adjusted R Squared = 0.248)

Total Maltese Score. Lastly, writing speed in Maltese, a measure of performance obtained from the sum of all the Maltese subtests, is best predicted by Geographical Region, First Language and Ability ($p = 0.000$), followed by Gender ($p = 0.006$) and Writing Style ($p = 0.045$) (Table 158). This five predictor model explained 23.0% of the total variability of the number of words written per minute in Total Maltese Score (Table 158).

Table 158

Regression Analysis for Total Maltese Score Subtest

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1612.493[a]	13	124.038	8.601	0.000
Intercept	11835.815	1	11835.815	820.689	0.000
Ability	231.156	1	231.156	16.028	0.000
First Language	631.651	3	210.550	14.599	0.000
Gender	111.339	1	111.339	7.720	0.006
Geographical Regions	358.719	5	71.744	4.975	0.000
Writing Style	117.497	3	39.166	2.716	0.045
Error	4571.710	317	14.422		
Total	116010.816	331			
Corrected Total	6184.202	30			

a. R Squared = 0.261 (Adjusted R Squared = 0.230)

Linear Regression

Following separate regression analysis of each of the subtests in both language versions of the assessment, a Linear Regression analysis was computed to determine if one assessment battery predicted the other. Linear Regression analysis for English (Table 159) determined which English subtests predicted Total English Score. Table 159 shows that the best predictor is English *Free Writing* (adjusted R Squared = 92.7%; p = 0.000).

Table 159

Predictors for Total English Score

Sub Test	R Squared	Adjusted R Squared	p-value
English Copy Neatly	0.565	0.564	0.000
English Copy Quickly	0.556	0.555	0.000
English Copy from the Board	0.527	0.526	0.000
English Free Writing	0.927	0.927	0.000

A similar Linear Regression analysis was also conducted on the Maltese assessment battery (Table 160). The aim of this analysis was also to determine which Maltese subtests predicted Total Maltese Score. Table 160 shows that the best predictor of writing speed in Maltese is Maltese *Free Writing* (adjusted R Squared = 90.9%; p = 0.000).

Table 160

Predictors for Total Maltese Score

Sub Test	R Squared	Adjusted R Squared	p-value
Maltese Copy Neatly (Ikkopja Pulit)	0.610	0.609	0.000
Maltese Copy Quickly (Ikkopja Malajr)	0.617	0.616	0.000
Maltese Copy from the Board (Ikkopja mill-Bord)	0.590	0.589	0.000
Maltese Free Writing (Kitba Kreattiva)	0.909	0.909	0.000

Linear regression analysis across languages shows that subtests in one language predicted parallel subtests in the other language, accounting for an average of 54% of the variance in scores in all the subtests (Table 161). Likewise, the Total Score in one language predicted 52.8% of the total variability of scores in the Total Score of the other language.

Table 161

Predictors of the EMASH Subtests and Total Scores

Variable 1	Variable 2	R Squared	Adjusted R Squared	p-value
Copy Neatly (English or Maltese)	Copy Neatly (English or Maltese)	0.508	0.506	0.000
Copy Quickly (English or Maltese)	Copy Quickly (English or Maltese)	0.575	0.574	0.000
Copy from the Board (English or Maltese)	Copy from the Board (English or Maltese)	0.633	0.631	0.000
Free Writing (English or Maltese)	Free Writing (English or Maltese)	0.444	0.442	0.000
Total Score (English or Maltese)	Total Score (English or Maltese)	0.530	0.528	0.000

Teachers' Questionnaire

Lengthiest Writing Tasks

A teachers' questionnaire (see Appendix F), was given to all the form teachers in all 13 participating schools. The main purpose of the teachers' questionnaire was to determine language practices in schools (see section *Teacher's Questionnaire* in Chapter 2). The teachers' questionnaire also determined which writing task required the longest time for the students to complete. Findings show that students spend most time at creative writing tasks (Table 162).

Table 162

Lengthiest Writing Tasks

		Frequency	Percent
Valid	Creative writing	17	30.9
	Write own notes	11	20.0
	Copy from board	9	16.4
	Other	9	16.4
	Lab reports	4	7.3
	Poetry appreciation	2	3.6

	Total	52	94.5
Missing	System	3	5.5
Total		55	100.0

The responses of the nine teachers who indicated "other" as the writing task that required the longest time for the students to complete, gave a subject-specific explanation. For instance, the religion teacher explained that students took longest to work out crosswords; whereas the geography and graphical communication teachers explained that in their classes, students spent the longest amount of time drawing diagrams. Tables 163 and 164 present the amount of time students spend writing in class, and the amount of time they spend copying, respectively, according to the 55 teachers' responses. The majority of these teachers allocated 5% to 25% of their lesson time for writing, and the same amount of time for copying.

Table 163

Time Students Spend Writing in Class

Writing time	Respondents
5%	36
25%	13
50%	2
75%	2
95%	1
Total	54
Missing	1
Total	55

Table 164

Time Students Spend Copying in Class

Copying time	Respondents
5%	22
25%	23
50%	9
95%	1
Total	55

Standardization of the Data

For the standardization process, writing speed norms for 14-year-old students were developed in English and Maltese. The 15-year-old students were excluded from the sample, as their number was too small (19 students) to compile writing speed norms. In this section, the use of raw scores is described, as well as the standardization process. The Z-scores are laid on a normal distribution curve, for ease of interpretation, hence making scores that fall 1 SD or 2 SD below the mean easy to identify. The identification of such scores is important for the identification of those students requiring examination access arrangements and also for intervention purposes.

A raw score is the score a student obtains in a test, which is usually the number of answers they answer correctly (Klein, 2020). Raw scores may be used to:

1. Derive Z-scores, which measure how many standard deviations a raw score lies above or below the population mean (Siegle, n.d.).
2. Calculate a copy speed difference score to determine if a child is able to increase writing speed when instructed. Failure to increase writing speed is an indication of writing difficulties (Barnett et al., 2007).

3. Describe performance across time within a task (Barnett et al., 2007). In this case, the *Free Writing* subtest is the task that enables differentiation between the student who is slow throughout the performance of the whole task; the students who writes fast at the beginning but then slows down due to fatigue or lack of ideas; or the student who starts writing slowly but then speeds up at the end. Though all may have written an equal number of words per minute, intervention in each case may be different. In the first case, an appropriate handwriting intervention strategy could help the student speed up their writing. In the latter two cases, appropriate strategies on how to generate ideas could be the solution.

In this study, the raw score is the number of words written per minute in a subtest, or in the assessment battery, in its entirety. A score of 60 attained in one test, and a score of 80 attained in another test, have little meaning unless one knows the correspondence of that score to the mean (Siegle, 2020). In order for test comparisons to be possible, raw scores need to be standardized so that a student's score can be compared to others' and also to identify how many students have scored below or above the mean (Laerd Statistics, 2018c).

In this study the raw scores in WPM were converted to Z-scores. Z-scores have a mean of 0 and a SD of 1 (Laerd Statistics, 2018c). A Z-score can be placed on a normal distribution curve, and can range from -3 standard deviations (which would fall to the far left of the normal distribution curve), up to +3 standard deviations (which would fall to the far right of the normal distribution curve). Z-scores are derived from the raw scores, by subtracting the mean from the raw score, and then dividing the result by the SD (L. Camilleri, personal correspondence, March 28, 2020; McLeod, 2019b).

$$\text{Z-score} = \frac{\text{Raw Score} - \text{Mean}}{\text{Standard Deviation}}$$

Table 165 shows the mean and SD of the EMASH's (English and Maltese) subtests and total scores, used to compute the Z-scores in SPSS.

Table 165

Mean and Standard Deviation of EMASH's Subtests

WPM	Mean	Std. Deviation
English Copy Neatly	27.386	5.631
English Copy Quickly	32.557	5.525
English Copy from Board	20.176	4.373
English Free Writing	21.092	4.912
Total English Score	22.918	4.856
Maltese Copy Neatly (Ikkopja Pulit)	20.929	4.370
Maltese Copy Quickly (Ikkopja Malajr)	24.697	4.459
Maltese Copy from Board (Ikkopja mill-Bord)	20.170	4.749
Maltese Free Writing (Kitba Kreattiva)	16.257	4.547
Total Maltese Score	18.206	4.302

In some of the literature, tests have been standardized using a mean of 100 and a SD of 15 (Barnett et al., 2001; Beery et al., 2010; Larsen & Hammill, 1989). In this study, scores were also standardised using this numeric scale, in order to allow multiple comparisons to be made. This standard scale, which in this study shall be called Standard Scores, is derived from Z-scores by multiplying the Z-score by the SD (15), then adding the mean (100) (L. Camilleri, personal correspondence, March 27, 2020; F. Sammut, personal communication, January 27, 2019). All calculations were computed in SPSS.

$$\text{Standard Score} = (\text{Z-score} * 15) + 100$$

Appendices BG to BQ give the raw scores in WPM, the Standard Scores and the Z-scores of all the English and Maltese subtests and Total Scores. Appendix BM gives the raw scores of the total number of correctly drawn crosses, the Standard Scores and Z-scores of the Graphic Speed Test. This data was converted into scales that are easier for a tester to interpret and use. To this end, the following steps were followed:

1. The tables generated in SPSS presenting the raw scores, Standard Scores and Z-Scores of the English and Maltese subtests and Total Scores (see Appendices BG to BQ) were copied into Microsoft Excel 2016.
2. Scatter plots showing the relationship between raw scores and Standard Scores were created. The scatter plots show a linear relationship between the two variables for each English and Maltese subtest, and for the English and Maltese total scores (see Appendices BR for English and BS for Maltese). Figure BR4 in Appendix BR presents the scatter plot for the Graphic Speed Test. The graph equation was displayed for each table (see Appendices BR for English and BS for Maltese). This formula was used to calculate the value of *y* (Standard Score) for any known *x* value (raw score) (Cheusheva, 2019).
3. For the English and Maltese *Copy Neatly*, *Copy Quickly* and *Copy from Board* subtests, any missing raw scores values, such as the range in raw scores, (between 12.5 and 19.5), in the English *Copy Quickly* subtest (see Appendix BJ), were added (see Table BT2 in Appendix BT). This in order for users attaining raw scores of, for instance, 14 WPM or 16 WPM, to have standard scores for those raw scores. Raw scores were presented in an 0.5 scale, so the missing values were added at 0.5 intervals.
4. The equations of the scatter plots (see Appendices BR for English and BS for Maltese) were used to derive Standard Scores for the new raw score values. Hence, to derive the Standard Score for raw score value 11, of the English *Copy Neatly* subtest (see Table

BT1 in Appendix BT, highlighted), the equation derived from the scatter plot of the English *Copy Neatly* subtest was used (see Figure BR2 in Appendix BR). This is (2.6638x + 27.05), where x is the raw score. So for raw score 11:

$$\begin{aligned}\text{Standard Score} &= 2.6638x + 27.05\\ &= (2.6638*\text{raw score}) + 27.05\\ &= (2.6638*11) + 27.05\\ &= 56.3518\end{aligned}$$

5. The Z-scores corresponding to the new raw scores and Standard Scores were added to the scale. These were computed using the formula (Raw Score – Mean)/Standard Deviation. The mean and SD were those of the raw scores (Table 165).
6. The same process of converting raw scores into 0.5 scales for ease of interpretation was followed for the English (see Table BT5 in Appendix BT) and Maltese (see Table BU4 in Appendix BU) *Free Writing* subtests, and for Total English Score (see Appendix BV) and Total Maltese score (see Appendix BW). Corresponding Z-scores were again derived using the formula (Raw Score – Mean)/Standard Deviation, using the mean and SD of the raw scores (Table 165).

Following the computation of standard scores, percentile ranks were derived to allow for the comparison of a participant's performance in relation to the remainder of the sample. For ease of reference, percentile ranks have been provided for each standardised table (see Appendices BV to BU)[42], in addition to the Standard Scores and Z-scores. Percentile ranks do not form an equal interval scale. The majority of the participants' scores fall close to the centre of the normal curve (Statistics How To, 2018a).

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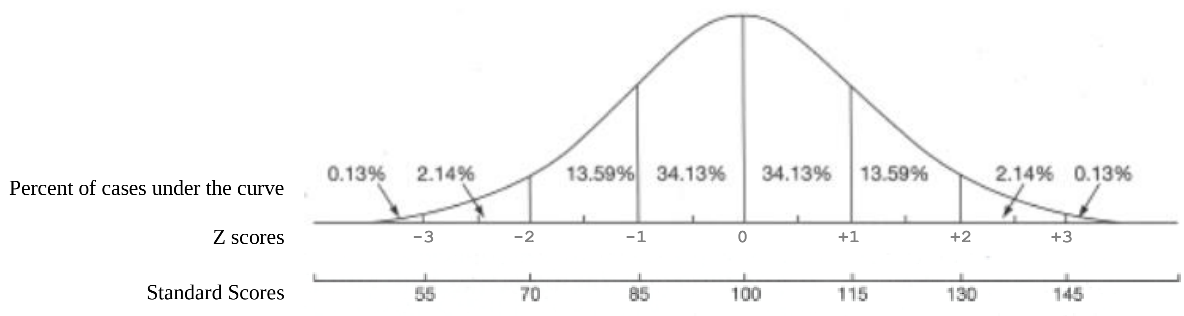
42 The standardised tables were imported into SPSS, and the fractional rank as % function was used to calculated the percentile rank for each score.

The range of Standard Scores for the English subtests (see Appendix BT), the Maltese subtests (see Appendix BU), for Total English Score (Appendix BV), and the Total Maltese Score (Appendix BW), is between 55 to 145, and between -3 to 3 for Z-scores, as these are the scores that fall under the normal distribution curve (see Figure 34).

Figure 34

The Normal Curve and EMASH Standard Scores and Z-scores



Note: Source: Barnett et al., 2001

The Graphic Speed Test

The raw scores (number of correct crosses per minute) of the Graphic Speed Test were converted to Z-scores. The mean and SD of the raw scores used for deriving Z-scores are presented in Table 166. The Z-scores were converted to Standard Scores with a mean of 100 and a SD of 15 (see section *Standardization of the Data* in this chapter). Table BT3 in Appendix BT presents the finalized scale of raw scores, Standard Scores, Z-scores and percentile ranks of the Graphic Speed Test. Again, raw scores, corresponding to Z-scores ranging from -3 to 3, were presented in this scale, as these are the scores that fall under the normal distribution curve.

Table 166

Mean and SD for the Graphic Speed Test

	Mean	Std. Deviation
Graphic Speed Test (Correct No. of Crosses)	42.174	13.249

Comparing Performance of the EMASH

One of the objectives of the research was to compare the performance of the students on the modified English assessment tasks with their performance on the novel Maltese assessment tasks. In order to meet this objective, the finalized standardised tables were placed next to each other for the Total Score of each language (Appendix BX), and for each subtest of the assessment batteries (see Tables BY1 to BY4, in Appendix BY).

Standard Scores, Z-Scores and Percentile Ranks for Males and Females

As there was a significant difference in Gender, whereby females wrote faster than males in English[43] and Maltese (see section *Gender)*, separate Standard Scores, Z-Scores and percentile ranks for each English and Maltese subtest, and for the Total Scores of the English and Maltese assessment batteries, were drawn. The same process described in section *Standardization of the Data* (in this chapter) was followed. Standard Scores, Z-Scores and percentile ranks, for the English and Maltese Total Scores and subtests, for males and females, are presented in Appendices BZ to CE. Table 167 shows the mean scores and SDs used to calculate Z-scores for English. Table 168 shows the mean scores and SDs used to calculate Z-scores for Maltese.

[43] Except for the *Copy Quickly* and the *Copy from the Board* subtests.

Table 167

Mean and SD of the English Subtests and Total English Score, Grouped by Gender

Gender		English Copy Neatly	English Copy Quickly	English Copy from Board	English Free Writing	Total English Score
Male	mean	26.66	32.14	19.84	20.15	22.26
	SD	5.28	5.50	4.08	4.84	4.54
Female	mean	28.16	33.01	20.54	22.13	23.63
	SD	5.90	5.53	4.65	4.79	5.09

Table 168

Mean and SD of the Maltese Subtests and Total Maltese Score, Grouped by Gender

Gender		Maltese Copy Neatly (Ikkopja Pulit)	Maltese Copy Quickly (Ikkopja Malajr)	Maltese Copy from Board (Ikkopja mill-Bord)	Maltese Free Writing (Kitba Kreattiva)	Total Maltese Score
Male	mean	20.18	23.97	19.61	15.57	17.49
	SD	4.30	4.29	4.69	4.61	4.42
Female	mean	21.69	25.44	20.74	16.95	18.93
	SD	4.32	4.52	4.75	4.39	4.06

As an example, Table 169 presents the Standard Scores, Z-scores and percentile ranks for raw score 20[44], which are highlighted in appendices BZ to CE.

Table 169

Standard Scores, Z-scores and Percentile Ranks for Raw Score 20 (time taken to write 20 words)

	Males			Females		
	Standard Score	Z-score	Percentile Rank	Standard Score	Z-score	Percentile Rank
English Copy Neatly	81.08	-1.3	30	97.25	-1.4	28
English Copy Quickly	66.89	-2.2	15	64.71	-2.4	12
English Copy from Board	100	0	52	98.26	-0.1	49
English Free Writing	99.54	0	51	93.33	-0.4	44
Total English Score	92.53	-0.5	43	89.30	-0.7	39

[44] The raw score 20 was selected as it is represented in all the tables.

Maltese Copy Neatly (Ikkopja Pulit)	99.37	0	51	94.13	-0.4	45
Maltese Copy Quickly (Ikkopja Malajr)	86.12	-0.9	36	81.95	-1.2	31
Maltese Copy from Board (Ikkopja mill-Bord)	101.25	0.1	53	97.66	-0.2	48
Maltese Free Writing (Kitba Kreattiva)	114.41	1.0	67	110.42	0.7	63
Total Maltese Score	108.52	0.6	60	103.95	0.3	56

Detailed instructions on how a user may interpret and use the standardised tables are given in Appendix CF.

Standard Error of Measurement (SEM)

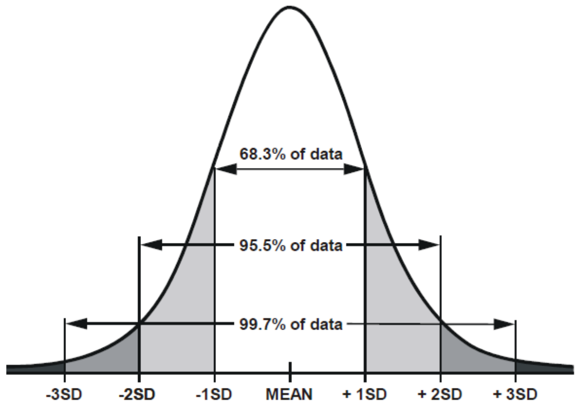
Scores are an estimate of the student's true ability at that moment in time (Barnett et al., 2007). According to Bishop (1996), a person's true score can never be known, as there is no tool that can derive a person's true score. The standard error of measurement (SEM) can be used to calculate the Confidence Interval (CI) around which the true score is likely to fall (McLeod, 2019a; Barnett et al., 2007). There are three typical confidence intervals that are estimated (Lewin, 2011):

$$68\%\ CI = \text{Total Standard Score} \pm SEM$$
$$95\%\ CI = \text{Total Standard Score} \pm (1.96 * SEM)$$
$$99\%\ CI = \text{Total Standard Score} \pm (2.58 * SEM)$$

As the confidence interval levels increase, the range under the normal distribution curve (see Figure 35) increases.

Figure 35

The Normal Distribution Curve



Note. Source: Jin, G. (2018). *Normal Distribution*. http://my.ilstu.edu/~gjin/hsc204-hed/Module-5-Summary-Measure-2/Module-5-Summary-Measure-28.html

To calculate the SEM for Standard Scores, the following formula was used (Tighe et al., 2010):

$$SEM = (\sqrt{1 - \text{Cronbach's Alpha}}) * \text{Standard Deviation}$$

Cronbach's Alpha, which determines internal consistency reliability (see Chapter 4), is 0.889 for the four English subtests and 0.903 for the four Maltese subtests. These values are based on the performance of 14-year-old students, excluding that of 15-year-olds. Hence the resultant SEM is related to 14-year-old students. The Standard Deviation of the tests' Standard Scores was 15, for both English and Maltese. Hence, for English the SEM was calculated as follows:

$$SEM = (\sqrt{1 - 0.889}) * 15$$
$$= 4.998$$

For Maltese the SEM was calculated as follows:

$$SEM = (\sqrt{1 - 0.903}) * 15$$
$$= 4.672$$

It is suggested that to calculate the CI for both the English and Maltese tests, users should round this SEM value to 5.0 (Barnett et al., 2007).

To calculate the 68% CI, the following formula is used:

$$68\%\ CI = \text{Standard Score} \pm SEM$$

This means that a test user has to calculate an interval of ± 1 SEM around a student’s Standard Score. For example, if a student obtained a Raw Score of 18 WPM in the English assessment battery, this corresponds to a Standard Score of 85 (see Appendix BV, highlighted). Calculating the rounded boundaries of ± 1 SEM around this Standard Score gives 80 and 90 respectively. It can therefore be stated, with 68% confidence, that the student’s score in the English assessment battery is between the Standard Score range of 80 and 90.

To calculate the 95% CI for the same score (18 WPM; Standard Score 85), the following formula is used:

$$95\%\ CI = \text{Total Standard Score} \pm (1.96 * SEM)$$
$$= 85 \pm (1.96 * 5)$$
$$= 85 \pm 9.8$$

This gives a score of 94.8 and 75.2 respectively. It can therefore be stated, with 95% confidence, that the student’s score in English is between the Standard Score range of 75 and 95.

To calculate the 99% CI for the same score (18 WPM; Standard Score 85), the following formula is used:

$$99\%\ CI = \text{Total Standard Score} \pm (2.58 * SEM)$$
$$= 85 \pm (2.58 * 5)$$
$$= 85 \pm 12.9$$

This gives a score of 72.1 and 97.9 respectively. It can therefore be stated, with 99% confidence, that the student's score in English is between the Standard Score range of 72 and 98.

Copy Speed Difference

For the copy speed difference score (Copy Quickly - Copy Neatly) (see section *Ability* in this chapter), the number of WPM written in the Copy Neatly subtest was deducted from the number of WPM written in the Copy Quickly subtest (see Appendix CG for English and Appendix CH for Maltese). The copy speed difference in WPM, at the 15th percentile (Barnett et al, 2007), is 1 SD below the mean (Table 170). This cut-off point was selected, as 1 SD below the mean indicates below average scores (Matriculation and Secondary Education Certificate, 2019a). For English this is 1.5 WPM; for Maltese 1 WPM. This means that students who fail to increase their writing speed at the *Copy Quickly* subtest, by at least three words in English, and two words in Maltese, have difficulty speeding up.

Table 170

Copy Speed Difference at the 15th Percentile

		Copy Speed Difference English WPM	Copy Speed Difference Maltese WPM
Sample size	Valid	342	328
	Missing	40	54
Percentiles	15	1.5	1.0

Conclusion

This chapter presented the results obtained from data analysis. Normality of data was ascertained and a description of overall participant performance provided. Inferential statistics determined which of the dependent variables were influenced by the independent variables. Findings showed that:

1. Dominant English first language speakers were significantly faster writers than Dominant Maltese first language speakers in English *Free Writing*. Participants whose first language was a non-native language were significantly slower to complete the following subtests: Maltese *Copy from the Board* (*Ikkopja mill-Bord*), *Free Writing (Kitba Kreattiva*) and Total Maltese Score.
2. School Language did not affect writing speed except for the English *Copy Quickly* subtest, where participants attending Dominant English speaking schools were significantly faster than participants attending Dominant Maltese speaking schools.
3. School Type did not have a significant effect on writing speed in Maltese. However, participants attending state schools were significantly slower than participants attending the independent school, or the girls' church schools, in the English *Copy Quickly* and the English *Free Writing* subtests, respectively.
4. The participants' dominant hand had no effect on writing speed.
5. Female participants were significantly faster than male participants in most of the English and all Maltese subtests.
6. Participants residing in the Western Region were the fastest writers in all English and Maltese subtests and Total Scores (except for English *Copy Neatly*). Those residing in the Southern Harbour region were the slowest.

7. Participants with a high SES background wrote significantly faster in all the English subtests and in Total English Score. They were also the fastest writers in the Maltese *Copy Neatly* (*Ikkopja Pulit*) and Maltese *Copy form the Board* (*Ikkopja mill-Bord*) subtests.

8. Students with a dual nationality wrote significantly faster in the English *Copy Neatly* subtest, than Maltese or Non-native students. There was no significant difference in the writing speed of participants of different nationalities, in the remaining English subtests or English Total Score. Non-native participants were significantly slower at writing in Maltese than Maltese citizens, except for the Maltese *Copy Neatly* (*Ikkopja Pulit*) and *Copy Quickly* (*Ikkopja Malajr*) subtests.

9. Age had no effect on writing speed in English, but students born between January and June were significantly faster in Maltese than those born between July and December by about one WPM.

10. Students with LD wrote significantly slower than typically developing students in all English and Maltese subtests and Total Scores.

11. With reference to English writing style, participants who mixed cursive and print, were significantly faster than exclusive print writers, except for the *Copy from Board* subtest, where no differences were found. For Maltese, significant differences were found between Print and Mixed mostly print writers for the Maltese *Copy Neatly* (*Ikkopja Pulit*) and Maltese *Copy Quickly* (*Ikkopja Malajr*) subtests only. The two prevalent writing styles in schools were Print only, and a mixture of Print and Cursive (Mixed mostly print). Print was more prevalent in state schools and girls’ church schools, while a mixture of Print and cursive styles (Mixed mostly print) was more prevalent in independent and boys’ church schools.

12. Students with LD had the most immature handwriting. However, immature handwriting was also identified amongst typically developing students.

13. Legibility and speed were dependent on language, with the fastest writers in English being those participants whose written product included some words or phrases difficult to decipher. Conversely, the fastest writers in Maltese had overall clear and mature handwriting.

14. Students spent the longest time in creative writing[45].

Correlations results showed positive correlations between all the English subtests and Total English Score; between all the Maltese subtests and Total Maltese Score; and between the English and Maltese subtests and Total Scores. Results from regression analyses identified the free writing subtest as the best predictor of writing speed. English and Maltese writing speed were mostly predicted by Ability, Writing Style, Geographical Regions, Gender and SES. The first language of the participants also predicted performance in Maltese. The latter results are however to be considered with caution as the predictions in this study are not powerful enough to make claims.

This chapter derived writing speed norms for 14-year-old students, compared student performance on the modified English assessment battery with their performance on the novel Maltese assessment battery. The following chapter (Chapter 6) discusses the findings in this study, whilst considering the review of the literature presented in Chapter 2.

[45] In this study, creative writing is referred to as Free Writing.

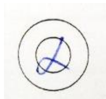
Chapter 6: Discussion

This chapter discusses the research findings in light of the reviewed literature. To reiterate, 401 14-15-year-old secondary school students were administered a total of nine subtests: four writing subtests in English, four writing subtests in Maltese, and a Graphic Speed Test. The four writing subtests in each language include two near copying tasks (*Copy Neatly* and *Copy Quickly*), one far copying task (*Copy from Board*), and a free writing task. This chapter seeks to address the research questions put forward in the first chapter. The first research question, Is the English-Maltese Assessment of Speed of Handwriting (EMASH) a valid and reliable tool to identify handwriting difficulties in Maltese 14-15-year-old students?, was discussed in Chapter 4. This chapter is divided into two broad sections that address the remaining two research questions:

RQ 2. Do factors such as First Language, School Language, Ability, Socio Economic Status, Geographical Regions, School Type, Handedness, Writing Style, Age, Nationality and Gender, affect writing speed?

RQ 3. Does writing speed affect Legibility?

The chapter starts by discussing the EMASH overall score distribution. The overall score distribution of the English and Maltese tests, as well as the Graphic Speed Test, shows that scores varied, but the majority of the participants' scores fell within the interquartile range. The participants whose Total Scores fell outside the first quartile, writing less than ten WPM in English, and eight WPM in Maltese, were either participants with low SES, participants with LD, or participants from the Southern Harbour Region. Data analysis shows that all these variables contribute to slower writing speeds.

There were two outliers in the Graphic Speed Test, both attending the independent school. One managed to draw 80 crosses correctly in one minute, but the other did not manage to get a single one correct. This was so as this participant failed to draw two lines that intercepted as a cross within the inner doughnut like circles  but instead drew this type of cross  which is considered invalid. One of the objectives of the research is to compare the performance of the students on the modified English assessment tasks with their performance on the novel Maltese assessment tasks. Descriptive statistics reveal that participants overall wrote more WPM in English than they did in Maltese, except for the *Copy from the Board* subtests, where writing speeds were similar in English and Maltese (see section *Comparison of Scores* in this chapter). This writing speed difference is true even with regard to the letter and character counts taken in the *Copy Neatly and Copy* Quickly subtests. Participants were faster in the number of characters and letters written per minute in the English *Copy Neatly* and *Copy Quickly* tasks, then they were in their Maltese equivalents. This could be because the words in the Maltese pangram are longer (15 words in the English pangram, and 12 words in the Maltese pangram) for an almost equal number of letters (55 letters in English and 54 letters in Maltese). Spelling the longer Maltese words could have meant that participants might have needed to refer to the printed text more often, to get the spelling right.

Most participants were from the middle and lower streams (Years 10.4 to 10.7), with relatively few participants from the higher streams (years 10.1 to 10.3) or Core Curricular Programme (CCP) classes. The participation of more students from the upper and lower streams could have affected the results as it could have skewed the data, thus affecting the distribution of data under the normal distribution curve, and shifting the mean.

RQ 2: Do factors such as First Language, School Language, Ability, Socio Economic Status, Geographical Regions, School Type, Handedness, Writing Style, Age, Nationality and Gender, affect writing speed?

Do Nationality, First Language and School Language Affect Writing Speed?

The majority of the participants in this study were Maltese (89.22%). However, a small percentage were non-native students (9.52%), or held dual nationality (1.25%). Participants in this study were mostly Maltese nationals, using Maltese as their first language (72.68%), or both English and Maltese (9.52%). This corresponds to the figures presented by the National Statistics Office (2014), which stated that the majority of ten to nineteen-year-olds spoke Maltese. According to the Culture Participation Survey (National Statistics Office, 2011), 90.8% of the respondents (16+) spoke Maltese as their first language.

Findings show that English writing speed, calculated from performance of the English battery (Total English Score) is the same across all nationalities, as non-native participants whose First Language was one other than Maltese or English, attained the same writing speed as Maltese participants and participants with a dual nationality. This could be because in Maltese schools, the language of communication of non-native students is English, since the local population is not familiar with the native tongue of these students. The higher prevalence of English textbooks in schools could also have an influence. This extra practice helps increase mastery of the English language. Further analyses shows that non-native students wrote significantly slower than Maltese students in the Maltese *Copy from the Bord (Ikkopja mill-Bord)* subtest, in the Maltese *Free Writing (Kitba Kreattiva)* subtest, and in Total Maltese Score. This could be because non-native students are not native speakers of Maltese like local students, and hence would be less confident in written Maltese than native speakers. It is quite arduous to write in one's native language, since this draws upon several language and metacognitive abilities. Writing in a second language may be even more challenging due to inadequate linguistic knowledge and limited vocabulary. The result is laboured writing and slower writing speeds. Students' nationality is a predictor of writing speed performance in the English and Maltese *Copy from the Board* subtests.

With regard to First Language, findings reveal that Dominant English speakers are significantly faster writers than Dominant Maltese speakers in the English *Free Writing* Subtest. This may be so as English is the first language of Dominant English speakers, and possibly this makes it easier for them to express their ideas in writing in English. This result is similar to the one reported by Cauchi (1990), where students whose parents spoke to them only in English during their childhood, and who used English when young and at the time of the study, achieved the highest essay grades in English at Form four. In both studies, the better results in English by English first language speakers could be due to the students' higher proficiency in the language. The copying subtests - *Copy Neatly*, *Copy Quickly* and *Copy from the Board* – may not have been affected by language proficiency as they are copying activities, and hence motoric tasks. Apart from free writing, first language did not have an effect on the English subtests. This is in line with findings by Brimmer (1997), who found no correlation between the language spoken at home and with friends, and academic achievement in English. It is worth noting however, that in Brimmer's (1997) study, there were no non-native participants. This is worth noting since the first language of non-native participants would have likely been one other than English. Hence, Brimmer (1997), could have attained different results with a cohort of non-native students, who might not have been so proficient in the English language.

With regard to Maltese, findings show that participants speaking a first language other than Maltese or English, wrote significantly less than other first language speakers (Dominant Maltese, Dominant English, or Mixed Maltese-English) in the Maltese *Copy from the Board (Ikkopja mill-Bord)* subtest; in the Maltese *Free Writing (Kitba Kreattiva)* subtest; and in Total Maltese Score. First Language predicted an effect on the Maltese *Copy from the Board (Ikkopja mill-Bord)* and the Maltese *Free Writing (Kitba Kreattiva)* subtests, and Total Maltese Score. In sum, Nationality, as well as First Language, affect writing speed in Maltese, as non-native students speaking a first language other than Maltese or English, were slower to write in Maltese. This may be due to the fact that these students would have been exposed to Maltese for the first time in Maltese schools, and though proficient enough to sit for the Maltese test (see section *Non-native participants* in Chapter 3), might not have been as confident in the language since their first language was not Maltese. This is in line with international studies (Ministry for Education and Employment, 2016b) claiming that across all countries, students perform better on a test when their first language is the same as the test language.

With regard to school language, findings show that School Language does not affect writing speed, except for the English *Copy Quickly* subtest, where participants attending the Dominant English speaking school were significantly faster to write than participants attending Dominant Maltese speaking schools. Although School Language was found to significantly predict a student's ability to copy quickly in English, findings show that it has no effect on writing speed in Maltese and English. This result is very different from the result attained for First Language, where English first language speakers were found to be faster in the English *Free Writing* task, and students whose first language was one other than Maltese or English, were the slowest writers in the Maltese *Free Writing* task and Total Maltese Score. This could be due to the different coding systems used at the data input stage. School Language was defined in this study as that language the students were mostly exposed to at school. Since local schools do not expose non-native students to their native tongue if this is one other than Maltese and English, due to the fact that they are not conversent in that language, Non-Native Language could not be part of the classification for School Language as it was for First Language. In her study, Agius (2012), likewise found no significant differences in English writing speed between children exposed to one or two languages. Yet for the Maltese language, Agius (2012) found that children exposed mainly to Maltese, were 50 seconds faster at the free writing task than children exposed mainly to English, and 40 seconds faster than children exposed to both Maltese and English. Agius (2012) attributed this difference to the different orthographic depth of the two languages, and recommended reviewing the scoring methods of the passages in favour of more qualitative analysis of writing. Results differred in these two studies maybe because different tests were used. In Agius's (2012) study, no particular topic was given for the free writing task, and writing speed was the time taken to write the paragraph. Furthermore, Agius's (2012) participants were aged between 8 to 12, and none spoke a foreign language.

Does Ability Affect Writing Speed?

In this study, Ability was found to affect writing speed because the writing productivity of students with learning difficulties (LD) was significantly slower than that of typically developing students, in both English and Maltese tests. Ability also emerged as a predictor of English and Maltese writing speed performance. These findings are in line with literature (Barnett et al, 2011; Mackie & Dockrell, 2004; Scott & Windsor, 2000), showing that despite the different populations and measurements used in the different studies, students with LD are reported to produce fewer words within a set time limit than their age matched peers. When producing narrative, argumentative or descriptive writing, students have to plan, organise and revise their work (Hooper et al., 1993). Revision is essential in order to monitor writing for coherence, detect errors, and edit accordingly. The audience and the purpose of writing have also to be identified, for effective communication. Students with LD face challenges with working memory and the cognitive tasks that characterise the writing process (Graham et al., 2017). Given these challenges, students with LD are less motivated to engage in demanding tasks like writing, which could explain the slower writing productivity of students with LD in this study. This is in line with Zimmerman and Risemberg's (1997) Social Cognitive Model of Writing, which ascribes writing success to motivation and self-efficacy. In this study, students with LD, including those with a profile of dyslexia and dyspraxia, were slower than average in the English and Maltese *Free Writing* task. This reduced handwriting practice decreases handwriting fluency (Martinez-Garcia et al., 2020), and might be another reason for their decreased performance.

In this study, the *Copy Quickly* subtest requires participants to copy the same pangram that is used in the *Copy Neatly* subtest, but participants are instructed to write faster. An inability to speed up indicates writing difficulties. In this study, the copy speed difference between the *Copy Neatly* and *Copy Quickly* subtests, of students with a profile of dyslexia and dyspraxia, was within the copy speed difference cut-off score for English, but not for Maltese. This could be because the English pangram is made up of shorter, monosyllabic words than the Maltese pangram, which consists mostly of longer, two syllabic words. The longer Maltese words might pose a greater challenge when writing, to students with a profile of dyslexia, because of their working memory deficits. As a result, students with a profile of dyslexia might have to refer to the printed text more often when they copy the pangram in Maltese, than they do when copying the English pangram. This frequent pausing might explain why students with a profile of dyslexia took longer to complete the Maltese pangram copying tasks. This is consistent with findings obtained by Martinez-Garcia et al., (2020) who reported that students with a profile of dyslexia spell and write short words (four letters) at the same speed as typically developing controls, but are slower to spell and write longer words (six to seven letters). This is also consistent with Kellogg's (2001; 1999; 1996) and Hayes's (1996), model of handwriting, which states that when working memory is overloaded by writing demands, the outcomes are frequent pauses and slower writing speeds.

Within the free writing task, the profile of raw scores within each of the two-minute period was examined to see how consistently the entire sample population wrote within the 10-minute period. When the writing speed raw scores of all participants were examined, results show a gradual decrease in writing speed over time, with participants writing four words more in the first two minutes than in the last two minutes in English, and three words more in the first two minutes than in the last two minutes in Maltese. Similar results were attained by typically developing students. Results show that in each instance, participants started off quite fast, but gradually slowed down, possibly on running out of ideas or out of fatigue. These results do not match those by Dutton (1990), whose 12-16-year-old participants wrote at a constant rate for at least 30 minutes, even during the last three minutes. A possible explanation of differing results between this study and those by Dutton (1990) is the duration of the task. Students, aware of the generous amount of time allotted to them for their writing task in the Dutton (1990) study, might have afforded to write at a leisurely pace, and so not tire themselves after the first few minutes. The 30-minute period could also have afforded them more thinking time to keep generating ideas till the end. Dutton's (1990) results are however to be interpreted with caution due to the small sample size (10 girls and 10 boys in each year group). Results from small sample sizes cannot be generalized to the entire population (Simmons, 2018).

The aim of monitoring the students' writing rate over a time period is to identify the students with writing difficulties who are constantly slow throughout the entire writing task, as those would be the ones in need of extra time. Hence the raw writing speed scores of students with LD were examined. A gradual decrease in writing speed over time, comparable to typically developing students', was noticed, with participants with LD writing four words more in the first two minutes than in the last two minutes in English, and two words more in the first two minutes than in the last two minutes in Maltese. The writing rates, over the 10-minute period, of just the students with a profile of dyslexia and dysgraphia, were also examined. The writing rates of these students were irregular for both English and Maltese. In English and Maltese free writing, participants with a profile of dyslexia and dyspraxia started off quite fast, gradually decreasing speed over time until the last two minutes, when an evident effort was made at increasing writing speed again. Students with a profile of dyslexia and dyspraxia usually have problems with spelling and handwriting (see section *Handwriting Difficulties* in Chapter 2). Furthermore, those with working memory deficits find it hard to transcribe their thoughts in writing. All these challenges disrupt the flow of writing. These students, perhaps aware of their difficulties, might have attempted to compensate for them, by attempting to increase their speed, and hence the word count, during the final two minutes of writing.

Given the higher order processes involved in free writing, this task may rightly be considered as the most time-consuming assignment to be produced in a classroom setting. In fact, according to the 55 teachers who responded to the questionnaire survey, students (31%) take longest to work out their creative[46] writing tasks. In spite of this fact, the majority of the participant teachers claim to allocate 5% to 25% of their lesson time to writing, and the same amount of time to copying. This could mean that students with LD would not have enough time to engage in the higher order and metacognitive activities of complex writing, in order to finish their writing tasks on time. Literature shows that in primary school, a child between the ages of 5 and 10, spends 30% to 60% of their time writing (McHale & Cermak, 1992). A survey of 459 US kindergarten to fifth grade teachers, showed that children spend 24% to 58% of classroom time writing on paper at tasks such as note taking, spelling tests, journal writing, completing maths worksheets and filling in science reports (Handwriting Without Tears, 2021). In secondary schools however, students do not spend the same amount of time writing across the curriculum (Schaffhauser, 2020). In this study, the academic subjects mentioned by some of the teachers[47], such as Information and Communication Technology (ICT), Personal, Social and Career Development (PSCD), Design and Technology, Graphical Communication, Art, Music, Physical Education, Health and Social Care, and Hospitality, are practical subjects that might require less writing. This is particularly true for the latter two subjects – Health and Social Care, and Hospitality, which are Vocational Education and Training (VET) subjects. These subjects are more hands-on, and were offered as an alterntive to students who learn more

[46] Referred to in this research as free writing.

[47] The other subjects are more academically oriented, and include the official languages – Maltese and English; foreign languages – Italian, French, Spanish and German; Mathematics; Religion; science subjects – Chemistry, Biology and Physics, Business Studies; and humanities subjects – Geography, Social Studies, European Studies and History.

by doing (Bonnici, 2015), and hence might require less writing. This might explain the reduced amount of writing time allocated in their classrooms, by the teachers in this study. Another reason could be response bias, with teachers giving the answer that was most likely expected of them, which might not reflect the real practices in the classroom, knowing too well that excessive copying time in class is not producive to learning.

It is worth nothing that both typically developing students and students with LD, wrote four words less per minute in Maltese than they did in English. This difference in writing speed between English and Maltese could be due to the different morpho-syntactic structures of the two languages (see section *What are the writing speed norms of 14-year-old students?* in this chapter). The Maltese language, despite being a semi-transparent language, is more morphologically complex. Words are marked for gender, time, person and number, which make Maltese more complex to write than English, possibly resulting in slower writing speeds.

Do School Type, Socio Economic Status and Geographical Region Affect Writing Speed?

Findings show that the type of school a student attends only affects the writing speed of the English *Copy Quickly* and the English *Free Writing* subtests. Furthermore, School Type was shown to predict writing speed performance in English *Free Writing*. Similar findings in the parallel Maltese tests were not found. With regard to the English *Copy Quickly* subtest, results show that participants from the independent school are significantly faster than participants from state schools. This result could be explained in terms of SES, in line with findings by Morley, et al. (2015) and Gottschling-Lang, et al. (2012), who both found that SES has a significant effect on fine motor skills. These studies however examined the fine motor skills of young children. An area for future research would be to confirm that SES impacts the fine-motor skills of 14-year-old teenagers, by administering specific tests that investigate motor skills[48], and testing them in relation to SES. It should also be noted that only one independent school took part in the study. It would be interesting to note any changes in results had other independent schools participated.

With regard to English *Free Writing*, results showed that the girls attending church schools were faster than the mixed-gender (males and females) participants attending state schools. The reason for this result may not be attributed to the first language or the school language of these participants, as data shows that language exposure in each case varied. Another possible reason could be the church schools' girls' SES, as most of them were from middle to high socio economic status families. However, if this were the case, they would have attained equally fast writing speeds in the Maltese assessment battery. Yet another possible reason for speed differences in the English *Free Writing* subtest could be related to different teaching methods. Teachers teaching different languages in different schools could employ different methods when teaching the grammatical structures of English and Maltese, given that the two languages have different morpho-syntactic structures. This study did not analyse the teachers' teaching methods, which is an area for future research. Another possible reason for church schools girls' faster writing speeds in the English *Free Writing* task could be that their level of proficiency in English is superior to that of state schools participants. This study did not examine the participants' level of proficiency in either English or Maltese. An area for future research could be an analysis of the participants' level of proficiency in both languages, and how this relates to writing speed.

As already discussed, the slowest writers in the English *Copy Quickly* subtest and the English *Free Writing* subtest, were participants attending state schools. Their slower writing

[48] One such test is the *Bruininks-Oseretsky Test of Motor Proficiency, Second Edition* (BOT-2 BF, Bruininks & Bruininks, 2005), which assesses the motor skills of students between 4 and 21 years.

speeds could be due to their level of proficiency in English, which is an area for future research. In their majority the state schools participants were Dominant Maltese first language speakers attending Dominant Maltese speaking schools. It would be expected that these participants' increased exposure to Maltese would lead to a parallel increase in Maltese writing speed. However, results show that this was not the case. This could be because the majority of the students attending state schools come from low to middle social status backgrounds. As stated by the PISA report (Ministry for Education and Employment, 2018), there is a positive correlation between SES and academic achievement, with the latter increasing as the former augments. In fact, this research tries to determine the effect of SES on writing speed. Results show that students coming from upper SES backgrounds were significantly faster in all the English subtests, and in Total English Score, than middle class or lower class students. Upper class students also wrote more than middle class or lower class students in all the Maltese subtests, and in Total Maltese Score, though results were significant only in the Maltese copying tasks that required them to copy neatly and to copy from the board. As in the English motoric tasks, fast writing speed scores in the Maltese motoric tasks were again attained by high SE students. SES predicted an effect on the English *Copy Neatly* and *Copy from Board* subtests, and English Total Score. It also predicted an effect on the Maltese *Copy Quickly (Ikkopja Malajr)* and *Copy from Board (Ikkopja mill-Bord)* subtests. The literature has generally shown that SES is an indication of academic achievement (Mifsud at al., 2004; Sirin, 2005), as students with low SES usually perform less well academically than children with high SES. However, a study by D'Angiulli et al. (2004), and another one by Howard et al. (2014), showed that high quality school instruction can reduce the impact of SES on academic achievement. Initially young children rely more on their parents for instruction, since they cannot read the texts themselves. Hence, children of parents with high SES may perform better academically than children of parents with low SES. For older children, high quality education may prevail over parental influence (Howard et al., 2014). In this study results show that SES affects student achievement in both languages, even at secondary level.

Results show no effect on writing speed when combining SES and School Type. Findings show that no correlation exists between these two variables. This result is different from those by the PISA (Ministry for Education and Employment, 2018) study, which showed a positive and significant relation between reading, science and mathematical attainment and SES, by all students from state, church and independent schools. This could be due to the different types of tests used, and the different skills under study, which included motoric tasks in this study, as opposed to the PISA, which only investigated academic achievement. This study examined writing speed, but perhaps a more qualitative analysis of the free writing task is warranted - an analysis that would examine sentence length, varied vocabulary and grammar awareness - reflecting home literacy practices related to SES. According to Havighurst and Levine (1979), working class children have poorer verbal environments when compared to middle class children, as working class parents speak half as much, and use less abstract words, in teaching, than middle-class parents. This is usually due to the parents' level of education.

This study looked at the first language spoken by participants with different SES, and investigated whether this affected writing speed. Results do not show that there is any particular language which is tied to any particular socio economic class. First language speakers of either English or Maltese do not write faster in either language because they speak the language. This goes against the results of Cauchi (1990), who found a strong association between SES, the language the parents used to address the students during their childhood, and the language the students spoke when young, and at the time of the study. The higher the parents' SES, the more inclined the parents were to speak English with their children when young, and the more inclined the students were to speak English. This resulted in the latter achieving higher essay grades in English[49] in Form four. Differences in results could be due to research methodology, as this study did not look for the content and arrangement, expression, and correct grammar of the free writing tasks, as did Cauchi's (1990) study. A recommendation for future research would be in favour of a more qualitative analysis of writing, to correlate if SES and exposure to a language affect the quality of writing.

The participants who took part in this study came from the various geographical regions of Malta (5 in Malta and 1 in Gozo), as defined by the NUTS (Nomenclature des Unites Territoriales Statistiques, 2009). Findings show that participants living in the Western Region of Malta were the fastest writers when compared to participants living in other regions, whereas participants from the Southern Harbour Region were the slowest. Regression analysis also showed that Geographical Region predicts writing speed performance in both English and Maltese, specifically, the English and Maltese *Copy Neatly* subtests and Total Scores, as well as the English *Copy from the Board*, the Maltese *Copy Quickly (Ikkopja Malajr)* and the Maltese *Free Writing (Kitba Kreattiva)* subtests. This may be due to the fact that, according to the 2011 National Census of Population and Housing (National Statistics Office, 2014), Attard, Balzan, Lija, and Mdina, which form part of the Western Region, are among the Maltese towns that register the highest levels of tertiary education. In these localities, between 25%-33% of the population have been to university. In contrast, localities forming part of the Southern Harbour Region, of which Marsa, Cospicua and Senglea, register very low levels of tertiary

[49] Only Essays written in English were examined in the study.

education, with the percentage of university graduates being less than 5%. Altogether, only 9% of the population living in the Southern Harbour region received a university education (Debono, 2014). This discrepancy may be due to the fact that Attard, Balzan, Lija, and Mdina are amongst the most affluent towns in Malta, whereas Marsa, Cospicua and Senglea are poorer working class localities (Debono, 2014). Furthermore, students from disadvantaged areas end up attending a school with students of similar backgrounds as them, which might not help to raise their expectations. The results of this study are similar to Debono's (2014) results, as the majority of the participants with low SES resided in the Southern Harbour Region, whereas the largest number of participants with High SES came from the Western Region. These findings, and the results of the 2011 census, reaffirm the link between affluence and educational achievements (Debono, 2014, Mifsud, et al., 2004). Sultana (1991) claims that working-class parents might choose to invest less in schooling, having different educational aspirations than middle-class parents. According to Lindmark (1993), due to the stressors of poverty, poor families may not give letter formation and reading their due importance.

Do Age and Gender Affect Writing Speed?

Research shows that the youngest members of each cohort (even 14 and 15-year-olds) overall score lower academically than the oldest members, due to maturity differences (Bedard & Dhuey, 2006; Dhuey et al., 2019). In this study participants were placed into two groups according to their birth month. Those born between January and June 2003 were grouped together; whereas those born between July and December 2003 formed the second group. Students born in 2002 (the year before) were placed with the January–June group. Studies have shown that handwriting speed increases with age (Phelps et al., 1985; Wallen, et al., 1996; Ziviani, 1984; Ziviani & Watson-Will, 1998). This research did not reveal significant differences in English writing speed between the two age groups (January-June and July-December). In spite of this, findings reveal that age influences Maltese writing speed performance in all the Maltese subtests, and in Total Maltese Score. Age predicts writing speed performance and in the Maltese *Copy Quickly (Ikkopja Malajr)* subtest, and the *Maltese Copy form the Board (Ikkopja mill-Bord)* subtest. Participants born between January and June wrote faster in all Maltese writing tasks than their younger counterparts born between July and December. This finding may have been a direct result of the inclusion of non-native participants (5%) in the younger age group, for whom Maltese was not their native language. To determine if this was the cause of the difference in writing speed between age groups, the non-native students were removed from the sample, and the data was re-analysed. As the results derived from the second analysis were similar to those attained from the first analysis, it was concluded that non-native students do not contribute to the differences in writing speed. Differences in the diverse grammatical structures of English and Maltese could account for the slower writing speeds in Maltese by the younger cohort of students in this study. English and Maltese have different morpho-syntactic structures, with Maltese having a more complex morphological system than English. These two factors - age, and the more complex morpho-syntactic structure of Maltese - might account for the slower writing speeds in Maltese by the younger cohort of students in this study. An alternative explanation could be that schools allocate more time to English than they do to Maltese, with English being allocated one or two more lesson per week than Maltese (L. Friggieri, personal communication, April 2nd, 2021). Furthermore, as most textbooks and examinations in secondary school are in English, students are more exposed to written English than they are to written Maltese and presumably receive more opportunities to practice English. Without this added exposure to English, it could be that the younger students (June-December) would be slower than the January-June students in English, as they are in Maltese. In sum, Age does not affect writing speed in English, but affects writing speed in Maltese.

Given the dissimilar results in literature in written performance and speed between genders, this research was interested to determine if the writing speed of 14-15-year old boys and girls differs. Findings show that girls write significantly faster than boys in the English *Copy Neatly* subtest, the English *Free Writing* subtest and English Total Score. Girls were faster than boys in the other subtests too, though the results were not significant. With regard to Maltese, females were significantly faster than males in all the subtests and in Total Maltese Score. Results also show that gender predicts writing speed performance in free writing and in overall performance in both languages. It also predicts the ability to copy neatly and quickly in Maltese. There is a wealth of literature reporting girls' superiority in writing proficiency to boys (Aitken & Martinussen, 2013; Simons & Probst, 2014; Van Waelvelde, et al., 2012). This could be due to the fact that various regions of the brain develop at different rates in boys and girls. During early development, girls experience an earlier left hemispheric maturation which contributes to their superiority in writing (Hanlon, et al., 1999) and speech (Voyer, 1996). In their teens, girls are faster writers than boys due to their earlier physical maturity and different types of muscular development (Alston, 1995). Males outdo females in gross motor activities that require speed (running) and strength (ball throwing), reflecting the anatomical structure of males, which comprises having a larger heart, muscles and lungs (Davies & Rose, 2000).

Do Handedness and Writing Style affect Writing Speed; and does Handedness affect Legibility?

In this study, handedness is determined by the dominant hand of the participants. In this study there were 354 right-handed and 46 left-handed participants, respectively.[50] Similar to other research, (Groff, 1961; Vlachos & Bonoti, 2004), this study did not find any difference in the writing speeds of left-handed or right-handed participants in either the English or Maltese assessment batteries. O'Mahony et al.'s, (2008) results, likewise found no differences in the writing speeds of their left-handed and right-handed participants. Their participants were however of similar (average) ability, contrary to the participants in this study, who are of mixed ability. When Two-Way ANOVA and MANOVA tests were carried out to determine if Handedness and Ability had a combined effect on writing speed, none were found. This was similar to the results attained by Vlachos and Bonoti (2004) and Clark (1953). Handedness therefore, does not affect the writing speed in either English or Maltese.

This study tried to determine if Handedness affects Legibility. Results show that it does not. Lohman (1993), likewise, found no difference in the legibility of the left-handed and right-handed students in his sample. Bonoti et al., (2005), however, found that left-handers had more unclear handwriting. They attributed this to directionality, as left handed people curve their hand above the writing line to see what they are writing, as otherwise they can't do so since they write towards their body (Peachey, 2004). The participants in Bonoti et al.'s (2005) study were eight to twelve-year-old students. The participants in Lohman's (1993) study were university students, older than Bonoti et al.'s (2005) participants. It could be that by the time the students reach university level, it is possible that left-handers would have settled to a

[50] One participant did not specify their handedness.

mature hand, and found ways of writing quickly and legibly, despite directionality difficulties. In this study no differences are found between the legibility of left and right handlers, possibly because students start developing a mature hand as they approach their mid-teens (Roaf, 1998).

This study set out to establish which of the three styles - cursive, print, or a mixture of both - result in faster writing speed. Findings show that participants from all school types use a mixture of print and cursive writing in the same text, showing that during their primary years, (usually in year 3) (Directorate for Quality and Standards in Education, 2009), they have been introduced to cursive writing, which they then put into practice. The two prevalent writing styles of the secondary schools taking part in this study are Print (only) (42.1%), and a mixture of print and cursive (Mixed mostly print) (43.9%). Findings show that the print style of writing is more prevalent in state and girls' church schools, while a mixture of print and cursive styles (Mixed mostly print) is more prevalent in independent and boys' church schools. This could be because in boys' church and independent schools cursive writing is given more importance in primary years. This is supported by evidence gathered by Tarnopol and Feldman (1987), who reported that print and cursive script were combined by 59% of the 17-year-old participants (12^{th} graders) in their study. However, in this study, the number of participants using exclusively Cursive (1.7%) or Mixed mostly cursive writing (12.2%) is very low, possibly because no extensive instruction in cursive writing is taking place in our primary schools. Writing instruction methods in primary schools were not investigated in this study.

Writing Style significantly affects writing speed in all the English subtests and in English Total score, except for the English *Copy from Board* subtest. Writing Style also affects writing speed in the Maltese *Copy Neatly* and *Copy Quickly* subtests. Writing Style predicts performance in the English and Maltese *Copy Neatly* and *Copy Quickly* subtests and Total

Scores. Writing Style also predicts performance in the English *Free Writing* subtest. Findings show that participants who use mixed cursive and print scripts are significantly faster than print writers in both English and Maltese free writing. These findings are similar to those reported by Graham and colleagues (1998) who found that mixed cursive and print writing was the fastest, as students select the allographic form of the letter they are able to retrieve and execute the fastest. Hamstra-Bletz and Blote (1990) and Sassoon et al. (1986), claim that many children develop their personal handwriting by using mixed print and cursive writing, once formal handwriting training ends in primary school. Hence, when adequate cursive instruction is not given in primary schooling, it will be difficult for the students to develop their personal styles.

Literature (Barnett et al., 2001; Sovik, 1993; Suen, 1983) shows that students using cursive writing, write faster. In this study, though cursive writers are faster than print writers, (with the former writing on average three more WPM than the latter in both English and Maltese), the results are not statistically significant, probably because of the small sample size of cursive writers (only seven participants). Cursive writing may be faster than print writing as the writer does not need to lift his or her pen from the paper, which reduces word spacing, thus increasing rhythm and writing speed (Almeida et al., 2013). Print writing may be slower since each letter starts at a new point and more eye-hand coordination is necessary (Greutman, 2016). In answer to the research question, writing style (a mixture of cursive and print) affects writing speed.

RQ 3. Does Writing Speed affect Legibility?

In this research question, writing speed is considered to be an independent variable, and its effect upon legibility is examined. Results showed that in English and Maltese, legibility and speed are dependent on the language of the text[51]. In English, the handwriting of the fastest writers had some words or phrases that were difficult to decipher. This indicates that speeding up affects the legibility of the text. However, the same results were not attained in Maltese. The fastest writers in Maltese had overall clear and mature handwriting. This could be due to the complex morph-syntactic structure of Maltese. The complex morphological structure of Maltese makes it more complex to spell. Writers may not be so hasty in writing to get the spelling right, which might contribute to a neater handwriting.

Findings in this study show that ability had a significant effect on legibility and that the slowest writers, with immature handwriting, are students with LD. This is coherent with studies by Ferrier et al. (2013), and Ziviani and Watson-Will (1998), where students whose handwriting was more legible tended to write faster than those whose handwriting was less legible. Biotteau et al. (2019) attribute this to mastered handwriting skills. This is because legible handwriting frees the brain to focus on ideation and vocabulary, instead of letter shapes (Berninger et al., 1997). However, immature handwriting was identified in this research amongst all students, irrespective of age, and even among typically developing students. This means that legibility concerns all students, irrespective of ability.

This study also tried to determine which gender has more legible handwriting. This research showed that girls' handwriting is more legible than boys'. Other studies (Graham et al, 1998; Ziviani & Waston-Will, 1998), reached similar conclusions. Girls' earlier muscular development might contribute to this. However, children might handwrite in a way that meets the stereotypical expectations of handwriting in society. Females' handwriting is expected to be neat and consistent. Males' handwriting is expected to be hurried and irregular (Armenta,

[51] The free writing subtest was assessed for legibility.

2016). Boys' and girls' handwriting legibility could differ in keeping with society's handwriting stereotypes.

What are the writing speed norms of 14-year-old students?

On average 14-year-old students[52] wrote 22 WPM in English and 18 WPM in Maltese. Owing to these different writing speeds, separate norms for English and Maltese were drawn. Appendices BT and BU give the writing speed norms of the English and Maltese subtests, respectively. Appendices BV and BW give the writing speed norms for Total English Score and Total Maltese Score respectively.

The best predictor for overall writing speed in English and Maltese is the *Free Writing* subtest. These findings may be explained by the fact that free writing tests the skills addressed in the other subtests: letter formation, automaticity, speed and legibility. Given the bilingual context on the island, this study compares participants' performance in Maltese and English writing speed tests, as participants are exposed to, and use, both languages to varying degrees. Results show that subtests in one language predict their parallel subtests in the other language. This is in line with Caswell's (2002) research, which found a strong positive relationship between Spanish and English writing, concluding that students who wrote well in one language also wrote well in the other language. Students with developed literacy skills in their L1 are also likely to have developed literacy skills in their L2. This is explained by the Common Underlying Proficiency (CUP) (Cummins, 1992) model, which states that although all languages have distinct features, common features permit cross-linguistic transfer. The variance of scores for the copying subtests in one language (English or Maltese) predicts

[52] Excluding 15-year-olds

between 51% to 63% of the scores attained in the parallel copying subtests in the other language. The *Free Writing* subtest in one language predicts 44.2% of the scores attained in the parallel *Free Writing* subtest in the other language. Each assessment battery in its entirety (Total Score) predicts 52.8% of scores attained in the parallel assessment battery in its entirety. Though the subsets of any assessment battery (English or Maltese), and the assessment battery itself (English or Maltese), predict the scores that participants are likely to attain in the parallel subtests and assessment battery, the predictive performance in either language is not very high. Hence, it is not recommended for testers to administer just one assessment battery and from the results attained, deduct conclusions about a participant's possible writing speed performance in the parallel assessment battery. This is because English and Maltese are two diverse languages, with the former being an opaque language and the latter a semi-transparent language (Agius, 2012). In the case of bilingual children who can sit for either the English or Maltese test, it is recommended for testers to administer both tests separately.

Fourteen-year-old females wrote 24 WPM in English and 19 WPM in Maltese. When the Standard Scores, Z-scores and percentile ranks for males and females are compared, results show these to be close for both genders. However, some Z-scores differ by 0.4 (English *Free Writing*; Maltese Copy Neatly (*Ikkopja Pulit)*) which is considered large (½ SD) (L. Camilleri, personal correspondence, September 14th, 2020). Hence, separate norms for males and females were drawn for the English and Maltese assessment batteries, respectively. Appendix BZ gives the writing speed norms for Total English Score for males. Appendix CA gives the writing speed norms for Total English Score for females. Appendices CB and CC give the writing speed norms for the English and Maltese subtests, for males. Appendices CD and CE give the writing speed norms for the English and Maltese subtests, for females.

Differences in writing speed in English and Maltese could be due to the different orthographic depths of the two languages (see section *The Orthographic Depth Hypothesis* in Chapter 2). Due to the diverse orthographic depths of English and Maltese, participants in this study should have been better decoders and faster writers in Maltese more than in English. Since this was not the case, the differences in writing speed in English and Maltese must be due to the different morpho-syntactic structures of the two languages. English has a stem-based morphology. The basic meaning of a word is borne by the stem, composed of a sequence of consonants and vowels, as in ‘book’, ‘book-s’, ‘book-ish’, ‘book-ed’, ‘booking’, ‘book-let’ (Fabri, 2015). Morphological complexity ensues from linking morphemes (re + connect + ing) (Eviatar et al., 2018). Maltese is a Semitic language. The basic meaning of a word is carried by a set of consonants, usually three or four, called roots. A typical example in Maltese would be “k-t-b’, in words like “kiteb’ (he wrote), “kitba’ (writing) and “ktieb” (book). This is very similar to Arabic in words like “kataba’ (he wrote), “kattab’ (caused to write), “kaatab” (correspond), “kuttib” (was caused to write), “kaatib’ (writer), and “kitaabat’ (writing) (Fabri, 2015). Morphological operations occur to form new words (Rosner, 2011). For example, “niktbuhomlhom” (we write them for them) and “kitibhomli” (he wrote them for me). These different linguistic structures mean that the same concept is expressed as a phrase in English but in a single word in Maltese.

To test whether the diverse morpho-syntactic structures of English and Maltese account for the different writing speeds in the two languages, a morpheme count of some of the participants’ free writing samples, in the two languages, was taken (see Appendix CI). For English this was calculated following Brown’s (1973) Mean Length Utterance (MLU) index (see *Handwriting Skills in Young Adults* in Chapter 2). For Maltese, the morpheme count was calculated following Portelli's (2005) MLU index (see Appendix CJ). MLUs give the average number of morphemes in an utterance (Gabig, 2003). To view the selected samples, see Appendix CI. In this study, the morpheme count was carried out on a total of 173 words for English and Maltese, respectively. There were 197 morphemes for English and 255 morphemes for Maltese. Morpheme count is more complicated for Maltese (see Appendix CJ) than for English (see section the *Handwriting Skills in Young Adults* in Chapter 2), as morphemes denoting person, number, gender and time (present, past or future), are counted in Maltese. For instance, the verb "to do" (għamel) is considered the base form (one morpheme). So "tagħmel" (she does) has three morphemes: "għamel", as well as the person (third person), and gender (female), which are also considered morphemes. "Għamlu" (they did) has four mophemes: "għamel", as well as the person and number (third person plural), and time (past), which are also considered morphemes.

The system for counting nouns and suffixed pronouns is also more complicated for Maltese than it is for English, as again morphemes denoting person, number and gender are counted. So for insance "djarhom" [their house] has four morphemes. The base form "dar" [house] is condidered one morpheme. The plural "djar" [houses], is counted as a another morpheme. The suffix "hom" indicates person and number (third person plural), and hence is counted as two seperate morphemes. An example of suffixed pronouns denoting gender is "idu" [his hand]. "Id" [hand], the base form, is one morpheme. The suffux "u" denotes possession and gender (his), and henceforth are counted as two seperate morphemes[53]. Morpheme count results (see Appendix CI) show that in order for students to express the same ideas in English and Maltese, they have to write words with more morphemes in Maltese.

[53] Number for the first, second and third person singular is not counted, but it is being counted for first, second and third person plural since it is a distinguishing factor (Portelli, 2005).

These bound morphemes in Maltese can make spelling words complex and time consuming, especially in the presence of unvoiced letters such as "għ" and "h" (see section *The Maltese Language* in Chapter 1). This might account for why participants wrote less words in Maltese than English, given that the testing conditions were similar.

Differences in writing speed in English and Maltese could be related to the average word length of both languages. Computer generated figures state that 80% of the words in English seem to be between two to seven characters long, with the average being 4.79 characters (Norvig, 2013)[54]. This figure may vary depending on the corpus used, with Wolfram Language (2020)[55] giving an average of 5.1 characters. An attempt to determine the average word length in Maltese was made in this study, as this had never been calculated before (M, Spagnol, personal correspondence, February 22, 2019). This was done in collaboration with academics in the Department of Maltese at the University of Malta. Discussions stipulated that the average length of a word in Maltese is to be established by examining words of various lengths. The list should comprise a variety of words, and not just high frequency words, which usually have a grammatical function, such as articles, prepositions and conjunctions, and hence are usually shorter in length. Results may also vary depending on the corpus. Words taken from a dictionary are usually bereft of prefixes and suffixes, and hence shorter than words taken directly from a text, which usually abound with prefixes and suffixes (M. Mifsud, personal correspondence, February, 22, 2019). If accurate comparisons are to be made between Maltese and English, the corpora of both languages has to be the same, with the electronic generation of data being recommended for greater accuracy (M, Spagnol, personal correspondence, February 22, 2019). As determining the average length of Maltese words is a

[54] The corpus for this study was Google Books Ngrams, books that have been scanned by Google.
[55] The corpus for this study was Britannica online, Wikipedia and Academic Prose.

research project in its own right (A, Borg, personal correspondence, July 1, 2019), it was not possible to establish if differences in average word length in English and Maltese contributed to the differences in writing speed in these two languages.

Standard Scores, Z-scores and Percentile Ranks

Access arrangements for extra time are granted when the student attains:

1. below average scores of 2 SD below the mean, that is, a total standard score below 70, at the EMASH assessment battery (a raw score of 13 WPM in the English assessment battery, and a raw score of 9.5 WPM in the Maltese assessment battery);

or

1. below average scores, 1 SD below mean, that is, a total standard score below 85, at the EMASH assessment battery (a raw score of 18 WPM in the English assessment battery, and a raw score of 14 WPM in the Maltese assessment battery);
2. together with a standard score of below 85 (1 SD) on the Graphic Speed Test. These guidelines are in accordance to the MATSEC Examinations Access Arrangements' regulations **(**Matriculation and Secondary Education Certificate, 2019a).

A student whose total writing speed score falls at or above the 16th percentile is to be considered as having no difficulty with handwriting speed (Barnett at al., 2007). For Total English Score, this means attaining a raw score of 18.5 WPM (or more). For Total Maltese Score this means attaining a raw score of 14.5 WPM (or more).

Comparison of Scores

Comparisons of student performance on the modified English assessment tasks, with their performance on the novel Maltese assessment reveal that, with the exception of the *Copy from the Board* subtest, the English and Maltese tests cannot be administered interchangeably, as different norms apply, due to the different linguistic structures of English and Maltese. When Total English Score is compared to Total Maltese Score (Appendix BX), participants score about 1SD in English less than they do in Maltese. For instance, when participants write 17 WPM in English, this corresponds to a Z-score of -1.22. When participants write 17 WPM in Maltese, this corresponds to a Z-score of -0.28, which is almost 1SD more than for English. When the English and Maltese *Copy Neatly* scores are compared, participants again score about 1SD less in English than they do in Maltese. Likewise, for the *Copy Quickly* subtests, participants score about 1.5 SD less in English than they do in Maltese. With regard to the *Free Writing* subtests, again participants score ½ a SD less in English than they did in Maltese. When Total English Score was compared to Total Maltese Score (Appendix BX), it was found that participants attaining a standard score of 94 in English and Maltese, corresponding to a Z-Score of -0.40 (highlighted in Table BZ1 in Appendix BZ), wrote 21 WPM in English and 16.5 WPM in Maltese. Similar results were attained for the *Copy Neatly*, *Copy Quickly* and the *Free Writing* subsets, with participants writing more in English than in Maltese. The only exception was the *Copy from Board* subtest (Table CA3 in Appendix CA), where similar norms apply. When the English *Copy from Board* subtest was compared to the Maltese *Copy from Board (Ikkopja mill-Bord)* subtest, it was found that participants attaining a standard score of 141 in English and Maltese, corresponding to a Z-Score of 2.70 (highlighted in Table CA3 in Appendix CA3), wrote at almost similar speeds (32 WPM in English and 33 WPM in Maltese).

The similar writing speeds of the English and Maltese *Copy from the Board* subtests could be due to the different linguistic structures of the two languages. The 19 articles (e.g. il- ; is-), or prepositions bound to articles (e.g. fis- ; mar-) in the Maltese *Copy from the Board (Ikkopja mill-Bord)* text, were counted separately as single words (see Appendix A15). The brevity of these words, making them fast to write, could have contributed to the augmented word count in Maltese, bringing it at a par to English. In the Maltese *Free Writing (Kitba Kreattiva)* subtest, participants followed the correct grammatical rules of the language and added articles to words, which were counted separately. It would be interesting to note if the word count would have differed drastically had articles, and prepositions bound to articles, been counted together with the word they modified (i.e. "il-kelb" to be counted as one word instead of two.) The word count of the Maltese assessment battery would have been even lower than that of English. This could be an area for future research.

Conclusion

This chapter discussed the research findings in light of the reviewed literature by addressing two research questions. Results showed that Ability, First Language, SES, Geographical Region, Gender and Writing Style have an effect upon the writing speed performance of 14-15-year-old Maltese students in both English and Maltese. Additionaly, whilst the type of school affects a student's writing speed ability in English, it does not have a similar effect upon Maltese writing speed which is mostly affected by Age and Nationality. With regard to legibility and speed in English and Maltese, these are dependent on language, with the fastest writers in English being those participants whose written product includes some words or phrases difficult to decipher. Conversely, the fastest writers in Maltese have overall clear and mature handwriting.

The next chapter (Chapter 7), highlights the main findings of this research, discusses its limitations, proposes recommendations for future related studies, and outlines the clinical and educational implications of this research and their relevance to professionals in the educational and health sciences fields.

Chapter 7: Conclusion

This chapter highlights the main research findings and puts forward conclusions drawn from the findings. It also outlines the limitations of the study, provides recommendations for future related research and outlines clinical and educational implications in the assessment and intervention of students with writing difficulties

Main Research Findings

This research aimed to modify an English handwriting speed assessment battery, develop a Maltese version, and standardize writing speed scores of 14-year-old Maltese pupils, in order to identify students who are at risk of writing difficulties (for example, dysgraphia). The following 11 independent variables on writing speed were studied: First Language, School Language, Nationality, Ability, Geographical Regions, Socio Economic Status (SES), School Type, Gender, Age, Handedness and Writing Style. In the third research question: Does writing speed affect Legibility?, writing speed was considered to be an independent variable, and its effect upon legibility was examined. Results showed that the variables that have an effect on writing speed in English and Maltese were: Ability, First Language, SES, Geographical Regions, Gender and Writing Style. School Type was found to affect writing speed in English, and Age and Nationality affect writing speed in Maltese. In English and Maltese, the fastest writers were typically developing participants; female; participants residing in the Western Region of Malta and participants with a high SES. The slowest writers in English and Maltese were participants using a Print only Writing Style. In English, Dominant English First Language speakers wrote faster than Dominant Maltese First Language speakers. The slowest writers in English were participants from State Schools. The slowest writers in Maltese were

Non-native participants speaking a Non-native language, and the younger participants of the cohort. Regression analysis findings indicated that English and Maltese writing speed is best predicted by Ability, Writing Style, Geographical Regions, Gender and SES. The study also determined that legibility and speed were dependent on language, with the fastest writers in English being those participants whose written text included some words or phrases difficult to decipher. Conversely, the fastest writers in Maltese had overall clear and mature handwriting. The slowest writers with immature handwriting were students with learning difficulties.

All the subtests correlated positively with one another both within and across languages (English and Maltese). This means that when a student obtained low scores in a subtest (or in the entire) assessment battery in one language, they also performed poorly in the subtests in the parallel language. Both the English and Maltese assessment batteries can be used to identify students with LD. When standard scores in English are compared to standard scores in Maltese, results show that testers cannot administer the English and Maltese assessment batteries interchangeably, as different norms apply, due to different resultant writing speed scores. Likewise, different norms apply for males and females.

Research questions the applicability of UK or US literacy assessment measures to the Maltese situation (Martinelli, 2009; Pace, 2012). With a sensitive tool and available standard scores, assessors will be able to feel confident in the report of diagnosis that lead to tailor-made intervention plans. When students attain below average scores of 2 SD below the mean, that is, a total standard score below 70, at the EMASH assessment battery (a raw score of 13 WPM in the English assessment battery, and a raw score of 9.5 WPM in the Maltese assessment battery), students become eligible for access arrangements for extra time.

Limitations

The following limitations have been identified during the course of the study:

1) There is limited research in Malta related to handwriting, and therefore it was hard to compare and contrast findings in an objective manner. The only local literacy assessment that included writing is the *Test of Reading, Phonological Awareness and Memory* (TORPAM) (Agius, 2012). However Agius's (2012) study targeted a younger age group than the one in this study, and hence comparisons were not possible.

2) There was some attrition during data collection. One student in a state school came late for the session and missed the first exercise. The student was not made to do the exercise as making the students do the first exercise at the end would have disrupted the order in which the subtests were planned. Furthermore, the researcher did not wish the student to miss the next lesson. The score for that exercise remained blank.

3) One student omitted the time mark in all subtests despite the researcher's instructions. Another inserted the time mark at the end of each sentence of the pangram copying subtests, and none in the free writing subtest. One last student omitted one time mark in the English free-writing subtest. In all these instances, only the global mark for each subtest was inputted into SPSS.

4) Another student in another state school started writing in Maltese during the English free writing activity, as he found it difficult to express himself in English. The researcher encouraged him to try writing in English, which he did. The words written in Maltese were still counted as the DASH does not specify that words written in a foreign language are to be discarded. Furthermore, occupational therapists have had students writing in Maltese when

assessed by the DASH for access arrangements, and they have counted what they have written, albeit in a different language (R. Bondin, personal correspondence, September 19, 2018**).**

5) The graphic speed test was scanned from the DASH, transferred to a soft copy version, and printed. After administering the test to one fifth of the participants, the researcher realized that the circles were 1mm smaller than the original copy in the DASH. It was decided to discard this sample albeit this incident warrants future investigation to determine if 1mm smaller circles contribute to a significantly different final score of correctly formed crosses.

6) In spite of the relatively large number of participants included in this research (401), when stratified according to school type, the number of children attending independent schools was relatively low. This was because only one school consented to participate. Although the number of independent schools in Malta is also equally low in comparison to the state and religious sector, a larger number of children attending independent schools would have been more desirable. It would have been interesting to observe if resultant writing speeds would have differed since students attending independent schools have higher SES than students attending state and independent schools. Results from this study, as well as the literature (Mifsud at al., 2004; Sirin, 2005), show that SES is an indication of academic achievement as students with high SES usually perform better academically than children with low SES. Likewise, there was a lack of representation of girls attending a church school in Gozo, as consent to the research was not given.

7) Classifying parental occupation proved to be challenging as some occupations were very vague (e.g. airport). In such cases where classifying an occupation proved to be impossible, parental occupation was left blank. Likewise, occupations that proved to be impossible to define despite online searches were left blank.

8) This study measured the writing speed of 14-15-year-old students. Writing speed increases with age (Rosenblum et al., 2003b). Yet as the writing speed of younger students was not measured, the writing speed performace of local students could not be determined by age, and comparisons could not be drawn.

9) This study could not determine if the differences in writing speed of 14-year-old students, in English and Maltese (22 WPM in English and 18 WPM in Maltese), could be related to the average word length of both languages.

Recommendations for Future Research

The following recommendations are being put forward for future related research:

1) In the Maltese version of the assessment battery, articles and prepositions bound to articles were counted separately, as single words. Had they been counted together with the word they modified, the resultant average writing speed would have probably been less than 16 WPM in the *Free Writing* task. This would mean that participants would require more than an extra five minutes to write a 300-word essay in Maltese. It is recommended that further research is carried out to determine the extent to which the word count in Maltese would have differed from the one established in this study, had the article been counted together with the word it modifies.

2) As part of this study's inter-rater reliability measure, a percentage of the EMASH score sheets were scored by speech language pathologists graduands. The assessment tool is intended for use by allied health professionals (occupational therapists, speech and language pathologists) and educational psychologists, but also for teachers. Comparing the results of teachers evaluating the EMASH assessment battery could be a next step to support inter-rater reliability

further. There is a possibility that teachers and occupational therapists assess legibility in different ways. What matters for teachers is that they are able to read the assignments their students give them, to ensure that the latter have mastered the curriculum. Occupational therapists evaluate letter size, letter spacing, legibility of form and alignment when assessing handwriting, and so their legibility criteria differ from those of teachers.

3) Data available from school records, such as examination results, to compare writing speed scores with examination attainment, was not collected. Future research could take into account summative assessments and correlate these with writing speed performance, to determine the extent to which writing speed affects examination grades.
4) Likewise, the participants' witing proficiency in English and Maltese was not examined in this study. An area for future research could be an analysis of the participants' level of proficiency in both languages, and how this relates to writing speed.
5) Since a writer's awareness of their handwriting is a basis for improvement, it is recommended that handwriting intervention be accompanied by information from the student regarding their handwriting abilities, to provide a better understanding about the way in which handwriting deficiencies affect the specific student, and about the student's strategies of coping with those deficiencies. Information from the student can be gained regarding their performance, such as the need to look at the paragraph repeatedly when copying from the whiteboard, or erase often while writing, and their physical and emotional well-being. Students should also be able to evaluate their handwriting legibility. It is recommended for future research to test for student awareness of their handwriting by including a questionnaire, or interview, asking students to evaluate their handwriting according to size (width, height), spacing between letters and words,

slant, shape (letter form and shape), and general look. When students self-evaluate their handwriting, they can improve it continuously.

6) Future research could establish a benchmark for orthographic-motor integration for primary and secondary students. This could be a simple test such as the *Copy Neatly* pangram of the EMASH for secondary, and the *Copy Best* pangram of the DASH for primary, that require the students to write out all the letters of the alphabet.

7) When a student presses the writing instrument too hard on a paper, it is recommended that the observer determines where the excessive pressure is coming from. This could be due to an awkward grip, with the pressure travelling through the whole arm, or because the student is generally emotionally tense, and therefore physically too. It is recommended that the student makes huge circles, ovals etc., with an easily flowing felt tip pen, on a large piece of paper, to shed the tightness. As the ability of children with handwriting difficulties to regulate force appears to be less than that of typically developing children (Wann, 1987), future research could make use of a digitizing tablet to determine writing pressure. Sensors at the tip of the pen determine the pressure exerted by the writer while writing. A digitizing tablet can also measure the In Air time of the writing instrument, which is longer for students with dyslexia and dysgraphia (Wann, 1987; Wann & Kardirkamanathan, 1991). Hence, a digitizing tablet can further indicate handwriting difficulties. Digitizing tables reveal which letters are problematic for the child, these being those the child writes over many times with the electronic pen (Rosenblum et al., 2006). These various strokes on the same letter should give a clear indication to therapists and educators as to which letters need attention, to help them develop a tailor-made intervention programme. Future research could utilise digitizing tablets to identify the problematic areas with handwriting.

8) Future research could study typing speed and perhaps even develop norms, and compare these to this study's writing speed norms.

9) Pupils' writing can provide teachers and examiners with invaluable information. Research has shown that SES and exposure to a language result in the improved quality of essay writing (Cauchi, 1990). A recommendation for future research would be in favour of a more qualitative analysis of writing, by examining the effects of SES and language exposure to the quality of the written text – the tenses used, the vocabulary, sentence and word syllable length and the grammatical structure of the sentences.

10) In this study there were no students with dysgraphia. A suggestion for future research would be to include a cohort of students with dysgraphia to determine whether the test can identify this condition. The *Copy Neatly* and *Copy Quickly* subtests can be used for this purpose, as students with dysgraphia cannot speed up when requested (Weintraub & Graham, 1998). Furthermore, the *Free Writing* task can give an indication of this writing difficulty if the tester notices poor spatial planning, poor spelling, including missing letters and unfinished words or missing words, and sudden changes in the size and directionality of letter writing (Hamstra-Bletz & Blote, 1993).

11) This study did not directly address the manner in which writing was produced. Since the EMASH was administered in a group setting, the researcher was unable to watch the way the students wrote. Future research recommends one-to-one assessment administration in order for the tester to notice frequent erasing, and a cramped grip resulting in hand pain (Hamstra-Bletz & Blote, 1993), also indications of dysgraphia. Poor writers find it difficult to maintain an appropriate and consistent size, which makes handwriting appear illegible. Confusion of upper/lower case letters is another indication of writing difficulties. Crammed handwriting may

be an attempt to hide poor spelling. Inappropriate spacing between the letters in a word may also be an indication of difficulties with movement control (Barnett et al., 2007). A more qualitative analyses of writing is recommended in future studies to detect handwriting deficiencies.

12) Care has to be taken with the grip of the writing instrument. Research has shown that an ideal pencil grip does not affect speed and legibility (Schwellnus et al., 2012). In fact, trying to change a set pencil grip is often detrimental to the writer. A good pencil grip keeps the wrist steady. The pencil tip is moved only by the fingers. Future studies could include one-to-one administrative sessions to notice whether the wrist, instead of the fingers, is moving the tip of the writing instrument. This may happen if the fingers are too bent or the writing instrument is gripped too strongly. This is when the grip needs to be changed, to avoid discomfort and fatigue.

13) In this research, writing speed and legibility were assessed during the free writing activity. However, students also take their own notes during lessons, but the legibility or handwriting quality during note taking in class was not examined in this research. Producing legible notes is essential for revision and studying, and hence academic progress. Handwriting legibility might differ as a result of the difference in task type – from an assessment subtest to taking notes. So future studies could also look into differences in legibility and writing quality between these two writing situation.

14) This study investigated the writing speed of 14-year-olds in Year 10 classes. This target group was selected because this is the age students in Malta are usually tested when granted access arrangements for their national examinations in Year 11. Other year groups were not

investigated. Future research could target the other year groups, to have writing speed norms for a wider range of school-aged children.

15) When students are taught both print and cursive, they can develop their own handwriting style, which allows them to select the allographic form of the letters that they are able to retrieve and execute fastest when writing (Graham & Weintraub, 1996). A longitudinal study examining writing instruction in primary years, and how students' handwriting is personalized in secondary years, would be a recommended area for future research. Future research could also try to determine whether handwriting programmes influence students' performance on writing speed tests, such as the EMASH or DASH. This is so as if students learn to write exclusively in cursive, resultant writing speeds will be faster, which may result in a need to draw new writing speed norms for secondary school students.

16) Another recommendation for future research would be to take into account the ecological context of handwriting acquisition. The ecological context, apart from the classroom environment, includes the home environment, parental involvement, and culture. In this study, home environment and parental involvement were considered in relation to writing speed attainment but not in reference to handwriting acquisition. It is recommended for future research to take into account the role of parental involvement and the influence of home and cultural environment on handwriting acquisition.

17) Future research could include a higher student participation rate from the top and bottom streams in state schools, and compare the new results to the results obtained in this research.

18) The differences observed in writing speed between the three school types might be explained by the different teaching methods adopted by the teachers in the different school sectors. This study did not analyse the teaching strategies applied to teach the planning, organization, or

correct grammatical structure of free writing tasks. Yet these strategies could contribute to participants writing longer paragraphs within the same time limit. It is recommended that future research takes into account the different teaching methods imparted by teachers when teaching free writing.

19) This study did not look for underlying sources of handwriting dysfunction, such as weak shoulder strength, weak fine motor skills, lack of bilateral coordination[56] or lack of automaticity of letter production. A recommendation for future research would be to look at these underlying sources of handwriting dysfunction for a better understanding of cause of handwriting difficulties.

20) Future research could try to determine if the average writing speed rates of 14-year-old students (22 WPM in English and 18 WPM in Maltese) were related to the average word length of both languages. For accurate comparisons to be made, the corpora of both languages has to be the same, comprising shorter words, such as articles, prepositions and conjunctions; and longer words taken directly from a text, which usually abound with prefixes and suffices (M. Mifsud, personal correspondence, February, 22, 2019).

21) The number of participants in this study using exclusively cursive writing was very small (1.7%). The majority of the participants used a predominantly print style (86%). Future research could draw writing speed norms for exclusive cursive writers, and compare these norms to the ones derived in this research.

[56] Coordinate both sides of the body, such as when using a scissors.

Educational and Clinical Implications

The following is a list of implications for professionals that have arisen as a result of this research.

1) Handwriting instruction in primary years has not been investigated in this study. However, few schools require their teachers to obtain handwriting training, and most primary schools have no formal handwriting instruction program. If handwriting training is not given its due importance in mainstream education, the students' academic achievement may suffer, as proficient handwriting is correlated to language and literacy development, and can advance or hinder academic attainment. Studies have shown that most people's handwriting is not mature before their mid-teens (Roaf, 1998), and therefore the implication in education is that attention to handwriting should persevere throughout the school years.
2) Given that this research has shown that participants who use cursive, or some form of cursive script in their writing, write more words in the same span of time than those who use print script, formal cursive script teaching may be recommended in local schools. The use of fluent, joined up handwriting is also recommended, as it improves spelling. By memorising the movements of common spelling patterns by hand (kinesthetically), as well as visually, writers improve their spelling (Peters & Smith, 1993). Cursive writing is also recommended as it prevents reversals (Montgomery, 2012), and confusion of letters such as "b" and "d" which are often reversed in print. When writing in print, children's letters in words are sometimes too close together or too far apart (Greutman, 2016). Cursive writing helps to regulate the spacing between letters in words. In the early grades, a style of writing to which 'tails' are added to print letters is recommended, as it eases the transition to cursive writing

at a later stage. This recommendation has wide-ranging implications for staff development, as teachers may need to learn the system themselves before teaching it to their students.

3) Overall, participants wrote fewer words in Maltese, than in English, in the same amount of time. This is probably due to the diverse morpho-syntactic structures of English and Maltese. This might mean that more time is needed for students to write the same number of words in Maltese, than English. In order for students to write a 300-word essay in Maltese, at the average rate of 16 WPM[57], as determined by the EMASH, they would need 19 minutes. For students to write the same number of words in English, at an average of 21 WPM, again as determined by the EMASH, they would need 14 minutes. This time excludes planning and correction time. Hence, on average, students require an extra five minutes in Maltese to complete the same 300-word free writing task. This has implications for assessment planners who should take into consideration the language differences when assigning word length to written tasks, or timed writing tasks.
4) In this technological age, students are more exposed to typed than to written text. Though in Maltese schools written text prevails during lessons and examinations, typed text becomes more prevalent and relevant in adulthood. As such, the recommendations of Occupational Therapists (OTs) for students with writing difficulties to type, rather than write, becomes relevant for all students (Donica, 2018). However, just as letter automaticity is important in handwriting, students are to be taught touch typing that involves using all ten fingers to find the keys on the keyboard kinesthetically, rather than by sight. Touch typing speeds could range between 50 to 80 WPM (Fort, 2014). This in turn has implications for policy makers who should then reconsider the time allotted for written task in examinations.

[57] The average free-writing writing speed.

5) Whenever a slow writer is identified by a teacher, that child should be referred for a handwriting diagnostic assessment as soon as possible, to minimize the negative outcomes of handwriting deficiencies on that child. Teachers need to help students with writing problems, or very slow handwriting (below 13 WPM in English, and 9.5 WPM in Maltese), to develop strategies to record their work, such as using computers. It is recommended to study the total amount of written work expected of students, taking into account when they write during the lesson (beginning, middle or end of lesson); the length of time they spend writing (5 min, 10 min, 30 min, at once, or sporadically); how much they are expected to write to allocate enough time to finish; and who reads what they write (the teacher, parents, peers, self, examiner). This could lessen writing demands on students, in favour of worksheets and handouts, or the use of technology. In Maltese classrooms this means allowing the use of technology more.
6) All students should be able to write very neatly and legibly when the need arises, such as when writing formal letters for job applications. They should preserve their ‘best’ handwriting by occasionally practising writing short pieces of text (Connor, 1995). Students should also develop fast but legible handwriting for exams. In this study, students with learning difficulties had the most immature handwriting. However immature handwriting was observed also amongst typically developing students. This suggests that legibility is a general issue among students, and is therefore a matter of concern for all educators. Teachers need to train students on how to improve their handwriting. In those lessons where students don’t have to write very quickly (e.g. Geography, Technology and Science), teachers should expect students to write very neatly. Another strategy teachers could use to helping struggling writers make reading their own work possible, is to encourage them to

read out what they have written. It is recommended that schools allocate time to handwriting practice during lessons.

7) Writing speed performance was compared across different geographical regions. Students from the Southern Harbour Region were shown to be the slowest writers. This places them at an increased risk of failing their exams and possibly dropping out from school. This is because writing speed is a key factor for academic success. Hence this study identified the geographical region which requires more attention from policy makers in terms of investment in educational resources, this being the Southern Harbour Region. The results of this study could help policy makers make the required informed decisions with regard to educational resources, directing them towards disadvantaged students, to permit a fairer access to learning opportunities.
8) The research showed that SES continues to have a negative impact upon performance in secondary education. This calls attention to the type of instruction being imparted in our schools, as instruction mitigates the effects of SES on attainment (D'Angiulli et al., 2004). Again, these results should help policy makers make informed decisions as to where they should channel their educational resources, if the number of early school leavers is to be decreased, as projected by the education strategy for Malta for 2014-2024 (Ministry for Education and Employment, n.d.4).
9) The reliability of assessors who are not familiar with an assessment tool is questioned when they use that particular tool (Graham at al., 1989). Hence it is recommended that evaluators practise on written samples before administering the EMASH. Written samples are to be inserted in the test manual of the EMASH, which carefully and thoroughly details the method of administration and scoring. These written samples provide evaluators with an

opportunity for practice, prior to administering the actual test. This is most useful for teachers, as teachers who are conversant with a particular test, have been found to be more reliable in judging writing (Feldt, 1962). Teachers are in the best position to detect children with handwriting difficulties. Before referring a child for a handwriting assessment, teachers can administer the EMASH in order to detect significant difficulties in handwriting speed.

10) In order to detect writing difficulties, the starting point must be the identification of the child's first language and language of instruction, through questionnaires and interviews. Once the language profile has been established, the assessment battery that conforms to the language with which the child is most proficient (whether English or Maltese) can then be selected.

11) In order for clinicians to ensure a comprehensive assessment of handwriting difficulties, they must make sure that the writing assessment battery used must include: 1) a pangram subtest to assess letter formation; 2) a free writing component to permit assessors to examine the text in order to identify writing disorders such as dyslexia and dysgraphia; 3) a subtest that requires speeding up to help identify students with dysgraphia, since these are unable to increase their speed of writing when asked to; 4) a mechanical writing speed subtest, such as copying a repetitive sentence, to identify students with a profile of dyspraxia, as these experience difficulties with the mechanical production of letters and words on paper; 5) a graphic speed test to assess perceptual-motor competence.

12) Handwriting difficulties are often symptoms of developmental disorders such as Attention Deficit Hyperactive Disorder (ADHD) and Autism. Hence, it is recommended to screen children with handwriting difficulties for these developmental disorders, using the EMASH

in conjunction with other specialised assessments relative to the professional working with that child.

13) In case of atypical writing speeds which fall 2 SD below the norms of the EMASH, access arrangements, such as extra time (up to 25%), or the use of a word processor (Matriculation and Secondary Education Certificate, 2019), may be provided during school and national exams, as recommended by the professional who conducted the assessment. The EMASH may be used by professionals working in education to quickly, reliably, and validly assess large groups of students in their classroom setting, thus reducing the waiting lists at the Child Development Assessment Unit (CDAU), or at private clinics, where screening for writing difficulties normally takes place in Malta.

14) With this tool and available standard scores, assessors will be able to identify those students needing writing support; feel confident in the report of the diagnosis; and recommend well-suited intervention plans. These could either be the teaching of letter formation for automaticity, or referral to occupational therapists who set exercises designed to strengthen the muscles, in case of motor difficulties.

15) The EMASH may be used to monitor progress over time, after the student has received intervention.

16) Given that the average WPM was different in English and Maltese (22 WPM in English and 18 WPM in Maltese), assessors should therefore administer both tests individually rather than choose one test and assume that the same results will be obtained in the other language. Assessors should therefore administer the English and Maltese tests separately, to get a more accurate profile of the students' writing speed abilities in both languages.

17) Maltese children perform differently to foreigners who have been administered the same (UK and US) tests. Caution should be exercised in the interpretation of scores that were normed on other populations. Ideally, standard scores derived from foreign populations are not used at all. The writing speed norms for 14-year-old students derived from this research, provide assessors with a better picture of whether or not the writing performance of students in this age bracket is typical. The Z-scores (see Appendices BT to BW) derived from this research provide a separate measure of standardisation. A separate measure of standardisation for 14-year-old males and females is also provided (see Appendices BZ to CE). Using the provided standard scores, implies diminishing the risk of under- or over-diagnosis of children with writing difficulties, which may be the case if tests standardized in the UK or US are used.

This research has modified an English writing speed assessment battery, created a Maltese counterpart, and standardized both tests. The novel writing speed assessment battery, the EMASH, is for use with the local population of students, who so far was being administered assessment batteries standardised on foreign populations. This tool should provide professionals with a better instrument for assessing the handwriting difficulties of Maltese students.

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Appendices

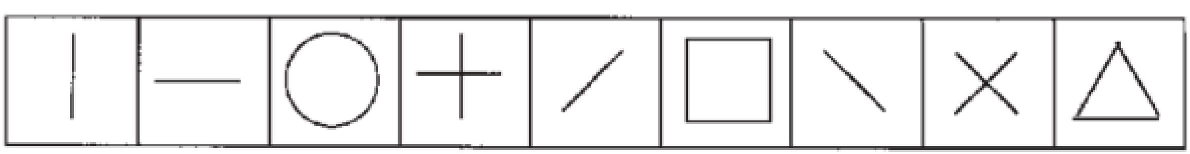
Appendix A

Handwriting Development

The development of handwriting begins with scribbles (Oliver, 1990), which evolve first into shapes, then letters (Willats, 1985). At around the age of two the child starts drawing vertical lines. About six months later the child adds horizontal strokes. Circles are formed at around the age of three (Beery et al., 2010). The cross is produced at around the age of four, and is a sign of writing readiness in children (Weil & Amundson, 1994). Weil & Amundson (1994) used the *Developmental Test of Visual–Motor Integration* (VMI) (Beery et al., 2010), to examine 60 typically developing kindergarten children for printing ability. Those children who could copy the first nine items on the VMI test (see Figure A1), of which the oblique cross (X), copied more letters than those who could not copy these items. Letters often appear in children's drawings and can be seen as practice for writing (Willats, 1985).

Figure A1

The First 9 items on the Test of Visual-Motor Integration (VMI)



Eye-hand coordination is related to academic achievement (*Reid Chassiakos, 2017)*. This is confirmed by Dinehart and Manfra (2013), who state that academic achievement is predicted by the development of children's writing skills before formal schooling. In their longitudinal two-year study, the researchers observed 3,000 pre-school children undertaking fine motor tasks of which lacing beads, building with blocks, cutting with scissors and weaving string; as well as some fine motor writing tasks, such as drawing people and houses and copying numbers, letters and shapes. Their performance was compared to their academic achievement two years later. Results indicated that the proficient execution of the fine motor skills examined were linked to academic achievement, but the fine motor writing skills were the stronger predictors of mathematics and reading achievement (Dinehart & Manfra, 2013). These results suggest the importance of direct teaching of letter formation in the early years.

A study by Overvelde and Hulstijn (2011a) tried to determine which handwriting method was best suited in the teaching of new letters. Participants were 36, 8-year-old children, 18 of whom were proficient writers, and the remaining 18 poor writers. The children were required to learn three unknown letter-like patterns by employing three methods. The first was learning by tracing; the second was learning by pursuing a moving target, which the authors likened to the teacher holding the child's hand while writing; and the third was by following explicit instruction. Overvelde and Hulstijn (2011a) found that the most efficient method, both for proficient and poor writers, was when the children had explicit instructions to follow. Tracing proved to have little instructional value, even though it is a method widely used in education. The authors suggest that hand holding is beneficial only if the teachers provide verbal cues with regard to the movement patterns.

Appendix B

Classification of the Geographical Regions as Defined in the Malta Primary Literacy Value Added Study (Mifsud et al., 2004)

Inner Harbour

Valletta, Floriana, Marsa, Senglea, Cospicua, Vittoriosa, Kalkara, Paola, Sliema, Gzira, Msida, Hamrun, Pieta'

Outer Harbour

Zabbar, Xgħajra, Fgura, Tarxien, Luqa, Qormi, Birkirkara, Santa Venera, St Julian's, San Gwann, Santa Lucia, Pembroke

South Eastern

Marsascala, Gudja, Għaxaq, Zejtun, Marsaxlokk, Birzebbugia, Mqabba, Kirkop, Safi, Qrendi, Zurrieq

Western

Zebbug, Siggiewi, Dingli, Lija, Attard, Mtrfa, Rabat, Bahrija

Northern

Naxxar, Għargħur, Mellieħa, St. Paul's Bay, Mosta, Mgarr

Gozo

Għarb, Żebbuġ, Xagħra, Kerċem, Victoria, Nadur, Qala, Sannat, Xewkija, Għajnsielem, San Lawrenz

Appendix C

Version 1 of the Test used for Data Collection (English)

For office use only:

Handwriting Speed Assessment

Name: ________________________

Male/female (*please circle*)

Date of Birth: ___________________

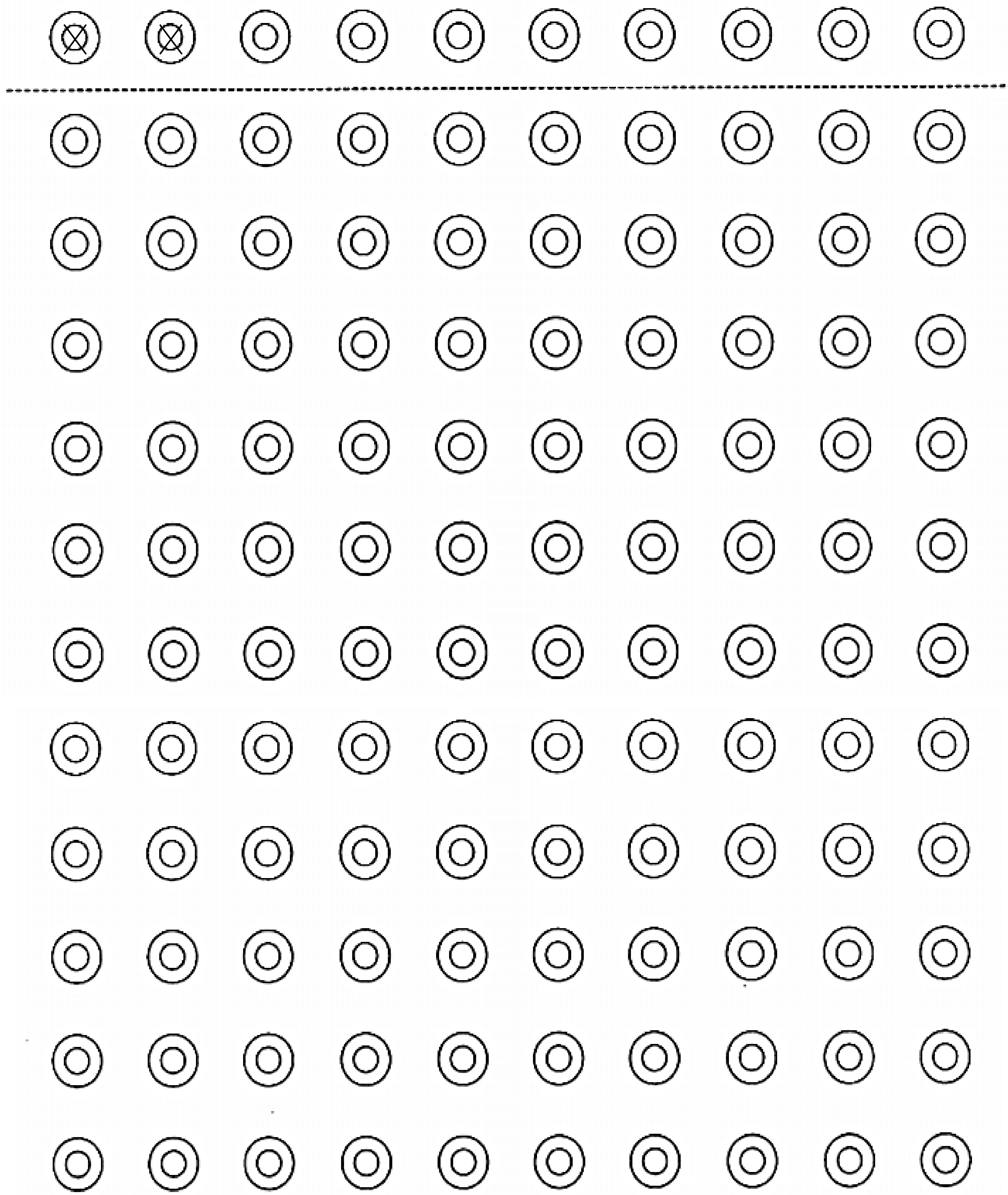
Left handed/right handed (*please circle*)

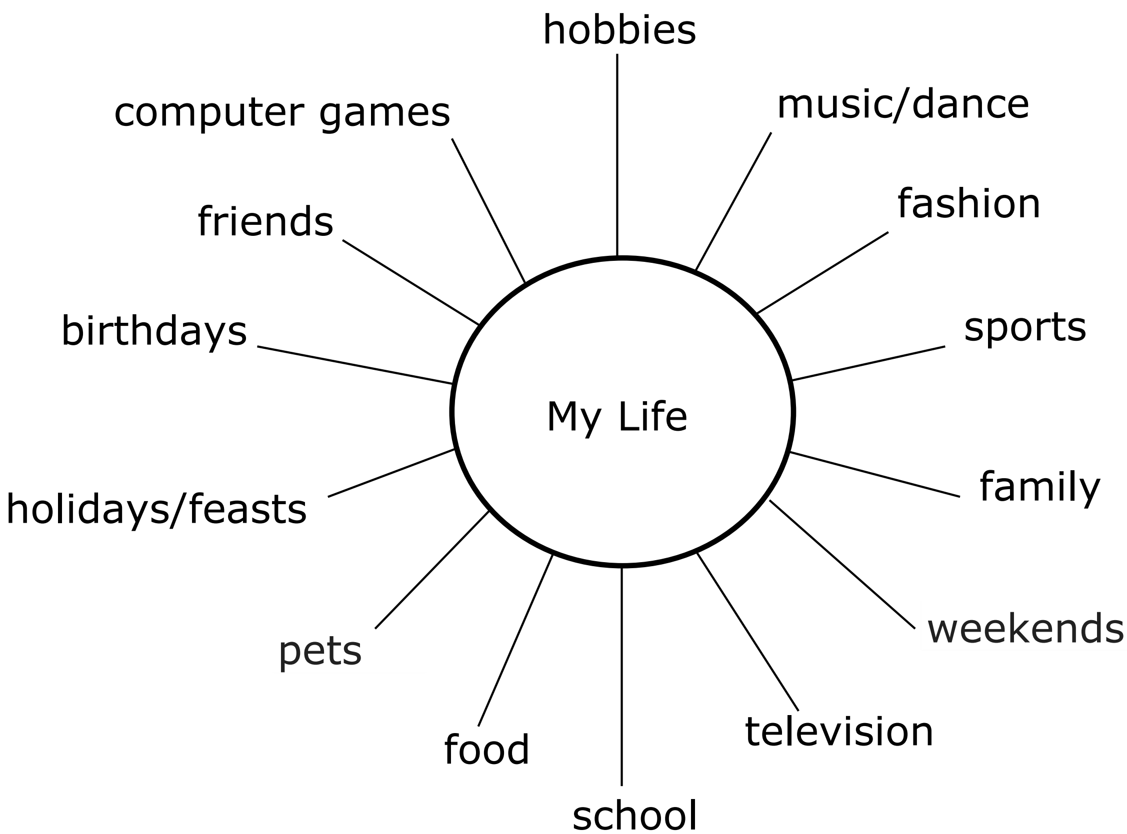
Town/village: _______________________

School: ___________________________

A mad boxer shot a quick, gloved jab to the jaw of his dizzy opponent.

A mad boxer shot a quick, gloved jab to the jaw of his dizzy opponent.




hobbies
music/dance
fashion
sports
family
weekends
television
school
food
pets
holidays/feasts
birthdays
friends
computer games
My Life

Appendix D

Version 1 of the Test used for Data Collection (Maltese)

Għall-użu uffiċċjali biss:

Ħiliet fil-Kitba

Isem: ______________________

Tifel/tifla (*agħżel*)

Data tat-Twelid: _____________

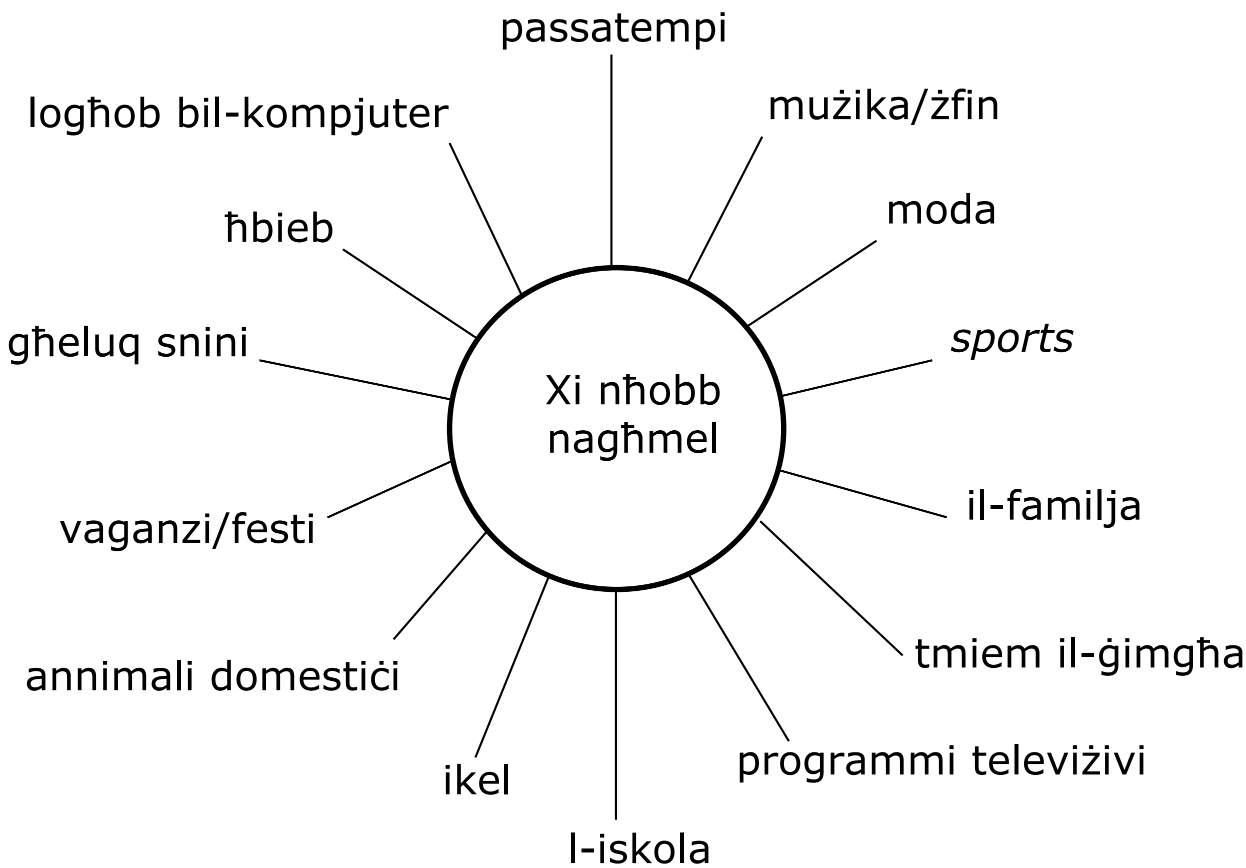
Lemin/xellug (*agħżel*)

Belt/raħal: ____________________

Skola: ________________________

Kien liebes gozz ħwejjeġ u ċraret vera qodma u m'għażluhx fil-pront.

Kien liebes gozz ħwejjeġ u ċraret vera qodma u m'għażluhx fil-pront.


passatempi
mużika/żfin
moda
sports
il-familja
tmiem il-ġimgħa
programmi televiżivi
l-iskola
ikel
annimali domestiċi
vaganzi/festi
għeluq snini
ħbieb
logħob bil-kompjuter
Xi nħobb nagħmel

Appendix E

Parents' Questionnaire[58]

Name of child: ____________________ Child's nationality ____________________

Name of school: ____________________________________

Mother's[59] level of education (*circle*): **primary** **secondary** **post-secondary** **vocational** **tertiary**

Father's[60] level of education (*circle*): **primary** **secondary** **post-scondary** **vocational** **tertiary**

Mother's nationality _____________________ Father's nationality ____________________

Mother's occupation ____________________ Father's occupation ____________________

Please tick √ the correct answer. If you use both languages, or even another, please feel free to tick both or write down the third language.

	Maltese	**English**	**Other**
1 Which language/s does your son/daughter speak with his/her mother?			
2 Which language does your son/daughter speak with his/her father?			
3 Which language does your son/daughter speak with his/her brothers and/or sisters, if any?			
4 Which language does your family speak when you are having a meal together?			
5 Which language does your son/daughter speak with his/her friends?			
6 In which language do you think your son/daughter is more proficient?			
7 Which language does your son/daughter speak when he/she is angry?			
8 Which language does your son/daughter speak when he/she wants to talk about a problem?			

58 Used in part from Agius, R. (2012). *The development of a literacy assessment battery for Maltese children.* Unpublished Doctoral dissertation. Faculty of Health Sciences, University of Malta.
59 Including stepmother or foster mother.
60 Including stepfather or foster father.

Please tick √ **Yes** *or* **No**.	**YES**	**NO**
1. Was your child a late speaker?		
2. Were you ever concerned about your child's hearing?		
3. Has your child ever experienced any difficulties that might have interfered with schooling?		

Isem it-tifel/tifla: ______________________ Nazzjonalita': ____________________

Isem l-iskola: ____

Il-livel t'edukazzjoni tal-omm[61] (*immarka)*: **primarja** **sekondarja** **post sekondarja** **vokazzjonali** **terzjarja**

Il-livel t'edukazzjoni tal-missier[1] (*immarka)*: **primarja** **sekondarja** **post sekondarja** **vokazzjonali** **terzjarja**

In-nazzjonalita' tal-omm ________________ In-nazzjonalita' tal-missier _________________

Ix-xogħol tal-omm _____________________ Ix-xogħol tal-missier ______________________

Jekk jogħgbok, immarka √ l -lingwa li tuża. Jekk tuża t-tnejn flimkien, jew lingwa oħra, tista' timmarka ż-żewġ lingwi jew tista' tniżżel it-tielet lingwa hawn taħt.

	Malti	**Ingliż**	**Oħra**
1 B'liema lingwa j/titkellem it-tifel/tifla ma' ommu/ommha?			
2 B'liema lingwa j/titkellem ma' missieru/ha?			
3 B'liema lingwa j/titkellem it-tifel/tifla ma' ħutu/ha?			
4 B'liema lingwa titkellmu waqt li tkunu qegħdin tieklu?			
5 It-tifel/tifla, b'liema lingwa j/titkellem mall-ħbieb tiegħu/tagħha?			
6 B'liema lingwa taħseb li j/titkellem l-aħjar?			
7 B'liema lingwa j/titkellem meta j/tkun irrabjat/a?			
8 B'liema lingwa j/tesprimi l-problemi tiegħu/tagħha?			

[61] Jew kustodju legali

Jekk jogħgbok, immarka √ **IVA** jew **LE**.	**IVA**	**LE**
1. Ibnek/bintek beda/bdiet j/titkellem tard?		
2. Qatt kont imħasseb/ba dwar is-smigħ tat-tifel/tifla tiegħek?		
3. Ibnek/bintek qatt kellu/kellha xi diffikultajiet li żammewh/żammewha lura fl-istudju?		

Appendix F

Teachers' Questionnaire

Dear Teacher,

Thank you for taking the time to complete this questionnaire. Kindly tick or circle accordingly and feel free to include any suggestions you may have.

- Which subject do you teach? ____

- Which language do you use to address the children in class (during instruction)?
-

  1. Maltese
  2. English
  3. Mixed Maltese English
  4. Other _____________________________________

- Which language do you use when you address the children outside the classroom?
  1. Maltese
  2. English
  3. Mixed Maltese English

.

- Approximately how much time do students spend writing in class?

  5% 25% 50% 75% 95% of the lesson

- Approximately how much time do students spend copying from the board?

  5% 25% 50% 75% 95% of the lesson

- Tick the activity that requires the <u>longest</u> time for the student to complete at school:
  - ☐ write their own notes
  - ☐ copy from the board
  - ☐ creative writing
  - ☐ poetry appreciations
  - ☐ lab reports
  - ☐ other ____

Thank you.

__________________________ __________________________

Fiona Galea
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Dr Rachael Agius
Supervisor
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Appendix G

Permission from the Publishers to Modify DASH

Pearson

Pearson Clinical Assessment
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London WC2R 0RL, UK
+44 (0)845 630 8888
info@pearsonclinical.co.uk
pearsonclinical.co.uk

Detailed Assessment of Speed of Handwriting (DASH): Research Agreement

25th April 2017

Note: This notice will replace the previous notice of 10th April 2017

Dear Ms Galea,

This memo is intended to notify Ms Fiona Galea that she may proceed with plans to produce a derivative of the DASH in Maltese and English for the purposes of research only, while awaiting the full completion and execution of their official license from Pearson. Pearson understands the

relevant details of the license (number of administrations, languages, format, etc...) are expected to be maintained during this interim period and will be reconciled upon execution and of the actual license. If administrations and derivatives remain at 300 per year (from 2017 – 2020) or less and remain as stated in the details below (provided by Ms Galea) then no fees will be payable.

Details of request per Ms Galea:

Purpose of Translation: Research

Brief Description: I need permission to reproduce the format of the test. In my test the participants will copy best and copy fast a DIFFERENT pangram for two minutes. The alphabet task will be replaced by a copy from the board task. The graphic speed test will be kept. The free writing task will be kept, and the participants will still be asked to write about My Life. However some ideas will be modified. The time mark // will be kept, and similar scoring procedures as those in the DASH will be adopted.
Specific list of materials: I will not reproduce any of the material in the DASH directly, except for the graphic speed test, but will add a couple of crosses on the top line by way of example. Furthermore, the record form of my test will be very similar to that of the DASH, but will not be an exact replica.
Number of subjects/administrations or copies needed per year: 300
Adaptation and/or format changes required:
Is this request for permission to translate: Yes
Is this request for permission to use materials in a book: No
Permission Requests - Section II (Translation Information)

Additional Comments: A version of the DASH will be created in Maltese. The format of the DASH test is kept, such as pangram copying; the graphic speed test; and the free-writing task. However, the pangram is not a direct translation of the one in the DASH. The title of the free writing task will be XNhobb Naghmel (What I Like to Do). The web will be kept. However, just as in the English version of the test, some more ideas will be added to the original web of the DASH. These shall be translated into Maltese. A copy from the board exercise will replace the alphabet writing task. Very similar scoring procedures as the ones proposed in the DASH will however apply.

Yours sincerely,

Shelley Hughes

Shelley Hughes
Senior Product Manager
+44 (0)114 2555 195
shelley.hughes@pearson.com

Appendix H

Level of Attainment 8 - English

Subject Focus: Language awareness and production

1] I can use the full range of punctuation marks.

ACCURACY

2] I can construct complex sentences.

PLANNING AND REFLECTION

3] I can use and explain spelling rules. I am aware of well-known exceptions to these rules.

ACCURACY

4] I can use the passive voice accurately and can apply it to appropriate contexts *e.g. report writing in science subjects*.

PLANNING AND REFLECTION

5] I can understand and use language which expresses hypothetical situations and possibilities *e.g. modals and conditionals*.

6] I can report, both in speech and in writing, what others have said or written,

7] I can understand how most words behave together *e.g. collocations, false friends* and use these patterns in context of specific situations.

8] I can make use of affixes *e.g. -ness, -ly, -ful, -un, -dis,* to build new words.

9] I can make use of link words to sum up and to compare and contrast ideas.

10] I can distinguish between compound and complex sentences, and I can use them accurately to achieve some stylistic variety in my writing.

11] I can narrate events/stories, describe persons/objects/scenes, and accurately express simple arguments for and against in writing.

Subject Focus: Writing

1] I can use a wide range of complex sentence structures.

WRITING

2] I can edit and revise my own writing.

3] I can write in an appropriate way with the right tone as well as make use of words to create a particular mood or feeling.

PLANNING AND REFLECTION

4] I can write a longer text organised in a series of paragraphs.

LEARNING TO DO

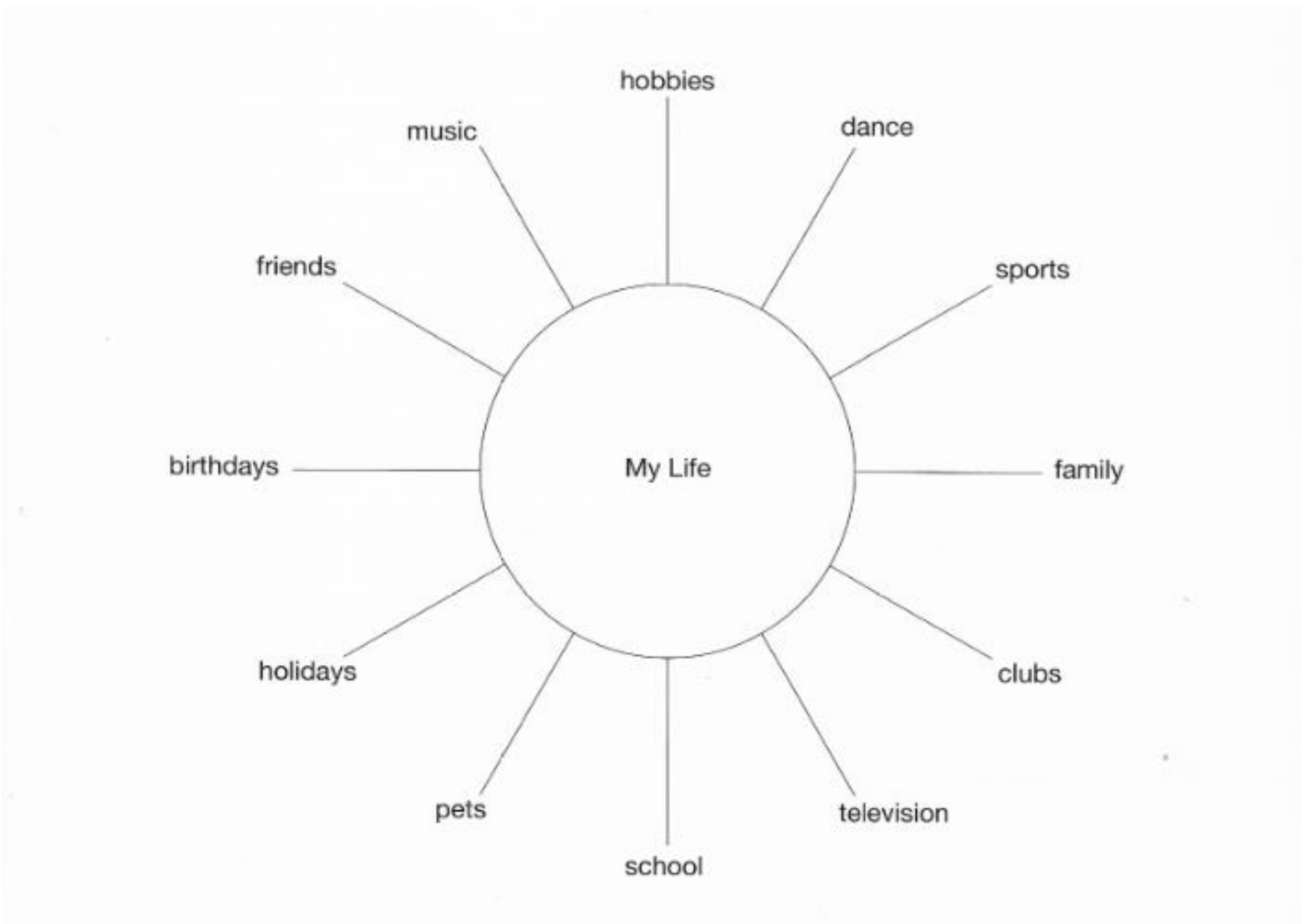
5] I can write appropriately and with a purpose for an audience.

6] I can write using the appropriate register.

7] I can produce texts in different genres.
8] I can order and link my sentences and paragraphs in a way that makes sense.
9] I can produce scientific and technical pieces of writing.

Appendix I

DASH *Free Writing* Spider Diagram



Appendix J

Test Sheet Administered During the English Pilot Study

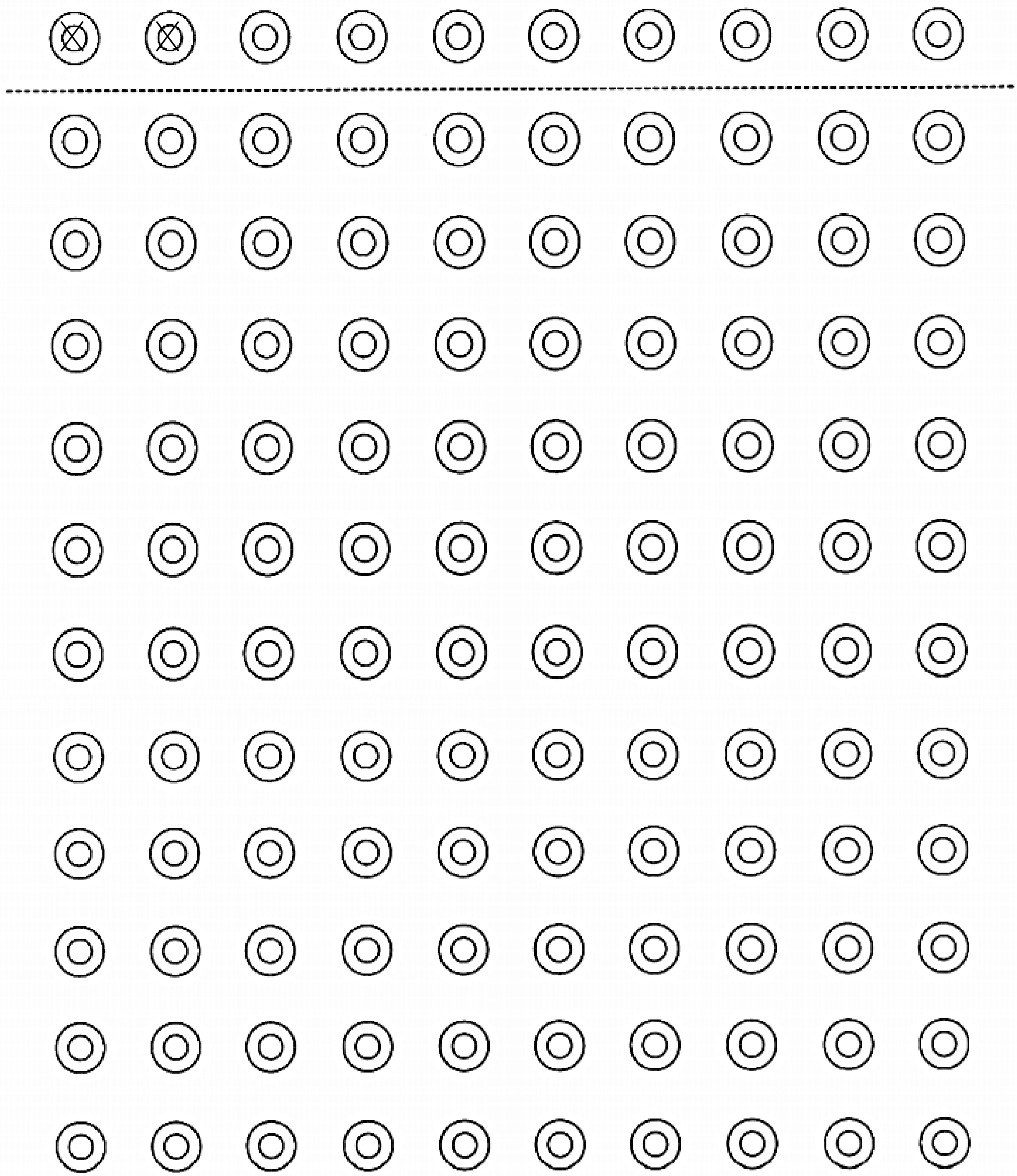
For office use only:

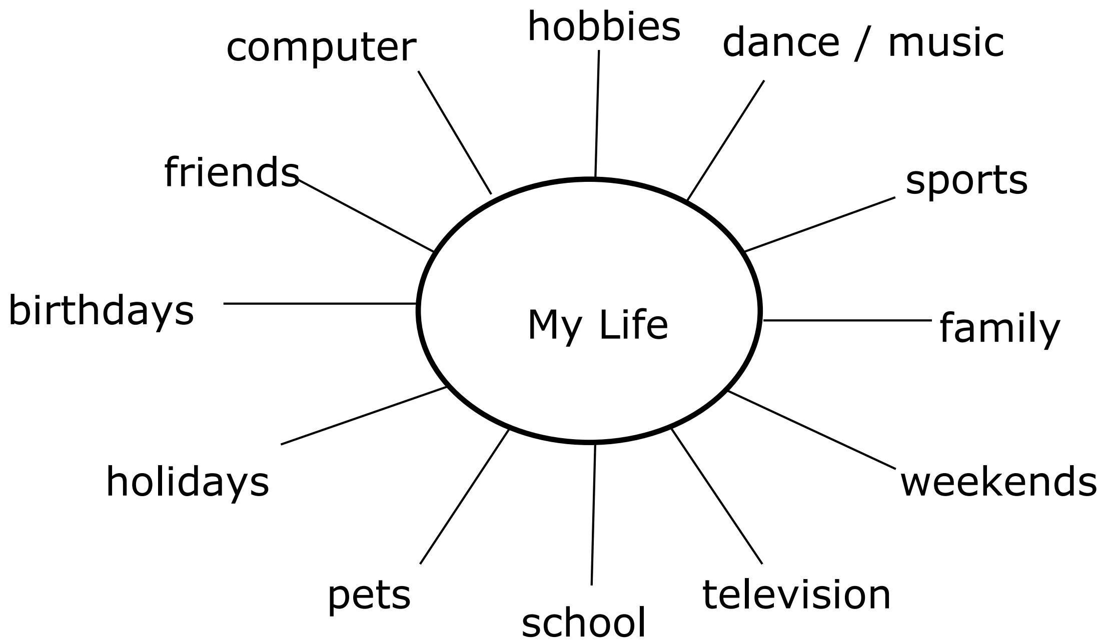
Handwriting Speed Assessment

Name: ______________________	Left handed/right handed (*please circle*)
Male/female (*please circle*)	Town/village: _____________________
Age: ________________	School: _________________________

A mad boxer shot a quick, gloved jab to the jaw of his dizzy opponent.

A mad boxer shot a quick, gloved jab to the jaw of his dizzy opponent.




My Life
hobbies
computer
dance / music
friends
sports
birthdays
family
holidays
weekends
pets
school
television

Appendix K

Test Sheet Administered During the Maltese Pilot Study

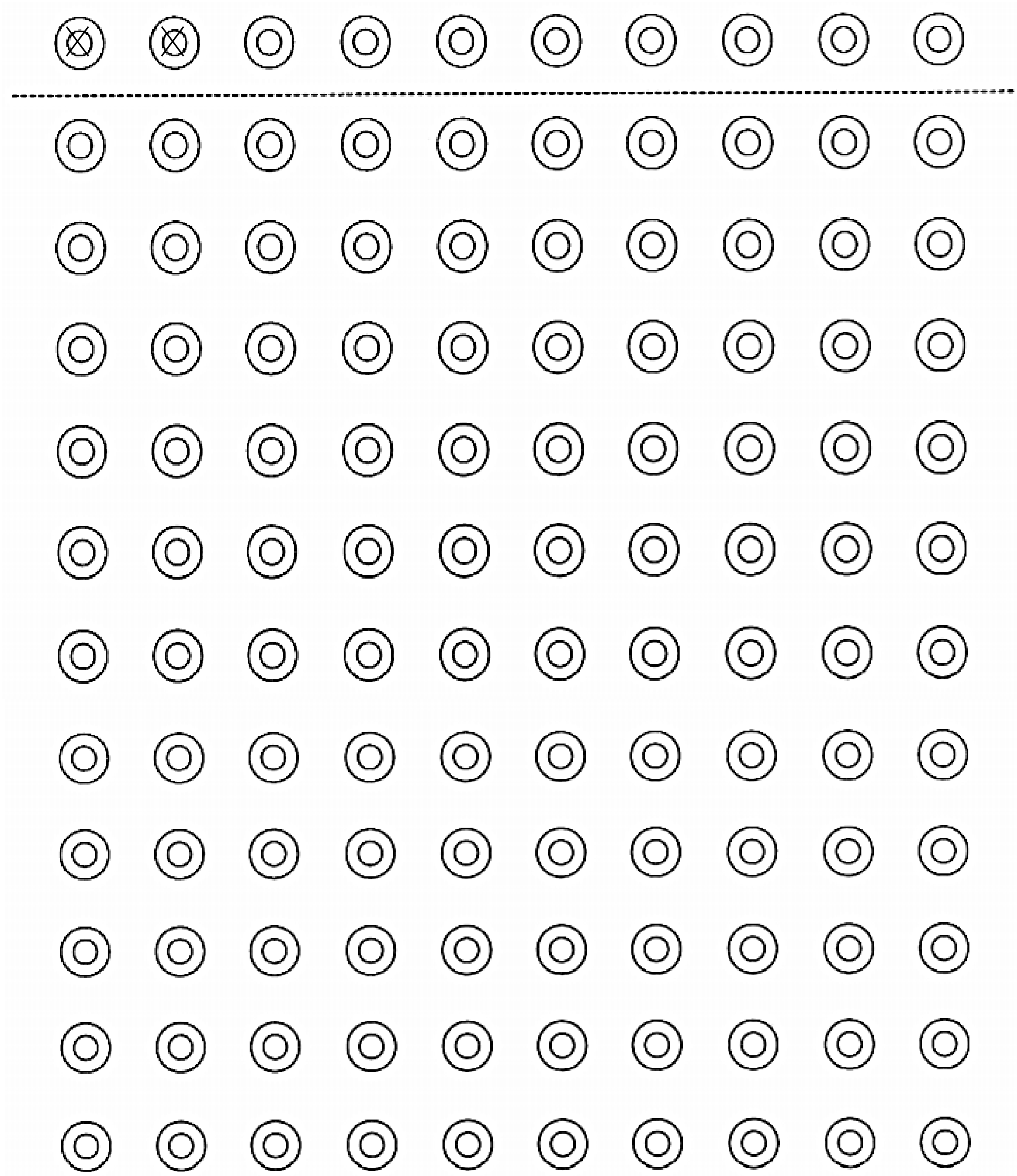
Għall-użu uffiċċjali biss:
____

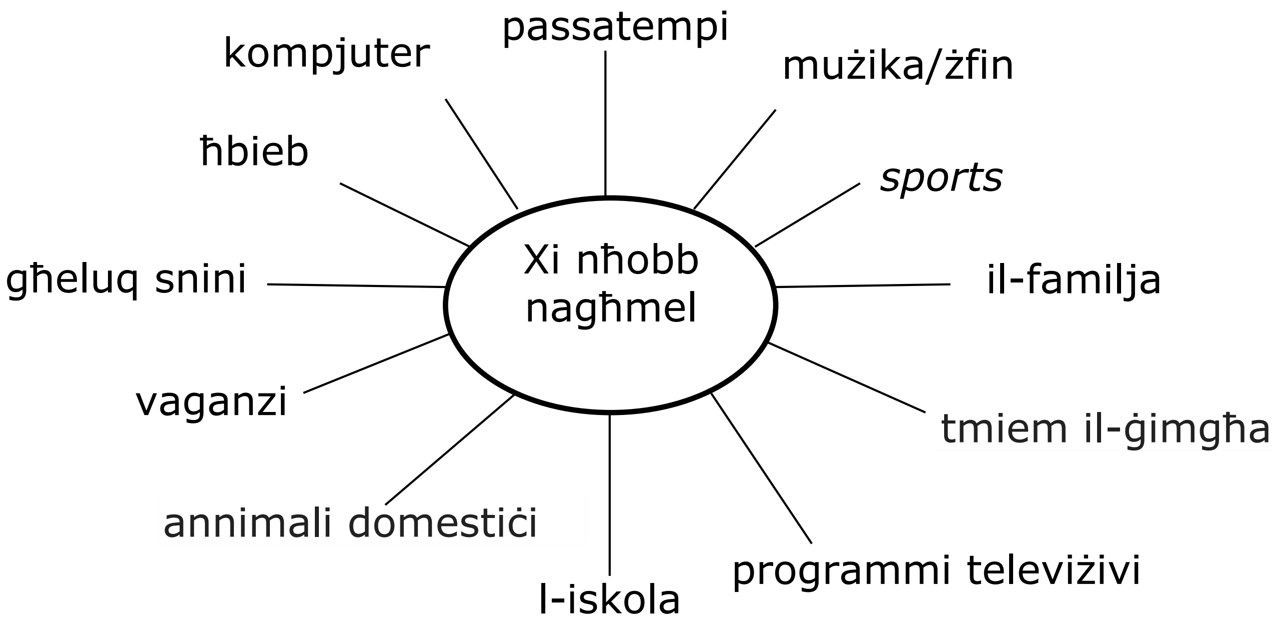
Ħiliet fil-Kitba

Isem: ____________________	Lemin/xellug (*agħżel*)
Tifel/tifla (*agħżel*)	Belt/raħal: ___________________
Eta': ____________	Skola: ________________________

Kien liebes gozz ħwejjeġ u ċraret vera qodma u m'għażluhx fil-pront.

Kien liebes gozz ħwejjeġ u ċraret vera qodma u m'għażluhx fil-pront.




Xi nħobb nagħmel
passatempi
kompjuter
mużika/żfin
ħbieb
sports
għeluq snini
il-familja
vaganzi
tmiem il-ġimgħa
annimali domestiċi
programmi televiżivi
l-iskola

Appendix L

Level of Attainment 8 – Maltese

Subject Focus: The Language

The consonants:
1] I know how assimilation happens between 2 strong consonants at the end of a word, e.g***. Il-ħobż mixwi. / Radd ħajr. / Sadd il-bir. / Ħadd ma ġie.***
2] I know that there a number of consonants that are pronounced as a specific sound even though they are written in a different way, for example zz pronounced as /żż/ like in '***gazzetta'***; ts/ds/dds/ pronounced as /zz/ like in ***'għadsa***'; tx/ttx/dx/ddx/dtx pronounced as /iċ/ like in '***ħattx***'; sx/ssx/żx/żżx/ pronounced as /xx/ as in 'ħ***ażżx***'.
3] I know when liquid consonants can stand without a vowel, such as when they have 'j/w' directly before or after them, for example in '***bejnna***', '***rawlna***', '***ittrejnjajt***'.
The vowels:
4] I know when the vowel belongs to the word (etymological), it's euphonic ***(tal-leħen***) or servile (morphological) in words like ***'importanti', 'assassin', 'l-iskola', 'nilagħbu', 'pajjiżi', 'ħaddiema***', and so on.
5] I know when I have to use the euphonic vowel in front of foreign nouns that start with a sequence of 2 consonants one after the other (double or not), such as ***'l-ipparkjar', 'l-ivvjaġġar', 'l-istampar***', and so on.
The article:
6] I know that I have to write the article in front of certain names and sometimes this is assimilated to the first consonant, such as in names like ***Il-Gudja*** and not ***Gudja***; ***Ħaż-Żebbuġ*** and not ***Ħaż Żebbuġ***, and so on.
7] I know that since in Maltese there is no indefinite article, we can still create a sense of indefiniteness by using '***wieħed/waħda***', for example ***'Kien hemm wieħed raġel***...'
8] I know that the article in front of words that start with '***għ/h***' can also be used with the euphonic vowel 'i', such as in ***'l-/il-għasfur'; 'il-/l- hena***'.
The particles:
9] I can correctly write and use the short version of lil/lill- such as in: ***'Tlabt 'l Alla' and 'Tlabt 'il Pawlu'; 'Rajna 'l-għalliema'; 'Kellimt 'il-Pap***a'.
10] I know when the prepositions '***bi***', '***xi***', '***fi***' cannot be shortened in front of a word that starts with 2 consonants, such as in words like ***'bi dwiefer twal'; 'bi mqass jaqta'', 'xi rrid', 'sejjer xi mkien', 'fi rzieze***t' and so on.
11] I know when the preposition cannot be shortened because it means something else, such as in ***'f'xi iġmla', 'xi isqra', 'xi ilsna', 'xi isqo***f' and so on.
12] When writing sentences, I can use well subordinate conjunctions such as ***'iżda', 'imma', 'lanqas', 'madankollu'***; and the conditional conjunctions such as ***'kieku', 'jekk', 'li ma***'.
13] When writing sentences, I can use well the adverbs that show quantity, negation and questions such as '***bosta***', '***qatt***', ***'kif***'.
The verb:
14] I can use foreign verbs (those derived from Romance languages and English and did not integrate into the semitic ones) in the perfect tense and person in speech and in writing of

sentences such as in ***'Marc ipparkja l-karozza ħażin'; 'It-tim ittrenja ħafna'; 'L-għalliem issejvja kollox fuq diska kompatta'.***
15] I can use foreign verbs (those derived from Romance languages and English and did not integrate into the semitic ones) in the imperfect tense and person in speech and in writing of sentences such as in ***'Marc jipparkja l-karozza ħażin'; 'It-tim jittrenja ħafna'; 'L-għalliem jissejvja kollox fuq diska kompatta'.***
16] I can use foreign verbs (those derived from Romance languages and English and did not integrate into the semitic ones) in the future tense and person in speech and in writing of sentences such as in ***'Marc se jipparkja l-karozza ħażin'; 'It-tim ser jittrenja ħafna'; 'L-għalliem ser jissejvja kollox fuq diska kompatta***'.
The negative:
17] I can out verbs in the negative by using the particles '***la', 'qatt ma', 'xejn bħal', 'La tisraqx', 'Ma kienet tajba xejn', 'Qatt mhu se tarani aktar'.***
18] I can shorten the participle of the negative '***ma***' to '***m***'' when it features in front of a vowel, an '***għ***' or '***h***' such as in '***ma hemmx/m'hemmx'; 'm'afdax/ma afdax***'.
The morphemic stem:
19] I know that instead of the consonantal root, some verbs use the morphemic stem together with a number of prefixes and suffixes to create new words and meanings, such as ***'nedukaw', 'edukajna', 'edukat', 'edukatur', 'edukattiv***', '***maledukat***' and so on derived from the root ***'eduk***'.
The forms of the semitic verb:
20] I know how verbs are created in the 2nd, 5th, 3rd and 6th form, and I appreciate the different meanings that can be derived such as ***'kiser idu', 'kisser it-tazza', 'tkisser bix-xogħol', 'il-ħġieġa tkissret'; 'id-dar tbierket', 'il-qassis bierek l-iskola'.***
The composed and auxiliary verbs:
21] I can use the word '***għad***' to mean a far away future such as in ***'Għad jasal żmien li..***.'
22] I can create and use the auxiliary verbs ***'kien***', '***qiegħed'*** and '***kellu***' both by themselves as well as when they are used in front of other verbs such as '***kien jiekol', 'qiegħda tisma'', 'kellu jiltaqa***''.
The nouns:
23] I know how to derive diminutive or augmentative nouns from other nouns, whether the words have semitic or Romance origins such as '***ġnien-ġnejna'; 'tifel-tfajjel'; 'bank-banketta', 'bankun'; 'furketta-furkettun'; 'tromba-trumbetta' and 'trumbun'.***
24] I know that some verbs are considered singular when they refer to groupings such as '***ġemgħa', 'folla nies', 'klassi tfal', 'mazz karti', 'serbut nemel', 'armata suldati'.***
25] I know that certain foreign nouns can have different forms of plural (both '***miksur***' and ***'sħiħ'***) such as ***'bnadar/bandieri'; 'toroq/triqat', 'bolli/bolo***l'.
The possessive in the construct state (***l-istat kostrut***t):
26] I can use the possessive by making use of phrases in the construct state between 2 nouns or more such as in '***bint is-sultan***'; '***f'daħlet Bieb il-Belt'***.
The pronouns:
27] I know how to write correctly the attached pronouns (***pronomi mehmużin***) when they are attached to verbs (both in the affirmative and the negative) and that they have both the direct and the indirect object attached to them, especially when I use pronouns in the third person (u/hu/ha) in the middle of a composite word such as '***għaddih', 'm'għaddihiex'; 'għaddihulna/għaddihielna***'.

28] I know how to write the participle ***'kontra***' when used with pronominal suffixes such as ***'kontrija'*** and '***kontrih***'.
The adjective:
29] I know how to use the adjective in the absolute superlative form, for words with semitic as well as foreign origins such as ***'aħmar nar'; 'interessantissimu' and 'importantissimu***'.
Affixation:
30] I can recognise that there are quite a number of prefixes that I can use to build new words such as '***maledukat***' and '***maledukazzjoni***' from '***edukat', 'arċisqof'*** from '***isqof'*** and '***bużnannu***' from ***'nannu'***.
31] I know when I should attach the prefix to the word and when it should remain separate such as in '***antiklerikali***' and ***'anti-Taljan***'.
32] I know I can add a foreign consonant in the middle of the consonantal root to create a new form and meaning of the verb such as '***kiser-kisser'*** and '***waqa' -waqqa***''.
33] I know that I can add a number of different suffixes to nouns, verbs and adjectives (consonants and/or vowels at the end of the word) to build words with new meanings such as suffixes for the ***'plural sħiħ***', the pronominal suffixes and the perfect, among others, for example '***ommijiet***', '***qalbek***' and '***ġabet***'.
Syntax:
34] I can change an active sentence into a passive one by using the forms of the verb as well as the past participle, such as ***'Il-qattus qabad il-ġurdien' - 'Il-ġurdien inqabad/ġie maqbud mill-qattus***'.

Subject Focus: Writing

1] I can find good models of writings in different genres to expand my vocabulary, expression, idiomatic use, style and progression of my writings depending on my aims and the audiences I have in mind.
2] I can read my writings and revise them by editing, deleting repetitions, adding where needed, clarifying some points and refining them.
3] In my writing I use whole, composite and complex sentences and I tie a paragraph with another in a sequence when I'm writing about complex themes.
4] I can write captions with essential and concise information for photos of artistic works like sculptures and paintings in classical, modern and abstract art.
5] I can write adverts of between 50 and 70 words together with slogans related to them.
PRACTICAL
6] I can write informal emails of between 50 and 70 words.
COMMUNICATION
7] I can write instructions on how to work and use different equipment like tools, computers, televisions, mobile phones and so on.
8] I can write reports of between 50 and 70 words about stories and events that happened.
9] I can write fictional stories, for example those with a historical setting, thrillers, maritime and so on, of between 200 and 250 words that feature characters, stories, places and settings.
10] I can write stories and poems by using human voices, creatures, objects and so on, that are animated/inanimate depending on the different contexts where I show sympathy, empathy, anger, regret, appreciation and so on.

11] I can write texts and dialogues in different registers of the Maltese language used in Mathematics, Physics, Chemistry, Biology, Geography, Social Studies, History, Religion, Information Technology, Home Economics, Art, Physical Education, Technological Design, Personal Development Studies, Drama, Expressive Arts and vocational subjects.
12] I can write biographies of between 250 and 300 words about Maltese and foreign authors, artists, singers and actors that include an appreciation of their artistic and cultural contribution.
13] I can write argumentative pieces of between 250 and 300 words based on pre-researched information and give my personal views and positions.
14] I can write a speech about a current theme of between 250 and 300 words.
15] I make sure I write or type my pieces in Maltese that is free of mistakes in syntax, morphology and grammar, spelling and punctuation, and I present them in a clear and neat way.

USE OF DIGITAL MEDIA

16] I use modern technological means to present my writings in Maltese fonts, for example when I write an email, present a project and so on.

Appendix M

Instructions for Test Administrators

Instruct the students to use only blue or black ink during the test (no pencils or other coloured pens) and not to use correction fluid.

The *Copy Neatly* Subtest

Ask the students to look at the sentence *A mad boxer shot a quick, gloved jab to the jaw of his dizzy opponent* (or *Kien liebes gozz ħwejjeg u ċraret vera qodma u m'għażluhx fil-pront* for the Maltese test). Point to the sentence and read it aloud slowly and clearly. If you have any doubts about the pupil's knowledge of the meaning of certain words, explain the meaning of these words to them.

Circulate round the room to make sure that everybody is at the right exercise.

Say: 'When I say 'start', I'd like you to write this sentence in your best handwriting. Keep writing the same sentence in your best handwriting over and over again until I tell you to stop. After one minute, I will say 'time mark' (or '*mark tal-ħin*' or simply '*marka*' for Maltese). When you hear this, insert the time mark // on the test paper, even if you are in the middle of a word.

If you make a mistake, just cross out that mistake with a single line.'

Say: 'Ready....start'.
Start the timer as unobtrusively as possible.

At one minute say: 'Time mark' or 'Marka tal-ħin'.

At two minutes say: 'Stop! Stop writing and put your pen down.'

The Copy Quickly Subtest

Ask the students to turn over the page and to look again at the sentence A mad boxer shot a quick, gloved jab to the jaw of his dizzy opponent *(or* Kien liebes gozz ħwejjeg u ċraret vera qodma u m'għażluhx fil-pront *for the Maltese test)*. Circulate round the room to make sure that everybody is on the second page.

Say: 'Now look again at the sentence. This time I want you to imagine that you are doing an exam and that you have to write very quickly. However what you write has to be readable. So now I want you to write this sentence as quickly as possible, but legibly.

Keep writing the same sentence over and over until I tell you to stop. After one minute I will say 'time mark' (or '*mark tal-ħin*' or simply '*marka*' for Maltese). When you hear this, insert the time mark // on the test paper, even if you are in the middle of a word.

If you make a mistake, just cross out that mistake with a single line.'

Say: 'Ready....start'.
Start the timer as unobtrusively as possible.

At one minute say: 'Time mark' or 'Mark tal-ħin'.

At two minutes say: 'Stop! Stop writing and put your pen down.'

The *Copy from the Board* Subtest

Project the text to be copied on the interactive white board (the English version for the English assessment battery and the Maltese version for the Maltese assessment battery). Ask the students to find page 3 of the test, and circulate round to make sure that everybody is on the right page. Explain to the students that they will have two minutes in which to copy as much of the projected text as possible.

Say: 'Try to write as fast but as neatly as possible. Imagine that you are copying notes off the baord. You have to be fast before the teacher changes the slide or rubs off the baord, but you have to be neat, as later on you will have to read the notes again for revision.

Do not write anything in the margin on the right.

Cross out any mistakes that you make with a single line and keep on writing.

Stop writing when I say 'stop', even if you are in the middle of a word.'

Say: 'Ready....start'.

Start the timer as unobtrusively as possible.

At one minute say: 'Time mark' or 'Mark tal-ħin' (for Maltese).

At two minutes say: 'Stop! Stop writing and put your pen down.'

The Graphic Speed Test subtest

Ask the students to turn over the page and to find the page with the circles on it.

Participants have to draw Xs in circles for 1 minute. Demonstraw the task to the students on the baord, emphasising the following rules:

• drawing an X not a cross (+)
• the two lines must intercept within the inner circle
• the lines must extend at least to the boundaries of the inner circle
• the lines must not extend beyond the outer circle
• working quickly but accuraidy.

Also show what is not acceptable.

For practice, allow the student to complete the first row on their page. Circulate round the room to make sure that everybody has understood the instructions. Re-demonstrate if necessary.

Say: 'Now I want you to draw Xs, like this one (demonstrte on board) in each circle. Try to do as many as you can, but don't break the rules. Work quickly but carefully. Keep on working even if you make a mistake. You have one minute for this exercise. Don't expect to fill-in all the circles on the page. Start when I say 'start', and stop when I say 'stop'. When I say 'stop', put down your pens immediatley.

Say: 'Ready....start'.
Start the timer as unobtrusively as possible.

At one minute say: 'Stop! Stop writing and put your pen down.'

The *Free Writing* Subtest

Ask the students to go to page 5 of the test. Circulate round to make sure that everybody is on the right page. Explain that this is a longer writing task in which the students will write about their lives (for English) or what they like to do (for Maltese).

Point at the Spider Diagram at the top of the page. Explain that these are topics they may write about, but that they will have one minute planning time to add to these topics, delete or replace them as they deem fit. You could create a similar spider diagram on the board to discuss the different prompts provided, or else do it orally. Ideas may be exchanged and students may take down notes during the discussion.

Say: 'If you don't like this title, you may write about something else. It does not really matter what you write about as long as your write continuously for ten minutes. You do not have to write about what really happened or full truths.'

Write whatever comes to mind in whichever order this occurs. You don't have to bother about introductions or conclusions or putting paragraphs in order.

Do not produce a list.

Do not write anything in the margin on the right.

Write in your everyday handwriting.

If you make a mistake, just cross out that mistake with a single line.

When you are writing I will be calling 'time mark' (or '*mark tal-ħin*' or simply '*marka*' for Maltese) every two minutes. When you hear this, simply mark the point in your writing with this rnark // (demonstrate on the board) and then carry on. No matter how much you have written since the last mark, maybe even no words at all, always put in the time mark when you are told.

If you need more paper I will give it to you.

We are now going to have a minute to discuss the prompts and think about what to write and to make some notes, and then I'll tell you when to start writing.'

Start timing for the 1-minute preparation period. Allow the student to make brief notes on what they might write about on the given spider diagram. After 1 minute, stop timing. During this 1 minute, ideas may be exchanged. Instruct students not to write anything on the lines, but to add their notes to the spider diagram.

Ask the students to get ready to sart writing on the lined paper below the spider diagram. They do not need to write the title.

When they are ready say: 'Ready... now start writing'. Start the timer as unobrusively as possible.

Call out the time mark after 2, 4 6 and 8 minutes have passed. While the students are writing, circulate round the room to make sure that everybody is marking the time line appropriatley.

When the 10 minutes are up, say: 'Stop. Stop writing and put your pen down even if you are in the middle of a sentence.'

Appendix N

Informative Letter to Parents/Guardians and Consent Form

Dear Parents/Guardians,

I am a PhD student with the Department of Communication Therapy, Faculty of Health Sciences, University of Malta. As part of my research, I hope to develop a handwriting speed test for children aged between 14 and 15 years. The aim of this assessment is to identify students with writing difficulties.

I would like to request your kind consent to your child's participation in this research. Should you consent, your child will be asked to take part in a few short writing tasks, including copying text from the board and writing a short paragraph. Testing will take place at school on two different sessions, within a few days of each other, with each session lasting about 35 – 40 minutes. During each session, the class will be tested altogether. Participation in this research is anonymous, confidential and voluntary, and you may withdraw from this study at any time.

The Head of School, the Education Division, and the Secretariate of Education have also been informed and the necessary consent obtained. If you consent, kindly complete and sign the consent form below and fill in the attached questionnaire. Please return the forms with your child to school at your earliest convenience.

The aims and details of the project on Handwriting Speed Assessment have been explained to me by Ms. Fiona Galea. I have also explained to my child what this study entails.

I understand that the information collected will remain confidential, and that it will be used only for research purposes. I also know that a written report will be drawn, but that neither I nor my child will be identified in any way, and that once the study is complete, all the information collected will be destroyed.

I therefore give my consent to Ms. Fiona Galea to make the necessary observations on my child ____________________________.

I am aware that I am under no obligation to participate and that I can withdraw my participation at any time without giving any reason. In case of difficulty during the study I can contact Ms. Fiona Galea on 79273984 or via e-mail (fiona.galea.99@um.edu.mt).

Name of parent/guardian: ________________________ Signature: __________________

____

Fiona Galea
PhD Student
fiona.galea.99@um.edu.mt
Mob: 79273984

____

Dr Rachael Agius
Supervisor
rachael.agius@um.edu.mt

Ittra nformattiva lill-ġenituri

Għeżież Ġenituri/Kustodji,

Jien qed nagħmel dottorat mad-dipartiment tal-*Communication Therapy,* fi ħdan il-fakulta tax-Xjenzi tas-Saħħa, l-Universita' ta' Malta. Jiena qed naħdem biex niżviluppa test ta' kitba għal tfal ta' bejn l-14 u l-15-il sena, li jista' jgħin jiddetermina xi diffikultajiet li jista' jkun hemm fil-kitba.

Nixtieq nitlob il-permess tiegħek biex ibnek/bintek t/jieħu sehem f'dan l-istudju. Jekk taċċetta, ibnek/bintek ser j/tkun mitlub/a j/tikkopja xi sentenzi qosra minn fuq il-karta u minn fuq il-bord, u j/tikteb storja. It-test ser isir l-iskola f'żewġ seduti ta' madwar 35 – 40 minuta l-waħda, fi żmien ftit jiem minn xulxin. It-tfal ser jagħmlu t-test f'daqqa. Il-parteċipazzjoni f'dan l-istudju hija waħda anonima, kunfidenzjali u volontarja u int u ibnek/bintek j/tista' j/tieqaf j/tagħmel it-test meta j/trid.

Il-kap tal-iskola, id-Diviżjoni tal-Edukazzjoni, u s-Segretarjat tal-Edukazzjoni huma diġà infurmati b'din ir-riċerka u taw il-kunsens tagħhom. Jekk taqbel, jekk jogħġbok, imla l-formola hawn taħt u l-*questionnaire* mehmuża u ibgħathom lura l-iskola mat-tifel/tifla tiegħek mill-aktar fis possibbli.

L-iskopijiet u d-dettalji tal-proġett dwar *Handwriting Speed Assessment* spjegathomli Ms. Fiona Galea. Jiena spjegajt ukoll lit-tifel /tifla tiegħi dak li se jsir.

Jiena naf li l-informazzjoni miġbura se tinżamm kunfidenzjali, u li se tintuża biss għal skopijiet ta' riċerka. Naf ukoll li ser isir rapport bil-miktub tar-riżultati u li meta dan iseħħ, jiena jew it-tifel/tifla tiegħi, bl-ebda mod m'aħna se nkunu nistgħu niġu identifikati. Meta jispiċċa l-istudju l-informazzjoni miġbura se tiġi meqruda. Għalhekk qed nagħti l-kunsens tiegħi lil Ms. Fiona Galea biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel / tifla tiegħi ____________________________.

Jiena konxju li ma għandi l-ebda obbligu nipparteċipa f'dan l-istudju u li nista' nirtira fi kwalunkwe punt mingħajr ma nagħti raġuni. Jekk ikolli diffikultà waqt l-istudju nista' nistaqsi għal Ms. Fiona Galea, inċemplilha fuq 79273984, jew nibagħtilha e-mail fuq fiona.galea.99@um.edu.mt

Isem tal-ġenitur/kustodju ____________________________ Firma ____________________

Grazzi tal-għajnuna tiegħek.

____

Fiona Galea
Studenta tal-PhD
fiona.galea.99@um.edu.mt
Mowbajl: 79273984

____

Dr Rachael Agius
Superviżur
rachael.agius@um.edu.mt

Appendix O

Permission from Dr. Agius to Modify Questionnaire

Test of Reading, Phonological Awareness and Memory (TORPAM)
Rachael Agius 2012

The Literacy Assessment Battery (TORPAM) – Permissions to use questionnaire

The following is in reference to Ms Fiona Galea's email request (dated Friday, April 29, 2016) to consult with the *Language Preference Questionnaire* (Agius 2012) and adapt to suit the purpose of her proposed doctoral study in Health Sciences entitled *The development of a writing speed diagnostic assessment for Maltese pupils aged 14-15 in the Maltese and English Languages*.

Permission to adapt the Language Preference Questionnaire (LPQ) is granted only if the following conditions are met:

1. The student[1] is to acknowledge the author[2] in her manuscript.
2. The student is not to share the LPQ in any form or part with any third party.
3. The LPQ, in its entirety, is not to be included in the main text or the appendix of the PhD manuscript.
4. The LPQ, in its entirety, is not to be included in or appended to a research proposal or requests to ethics committees.
5. The LPQ, in its entirety, is not to be included or appended to information letters, consent forms or the like, that are distributed to parents, teacher, education staff, school principals and other professionals or third parties.
6. Should the student choose to use the LPQ in its entirety, she may do so only for the duration of the data collection phase with the specific participants of the proposed PhD study. Following completion of the data collection phase, the student no longer has permission to use the LPQ in its entirety.
7. If the student publishes information related to the LPQ in a journal, newspaper, magazine (and the like), publication must be in conjunction with the author of the LPQ. If the publication in question does not refer to the LPQ in any manner, then the student need not publish in conjunction with the author.

If the student is able to meet the above conditions, permission to consult with and adapt the Language Preference Questionnaire is granted for the duration of Ms Galea's PhD study.

Rachael Agius
29th April 2016

[1] Ms Fiona Galea
[2] Dr Rachael Agius

Appendix P

Informative Letter to Form Teachers

Dear Teacher,

I am a PhD student with the Department of Communication Therapy, Faculty of Health Sciences, University of Malta. As part of my research, I hope to develop a handwriting speed test for children aged between 14 and 15 years. The Education Division, the Head of School, the Secretariat for Catholic Education, as well as the students' parents, have been notified about this research, and the necessary consent has been obtained. The aim of this handwriting assessment is to identify students with writing difficulties.

As part of my research, I hope to test a group of Year 10 students within your school. They will be asked to take part in a few short writing tasks such as text copying and free writing. Testing will take place on two different occasions within a few days of each other, and should last about 35 to 40 minutes each. A short questionnaire will be handed out to the class teachers of the participating students to gather information about general language use at school and to determine how much time students spend writing in class. I would appreciate your valuable contribution. Could you kindly complete the attached questionnaire and return it to the head of school at your earliest convenience?

Thank you in advance for your support. Please do not hesitate to contact me should you have any queries.

Sincerely

Fiona Galea
PhD Student
fiona.galea.99@um.edu.mt
Mob: 79273984

Dr Rachael Agius
Supervisor
rachael.agius@um.edu.mt

Appendix Q

Approval from Faculty Research Ethics Committee (FREC) and the University Research Ethics Committee (UREC)

To be completed by Faculty Research Ethics Committee

We have examined the above proposal and advise

Acceptance **Refusal** **Conditional Acceptance**

For the following reason/s:

Discussed proposal with Prof Helen Grech as the student has been awaiting for permission to use a particular test for a number of months.

Signature:

Date: 16/02/2017

To be completed by University Research Ethics Committee

We have examined the above proposal and advise

Acceptance **Refusal** **Conditional Acceptance**

For the following reason/s:

15/3/2017

Signature:

Date:

9

Appendix R

Permit from the Ministry of Education to Carry out Research in State Schools

DIRETTORAT GHAL KWALITA' U STANDARDS FL-EDUKAZZJONI FURJANA VLT 2000 MALTA

DIRECTORATE FOR QUALITY AND STANDARDS IN EDUCATION FLORIANA VLT 2000 MALTA

Request for Research in State Schools

A. (Please use BLOCK LETTERS)

Surname: GALEA Name: FIONA

I.D. Card Number: 331077(M)

Telephone No: 21636231 * Mobile No: 79273984 *

Address: 25 MISTLETOE TRIQ L-ISKAL

Locality: M'SKALA Post Code: MSK 2135

E-mail Address: cyberfio@gmail.com

Faculty: SPEECH THERAPY Course: PhD Year Ending: 2021

Title of Research: THE DEVELOPMENT OF A WRITING SPEED DIAGNOSTI ASSESSMENT FOR MALTESE PUPILS

Aims of research: ☐ Long Essay ☐ Dissertation ☑ Thesis ☐ Publication

Time Frame: 6 YRS Language Used: ENGLISH

Description of methodology: THE DEVELOPMENT OF A WRITING SPEED DIAGNOSTIC ASSESSMENT FOR MALTESE PUPILS - A QUALITATIVE RESEARCH ANALYSIS

School/s where research is to be carried out: ALL SECONDARY STATE SCHOOLS students/ teachers/ parents

~~Years~~ / Forms: 4 Age range of students: 14-15

*** Telephone and mobile numbers will only be used in strict confidence and will not be divulged to third parties.**

I accept to abide by the rules and regulations re Research in State Schools and to comply with the Data Protection Act 2001.

<u>Warning to applicants</u> - Any false statement, misrepresentation of concealment of material fact on this form or any document presented in support of this application may be grounds for criminal prosecution.

Signature of applicant: [signature] Date: 7/4/2016

B. Tutor's Approval (where applicable)

The above research work is being carried out under my supervision.

Tutor's Name: RACHAEL AGIUS Signature: ____________

Faculty of Health Sciences
University of Malta

Faculty: HEALTH SCIENCES. Faculty Stamp: ____________

C. Directorate for Quality and Standards in Education - Official Approval

The above request for permission to carry out research in State Schools is hereby approved according to the official rules and regulations, subject to approval from the University of Malta Ethics Committee.

Raymond Camilleri
Director
Research and Policy Development

____________ Date: 05 / 05 / 2016 Official Stamp

Director
(Research and Development Department)

<u>**Conditions for the approval of a request by a student to carry out research work in State Schools**</u>

Permission for research in State Schools is subject to the following conditions:

1. The official request form is to be accompanied by a copy of the questionnaire and / or any relevant material intended for use in schools during research work.

2. The original request form, showing the relevant signatures and approval, must be presented to the Head of School.

3. All research work is carried out at the discretion of the relative Head of School and subject to their conditions.

4. Researchers are to observe strict confidentiality at all times.

5. The Directorate for Quality and Standards in Education reserves the right to withdraw permission to carry out research in State Schools at any time and without prior notice.

6. Students are expected to restrict their research to a minimum of students / teachers / administrators / schools, and to avoid any waste of time during their visits to schools.

7. As soon as the research in question is completed, the Directorate for Quality and Standards in Education assumes the right to a full copy (in print/on C.D.) of the research work carried out in State Schools. **Researchers are to forward the copies to the Assistant Director, International Research, Directorate for Quality and Standards in Education.**

8. Researchers are to hand a copy of their Research in print or on C.D. to the relative School/s.

9. In the case of video recordings, researchers have to obtain prior permission from the Head of School and the teacher of the class concerned. Any adults recognisable in the video are to give their explicit consent. Parents of students recognisable in the video are also to be requested to aprove that their siblings may be video-recorded. Two copies of the consent forms are necessary, one copy is to be deposited with the Head of School, and the other copy is to accompany the Request Form for Research in State Schools. Once the video recording is completed, one copy of the videotape is to be forwarded to the Head of School. The Directorate for Quality and Standards in Education reserves the right to request another copy.

10. The video recording's use is to be limited to this sole research and may not be used for other research without the full consent of interested parties including the Directorate for Quality and Standards in Education.

Statement of Consent

I hereby give my consent to the Directorate for Quality and Standards in Education to process and record personal and sensitive data being given herewith in order to be able to render me with the service I am applying for.
I fully understand that:
a) by opting out my application cannot be processed;
b) authorised personnel who are processing this information may have access to this data in order to supply me with the service being applied for;
c) edited information, that would not identify me, may be included in statistical reports.

I know that I am entitled to see the information related to me, should I ask for it in writing.
I am aware that for the purpose of the Data Protection Act, the Data Controller for this Directorate is:
The Directorate for Quality and Standards in Education
Floriana, VLT 2000

I have read and understood this statement of consent myself ✓

This statement of consent was read and explained to me ___________

Signature: __________ ID number: 331077(M) (Data subject)

Signature: __________ ID number: __________ (Reader if applicable)

Date: 7/4/ 2016

Data Protection Policy

The Data Protection Act, 2001 regulated the processing of personal data held electronically and in manual form. The Directorate for Quality and Standard in Education is set to fully comply with the Data Protection Principles as set out in the Act.

a) The Directorate will hold information you supply in accordance to your request to carry out research in State Schools and / or Directorates' documents.
b) The information you give may be disclosed to other Departments of the Directorate for Quality and Standards in Education, who may also have access to your data.

Your rights:
You are entitled to know what information the Directorate holds and processes about you and why; who has access to it; how it is kept up to date; what the Directorate is doing to comply with its obligations under the Data Protection Act, 2001.

The Data Protection Act, 2001 sets down a formal procedure for dealing with data subject access requests which the Ministry of Education, Culture, Youth and Sport follows.

All data subjects have the right to access any personal information kept about them by the Directorate either on computer or in manual files. Requests to access to personal information by data subjects must be made in writing and addressed to the Data Controller of the Ministry of Education, Culture, Youth and Sport. An identification document such as a photocopy of the Identity Card, photocopy of passport etc. of the data subject making the request must be submitted with the request. Such identification material will be returned to the data subject.

The Directorate aims to comply as quickly as possible with requests for access to personal information and will ensure that it is provided within reasonable time, the reason will be explained in writing to the data subject making the request.

All data subjects have the right to request that their information be amended, erased or not used in the event the data is incorrect.

Appendix S

Permit from the Secretariat of Catholic Education to Carry out Research in Church Schools

MALTESE EPISCOPAL CONFERENCE
Secretariat for Catholic Education

The Head
All Church Schools (Secondary)

5th February, 2016

Ms Fiona Galea, currently reading for a PhD in Writing Speed and Writing Speed Assessment at the University of Malta, requests permission to conduct a handwriting speed assessment with all secondary students.

The Secretariat for Catholic Education finds no objection for Ms Fiona Galea to carry out the stated exercise subject to adhering to the policies and directives of the schools concerned.

Rev Dr. Charles Mallia
Delegate for Catholic Education

Secretariat for Catholic Education. 16, The Mall, Floriana, FRN 1472. Tel: 27790060
E-mail: charles.mallia@maltadiocese.org

Appendix T

Letter of Request to College Principal

Dear Sir / Madam,

I am currently reading for a PhD, with the Department of Communication Therapy, Faculty of Health Sciences, University of Malta. As part of my research, I hope to develop a handwriting speed test for children aged between 14 and 15 years (Year 10). The aim of this test is to identify those students with writing difficulties. I would like to request your consent to administer the assessment battery to the Year 10 students within your college.

The tests, one in Maltese and one in English, include 3 copying tasks, a perceptual-motor integration task and a free writing task. Participation is on a voluntary basis, and participants may withdraw from the study at any time. Prior to testing, an informative letter and consent form will be sent to the students' parents through the school. Another informative letter and a questionnaire will also be distrubuted to the Year 10 form teachers through the school.

The Education Division has been notified about this research and has granted consent. If you agree to participate in this research, I would appreciate if you could kindly complete the attached consent form.

Thanking you in advance for your cooperation. Please do not hesitate to contact me should you have any queries.

Sincerely,

Fiona Galea
PhD Student
fiona.galea.99@um.edu.mt
Mob: 79273984

Dr Rachael Agius
Supervisor
rachael.agius@um.edu.mt

Appendix U

Letter of Request to Heads of Schools

Dear Sir / Madam,

I am a PhD student with the Department of Communication Therapy, Faculty of Health Sciences, University of Malta. As part of my research, I hope to develop a handwriting speed test for children aged between 14 and 15 years. The aim of this test is to identify students with writing difficulties. I would like to request your kind consent to test a group of Year 10 students within your school.

The students will be asked to complete 5 subtests: 3 copying tasks, 1 perceptual-motor integration task and 1 free writing task. Testing should last about 35-40 minutes, and will take place on two different occasions, within a few days of each other. Participation is on a voluntary basis, and participants may withdraw from the research at any time. Prior to testing, the parents will be provided with an informative letter and consent form, together with a questionnaire. With your permission, I hope to distribute these forms to the parents and returned to the school through the students. An informative letter and a questionnaire on teaching practices will also be distrubuted to the Year 10 form teachers through the school's administration.

For the purpose of this research, I would also like to ask for your permission to access the academic reports and profiles of the students. If granted, I hope to access the information through the inclusion coordinator and I would only use information that is directly related to the research. The inclusion coordinator will be provided with an information letter in this respect.

The Education Division, the College Principal and the Secretariate of Education have been notified about this research and have granted consent. If you agree to participate in this research, I would appreciate if you could kindly complete and sign the attached consent form.

Thanking you in advance for your attention. Please do not hesitate to contact me should you have any queries.

Sincerely,

Fiona Galea
PhD Student
fiona.galea.99@um.edu.mt
Mob: 79273984

Dr Rachael Agius
Supervisor
rachael.agius@um.edu.mt

Consent form for research in school

Project title: The Development of an English-Maltese Assessment of Speed of Handwriting
Name of Researcher: Ms Fiona Galea
Name of Supervisor(s): Dr Rachael Agius
Name of School: ______________________________________

Name of Head: ______________________________________

1	I confirm that I have read and understood the information for the above study and have had the opportunity to ask questions.	☐
2	I confirm that I have had sufficient time to consider whether or not I want the school to be included in the study.	☐
3	I understand that the school's participation is voluntary and that it is free to withdraw at any time, without giving any reason, without medical care or legal rights being affected.	☐
4	I understand that children's participation is voluntary and they are free to withdraw at any time, without giving any reason, without their medical care or legal rights being affected.	☐
5	I understand that children's participation will take place only after written parental consent.	☐
6	I understand that sections of any students' records may be looked at by the researcher, responsible individuals from the university or from regulatory authorities where it is relevant to taking part in research. I give permission for these individuals to have access to these records.	☐
7	I agree to take part in the above study.	☐

Name: __________________________________ Date of Signature: ____________

Signature: ________________________________

Appendix V

Recruitment of Participants for the Pilot Study

Independent Co-ed School

The pilot was carried out at a mixed-ability independent co-ed school. Participants were selected according to their performance at summative assessments. The consent form was given to 30 students (15 boys and 15 girls), 10 of which were high achievers (5 boys and 5 girls), 10 were average students (5 boys and 5 girls), and 10 were low achievers (5 boys and 5 girls). The consent form was not given to the international students who were excused from participating as they did not take Maltese as one of their subjects. Hard copies of the parental consent forms were passed on to the school by the researcher. Administration also sent out a soft copy to the parents to assist the recruiting process. Twenty-three students returned the parent consent form, but seven did not assent to testing. Table V1 presents the number of students who returned the consent form and consented to sit for the test, and the number of students who returned the consent form but did not assent to sit for the test. These students did not sit for the test on the day of testing, but sent word with their peers that they were not coming. The names of these students were noted by the researcher, prior to testing. Table V2 presents the number of students who assented to sit for the test, but who missed a session, as well as the total number of students who sat for both tests. Two of these students were statemented, one with general learning disabilities, and the other with ADHD and dyspraxia. These two had LSEs, who were not present during testing.

Table V1

Number of Students who Returned Consent Form in Independeent School

	Boys		Girls	
	Returned consent form but did not assent to sit for test	Retuned consent form and accepted to sit for test	Returned consent form but did not assent to sit for test	Retuned consent form and accepted to sit for test
High achievers	2	2	2	2
Average	0	5	0	3
Low achievers	0	2	3	2
Total	2	9	5	7

Table V2

Number of Students who Sat for Testing

	Boys		Girls	
	Sat for both sessions	Missed a session	Sat for both sessions	Missed a session
High achievers	2	0	2	0
Average	4	1	2	1
Low achievers	1	1	2	0
Total	7	2	6	1

Boys' State School

In the boys' state school, students were set into six classes, with Year 10.1 having the high ability students and Year 10.6 having students following the Core Curricular Programme (CCP) (see *The Maltese Educational System* in Chapter 1). Setting was determined on the grades the students attained in the core subjects, that is, Mathematics, Maltese and English, in the half yearly[62] and yearly examinations[63]. Three students from each class were selected at random to participate in the pilot study. The consent form was therefore given to 18 students in all (six classes). The parents of 14 students consented to the research. Two students did not

[62]The half yearly exam is the exam students used to sit for at around February, that is half way through the scholastic year. This exam has been removed in 2019, and replace with continuous assessment.
[63] The yearly exam is the exam students sit for in June, at the end of the scholastic year.

assent to sit for the test on the day. Of the remaining 12 students who sat for both tests (see Table V3), four were reported to have dyslexia, though they were not officially statemented[64]. None had a Learning Support Educator (LSE).

Table V3

Number of Students who Returned Consent Form

Class	Returned Consent Form but did not Assent to Sit for Test	Retuned Consent Form and Accepted to Sit for Test
4.1	0	2
4.2	0	2
4.3	0	2
4.4	0	3
4.5	0	2
4.6	2	1

Boys' Church School

This school streamed its students into two groups. The high achievers were set in one class, whereas the rest of the students were set in the remaining two classes. The rank order was determined by adding up the Global Mark of all subjects together. The Global Mark was worked out as follows:

a) 5% of the first evaluation (mid-term tests);

b) 30% of the half-yearly examinations;

c) 5% of the second evaluation (mid-term tests), and

d) 60% of the annual exam.

Fifteen students were selected for the pilot study: five were selected from the top, five from the middle and five from the bottom of the rank order. Fifteen consent forms were distributed and all 15 were returned signed in the affirmative. Five of these students were statement, one of whom had a shared Learning Support Educator (LSE). The needs of the

[64] The Maltese educational system does not award LSEs to students with dyslexia. This learning difficulty is however recognised by schools, which try to assist students in their studies by offering the support of LSEs of statemented students in the same class.

remaining four were met by the class teacher and the LSE. On the day of testing, all students were present for the test.

Girls' State School

In this girls' state secondary school, students were set into nine classes, with Year 10.1 hosting the high achievers, and Year 10.9 the low achievers, following the Core Curricular Programme. Three students from each class were selected at random to participate in the pilot study. Hence the consent form was given out to 27 students. Twenty-three students returned the consent form, though one students did not assent to sit for the test, and two students were absent for the second test (Maltese). Hence data was collected from 20 students, as shown in Table V4. Four of these students were statemented with LD, and a fifth with ADHD. The latter had an LSE, who however during testing did not assist in any way, except to ensure that the demographic information at the front of the test paper had been written correctly, and that the time mark was being inserted correctly. One of the students who missed the second session had cognitive delay and ADHD, and likewise an LSE, who likewise did not intervene directly during testing.

Table V4

Number of Participants per Class

Class	Returned Consent Form but did not Assent to Sit for Test	Retuned Consent Form and Sat for Both Sessions	Retuned Consent Form but Missed a Session
4.1	0	2	0
4.2	0	2	1
4.3	1	2	0
4.4	0	3	0
4.5	0	3	0
4.6	0	2	0
4.7	0	3	0
4.8	0	2	0
4.9	0	1	1

Girls' Church School

In this school students were not set or streamed but were of mixed-ability in the same class. For this pilot, students were selected according to their rank order in the 2016 yearly exam, obtained by summing up the core subjects. This rank order was prepared by the school secretary. The consent form was given to five high achievers, to five average students and to five low achievers. None of these students had any LD. Three students did not return the consent form, ten students sat for both sessions of the pilot, one student was absent for both sessions (did not assesnt to sit for the test), and another missed the second session.

Appendix W

Informative Letter to Inclusion Coordinator

Dear Sir / Madam,

I am a PhD student with the Department of Communication Therapy, Faculty of Health Sciences, University of Malta. As part of my research, I hope to develop a handwriting speed test for children aged between 14 and 15 years. The Education Division, the College Principal, the Head of School, the Secretariat of Education, as well as the students' parents, have been notified about this research, and the necessary consent has been obtained. The aim of this handwriting assessment is to identify students with writing difficulties.

In order to develop this assessment battery, I would like to test a group of Year 10 students within your school. Participants will be asked to complete five subtests including 3 text copying tasks, a perceptual-motor integration task, and a free writing task. Testing should last about 35-40 minutes, and will take place on two different occasions, within a few days of each other. For the purpose of this research, students with learning diabilities need to be identified by the teachers, LSEs or your kind self, and noted down on the test sheets, after testing. The head of school has granted me access to students' reports for information that is directly related to the research. I would like to request a meeting with your kind self, at your convenience, to discuss these reports.

Thank you in advance for your attention.

Sincerely,

____
Fiona Galea
PhD Student
fiona.galea.99@um.edu.mt
Mob: 79273984

____
Dr Rachael Agius
Supervisor
rachael.agius@um.edu.mt

Appendix X

Student Assent Form

ASSENT TO PARTICIPATE IN A RESEARCH STUDY

The Development of an English-Maltese Assessment of Speed of Handwriting

Good morning! My name is Fiona Galea, and I am a student in the *Department of* Communication Therapy (Faculty of Health Sciences) at the University of Malta. I am conducting a research study about Handwriting Speed. I'd like to tell you about this study and ask if you would like to help me out by taking part.

What is a research study?
A research study is when people like me collect a lot of information about a certain thing to find out more about it. Before you decide if you want to be in this study, it's important for you to understand why I am doing the research and what's involved. If you have questions about this research, feel free to ask me.

Why am I conducting this study?
I am conducting this study to find out how fast 14-15-year-old students can write. This study is not part of your school work, and you won't get graded on it.

What will happen if you are in this study?
If you agree to be in the study and your parents consent to your participation, I will ask you to:

Copy a sentence neatly for a minute.
Copy the same sentence as fast as possible for a minute.
Copy text from the board for a minute.
Draw Xs in circles for 1 minute.
Write about a given topic for 10 minutes.

In total, these tasks will take about 35-40 minutes.

If you don't want to be in the study, what can you do instead?

If you don't want to be in the study, or if your parents have not consented to your participation, your teacher will give you a different activity to work on. It will take about the same amount of time as the research activity.

Are there any benefits to being in the study?

I hope that the results of the research will help me develop a test that will help identify students with writing difficulties. This means that by taking part your will be helping other students.

<u>Are there any risks or discomforts to being in the study</u>?

During the activity, if you get tired feel free to let me know and you can decide whether or not to continue the tasks.

<u>Will you be identified in any way?</u>

I will not use your name or any other personal information that would identify you.

To help protect confidentiality, your name will be removed from the test sheet, and you will be assigned a code to which only I will have access.

<u>Do you have to be in the study</u>?

No, you don't. Your participation is voluntary. You can even decide to take part and then change your mind later. Either way will have no effect on your grades at school.

Verbal assent: The following students have verbally indicated that s/he is/is **NOT** interested in participating in this research:

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
15.
16.
17.
18.

______________________________________ _________________________

Signature of Investigator/Person Obtaining Assent Date

Appendix Y

Researcher's Comments/ Observations During Testing

Table Y1

Observations Made in the Independent School

Student performance by sub-test	Researcher's comments/observations during testing	
	English	Maltese
Copy Neatly	The researcher explained to the participants that the given phrase was a pangram, a phrase containing all the letters of the alphabet. The researcher read the phrase and instructed the participants to copy the given phrase in their best handwriting in two minutes, and to insert a time mark // when "time mark" was called at the end of one minute. The participants started writing when the researcher called "Go". When the first minute was up, the researcher called "time mark". A few students stopped writing when they heard this, so the researcher had to prompt them on. Others stopped to check where they had arrived before inserting the time mark //, and then proceeded with their writing. All participants stopped writing when the researcher called "Stop".	The pangram was read by the researcher prior to the commencement of the *Copy Neatly* Subtest. Administering the tests proved to be easier this time round, as the participants knew what was expected of them. In fact, as the researcher was reminding the instructions to the students, some started repeating them with the researcher. The researcher explained that for this test, instead of "time mark", the words "marka tal-ħin" (time mark) or simply "marka" (mark) were going to be called out. When during testing the researcher said "marka", the participants did not stop, but continued writing. Neither did they lift up their heads as they had done during the English assessment battery. The students inserted the time mark // in the middle of words as requested, without stopping.

Copy Quickly	The researcher repeated the instructions again and emphasized that when the participants heard “time mark”, they were not to stop writing, and that they stopped only when they heard “Stop”. Things went more smoothly this time as the participants knew better what was expected of them.	The same administrative procedures were followed as in the English subtest. “Marka” was called instead of “time mark” at the end of one minute.
Graphic Speed Test	The participants were instructed to draw crosses without touching the outer circles, and to intercept the crosses inside the inner circles. The researcher also demonstrated how to do this on the board. The participants were then given a few minutes to practice by marking the first line of circles. During this time, the researcher went round to ensure that all had performed the task correctly, addressing any mistakes as necessary. The participants then performed the actual task during the allotted time (one minute).	
Free Writing	During the one-minute planning time, the researcher went through the spider diagram and gave more ideas about most points. The participants were allowed to take down notes if they wished to do so. The researcher did not have time to discuss the prompts “friends”, “hobbies” and “dance/music”. No further problems were experienced with regard to the time mark, for the duration of the task.	As in the English test, during the one-minute planning time, the researcher went through the spider diagram and gave more ideas about each point. The participants were allowed to take down their own notes. This time, the researcher had time to discuss all points before the time was up. The same administrative procedure of the “time mark” (called out as “marka”) applied for this task too. This time though, the participants seemed to be slower writing, though they appeared to be on task all the time. Their ideas seemed to be slower in coming. Progress was slow. Whenever they stopped, they looked at the spider diagram for ideas. At a certain point, a participant stopped writing

		completely, though he did not look up but kept staring at the paper. The researcher urged him to go on writing, which he did. Overall, the participants wrote less words than in the English assessment battery. When, at the end of the test, the researcher enquired why this was so, they stated that it was easier for them to write in English, as they conversed in English, played games in English, read in English and watched TV in English, and so it was easier for them to come up with ideas in English than in Maltese.
Copy from the Board	Participants were instructed to copy the projected text in two minutes. "Time mark" was called after one minute, and "Stop" after two.	The projected text was clear, and students experienced no difficulty in copying it.
Conditions of testing	Testing for Maltese and English took place in the same class.	
Time of testing	9.30am	1.15pm
Overall duration of test	45 minutes	As participants were familiar with the test items, less instructions needed to be given by the researcher, so the test took about 15 minutes less than the English test.

Evaluation	
	Initially some students experienced difficulties with the instruction “time mark” as they were taking that to mean “time up” and stopped writing altogether. However, they quickly understood what was expected of them, and kept on writing without stopping after inserting the time mark //.
Students’ comments	The students expressed fatigue when they had two consecutive writing tasks that required them to speed up, such as the *Copy Quickly* and the *Copy from the Board* subtests.
Teacher’s comments	For the first test (English) the form teacher was there and for the second test (Maltese), both the form teacher and the assistant head were present. They urged the students to settle down fast and to do their best at all tasks.
Other comments	On the day of both tests, the participants were grouped in one classroom. The rest of the students remained in their classrooms with their teachers. However, no formal lessons took place at the time of testing. They were engaged in a discussion about the outing they were going to later on in the day. All students, irrespective of whether they had LD or not, coped well with the instructions of the tests, albeit not all performed at the same rate. To assist the English speaking participants with the Maltese free writing task, more prompts were added to the spider diagram, to give them more ideas to write about in Maltese. These changes were reflected in the English spider diagram. “Food” was added to the spider diagram, as well as “fashion” and “holidays”. “Computer games” replaced “computer”. “Feasts” was added to make it more culturally acceptable. The size of the spider diagram was itself increased to give the students more space for writing.

Table Y2

Observations Made in the Boys' State School

Student performance by sub-test	Researcher's comments/observations during testing	
	Maltese	English
Copy Quickly	The researcher noticed that two students started writing before the rest, and crossed out the extra words.	
Free Writing Copy Neatly	These subtests followed the same administrative procedures explained above, with "time mark" being called for English and "marka" being called for Maltese.	
Copy from the Board	When the text to be copied was projected, some students expressed concern that they might not manage to copy it all in two minutes, and wanted to know what would happen if they did not succeed in completing the task in time. However, when they were reassured that they were not expected to copy it all in that short span of time, they felt reassured, and carried out the task to the best of their abilities. The researcher noticed that one student started writing before the rest, and crossed out the extra words.	A student who was sitting at the side of the classroom could not see part of the board because the speakers were in the way. He quickly shifted to another desk but as this had no chair, he went down on his knees. The researcher quickly pushed him a chair, but he refused to sit down not to lose time.

Graphic Speed Test	The same administrative procedures of the first pilot test were followed.	The researcher noted that one student was drawing just one line inside the circles and then going back to draw a second line over the first line to form crosses. The researcher quickly corrected the student and instructed him to draw proper crosses.
Conditions of testing	Two different rooms were assigned for the tests, which however were identical in their layout.	
Time of testing	10.30am	8.45am
Overall duartion of test	45 minutes	30 minutes

Evaluation	
Students' comments	The students expressed fatigue when they had two consecutive writing tasks that required them to speed up, such as the *Copy Quickly* and the *Free Writing* subtests. Some complained that the base of their thumbs were hurting.
Teacher's comments	No teachers were present.
Other comments	The Maltese test was carried out in two sessions, since most of the students went on an outing on the first day. The test lasted 45 minutes. Those students who did not take part in the pilot study stayed in their respective classes with their respective teachers. So did the students who did not assent to sit for the tests, whose names were noted down by the researcher. The English test was administered the following week. This time the test lasted 30 minutes, as the students knew what was expected of them. Overall, both tests ran smoothly. All students, irrespective of whether they had LD or not, coped well with the instructions of the tests, albeit not all performed at the same rate.

	In response to the students' reaction to the chunk of projected text, the researcher considered shortening the text to be copied. However, when the researcher examined the written text, it was found that some students had almost copied the whole text in the span of two minutes, and so it was decided to keep the same number of words without deleting anything.

Table Y3

Observations Made in the Boys' Church School

<table>
<tr><td>Student performance by sub-test</td><td colspan="2">Researcher's comments/observations during testing</td></tr>
<tr><td></td><td>English</td><td>Maltese</td></tr>
<tr><td>Copy Neatly</td><td>The researcher noticed one student inserting the time mark // not at the time this was called, but at the end of the word. Likewise, this student did not stop writing when "Stop" was called. He first finished off the word, and then stopped. Following this incident, the researcher repeated the instructions for the Copy Quickly subtest, and stressed the importance that these are followed to the letter. The rest of the tasks were performed correctly.</td><td rowspan="4"></td></tr>
<tr><td>Copy Quickly</td><td rowspan="2">The same administrative procedures administered in the previous pilot tests were followed.</td></tr>
<tr><td>Copy from the Board</td></tr>
<tr><td>Graphic Speed Test</td><td>The students were concerned at not being able to mark all the circles in just one minute. However they were reassured that they were not meant to, and that it sufficed if they worked quickly and well during the allotted time.

One student used a pencil instead of a pen for this exercise. The researcher let the student terminate the exercise in pencil, as the DASH allows the use of pencils for testing. Furthermore, had the researcher asked the student to change the medium of writing half way through the task, that would have taken up most of the allotted time for this exercise (this being just one minute).</td></tr>
</table>

	However, when the researcher later contacted the MATSEC office, she was informed that only "blue or black ink should be used used in all language examinations" (MATSEC unit, personal correspondence, May 9, 2017). Following this incident, the researcher added another instruction to the manual, clarifying the user to inform participants to use only black or blue pens, not pencils or other coloured pens, for testing. As the EMASH is a tool that may be used to grant extra time during examinations, the researcher took this decision to simulate examination conditions.	
Conditions of testing	Same class	
Time of testing	11.50am	9.35am
Overall duration of test	45 minutes	30 minutes

Evaluation	
Students' comments	The students were concerned about what would happen if they did not manage to finish off the tasks on time. The students had to be reassured that they were not expected to do so, but that they simply had to work to the best of their abilities for the length of the allotted time.
Teacher's comments	The class teacher was present for the first few minutes, settled down the students, and then left.
Other comments	The LSE was not present during the session as he stated that the students statemented with general learning disabilities could manage the test on their own, as normally during English and Maltese they work on their own. As a matter of fact, the students handled the test well, without experiencing any difficulties. Both sessions ran smoothly, and the students did not encounter any difficulties.

Table Y4

Observations Made in the Girls' State School

Student performance by sub-test	Researcher's comments/observations during testing	
	English	Maltese
Free Writing	The same administrative procedures described in the previous pilot studies were followed.	
Copy Quickly		
Graphic Speed Test	The researcher noted that one student turned the page sideways and worked through the crosses from top to bottom rather than from left to right. The researcher did not stop this student as the DASH simply instructs participants to draw as many crosses as they can "one right after the other" (Barnett et al., 2007, p. 36), without specifying whether they have to work from left to right, or top to bottom.	
Copy Neatly	The same administrative procedures described in the previous pilot studies were applied.	
Copy from the Board		
Free Writing	The researcher noticed that the students had little space where to add their ideas in the spider diagram. As a result, the researcher increased the size of the spider diagram in the main study to give the students mores space for writing.	
Conditions of testing	Both tests took place in the same class.	
Time of testing	9.15am	9.15am
Overall duration of test	45 minutes	30 minutes

Evaluation	
Students' comments	Participants were very obliging and passed no particular comments. Neither did they make any particular queries.
Teacher's comments	The assistant head was present to oversee the running of things. She urged the students to settle down quickly and to do their best. She informed them about the certificate of participation they would receive upon completion of the pilot, and proposed that they set up a portfolio for such certificates. At the end of the session, the assistant head commented that the *Copy from the Board* subtest was very realistic as it reflected some practices in the classroom. For the first test, there were two LSEs with two different students, who, however, assisted them only in the first part of the test, when the students were expected to fill in their demographic information in the designated area on the test paper. They also ensured that their students marked the time mark correctly. Otherwise they did not intervene at all during the test. For the second test (Maltese), one of these students was absent, so there was only one LSE.
Other comments	The first test to be administered was English, with the Maltese test being administered a week later. Participants were withdrawn from their classes into a vacant classroom. Students who did not take part in the pilot study stayed in their respective classrooms with their teachers. All students, irrespective of whether they had LD or not, coped well with the instructions of the tests, albeit not all performed at the same rate. The assistant head requested a certificate of participation for the students who took part in the pilot study. The request was met and a certificate of participatin was issued to this school and to all the other participating schools.

Table Y5

Observations Made in the Girls' Church School

Student performance by sub-test	Researcher's comments/observations during testing	
	Maltese	English
Graphic Speed Test	Some students worked from top to bottom rather than from left to right. The researcher did not stop them as the DASH simply instructs participants to draw as many crosses as they can in sequence, without specifying whether they have to work from left to right, or top to bottom.	
Copy from the Board	The same administrative procedures described in the previous pilot studies were followed.	
Copy Neatly		
Free Writing		
Copy Quickly		
Conditions of testing	Same class	
Time of testing	12.00pm	12.00pm
Overall duration of test	45 minutes	30 minutes

Evaluation	
Students' comments	The students expressed exhaustion at the end of the session, and stated that the test was challenging for this reason. They expressed concern that this might be the writing speed at MATSEC examinations next year. They also stated that they found the English free writing task easier as they were more fluent in English than they were in Maltese.
Teacher's comments	No teachers were present during testing.
Other comments	The students were called on the PA by the head mistress and quickly settled in a classroom. Those students who did not take part in the pilot went in for their lessons as usual. Sessions were held over two consecutive weeks. Both sessions ran smoothly, without incidents.

Appendix Z

Version 2 of the Test used for Data Collection (English)

For office use only:
____

Handwriting Speed Assessment

Name: ______________________________

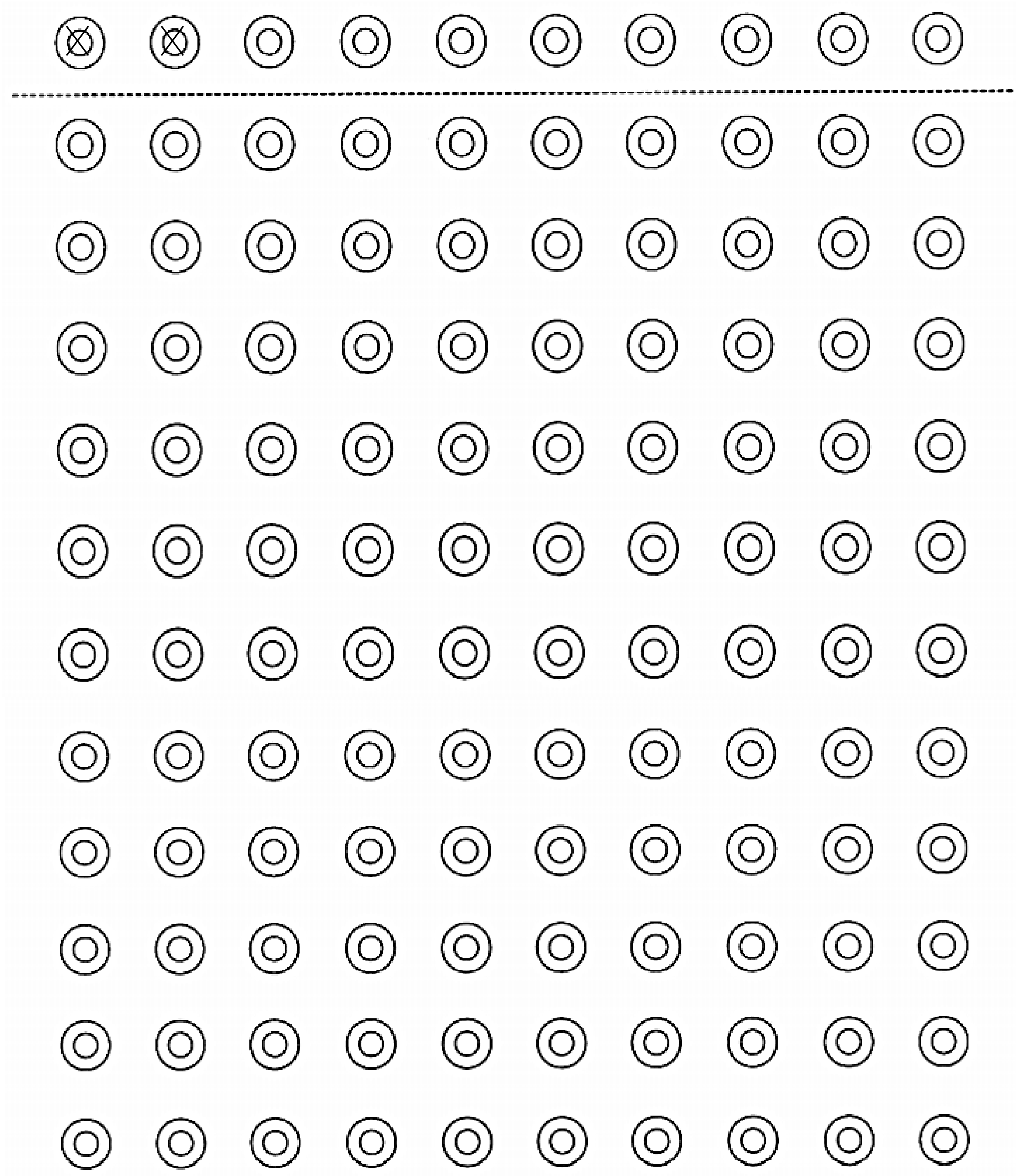
Male/female (*please circle*)

Date of Birth: ________________________

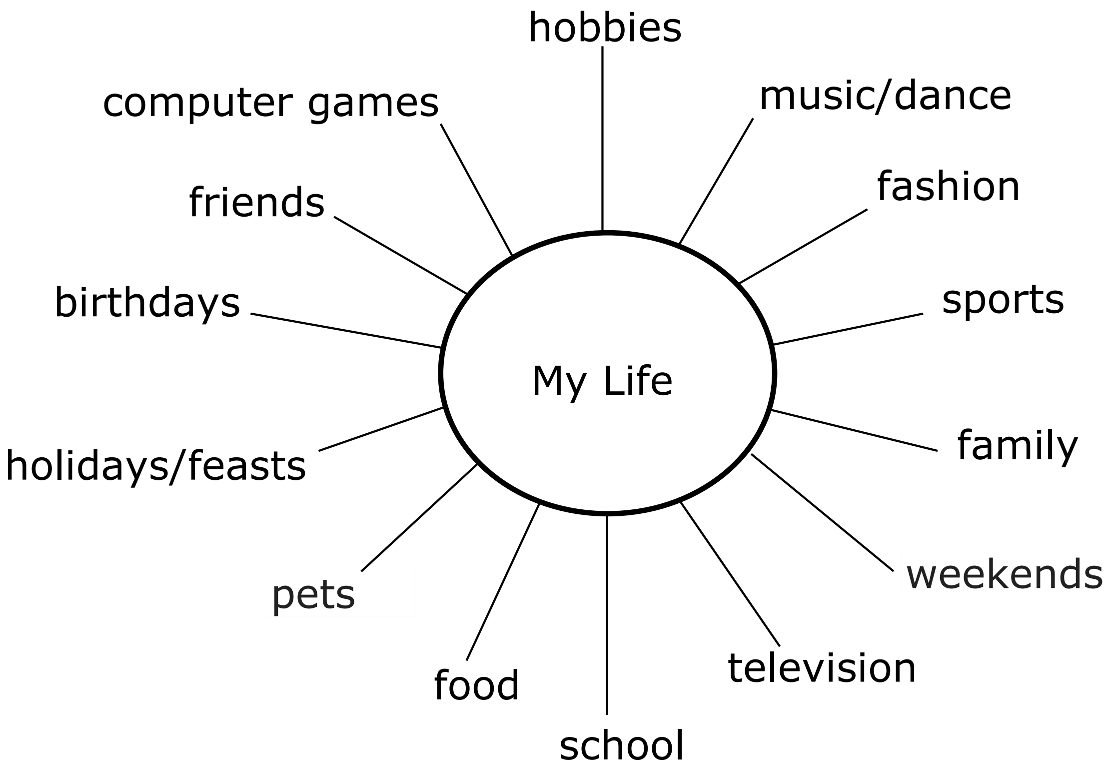
Left handed/right handed (*please circle*)

Town/village: ___________________________

School: _________________________________



A mad boxer shot a quick, gloved jab to the jaw of his dizzy opponent.


hobbies
computer games
music/dance
friends
fashion
birthdays
sports
My Life
holidays/feasts
family
weekends
pets
television
food
school

Version 2 of the Test used for Data Collection (Maltese)

Għall-użu uffiċċjali biss:
____

Ħiliet fil-Kitba

Isem: ____________________________

Tifel/tifla (*agħżel*)

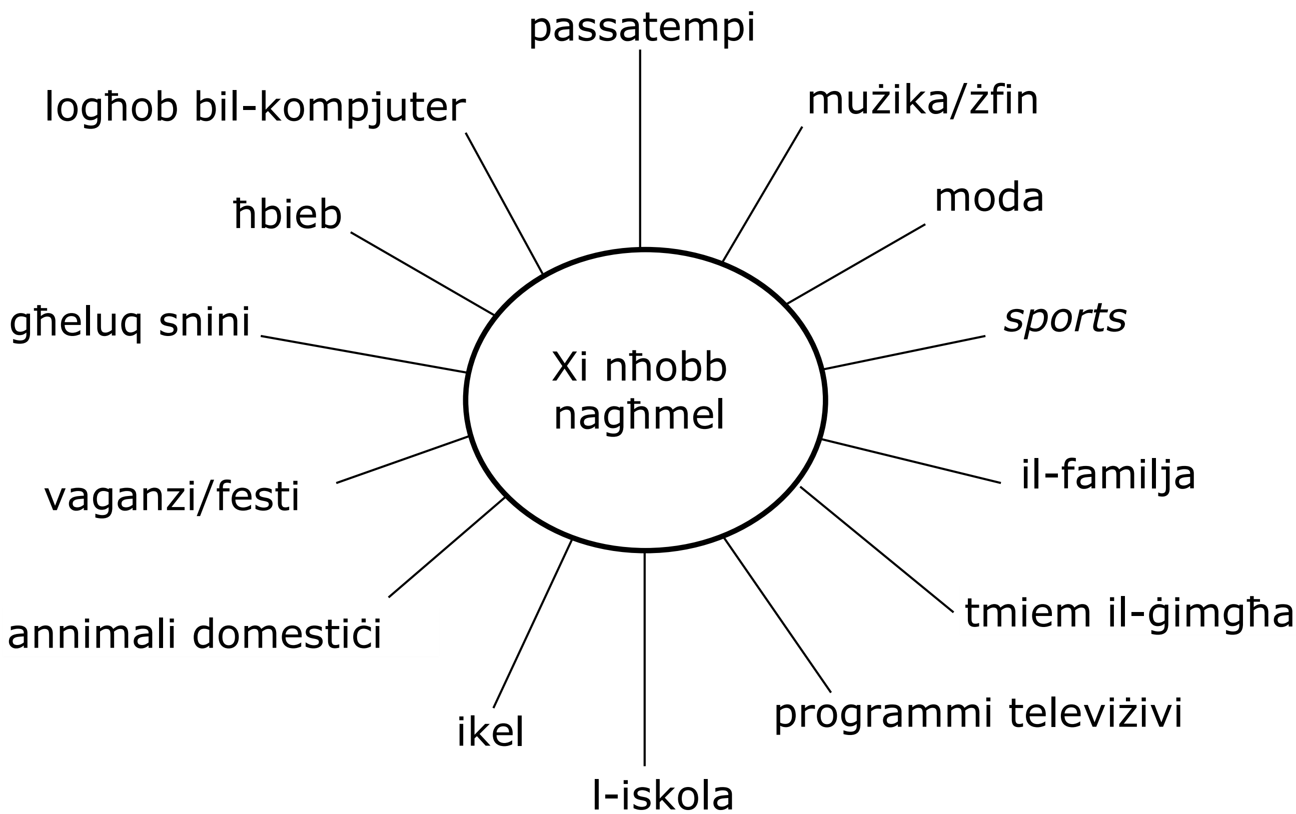
Data tat-twelid: _________________

Lemin/xellug (*agħżel*)

Belt/raħal: __________________________

Skola: ________________________________

Kien liebes gozz ħwejjeġ u ċraret vera qodma u m'għażluhx fil-pront.


Xi nħobb nagħmel
passatempi
mużika/żfin
moda
sports
il-familja
tmiem il-ġimgħa
programmi televiżivi
l-iskola
ikel
annimali domestiċi
vaganzi/festi
għeluq snini
ħbieb
logħob bil-kompjuter

Appendix AA

Levels for Each Independent Variable

Independent Variables	Code	Levels
First Language	1 2 3 4	Dominant Maltese Dominant English Mixed Foreign
School Language	1 2 3	Dominant Maltese Dominant English Mixed
Socio Economic Status	1 2 3	Low Middle High
Handedness	1 2	right left
Gender	1 2	male female
Geographical Regions	1 2 3 4 5 6	Southern Harbour Region Northern Harbour Region South Eastern Region Western Region Northern Region Gozo Region
Nationality	1 2 3	Maltese Foreign Dual - Maltese and non-Maltese
Age	1 2	January to June July to December[65]
School Type	1 2 3 4	State Independent Boys' church Girls' church

[65] Participants were stratified by age to have a month of birth profile since research shows that the youngest members of each cohort (even 14 and 15-year-olds) overall score lower academically than the oldest members (Bedard, & Dhuey, 2006).

Ability	1	typically developing
	2	dyslexia
	3	dyspraxia
	4	global developmental delay
	5	ADHD[66]/ADD[67]
	6	general learning disabilities
	7	literacy challenges
	8	Asperger's
	9	autism
	10	hearing impairment
	11	visual impairment
	12	SEBD[68]
Writing Style	1	cursive
	2	print
	3	mixed mostly cursive
	4	mixed mostly print

[66] Attention deficit hyperactive disorder
[67] Attention deficit disorder
[68] Social and emotional behavioural difficulties

Appendix AB

Levels for Each Independent Variable of the Parents' Questionnaire

	Code	Category
Mother's education	0	primary
	1	secondary
	2	vocational
	3	tertiary
	4	post-secondary
Father's education	0	primary
	1	secondary
	2	vocational
	3	tertiary
	4	post-secondary
Mother's nationality	1	Maltese
	2	foreign
	3	dual – Maltese and home nationality
Father's nationality	1	Maltese
	2	foreign
	3	dual – Maltese and home nationality
Maternal occupation	1	service worker
	2	labourer (unskilled)
	3	operative (semi-skilled)
	4	craft worker (skilled)
	5	office and clerical worker
	6	sales worker
	7	technician
	8	professional
	9	official or manager
	10	self employed
	11	unemployed
Paternal Occupation	1	service worker
	2	labourer (unskilled)
	3	operative (semi-skilled)
	4	craft worker (skilled)
	5	office and clerical worker
	6	sales worker
	7	technician
	8	professional
	9	official or manager

	10 11	self employed unemployed
Language spoken by student with mother (Language Mother)	1 2 3 4 5 6 7	Maltese English Other Maltese and English Maltese and another language English and another language Maltese, English and another language
Language spoken by student with father (Language Father)	1 2 3 4 5 6 7	1 Maltese 2 English 3 Other 4 Maltese and English 5 Maltese and another language 6 English and another language 7 Maltese, English and another language
Language spoken by student with siblings (Language Sibling)[69]	1 2 3 4 5 6 7	Maltese English Other Maltese and English Maltese and another language English and another language Maltese, English and another language
Language spoken by student at meal times (Language Meal)	1 2 3 4 5 6 7	Maltese English Other Maltese and English Maltese and another language English and another language Maltese, English and another language
Language spoken by student with friends (Language Friend)	1 2 3 4 5 6 7	Maltese English Other Maltese and English Maltese and another language English and another language Maltese, English and another language

[69] In cases where the participants had no sibl2i3ngs, the values were left blank.

Language student speaks best (Language Best)	1 2 3 4 5 6 7	Maltese English Other Maltese and English Maltese and another language English and another language Maltese, English and another language
Language used by student to express anger (Language Angry)	1 2 3 4 5 6 7	1 Maltese 2 English 3 Other 4 Maltese and English 5 Maltese and another language 6 English and another language 7 Maltese, English and another language
Language used by student to express problems (Language Problems)	1 2 3 4 5 6 7	Maltese English Other Maltese and English Maltese and another language English and another language Maltese, English and another language
Speech delay	1 2	Yes No
Hearing problems	1 2	Yes No
Learning difficulties that might have interfered with schooling (Learning Difficulties)	1 2	Yes No

Appendix AC

Codings for the Independent Variables Maternal Occupation and Paternal Occupation

Code	Occupation	Examples
1	Service workers Jobs including food service, personal service, cleaning service, and protective service activities. Skill may be acquired through formal training, job-related training or direct experience.	cooks bartenders waiters and waitresses medical assistants and other healthcare support occupations such as Learning Support Educators firefighters and fire protection guards steward cleaners janitors police officers soldiers private detectives and investigators guides ushers public transportation attendants hairdressers barbers porters public works nursing aid childcare
2	Labourers (Unskilled) Jobs requiring limited skills and only brief training to perform tasks that require little or no independent judgment.	Examples: construction labourers labourers performing lifting (material movers) digging/mixing loading and pulling operations fish farm worker port worker gardeners groundsmen farmers dredger sand blaster

		sewer pipe cleaners refuse and recyclable materials collectors service station attendants security
3	Operatives (Semi-Skilled) Workers who operate machines or processing equipment or perform other factory-type duties of intermediate skill levels which can be mastered in a few weeks and which require only limited training.	Examples: machine operators parking attendent blasters panel beater sprayer delivery workers postal operator labourers motor operators stationery firefighters truck and tractor drivers bus or taxi drivers cabby horse driver welders and flame cutters electrical and electronic equipment supervisors laundry and dry cleaning workers electrical and electronic equipment assemblers assemblers’ inspector bakers butchers forklift operators sailors riggers hand packers and packagers parking lot attendants testers handyman/houseman tile layer
4	Craft workers (Skilled) Manual labourers of relatively high skill level who possess a thorough and comprehensive knowledge of the processes involved in their work. They exercise considerable independent judgment and usually	Examples: brick and stone masons mechanics electricians painters (construction and maintenance) carpenters

	receive an extensive period of training.	plumbers plasterers elevator/AC installers explosive workers etchers and engravers aircraft mechanics electric and electronic equipment repairers tool makers oil and gas rotary drill operators pipefitters signwriter/tagger interior decorators foremen landscapers gypsum plasterers
5	Office and clerical workers Jobs involving non-managerial tasks providing administrative and support assistance, primarily in office settings	Examples: office clerks bookkeepers collectors (bills and accounts) messengers and office helpers shipping and receiving clerks typists and secretaries legal assistants accounting and auditing clerks computer operators proofreaders couriers banker call centre personal assistant customs officer store keeper receptionists
6	Sales workers Occupations engaging wholly or primarily in direct selling	Examples: advertising agents salespersons insurance agents real estate agents brokers stock and bond sales workers lotto receiver

		cashiers telemarketers sales agents promoter shop assistant
7	Technicians Occupations requiring a combination of basic scientific knowledge and manual skill which can be obtained through two years of post high school education, such as is offered in many technical institutions and junior colleges or through equivalent on-the-job training	Examples: drafters radio operators surveyors technicians (medical, dental, optical, electronic) internet installer
8	Professionals Jobs requiring bachelor or graduate degrees and/or professional certification or comparable experience.	Examples: accountants auditors airplane pilots flight engineers computer programmers architects chemists designers dieticians editors occupational therapists engineers magistrates lawyers librarians registered professional nurses midwives physical scientists physicians social workers teachers/headmasters assistant lecturers lecturers surveyors surgeons artists/musicians restorer

		scientists/biologists job coach draughtsmen fitness and nutrition IT solutions architect reading animator and editor photographer chef researcher HOD education quality controller credit controller business developers journalist draughtsmen pilots laboratory scientists
9	Officials and managers Individuals who plan, direct and formulate policies, set strategy and provide the overall direction of organizations.	Examples: officials executives chief executive officers presidents or executive vice presidents directors treasurers middle managers managers human resources managers consultants public relations compliance officers assistant principal planning officials
10	Self employed	Examples: businessmen contractor tradesman entrepreneur shop owner

11	Unemployed	Examples: unoccupied housewife pensionnaires student boarded out deceased

Appendix AD

Levels for the Variables of the Teachers' Questionnaire

Variables	Code	Levels
School type	1	State
	2	Independent
	3	Boys' church
	4	Girls' church
Subject taught	1	Foreign languages – Itaian, French, Spanish, German
	2	IT, Computer Studies
	3	PSCD
	4	Design and Technology/Graphical Communication
	5	Maths
	6	Art, Music
	7	Religion
	8	Science subjects – Chemistry, Biology, Physics
	9	Business Studies
	10	Geography, Social Studies, European Studies, History
	11	Official language – Maltese, English
Language of instruction	1	Dominant Maltese
	2	Dominant English
	3	Mixed
Language outside	1	Dominant Maltese
	2	Dominant English
	3	Mixed
Time writing	1	5%
	2	25%
	3	50%
	4	75%
	5	95%
Time copying	1	5%
	2	25%
	3	50%
	4	75%
	5	95%

Longest task	1	write own notes
	2	copy from board
	3	creative writing
	4	poetry apprecation
	5	lab reports
	6	other

Appendix AE

Consent Form for Research Assistants

Study: The English-Maltese Assessment of Speed of Handwriting

1. I confirm that I have understood the information for this study and have had the opportunity to ask questions.	
2. I confirm that I have had sufficient time to consider whether or not I want to be included in the study.	
3. I understand that I will be paid for assisting in the research project.	
4. I agree to abide by the requests of the principal researcher.	
5. I agree to review the test manual thoroughly prior to testing.	
6. I agree to complete the data collection to the best of my capabilities.	
7. I agree to contact the principal researcher if I have any queries at any time deemed necessary.	
8. I agree that record forms will not be accessible to anyone but myself and the principal researcher.	
9. I understand that the assessment tool is a research edition and will not be photocopied or reproduced in any form or manner.	
10. I agree to take part in the above research.	

Name of research assistant: ________________________ Signature: ____________________

____

Fiona Galea
PhD Student
fiona.galea.99@um.edu.mt
Mob: 79273984

____

Dr Rachael Agius
Supervisor
rachael.agius@um.edu.mt

Appendix AF

Scoring Criteria Followed by Research Assistants

The English *Copy Neatly* and Maltese *Copy Neatly* (*Ikkopja Pulit*) subtests. For these tasks, the number of words completed in the allocated 2 minutes should be counted, then halved, in order to determine the word count per minute. In order to decide whether a word should be counted or not, the following criteria apply.

- all legible words. If a word is untidy, or is hard to read, or has illegible characters, but it still can be read within the context of the sentence, then it should be counted as legible.
- illegible words, with two or more letters, are to be bracketed and counted separately
- all incorrectly copied words

Examples

English subtest	Maltese subtest
"A mat boxer" - "mat" counts as one word	"m'ażluhx" fil-pront" - "ażluhx" counts as one word

- all legible words that have been corrected or crossed-out (the crossing out itself is simply ignored) are to be counted as legible
- words where the capital letters have been omitted
- all repeated words

Examples

English subtest	Maltese subtest
"shot a a quick" - both "a"s are counted	"ħwejjeg u u ċraret" – both "u"s are counted.

- unfinished words - if two or more letters have been written, (but not if this is the final word), these should be counted.
- unfinished crossed-out words with two or more letters are counted
- misspelt words or nonwords

Examples

English subtest	Maltese subtest
"mad boser shot" – "boser" counts as one word.	"ħwejjeg u ġraret" – "ġraret" counts as one word.

- words that do not follow the language's orthographic rules

Examples

English subtest	Maltese subtest
	"ħwejjeg u craret" – "craret" counts as one word, even though the dot "." on top of the letter "c" has been omitted.

Exclude

- the title
- punctuation marks e.g. the full stop (.) and the hyphen (-)
- the final word if not compelete

The English *Copy Quickly* and Maltese *Copy Quickly* (*Ikkopja Malajr*) subtests. For these subtests, the same scoring procedures followed for the English *Copy Neatly* and Maltese *Copy Neatly* (*Ikkopja Pulit*) subtests apply.

The English *Copy from the Board* and Maltese *Copy from the Board* (*Ikkopja mill-Bord*) subtests. ln order to decide whether a word should be counted or not, the following criteria apply:

- all legible words
- illegible words, with two or more letters, are to be bracketed and counted separately
- all incorrectly copied words and spelling mistakes

Examples

English subtest	Maltese subtest
"climat change"- "climat" counts as one word.	"gżejer Maltin"- "gżejer" counts as one word.

- all legible words that have been corrected or crossed-out (the crossing out itself is simply ignored)
- all repeated words

Examples

English subtest	Maltese subtest
"linked to to climate change" - both "to"s are counted	"Malta u u ddaħħlet"- both "u"s are counted

- unfinished words, if two or more letters have been written, (but not if this is the final word)
- unfinished crossed-out words with two or more letters
- all unclear words which are still legible in context, are counted
- words with omitted capital letters

Examples

English subtest	Maltese subtest
“however” should still be counted, even though it should start with a capital letter, since it is at the start of the sentence	“maltija” should still be counted, even though it should start with a capital letter

- words that do not follow Maltese orthographic rules

Examples

English subtest	Maltese subtest
	“izda” – “izda” counts as one word, even though the dot “.” on top of the letter “z” has been omitted.

Exclude

- the title
- punctuation marks e.g. the full stop (.) and the hyphen (-)
- the final word if not compelete

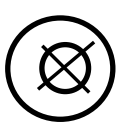
The *Graphic Speed* Test. Count the total number of correctly marked circles following these criteria:

- there must be an X not a +
- the two lines must intercept within the inner circle
- the lines must extend at least to the lines of the inner circle
- the lines must not extend beyond the outer circle

A correcly formed cross should look like the one portrayed in Figure AF1.

Figure AF1

Example of a Correctly Formed Cross

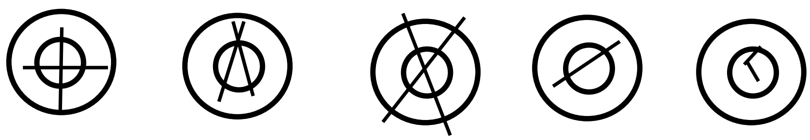


Exclude:

- the top practice row
- single lines and lines that do not cross
- crosses that do not adhere stricly to the above rules, and which may look like the ones portrayed in Figure AF2:

Figure AF2

Examples of Incorrectly Formed Crosses



The English *Free Writing* subtest. For the free writing task, apply the following scoring rules:

- joined/hyphenated words. Count hyphenated words as two words e.g. empty-handed.
- separated words. Count separated words as two words, e.g. summer school. If two words have been written as one word, e.g. ofcourse, they are to be counted as two words.
- misspelt words are counted.
- words split by a time mark (//). Where a word is split by the time mark, count the number of letters on each side of the mark. If they are even in number, count one word for those on the left of the time mark, and none for those on the right. If there is an uneven number of letters on each side of the time mark, count a whole word on the side with the most letters, do not count those on the other side of the time mark, e.g. “st//ereo” letters “st” are not counted, letters “ereo” are counted as one word; “divis//on” letters “divis” are counted as one word, letters “on” are not counted.
- different subject matter. If the student has not written about the topic or has made up material, this should still be counted and scored following the above criteria.
- abbreviations/acronyms.TV, CD, DVD, SMS and “+” written for “and”, are each counted as one word.
- numbers of one or more digits should be scored as a single word, e.g. 2, 11.
- dates, currency etc., are also counted as one word, e.g. €10.50c, A4, 12/9/16, 2017.

- therefore the time, e.g. 9.30am - the digits 9.30 are to be counted as one word, and the abbreviation "am" is to be counted as another word.
- ordinal numbers are to be counted as two words, e.g 1st; 2nd; 3rd are each counted as two words.
- names of saints, e.g. St Peter, are to be counted as as two separate words.
- names of people, e.g. Ms. Leanne Galea, are to be counted as separate words (in this example, the name Ms. Leanne Galea is to be counted as three separate words).
- names of places, e.g. Mc Donalds, are to be counted as two words.
- words where the capital letters have been omitted, e.g. valletta, should be counted.
- one letter words, such as "I", are each to be counted as one word.
- words with apostrophies, e.g. "o'clock" or "boy's" are each to be counted as one word. Likewise, contractions, such as "I'm" and "I've" are to be counted as one word. The apostrophe is simply to be ignored
- corrected words are counted.
- all unclear words that are still legible in context, are counted.
- crossed-out legible words. These are counted, (the crossing out itself is simply ignored).
- unfinished legible words are counted if two or more letters have been written, even if the word happens to be the last word.
- unfinished, legible, crossed-out words with two or more letters are also counted, even if the word happens to be the last word.
- all unclear/illegible words that cannot be read in context, are bracketed and counted sperately as illegible words.
- crossed-out illegible words. These are counted separetly, (the crossing out itself is simply ignored).
- illegible words, with two or more letters, are counted separately as illegible words, even if the word happens to be the last word.
- crossed-out illegible words, with two or more letters, are bracketed and counted separetly as illegible words (the crossing out itself is simply ignored), even if the word happens to be the last word.

- letter strings, such as “laaaaaaa”, “boo” or “pssss” are considered pseudowords, and hence contrubute to the word count of this test.
- words in Maltese, or any other language, are to be counted.

Exclude

- the title
- all punctuation marks

The Maltese *Free Writing (Kitba Kreattiva)* subtest. For the free writing task, apply the following scoring rules:

- abbreviations/acronyms. TV, CD, DVD, SMS and “+” written for “u” (meaning “and”), are each counted as one word.
- numbers of one or more digits should be scored as a single word, e.g. 2, 11.
- phrases denoting quantity, e.g. 12-il tifel, are each to be counted separately (3 words)
- misspelt words are counted.
- dates, currency etc., are also counted as one word, e.g. €10.50c, A4, 12/9/16, 2017.
- words split by a time mark (//). Where a word is split by the time mark, count the number of letters on each side of the mark. If they are even in number, count one word for those on the left of the time mark, and none for those on the right. If there is an uneven number of letters on each side of the time mark, count a whole word on the side with the most letters, do not count those on the other side of the time mark, e.g. “kum//binazzjoni” letters “kum” are not counted, letters “nazzjoni” are counted as one word; “fam//uż” letters “fam” are counted as one word, letters “uż” are not counted.
- one letter words, such as “u”, are each to be counted as one word.
- words with an article, e.g. “il-mama”, “ix-xemx”, “l-għaġin” are to be counted as two words.
- prepositions followed by a hyphen, e.g. “mid-dar”, “sal-belt”, “fil-ħarifa”, “bl-irkotta” are to be counted as two words.
- prepositions that are linked to the article, e.g. “fil-ħanut” and “lill-Isqof”, are to be counted as two words.

- words such as “ ‘il bogħod” and “ ’l isfel” (not hyphenated) are to be counted as two words.
- prepositions followed by apostrophies, such as “f’Malta”, “f’uħud”, “m’oħra”, “f’xi”, “and “f’widien”, “b’dik” and “f’moħħu” are to be counted as one word.
- negatives, such as “m’għandux”, “m’għamilx” are to be counted as one word.
- words in English with an apostrophie e.g. “o’levels” are to be counted as one word.
- prepositions that end with an apostrophe, e.g. “ma’ ” and “ta’ ” are to be couted as one word.
- names of people, e.g. is-sur Bertu Pace, are each to be counted as one word (four words in all. The hyphen (-) is simply ignored.)
- names of saints, e.g. San Lawrenz, are to be counted as two separete words.
- words with omitted capital letters, e.g. valletta, should be counted.
- corrected words are counted.
- all unclear words that are still legible in context, are counted.
- crossed-out legible words. These are counted, (the crossing out itself is simply ignored).
- unfinished legible words are counted if two or more letters have been written, even if the word happens to be the last word.
- unfinished, legible, crossed-out words with two or more letters are also counted, even if the word happens to be the last word.
- all unclear/illegible words that cannot be read in context, are bracketed and counted sperately as illegible words.
- crossed-out illegible words. These are counted separetly as illegible words, (the crossing out itself is simply ignored).
- illegible words, with two or more letters, are counted separately as illegible words, even if the word happens to be the last word.
- crossed-out illegible words, with two or more letters, are bracketed and counted separetly as illegible words (the crossing out itself is simply ignored), even if the word happens to be the last word.
- letter strings, such as “laaaaaaa”, are counted if they have linguistic meaning in context.
- words in English, e.g. weekend, or any other language, are to be counted.

- different subject matter. If the student has not written about the topic or has made up material, this should still be counted and scored following the above criteria.

Exclude

- the title
- punctuation marks, including the apostrophies (‘), the hyphenes (-), the commas (,) and the fullstops (.)

Appendix AG

Excel 2010 Sheet for Inputting the Word Count of Each Subtest (English)

	A	B	C	D	E	F	G	H	I	J	K
1	cursive	print	mixed mostly cursive	mixed mostly print			legibility				
2											
3	**Copy Neatly**		**number of legible words**	**Percentage legible words from total legible words**	**Percentage legible words from total legible + illegible words**	**number of illegible words**	**Percentage illegible words from total (legible +illegible)**	**% of illegible words** total number of illegible words ÷ total number of words x 100		**Total Raw Score (WPM)***	
4		1st minute	26	53.1%	53.1%	0	0.0%	0.0%			**Raw Score****
5		2nd minute	23	46.9%	46.9%	0	0.0%			total legible words ÷ 2 =	24.5
6		**Total**	49	100.0%	100.0%	0	0.0%			total legible words + total illegible words ÷ 2 =	24.5
7											
8											
9	**Copy Quickly**		**number of legible words**	**Percentage legible words from total legible words**	**Percentage legible words from total legible + illegible words**	**number of illegible words**	**Percentage illegible words from total (legible + illegible)**	**% of illegible words** total number of illegible words ÷ total number of words x 100		**Total Raw Score (WPM)**	
10		1st minute	33	52.4%	52.4%	0	0.0%	0.0%			**Raw Score****
11		2nd minute	30	47.6%	47.6%	0	0.0%			total legible words ÷ 2 =	31.5
12		**Total**	63	100.0%	100.0%	0	0.0%			total legible words + total illegible words ÷ 2 =	31.5
13											
14											
15	**Copy Speed Difference**			**legible words**	**legible words + illegible words**						
16			Copy Quickly (Raw Score)	31.5	31.5						
17			Copy Neatly (Raw Score)	24.5	24.5						
18			**WPM**	7	7						
19											
20											
21	**Copy from the Board**		**number of legible words**	**Percentage legible words from total legible words**	**Percentage legible words from total legible + illegible words**	**number of illegible words**	**Percentage illegible words from total (legible + illegible)**	**% of illegible words** total number of illegible words ÷ total number of words x 100		**Total Raw Score (WPM)**	
22		1st minute	23	53%	53.5%	0	0.0%	0.0%			**Raw Score****
23		2nd minute	20	47%	46.5%	0	0.0%			total legible words ÷ 2 =	21.5
24		**Total**	43	100%	100.0%	0	0.0%			total legible words + total illegible words ÷ 2 =	21.5
25											
26	**Graphic Speed Test**			**Number of Xs**			**Percentage**				
27			Total number of circles marked	39			100.0%				
28			Number of errors	8			20.5%				
29			Number of correctly drawn crosses		31		79.5%				

30										**Raw Score**
31	**Free Writing**		**number of legible words**	**Percentage legible words from total legible words**	**Percentage legible words from total legible + illegible words**	**number of illegible words**	**Percentage illegible words from total (legible + illegible)**	**WPM legible words**	total number of legible words ÷ 10 =	24.1
32		1st - 2nd minute	57	24%	24%	0	0.0%			
33		3rd - 4th minute	44	18%	18%	0	0.0%	**WPM legible words + illegible words**	total number of legible words ÷ 10 =	24.1
34		5th - 6th minute	46	19%	19%	0	0.0%		total number of illegible words ÷ 10 =	0.1
35		7th - 8th minute	51	21%	21%	1	0.4%		**Total Raw Score**	24.2
36		9th - 10th minute	43	18%	18%	0	0.0%			
37		**Total**	241	100%	100%	1	0.4%	**% of illegible words**	total number of illegible words ÷ total number of words x 100	0%
38										
39										
40										

41	**Total Raw Score (WPM) Legible Words**	**Raw Score****		**Total Raw Score (WPM) Legible and Illegible Words**		**Raw Score****
42	Copy Neatly (WPM)	24.5			Copy Neatly (WPM)	24.5
43	Copy Quickly (WPM)	31.5			Copy Quickly (WPM)	31.5
44	Copy from the Board (WPM)	21.5			Copy from the Board (WPM)	21.5
45	Free Writing (WPM)	24.1			Free Writing (WPM)	24.2
46	**Total**	101.6			**Total**	101.7

Sheet1 Sheet2 Sheet3

Appendix AH

Excel 2010 Sheet for Inputting the Word Count of Each Subtest (Maltese)

B4 | l-1 minutait-2 minuta

	A	B	C	D	E	F	G	H	I	J	K	L
1	magħqud	maħlul	taħlita l-aktar magħqud	taħlita' l-aktar maħlul			legibilita'					
2												
3	Ikkopja Pulit		numru ta' kliem li jingħaraf	% ta' kliem li jingħaraf minn total ta' kliem li jingħaraf	% kliem li jingħaraf minn total (jingħaraf + ma jingħarafx)	numru ta' kliem li ma jingħarafx	% kliem li ma jingħarafx minn total (jingħaraf + ma jingħarafx)	% kliem li ma jingħarafx total kliem li ma jingħarafx ÷ kliem totali x 100		Punteġġ (Kliem f'Minuta)		
4		l-1 minutait-2 minuta	27	57.4%	57.4%	0	0.0%	0.0%			Punteġġ*	
5		it-2 minuta	20	42.6%	42.6%	0	0.0%			numru ta' kliem li jingħaraf ÷ 2 =	23.5	
6		Total	47	100.0%	100.0%	0	0.0%			numru ta' kliem li jingħaraf + numru ta' kliem li ma jingħarafx ÷ 2 =	23.5	
7												
8												
9	Ikkopja Malajr		number of legible words	% ta' kliem li jingħaraf minn total ta' kliem li jingħaraf	% kliem li jingħaraf minn total (jingħaraf + ma jingħarafx)	numru ta' kliem li ma jingħarafx	% kliem li ma jingħarafx minn total (jingħaraf + ma jingħarafx)	% kliem li ma jingħarafx total kliem li ma jingħarafx ÷ kliem totali x 100		Punteġġ (Klien f'Minuta)		
10		1st minute	26	51.0%	51.0%	0	0.0%	0.0%			Punteġġ*	
11		2nd minute	25	49.0%	49.0%	0	0.0%			numru ta' kliem li jingħaraf ÷ 2 =	25.5	
12		Total	51	100.0%	100.0%	0	0.0%			numru ta' kliem li jingħaraf + numru ta' kliem li ma jingħarafx ÷ 2 =	25.5	
13												
14												
15	Differenza		kliem li jingħaraf	kliem li jingħaraf + kliem li ma jingħarafx								
16		Ikkopja Pulit (Punteġġ)	26	26								
17		Ikkopja Mgħaġġel	24	24								
18		Kliem f'Minuta	2	2								
19												
20												
21	Ikkopja mill-Bord		numru ta' kliem li jingħaraf	% ta' kliem li jingħaraf minn total ta' kliem li jingħaraf	% kliem li jingħaraf minn total (jingħaraf + ma jingħarafx)	numru ta' kliem li ma jingħarafx	% kliem li ma jingħarafx minn total (jingħaraf + ma jingħarafx)	% kliem li ma jingħarafx total kliem li ma jingħarafx ÷ kliem totali x 100		Punteġġ (Kliem f'Minuta)		
22		l-1 minuta	18	51%	51.4%	0	0.0%	0.0%			Punteġġ*	
23		it-2 minuta	17	49%	48.6%	0	0.0%			numru ta' kliem li jingħaraf ÷ 2 =	17.5	
24		Total	35	100%	100.0%	0	0.0%			numru ta' kliem li jingħaraf + numru ta' kliem li ma jingħarafx ÷ 2 =	17.5	
25												
26	Test ta' Kitba Grafika			Numru ta' Xs			%					
27			numru totali ta' ċrieki mmarkati	47			100.0%					
28			numru ta' żbalji	3			6.4%					
29			numru ta' ċrieki mmarkati tajbin		44		93.6%					
30												Punteġġ
31	Kitba Kreattiva		numru ta' kliem li jingħaraf	% ta' kliem li jingħaraf minn total ta' kliem li jingħaraf	% kliem li jingħaraf minn total (jingħaraf + ma jingħarafx)	numru ta' kliem li ma jingħarafx	% kliem li ma jingħarafx minn total (jingħaraf + ma jingħarafx)			numru ta' kliem li jintgħaraf f'minuta	numru ta' kliem li jingħaraf ÷ 10 =	16.9
32		Kitba Kreattiva l-1 sat-2 minuta	35	21%	19%	4	2.1%					
33		it-3 sar-4 minuta	31	18%	16%	4	2.1%			numru ta' kliem li jingħaraf u kliem li ma jingħarafx f'minuta	total ta' kliem li jingħaraf ÷ 10 =	16.9
34		il-5 sas-6 minuta	36	21%	19%	4	2.1%				total ta' kliem li ma jingħarafx ÷ 10 =	1.9
35		il-7 sas-8 minuta	34	20%	18%	0	0.0%				Punteġġ	18.8
36		id-9 sal-10 minuta	33	20%	18%	7	3.7%					
37		Total	169	100%	90%	19	10.1%					
38												
39										% ta' kliem li ma jingħarafx	total kliem li ma jingħarafx ÷ kliem totali x 100	10.1%
40												
41												
42	Punteġġ (Kliem f'Minuta) ta' kliem li jingħaraf			Punteġġ*				Punteġġ (Kliem f'Minuta) (jingħaraf + ma jingħar			Punteġġ*	
43			ikkopja pulit (Kliem f'Minuta)	23.5						ikkopja pulit (Kliem f'Minuta)	23.5	
44			ikkopja malajr (Kliem f'Minuta)	25.5						ikkopja malajr (Kliem f'Minuta)	25.5	
45			ikkopja mill-bord (Kliem f'Minuta)	17.5						ikkopja mill-bord (Kliem f'Minuta)	17.5	
46			kitba kreattiva (Kliem f'Minuta)	169.0						kitba kreattiva (Kliem f'Minuta)	188.0	
47			Total	235.5						Total	254.5	
48												

Sheet1 | Sheet2 | Sheet3

Stud. No.

Appendix AI

First Draft of the English Assessment Battery

For office use only:

*Round words per minute scores to a whole number. Round down for decimals below 5; round up for decimals of 5 and above.

TASK	Raw Score*
copy best (words per minute)	
copy fast (words per minute)	
text copying (words per minute)	
graphic speed test (number of correct Xs)	
free writing (words per minute)	
Total Raw Score (words per minute)	

cursive / print / mixed mostly cursive / mixed mostly print

legibility__________ ________________________________

Handwriting Speed Assessment

name: ________________________

male / female (please circle)

age: ______________

left handed / write handed (please circle)

town / village: ___________________

school: ____________________________

The results of these exercises will determine how many words a student your age can write in a minute.

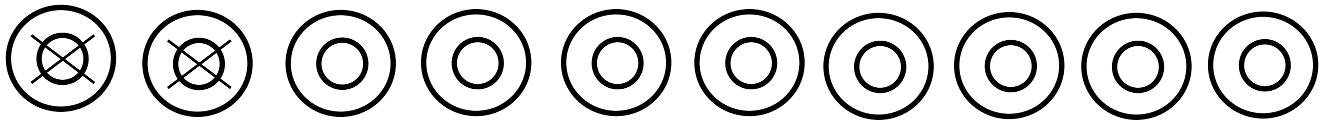
Please copy the following sentence:

A mad boxer shot a quick, gloved jab to the jaw of his dizzy opponent.

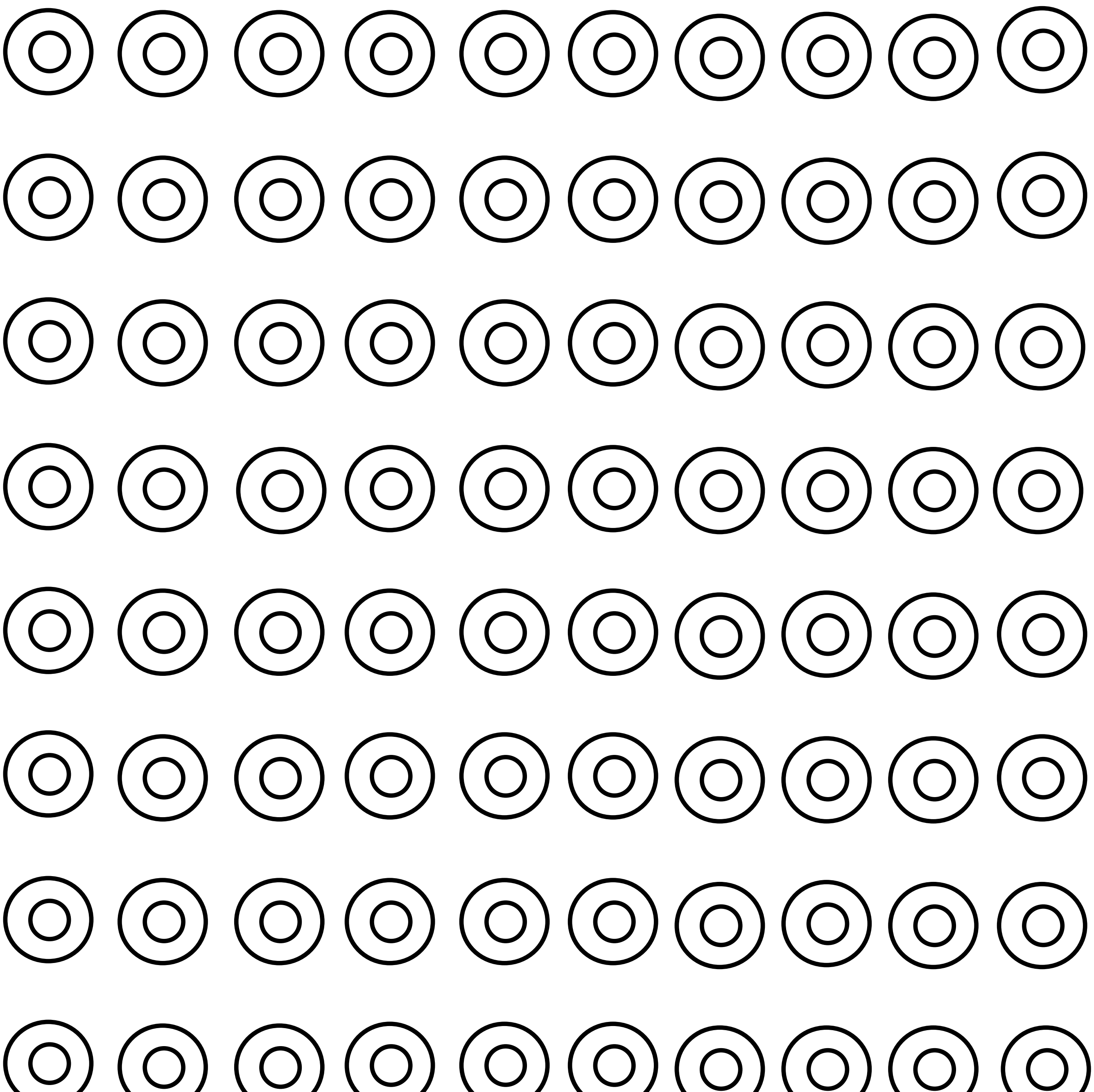
A mad boxer shot a quick, gloved jab to the jaw of his dizzy opponent.

Copy the text on the board. Do not write anything in the margin.

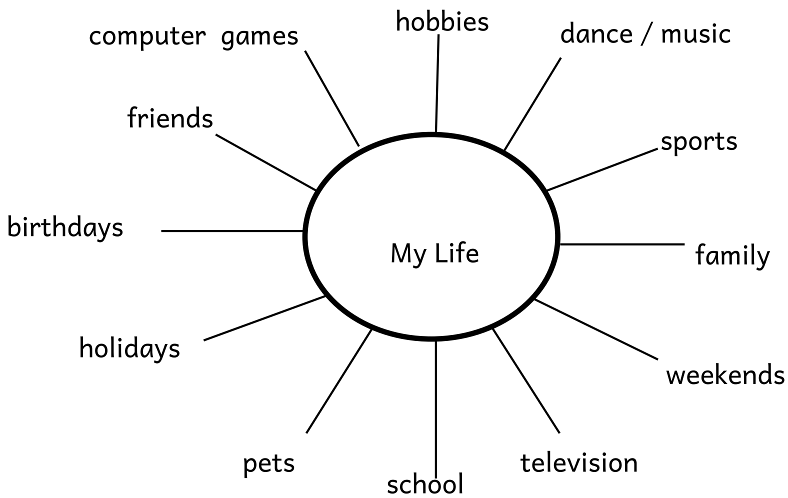
Mark the circles as in the examples.



Now mark these circles in the same way.



Plan, then write at length. Do not write anything in the margin.



My Life	

Numru tal-istudent

Appendix AJ

Għall-użu tal-uffiċċju:
*Ikteb it-total ta' kliem f'minuta fl-eqreb unita' maġġuri. Naqqas deċimali għal totali b'inqas minn punt ħamsa; żid deċimali għal totali b'deċimali b'iktar minn punt ħamsa.

Attivita'	Total*
ikkopja pulit (kliem f'minuta)	
ikkopja mgħaġġel (kliem f'minuta)	
ikkopja mill-bord (kliem f'minuta)	
Test ta' Veloċita' Grafika (numru ta' X tajbin)	
kitba kreattiva (kliem f'minuta)	
Total Globali (kliem f'minuta)	

maghqud / maħlul / taħlita l-aktar magħqud / taħlita' l-aktar maħlul

legibilia' __________ ______________________________

Assessjar tal-Kitba

isem: ______________________

tifel / tifla (agħżel)

eta': ______________

lemini / xellugi (aġħżel)

raħal / villaġġ: ___________________

skola: ______________________________

Ir-riżultat ta' dan l-eżerċizzju juri kemm student tal-eta' tiegħek kappaċi jikteb kliem f'minuta.

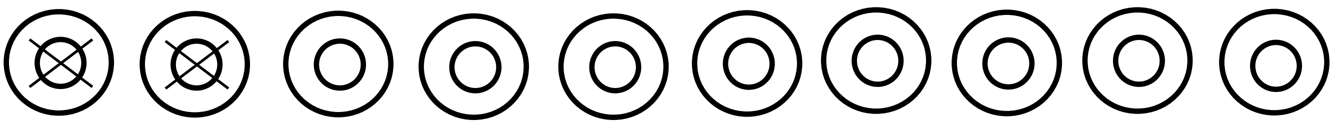
Jekk jogħgbok ikteb din is-sentenza:

Kien liebes gozz ħwejjeg u ċraret vera qodma u m'għażluhx fil-pront.

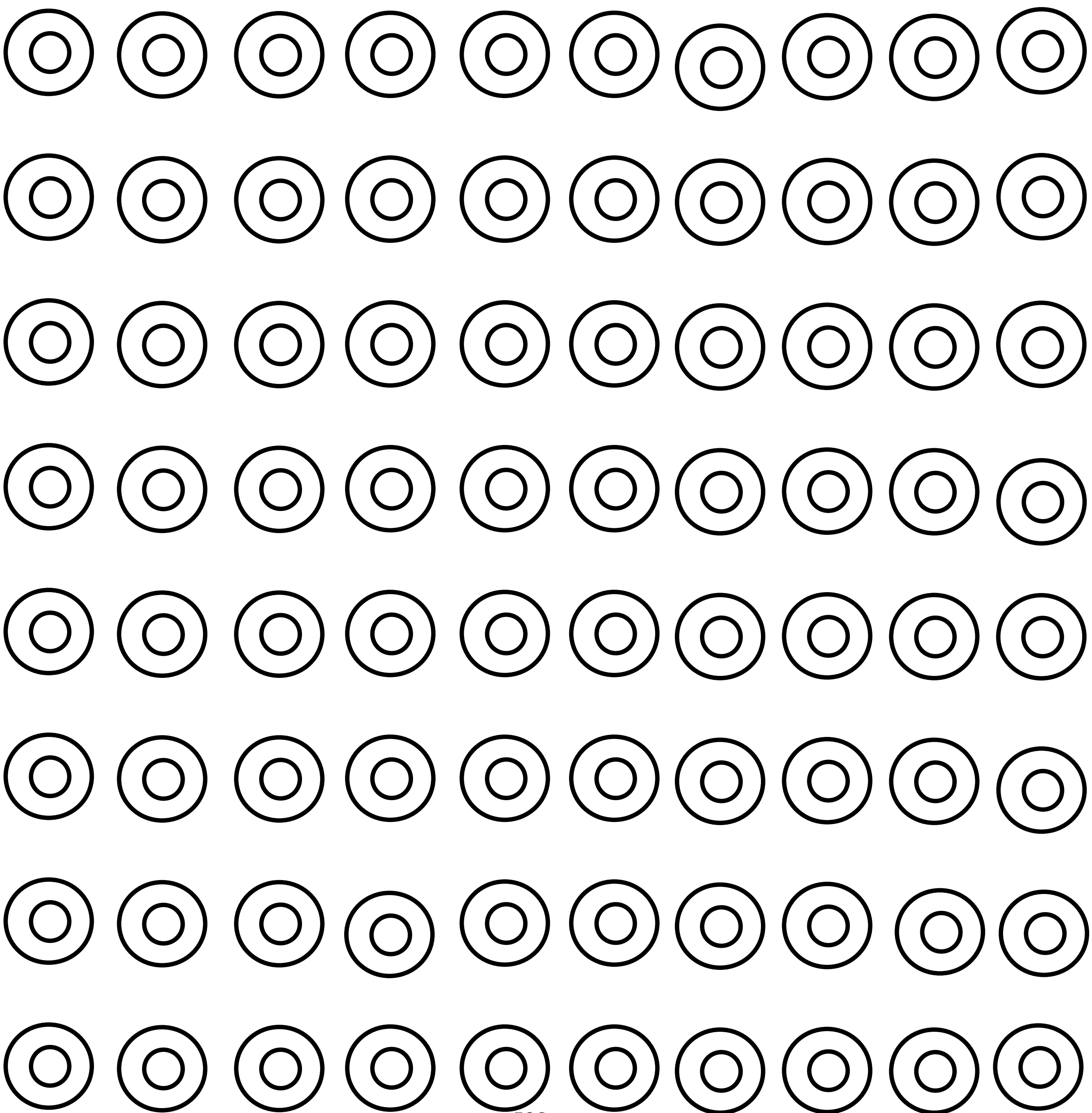
Kien liebes gozz ħwejjeg u ċraret vera qodma u m'għażluhx fil-pront.

Ikkopja it-test li hemm fuq il-bord. Tikteb xejn fil-ġenb.

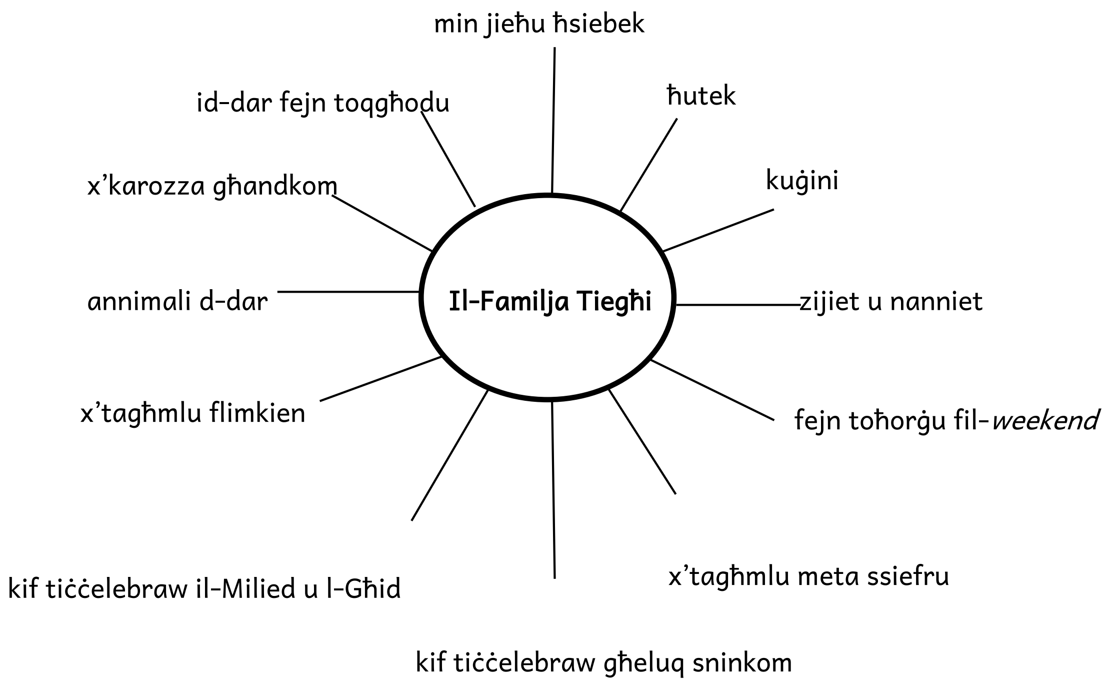
Immarka ċ-ċrieiki bħal fl-eżempju.



Issa mmarka dawn iċ-ċrieiki bl-istess mod.



Aħseb, imbagħad ikteb. Tikteb xejn fil-ġenb.



Il-Familja Tiegħi	

Appendix AK

Validation of the Assessment Battery Prior to the Pilot Study

First Validator

The first validator was a senior lecturer of English within the Faculty of Arts at the University of Malta. With this validator, the duration of the *Copy from the Board* subtest, and the issue of whether illegible words were to be counted or not, were discussed. With regard to the *Copy from the Board* subtest, prior to the meeting, participants were expected to copy the text projected on the board for a minute. Following the meeting, it was decided to time the students for two minutes to allow them enough time while writing to lift up their heads, read the text from the board, memorise this text, and copy the text on the test paper. As in all the other subtests, it was decided for the participants to insert the time mark // on the test paper after the first minute. As for illegible words, the DASH excludes these from the word count, except for the final writing task, were they are bracketed and counted separately. However, literature has shown that this could lead to abnormally low scores in cases where participants suffer from a developmental coordination disorder (Prunty et al., 2013). It was therefore decided to present two counts for all tasks: one for legible words only, and one for legible and illegible words. This allows a comparison to be drawn between the two counts, that is, a comparison between legible words, and legible *and* illegible words. Table AK1 summarises the changes that were affected on the assessment battery after consulting the validator.

Table AK1

List of Changes to the Testing Tools Following Expert Consultation

Points discussed	Before discussions with the validator	After discussions with the validator
Duration of the *Copy from the Board* subtest	one minute	two minutes
Illegible words	Illegible words were to be counted separately in the final writing task.	Illegible words were counted separately for all writing tasks, using two counts: one for legible words

		only, and one for legible *and* illegible words. For the final free writing task, a percentage of illegible words was to be calculated.

Second Validator

The second validator was a lecturer at the department of Occupational Therapy at the University of Malta. She commented on the fact that the lines on which participants were expected to write were too narrow, and recommended the use of the same line spacing in the DASH, so comparisons could eventually be drawn between the two tools. Since the tools are to be standardized on the local population, she also suggested checking the line spacing of the foolscaps used by students in Malta. Furthermore, she pointed out that the circles of the graphic speed test were larger than the ones in the DASH, and that these should be the same, so that comparisons could eventually be drawn between the two tests. For the same reason, the validator pointed out that the number of circles in each line of the EMASH, as well as the number of rows, should match those of the DASH. Otherwise the validator found the tool useful and expressed her satisfaction that the tool is to be administered on 14-year-olds in Year 10 classes, since that is the age students in Malta are usually tested when granted access arrangements for their national examinations.

Following the validator’s recommendations, the researcher checked the line spacing of foolscaps and found this to be 1.9cm wide. The line spacing in the DASH test was also measured, and was found to be 1.8cm. Hence double line spacing was applied to the EMASH to increase the line spacing from 1.6cm to 1.8cm. This was not only very close to the line spacing of foolscaps, but would make comparisons between the EMASH and the DASH possible at the end of data collection. The size of the inner and outer circles of the DASH were measured. The outer circles were found to be 1.95cm in diameter, and the inner circles 1.45cm in diameter. Accordingly, the sizes of the inner and outer circles in the EMASH were changed from 2.3cm and 1.7cm, to 1.95cm and 1.45cm, respectively. The number of rows in the EMASH were increased from 8 to 11, to match those of the DASH. The number of circles per line was found to be the same. Table AK2 is a table summarising the changes made to the EMASH after consulting the validator.

Table AK2

List of Changes to the Testing Tools Following Expert Consultation

Points discussed	Before discussions with the validator	After discussions with the validator
Line spacing	1.6cm	1.8cm
Outer circle's diameter	2.3cm	1.95cm
Inner circle's diameter	1.7cm	1.45cm

Third Validator

The third validator was a senior Pediatric Occupational Therapist at Child Development Assessment Unit (CDAU). This researcher expressed her satisfaction at the Maltese version of the EMASH, as during DASH testing, students sometimes end up writing in Maltese. Her concern was about the fact that the title of the free writing task in Maltese (this being *My Family)* differed from that in English (this being *My Life)*. She suggested having the same title for both tests, that is, *My Life*, as this is the one proposed in the DASH. Also, when assessed for access arrangements, students will in all probability take one writing speed test, either that in Maltese or English, according to their language preference. The validator explained that writing difficulties are usually evident irrespective of whether the students write in Maltese or English, and that having two tests helps the students write in the language they feel most comfortable with, rather than to submit them to both tests.

The validator also suggested removing all headings and instructions from the test paper, as the DASH just presents the students with blank lines, with no headings or instructions. She further proposed placing the sentence to be copied for the *Copy Neatly* task above the writing lines, to match the way it is presented in the *Copy Quickly* task (see Appendix J for English and Appendix K for Maltese). Furthermore, this corresponds to the test administration of the DASH, where the sentence to be copied is placed above the writing lines. Originally, the Andika font had been selected for the test paper and the projected text, as the Andika characters ‘a’ and ‘u’ closely resemble the way they are written, making this font dyslexia friendly. The validator suggested changing the font from Andika to Verdana, since a Matriculation and Secondary Education Certificate (MATSEC) study showed that this font was viewed as the most readable font, and hence was the one selected to set MATSEC papers (MATSEC, 2017). In keeping with MATSEC findings, it was decided to change the font of the whole test, including the font of the projected text, from Andika to Verdana.

Finally, the validator expressed her satisfaction at having a separate word count for illegible words for all tasks, as well as margins on the right of the *Copy from the Board* and the *Free Writing* tasks, for ease of computation. Table AK3 presents the modifications made to the EMASH after validation.

Table AK3

List of Changes to the Testing Tools Following Expert Consultation

Points discussed	Before discussions with the validator	After discussions with the validator
Title of the Maltese *Free Writing* task	*Il-Familja Tiegħi* (My Family)	*Ħajti* (My Life)
Instructions, headings and titles	Test pages had instructions, headings and titles at the top of each exercise.	Headings, instrutions and titles were removed from the test pages.
Test items	The *Copy Neatly* pangram was written between the first two writing lines of the first page.	The *Copy Neatly* pangram was placed above the first writing line of first the page.
Font style	The font of the test was Andika.	The font of the test was changed to Verdana.

Fourth Validator

The fourth validator was the Head of Department of Maltese within the Faculty of Arts at the University of Malta. This validator brought to the attention the fact that the instructions of both testing tools should have similar wording. Hence the instructions of the Maltese test paper for the final writing task was changed from *Aħseb, imbagħad ikteb. Tikteb xejn fil-ġenb* (Think, then write. Do not write anything in the margin), to *Agħmel pjan, imbagħad ikteb fit-*

tul. Tikteb xejn fil-ġenb, to match the instructions given in the English free writing task, these being ‘Plan, then write at length. Do not write anything in the margin.’

Fifth Validator

The fifth validator was a lecturer at the Faculty of Social Wellbeing at the University of Malta, who is also a dyslexia specialist. This validator suggested removing the scoring table, and other fancy borders from the front page, to keep the test paper as simple and plain as possible, and hence, dyslexia friendly. For the same reason, the validator also suggested changing the test paper title of the Maltese test paper from *Assessjar tal-Kitba (Writing Assessment)* to something simpler, in order to avoid using complicated language. Hence the title was changed to *Ħiliet fil-Kitba* (Writing Skills) as the diction is simpler. She also suggested removing ‘Student number’ from the front page, in order for the test not to feel like an exam, thus putting added pressure on the participants. The validator also pointed out that the accents at the end of certain words in the Maltese test, such as *eta'* (age), were apostrophes (’) not accents ('). She recommended changing these accordingly.

The validator also recommended printing the test on cream coloured paper and on single pages (not back to back). She also suggested printing a few copies on pink or light blue paper, to meet students’ requests. Again these recommendations were made with the dyslexic student in mind. However, when the MATSEC office was contacted to enquire about the colour of the booklets given to the students, as well as the colour of the examination papers, the researcher was informed that neither of these was cream coloured. The researcher was informed that Paper 1, to which all students sit, is white, whereas Paper 2A is yellow, and Paper 2 B is green.[70] The sole reason, MATSEC explained, why the latter two papers are colour coded was for convenience, as it made it more practical for examiners to distinguish between the two sets of papers (MATSEC Unit, personal correspondence, May 5, 2017). Dyslexia seemed not to be an issue in this matter. Hence the test paper was printed on white paper rather than cream, to simulate as close as possible MATSEC examination conditions, since all students sit for paper A. Furthermore, when the researcher asked the MATSEC office

[70] Students sit for paper 2A or Paper 2B depending on their proficiency in the subject. Students sitting for and passing a Paper 2A exam can attain a 1, 2, 3,4 or 5 grade, which are pass marks, or a U, which is Unclassified. Students sitting for Paper 2B can attain a 4, 5, 6 or 7 grade, which are pass marks, or a U (Unclassified).

how the booklet was expected to be used, the researcher was informed that the students were expected to write on both sides of the page rather than on reverse pages (MATSEC Unit, personal correspondence, May 5, 2017). For this reason, it was decided to print the test back to back, rather than on single pages, again to simulate MATSEC examination conditions.

The validator also recommended keeping the alphabet writing task, which is the second exercise in the DASH, as this is important for dictionary skills. However the alphabet writing task was removed from the assessment battery for the following reasons:

1. In this technological era, especially with the introduction of tablets in schools, dictionary skills are not that essential anymore as students can look up words online
2. Although children write out all the letters of the alphabet when doing their schoolwork, they rarely write the alphabet in sequence, especially in secondary schools, so the task is not well rehearsed (Medwell & Wray, 2017). This is especially true for the Maltese alphabet, which is rarely cited from memory, let alone written down.
3. Writing the alphabet in sequence from memory requires recalling the auditory-memorized sequence of the letters (Barrientos, 2017), which might initially have been learnt through song. As singing the alphabet song is not a common practice in secondary school, again this practice is not well rehearsed.

These two reasons can bring graphomotor execution to a halt, and generate a writing pause (McCutchen, 1996). In this context, frequent pauses my result in slow writing speed, which might not be due to writing difficulties but rather due to the execution of the long-term memory. The alphabet copying task was deemed unsuitable for the purpose of this research and hence removed from the assessment battery. A tester may still observe how a testee forms individual letters from the pangram copying tasks.

Another recommendation made by the validator was that of keeping the title *My Life* for the English free writing task, but changing the title of the Maltese *Free Writing (Kitba Kreattiva)* task to *Xi Nħobb Nagħmel* (What I Like Doing), as this makes it possible for both free writing tasks to have the same prompts in the web, whilst having different titles. Different promts had been proposed for the title *Il-Familja Tiegħi* (My Family). This makes it possible for testers to choose whether to use one or both tests. Yet if the tests are administered apart from each other, different tiles reduce the chances of students producing the same content in both tests.

The validator also recommended enlarging the web so that the font would be the same size as that of the pangrams. Hence, the font size of the web was enlarged from size 12 to size 15. The font size of the pagrams were as large as the ones in the DASH. Table AK4 is a summary of the changes made to the EMASH after consulting the validator.

Table AK4

List of Changes to the Testing Tools Following Expert Consultation

Points discussed	Before discussions with the validator	After discussions with the validator
Scoring practices	Scoring table on front page	Scoring table removed
Borders	Fancy borders	Plain borders
Coding system	“Student number” on front page	“Student number” removed. Student code to be inserted into an empty box (see Appendix J for English and Appendix K for Maltese).
Maltese test paper title	*Assessjar tal-Kitba*	*Ħiliet fil-Kitba*
Punctuation	Accents at the end of certain words in the Maltese test, such as *eta'* (age), were apostrophes (’).	Apostrophies were changed to accents.
Title of *Free Writing* task	My Life	Xi Nħobb Nagħmel
Font Size	12	15

Sixth Validator

The sixth validator was an educational psychologist at the Secretariat of Catholic Education. This validator was of the opinion that students should take both tests, as if given the option to choose a language, students would choose their strongest language, and hence might not get the help needed. As this validator proposed submitting the students to both tests, she expressed concern at the duration of the tests, and suggested shortening them. She proposed removing the *Copy from the Board* task and the *Graphic Speed Test*, the former because psychologists cannot perform this task in their clinics since there are no projectors, and the latter because it does not contribute directly to writing speed assessment. The validator stated that it is possible to administer two short tests on the same day, within a short interval of each other. Following this discussion, two sets of standard scores would be presented at the end of testing –

one that encompasses all five tasks, as well as standard scores for each individual subtest. This decision was made to help make the test more practical to educational psychologist, should they decided to administer individual items of both tests on the same day, within a short interval of each other, as proposed by this validator. However the researcher was of the opinion that due to test fatigue, testing should not take place on the same day, and hence the test could afford to be a little longer. Hence, it was decided not to remove the *Copy from the Board* task, and also to keep the Graphic Speed Test. The *Copy from the Board* task was kept because the EMASH, like the DASH, is a tool "for professionals, from both education and health" that may be used by "specialist and advisory teachers, Special Needs Co-ordinators (SENCOs)/learning support teachers and classroom teachers" (Barnett et al., 2007, pg. 19), who all have access to a projector in a school. Furthermore, the researcher is of the opinion that there should be no shortcuts to testing, and if needs be, the tester should go to the student's school to administer the test in a classroom context, rather than in a clinic.

Finally, the validator also proposed going back to the original idea of having two different titles for the free writing tasks[71], to reduce the risk of a better performance in the second writing task because of exposure to the same title in the first writing task.

[71] The proposed title in English was *My Life* and the proposed title in Maltese was *Il-Familja Tiegħi* (My Family).

Appendix AL

Informative Letter to Class Teachers for Face Validation

Dear Teacher,

I am a PhD student with the Department of Communication Therapy, Faculty of Health Sciences, University of Malta. As part of my research, I hope to develop a handwriting speed test for children aged between 14 and 15 years. The Education Division, the Head of School, the Secretariat of Education, as well as the students' parents, have been notified about this research, and the necessary consent has been obtained. The aim of this handwriting assessment is to identify students with writing difficulties.

As part of my research, I hope to test a group of Year 10 students within your school. They will be asked to take part in a few short writing tasks such as text copying and free writing. Testing will take place on two different occasions within a few days of each other, and should last about 35 to 40 minutes each. As part of the validation process, I would appreciate your feedback with regard to the adequacy of the test items in measuring writing speed and diagnosing writing difficulties.

Thank you in advance for your support. Please do not hesitate to contact me should you have any queries.

Sincerely

Fiona Galea
PhD Student
fiona.galea.99@um.edu.mt
Mob: 79273984

Dr Rachael Agius
Supervisor
rachael.agius@um.edu.mt

Appendix AM

Informative Letter to Parents/Guardians of Students with Learning Difficulties

Dear Parents/Guardians,

I am a PhD student with the Department of Communication Therapy, Faculty of Health Sciences, University of Malta. As part of my research, I hope to develop a handwriting speed test for children aged between 14 and 15 years. The aim of this assessment is to identify students with writing difficulties.

I would like to request your kind consent to your child's participation in this research. Should you consent, your child will be asked to take part in a few short writing tasks, including copying text from the board and writing a short paragraph. Testing will take place at school on two different occasions within a few days of each other, with each session lasting about 35 - 40 minutes. During this time, the students will be tested altogether. I would also like to request your kind consent to access information from the statementing report of your child, for research purposes. Participation is anonymous, confidential and voluntary, and you and your child may withdraw from the study at any time.

The Head of School, the Education Division, and the Secretariat of Education, have been informed and the necessary consent obtained. If you consent, kindly complete and sign the consent form below and fill in the attached questionnaire. Please return the forms with your child to school at your earliest convenience.

The aims and details of the project on Handwriting Speed Assessment have been explained to me by Ms. Fiona Galea. I have also explained to my child what this study entails.

I understand that the information collected will remain confidential, and that it will only be used for research purposes. I also know that a report will be drawn up, but that neither I nor my child will be identified in any way, and that once the study is complete, all the information collected will be destroyed.

I therefore give my consent to Ms. Fiona Galea to make the necessary observations on my child

__________________________.

I am aware that I am under no obligation to participate and that I can withdraw my participation at any time without giving any reason. In case of difficulty during the study I can contact Ms. Fiona Galea on 79273984 or via e-mail (fiona.galea.99@um.edu.mt).

Name of parent/guardian: ________________________ Signature: ____________________

___________________________	___________________________
Fiona Galea	Dr Rachael Agius
PhD Student	Supervisor
fiona.galea.99@um.edu.mt	rachael.agius@um.edu.mt
Mob: 79273984	

Ittra Nformattiva lill-Ġenituri ta' Studenti bi Bżonnijiet Speċjali

Għeżież Ġenituri/Kustodji,

Jien qed nagħmel dottorat mad-dipartiment tal-*Communication Therapy,* fi ħdan il-fakulta tax-Xjenzi tas-Saħħa, l-Universita' ta' Malta. Jiena qed naħdem biex niżviluppa test ta' kitba għal tfal ta' bejn l-14 u l-15-il sena, li jista' jgħin jiddetermina xi diffikultajiet li jista' jkun hemm fil-kitba.

Nixtieq nitlob il-permess tiegħek biex ibnek/bintek t/jieħu sehem f'dan l-istudju. Jekk taċċetta, ibnek/bintek ser j/tkun mitlub/a j/tikkopja xi sentenzi qosra minn fuq il-karta u minn fuq il-bord, u j/tikteb storja. It-test ser isir l-iskola f'żewġ seduti ta' madwar 35 – 40 minuta l-waħda, fi żmien ftit jiem minn xulxin. It-tfal ser jagħmlu t-test f'daqqa. Nixtieq nitlob il-permess tiegħek biex naqra l-*istatementing report* tat-tifel/tifla tiegħek għal skopijiet ta' riċerka. Il-parteċipazzjoni f'dan l-istudju hija waħda anonima, kunfidenzjali u volontarja u int u ibnek/bintek j/tista' j/tieqaf j/tagħmel it-test meta j/trid.

Il-kap tal-iskola, id-Diviżjoni tal-Edukazzjoni, u s-Segretarjat tal-Edukazzjoni huma diġà infurmati b'din ir-riċerka. Jekk taqbel, jekk jogħġbok, imla l-formola hawn taħt u l-*questionnaire* mehmuża, u ibgħathom lura l-iskola mat-tifel/tifla tiegħek mill-aktar fis possibbli.

L-iskopijiet u d-dettalji tal-proġett dwar *Handwriting Speed Assessment* spjegathomli Ms. Fiona Galea. Jiena spjegajt ukoll lit-tifel /tifla tiegħi dak li se jsir.

Jiena naf li l-informazzjoni miġbura se tinżamm kunfidenzjali, u li se tintuża biss għal skopijiet ta' riċerka. Naf ukoll li ser isir rapport bil-miktub tar-riżultati u li meta dan isir, jiena jew it-tifel/tifla tiegħi, bl-ebda mod m'aħna se nkunu nistgħu niġu identifikati. Meta jispiċċa l-istudju l-informazzjoni miġbura se tiġi meqruda.

Għalhekk qed nagħti l-kunsens tiegħi lil Ms. Fiona Galea biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel / tifla tiegħi _____________________________.

Jiena konxju li ma għandi l-ebda obbligu nipparteċipa f'dan l-istudju u li nista' nirtira fi kwalunkwe punt mingħajr ma nagħti raġuni. Jekk ikolli diffikultà waqt l-istudju nista' nistaqsi għal Ms. Fiona Galea, inċemplilha fuq 79273984, jew nibagħtilha e-mail fuq fiona.galea.99@um.edu.mt

Isem tal-ġenitur/kustodju ________________________ Firma ____________________

Grazzi tal-għajnuna tiegħek.

____

Fiona Galea
Studenta tal-PhD
fiona.galea.99@um.edu.mt
Mowbajl: 79273984

____

Dr Rachael Agius
Superviżur
rachael.agius@um.edu.mt

Appendix AN

Performance of Students with Learning Difficulties and Typically Developing Students in each of the English Subtests

Figure AN1

English Copy Neatly Subtest

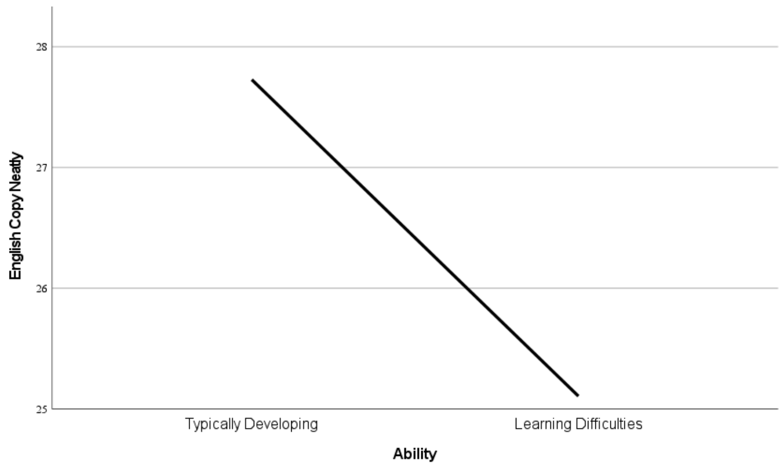


Figure AN2

English Copy Quickly Subtest

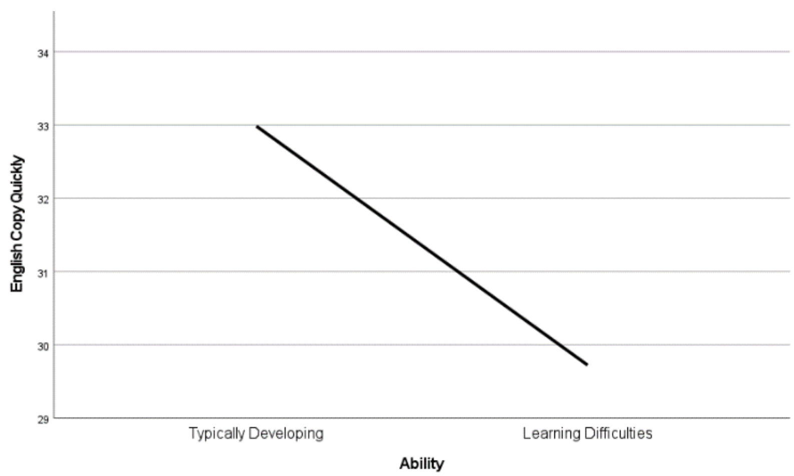


Figure AN3

English *Copy from the Board* Subtest

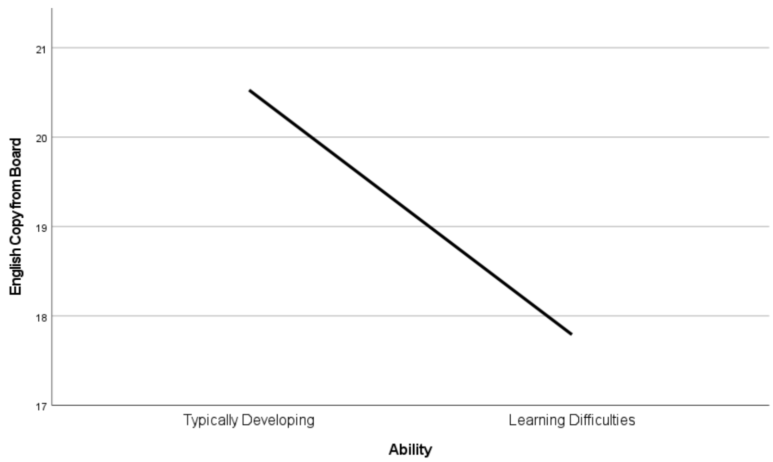


Figure AN4

Graphic Speed Test

Figure AN5

English Free Writing Subtest

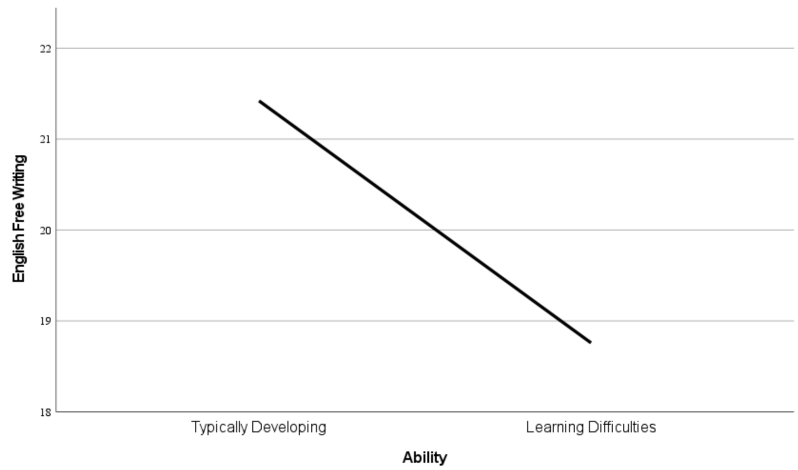
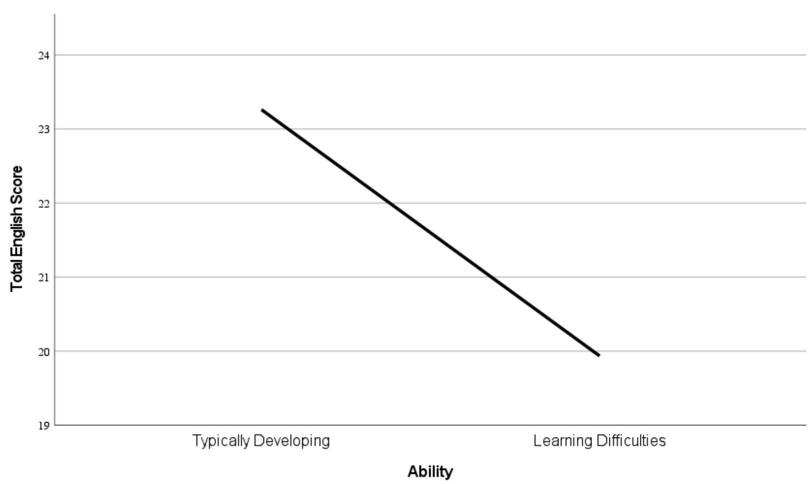


Figure AN6

Total English Score



Appendix AO

Performance of Students with Learning Difficulties and Typically Developing Students in each of the Maltese Subtests

Figure AO1

Maltese Copy Neatly (Ikkopja Pulit) Subtest

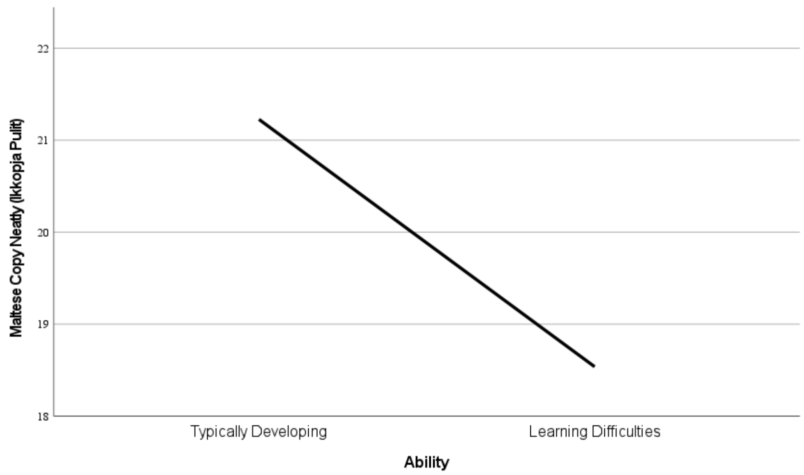


Figure AO2

Maltese Copy Quickly (Ikkopja Malajr) Subtest

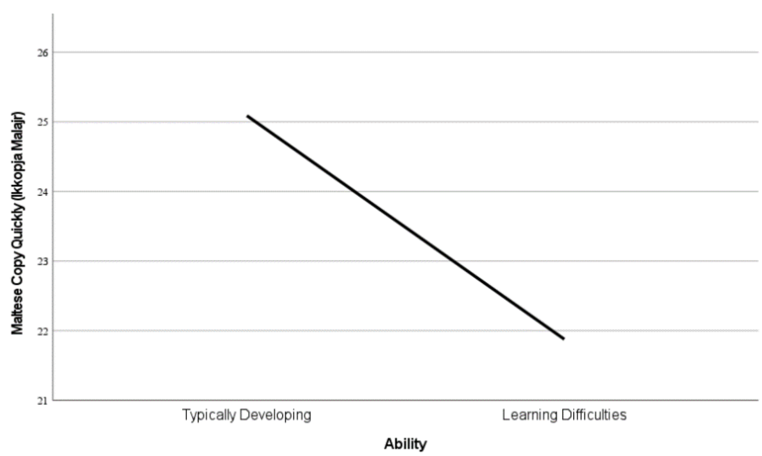


Figure AO3

Maltese Copy from the Board (Ikkopja mill-Bord) Subtest

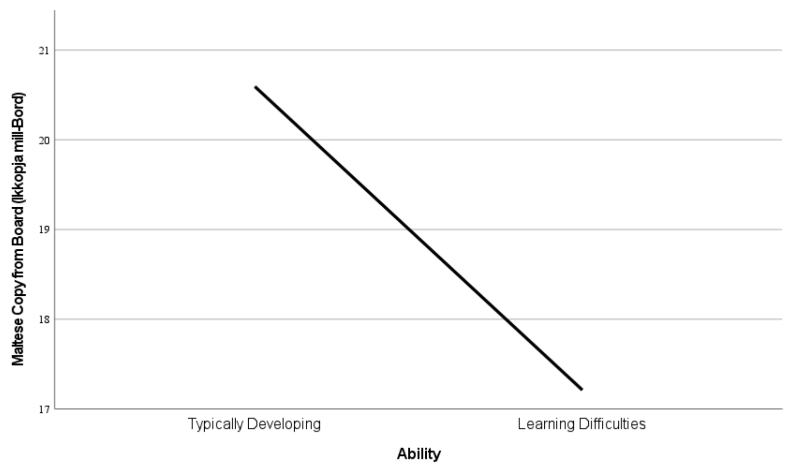


Figure AO4

Maltese Free Writing (Kitba Kreattiva) Subtest

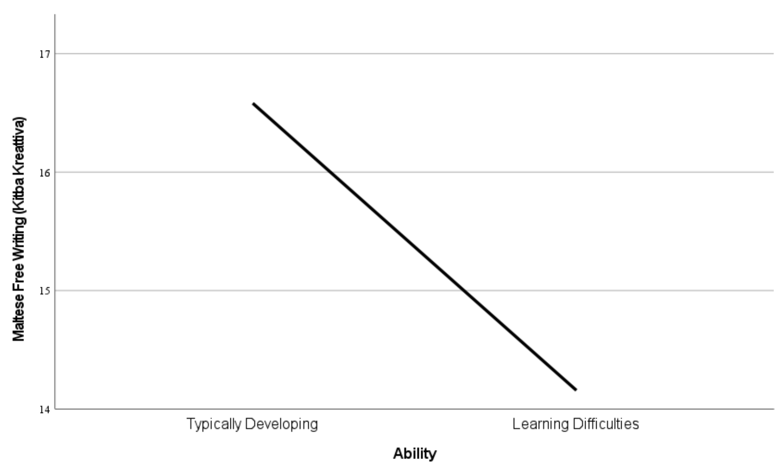
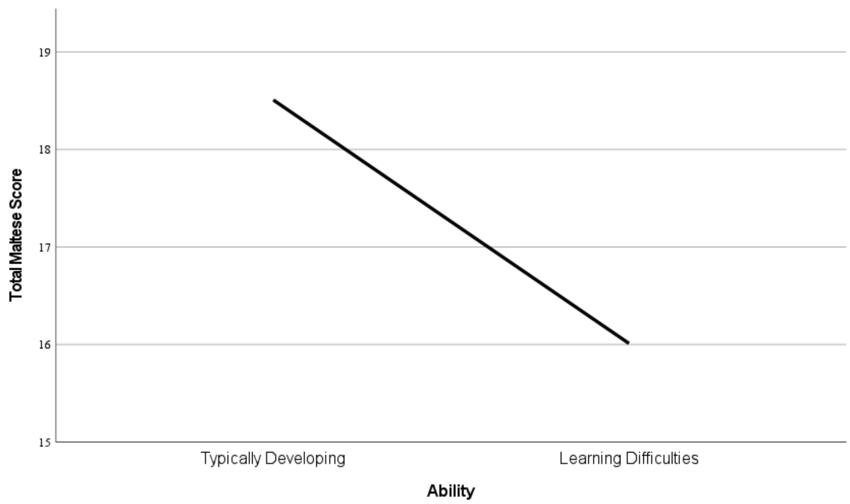


Figure AO5

Maltese Total Score



Appendix AP

The DASH Assessment Battery used for Concurrent Validity

For office use only:
____

Handwriting Speed Assessment

Name: ______________________

Male/female (*please circle*)

Date of Birth: ___________________

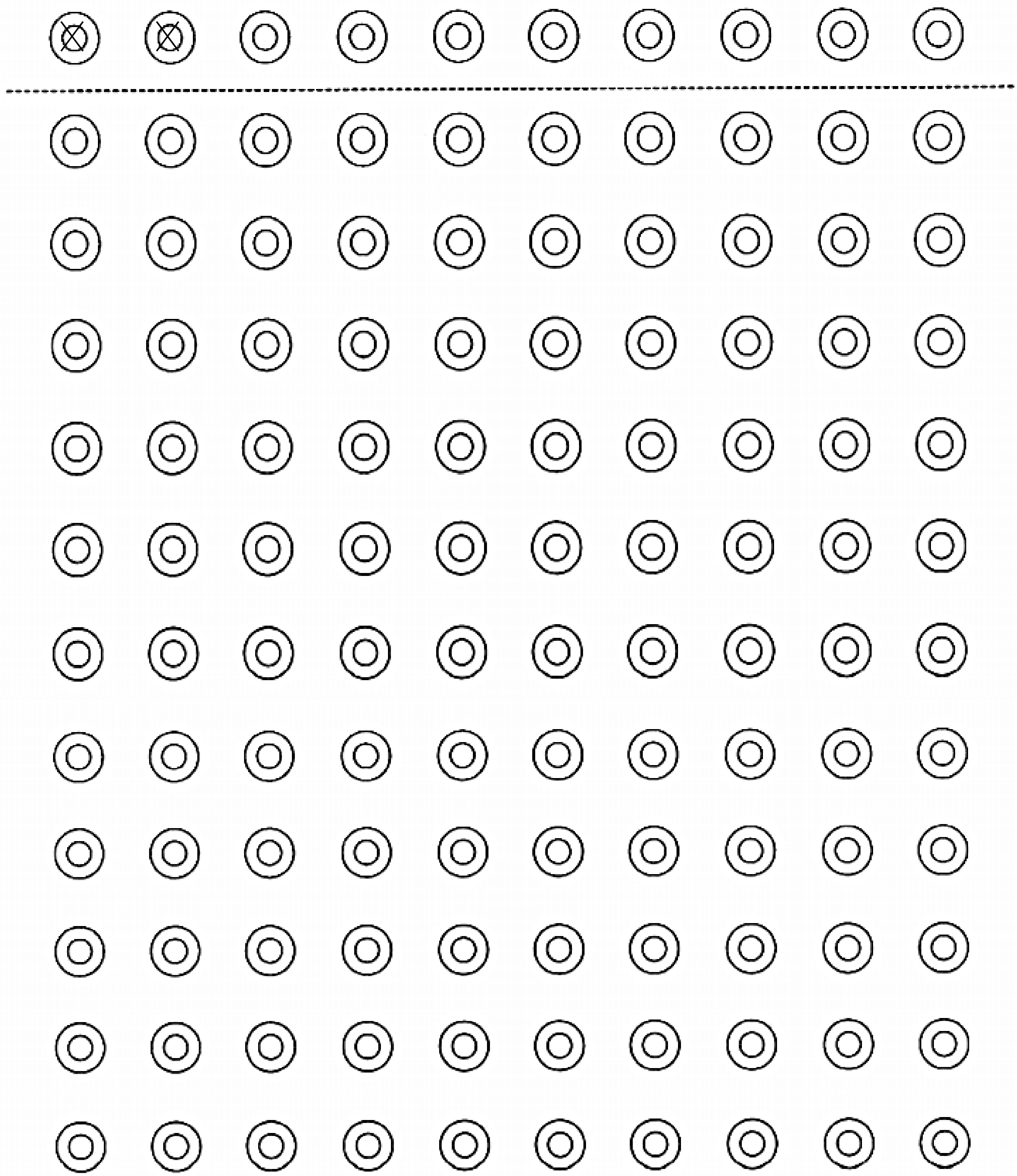
Left handed/right handed (*please circle*)

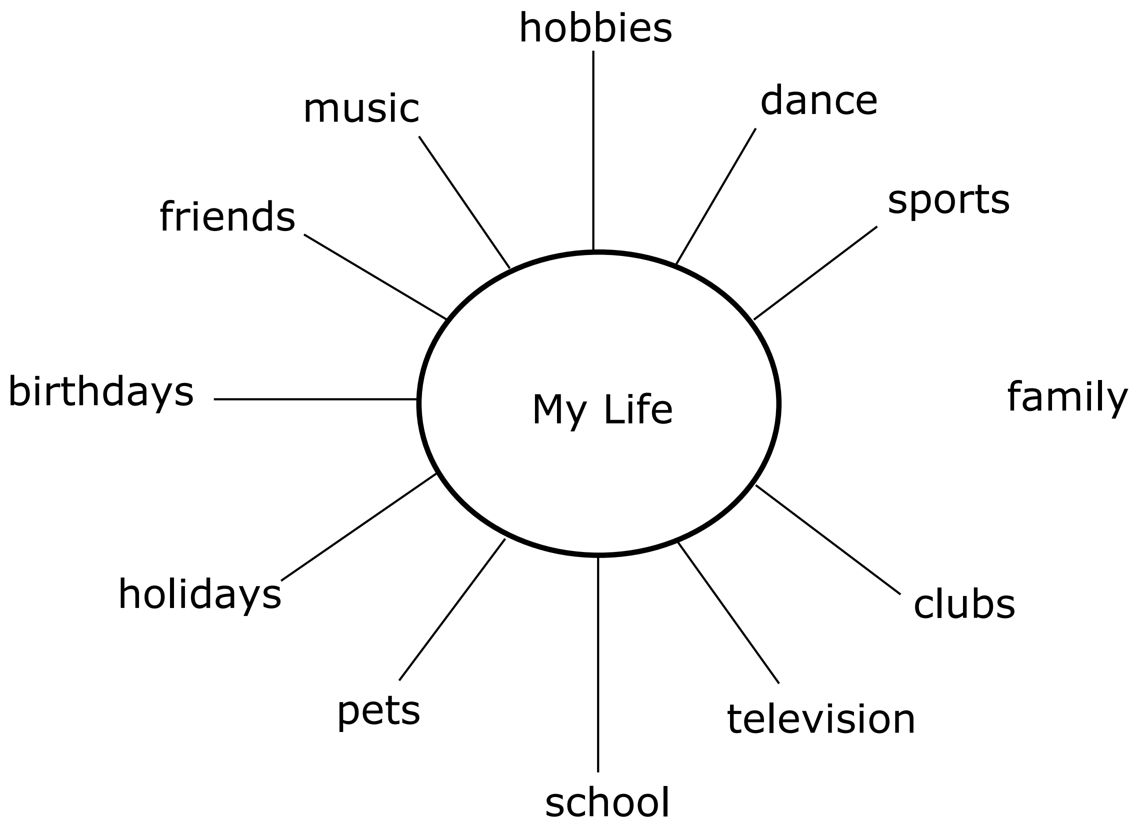
Town/village: __________________

School: ______________________

The quick brown fox jumped over the lazy dog.

The quick brown fox jumped over the lazy dog.




hobbies
music
dance
friends
sports
birthdays
My Life
family
holidays
clubs
pets
television
school

Appendix AQ

Consent Form for Test Reliability English and Maltese

Informative letter to parents/guardians – Test validity and reliability

Dear Parent/Guardian,

I would like to thank you for consenting to your child's participation in my PhD research with the Department of Communication Therapy, Faculty of Health Sciences, University of Malta. As part of my research, I am working on the development of a handwriting speed test for children aged between 14 and 15 years. As part of the standardisation of this newly developed test, I am required to conduct an exercise for validity and reliability purposes.

I would like to ask for your kind consent to test your child again on the tests s/he has already undertaken (copying sentences, copying text from the board and writing a short paragraph). Testing will again take place at school and each session will last approximately 40 minutes. During each session, the class will be tested altogether. Participation in this research is anonymous, confidential and voluntary, and you may withdraw from this study at any time.

This second and final part of testing is crucial to the validity and reliability of the test. Your support is very much appreciated. Should you consent to this final phase of this research, kindly complete and sign the consent form below and return it with your child to school at your earliest convenience.

The aims and details of the project on Handwriting Speed Assessment have been explained to me by Ms. Fiona Galea. I have also explained to my child what this phase of the research entails.

I understand that the information collected will remain confidential, and that it will be used only for research purposes. I also know that a written report will be drawn, but that neither I nor my child will be identified in any way, and that once the research is complete, all the information collected will be destroyed. I am aware that I am under no obligation to participate and that I can withdraw my participation at any time without giving any reason.

I give my consent to Ms. Fiona Galea to make the necessary observations on my child

____________________________.

In case of difficulty during the study I can contact Ms. Fiona Galea on 79273984 or via e-mail (fiona.galea.99@um.edu.mt).

Name of parent/guardian: ________________________ Signature: ____________________

____

Fiona Galea
PhD Student
fiona.galea.99@um.edu.mt
Mob: 79273984

____

Dr Rachael Agius
Supervisor
rachael.agius@um.edu.mt

Ittra nformattiva lill-ġenituri - Affidabilità tat-test

Għażiż Ġenitur/Kustodju,

Nixtieq nirringrazzjak talli ħallejt lil ibnek/bintek j/tieħu sehem fid-dottorat tiegħi mad-dipartiment tal-*Communication Therapy*, fi ħdan il-fakulta tax-Xjenzi tas-Saħħa, l-Universita' ta' Malta. Jiena qed naħdem biex niżviluppa test ta' kitba għal tfal ta' bejn l-14 u l-15-il sena, li jista' jgħin jiddetermina xi diffikultajiet li jista' jkun hemm fil-kitba. Bħala parti mill-istandardizzazzjoni ta' dan it-test ġdid, jeħtieġ li ssir eżerċizzju għall-affidabilità tat-test.

Nixtieq nitlob il-kunsens tiegħek biex ibnek/bintek j/terġa j/tagħmel it-test li diġa għamel/għamlet (ikkopja/t xi sentenzi qosra minn fuq il-karta u minn fuq il-bord, u kiteb/kitbet storja). Is-sessjonijiet ser jerġgħu jsiru l-iskola u kull sessjoni ddumu madwar 40 minuta. It-tfal ser jagħmlu t-test f'daqqa. Il-parteċipazzjoni f'dan l-istudju hija waħda anonima, kunfidenzjali u volontarja u int u ibnek/bintek j/tista' j/tieqaf j/tagħmel it-test meta j/trid.

Din it-tieni u l-aħħar parti tat-test hi kruċjali għall-affidabilità tat-test. L-għajnuna tiegħek hi apprezzata ferm. Jekk taqbel, jekk jogħġbok, imla l-formola t'hawn taħt u ibgħatha lura l-iskola mat-tifel/tifla tiegħek mill-aktar fis possibbli.

L-iskopijiet u d-dettalji tal-proġett dwar *Handwriting Speed Assessment* spjegathomli Ms. Fiona Galea. Jiena spjegajt ukoll lit-tifel /tifla tiegħi dak li se jsir.

Jiena naf li l-informazzjoni miġbura se tinżamm kunfidenzjali, u li se tintuża biss għal skopijiet ta' riċerka. Naf ukoll li ser isir rapport bil-miktub tar-riżultati u li meta dan iseħħ, jiena jew it-tifel/tifla tiegħi, bl-ebda mod m'aħna se nkunu nistgħu niġu identifikati. Meta jispiċċa l-istudju l-informazzjoni miġbura se tiġi meqruda. Jiena konxju li ma għandi l-ebda obbligu nipparteċipa f'dan l-istudju u li nista' nirtira fi kwalunkwe punt mingħajr ma nagħti raġuni.

Jien nagħti l-kunsens tiegħi lil Ms. Fiona Galea biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel / tifla tiegħi _____________________________.

Jekk ikolli diffikultà waqt l-istudju nista' nistaqsi għal Ms. Fiona Galea, inċemplilha fuq 79273984, jew nibagħtilha e-mail fuq fiona.galea.99@um.edu.mt

Isem tal-ġenitur/kustodju ______________________ Firma _____________________

Grazzi tal-għajnuna tiegħek.

____

Fiona Galea
Studenta tal-PhD
fiona.galea.99@um.edu.mt

____

Dr Rachael Agius
Superviżur
rachael.agius@um.edu.mt

Mowbajl: 79273984

Appendix AR

Consent Form for Main Study and Test Validation English and Maltese

Informative letter to parents/guardians

Dear Parents/Guardians,

I am a PhD student with the Department of Communication Therapy, Faculty of Health Sciences, University of Malta. As part of my research, I hope to develop to develop a handwriting speed test for children aged between 14 and 15 years. The aim of this assessment is to identify students with writing difficulties.

I would like to request your kind consent to your child's participation in this research. Should you consent, your child will be asked to take part in a few short writing tasks, including copying text from the board and writing a short paragraph. Your child will be required to sit for the same test twice. There will be two tests, one in English and one in Maltese, with each session lasting about 40 minutes. Testing will take place at school, within a few days of each other. During each session, the class will be tested altogether. Participation in this research is anonymous, confidential and voluntary, and you may withdraw from this study at any time.

The Head of School, the Education Division, and the Secretariate of Education have also been informed and the necessary consent obtained. If you consent to your child's participation in this research, kindly complete and sign the consent form below and fill in the attached questionnaire. Please return the forms with your child to school at your earliest convenience.

The aims and details of the project on Handwriting Speed Assessment have been explained to me by Ms. Fiona Galea. I have also explained to my child what this phase of the research entails.

I understand that the information collected will remain confidential, and that it will be used only for research purposes. I also know that a written report will be drawn, but that neither I nor my child will be identified in any way, and that once the research is complete, all the information collected will be destroyed. I am aware that I am under no obligation to participate and that I can withdraw my participation at any time without giving any reason.

I give my consent to Ms. Fiona Galea to make the necessary observations on my child

___________________________.

In case of difficulty during the study I can contact Ms. Fiona Galea on 79273984 or via e-mail (fiona.galea.99@um.edu.mt).

Name of parent/guardian: ________________________ Signature: ____________________

________________________	________________________
Fiona Galea	Dr Rachael Agius
PhD Student	Supervisor
fiona.galea.99@um.edu.mt	rachael.agius@um.edu.mt
Mob: 79273984	

Ittra nformattiva lill-ġenituri

Għażiż Ġenitur/Kustodju,

Jien qed nagħmel dottorat mad-dipartiment tal-*Communication Therapy,* fi ħdan il-fakulta tax-Xjenzi tas-Saħħa, l-Universita' ta' Malta. Jiena qed naħdem biex niżviluppa test ta' kitba għal tfal ta' bejn l-14 u l-15-il sena, li jista' jgħin jiddetermina xi diffikultajiet li jista' jkun hemm fil-kitba.

Nixtieq nitlob il-permess tiegħek biex ibnek/bintek t/jieħu sehem f'din ir-riċerka. Jekk taċċetta, ibnek/bintek ser j/tkun mitlub/a j/tikkopja xi sentenzi qosra minn fuq il-karta u minn fuq il-bord, u j/tikteb storja. Ibnek/bintek ser ikun/tkun mitlub/a t/jagħmel l-istess test darbtejn. Hemm żewġ testjiet, wieħed bil-Malti u l-ieħor bl-Ingliż, f'sessjonijiet ta' madwar 40 minuta l-waħda. Dawn is-sessjonijiet ser isiru l-iskola fi żmien ftit jiem minn xulxin. It-tfal ser jagħmlu t-test f'daqqa. Il-parteċipazzjoni f'dan l-istudju hija waħda anonima, kunfidenzjali u volontarja u int u ibnek/bintek j/tista' j/tieqaf j/tagħmel it-test meta j/trid.

Il-kap tal-iskola, id-Diviżjoni tal-Edukazzjoni, u s-Segretarjat tal-Edukazzjoni huma diġà infurmati b'din ir-riċerka u taw il-kunsens tagħhom. Jekk taqbel, jekk jogħġbok, imla l-formola hawn taħt u l-*questionnaire* mehmuża u ibgħathom lura l-iskola mat-tifel/tifla tiegħek mill-aktar fis possibbli.

L-iskopijiet u d-dettalji tal-proġett dwar *Handwriting Speed Assessment* spjegathomli Ms. Fiona Galea. Jiena spjegajt ukoll lit-tifel /tifla tiegħi dak li se jsir.

Jiena naf li l-informazzjoni miġbura se tinżamm kunfidenzjali, u li se tintuża biss għal skopijiet ta' riċerka. Naf ukoll li ser isir rapport bil-miktub tar-riżultati u li meta dan iseħħ, jiena jew it-tifel/tifla tiegħi, bl-ebda mod m'aħna se nkunu nistgħu niġu identifikati. Meta jispiċċa l-istudju l-informazzjoni miġbura se tiġi meqruda. Jiena konxju li ma għandi l-ebda obbligu nipparteċipa f'dan l-istudju u li nista' nirtira fi kwalunkwe punt mingħajr ma nagħti raġuni.

Jien nagħti l-kunsens tiegħi lil Ms. Fiona Galea biex tagħmel l-osservazzjonijiet li hemm bżonn fuq it-tifel / tifla tiegħi. Jekk ikolli diffikultà waqt l-istudju nista' nistaqsi għal Ms. Fiona Galea, inċemplilha fuq 79273984, jew nibagħtilha e-mail fuq fiona.galea.99@um.edu.mt

Isem tal-ġenitur/kustodju ______________________ Firma _____________________

Grazzi tal-għajnuna tiegħek.

_____________________ ___________________________

Fiona Galea
Studenta tal-PhD
fiona.galea.99@um.edu.mt
Mowbajl: 79273984

Dr Rachael Agius
Superviżur
rachael.agius@um.edu.mt

Appendix AS

Correlation Tests for the EMASH Subtests and Test and the Corresponding DASH Subtests and Test

Table AS1

Pearson Correlation Test for Mean Number of WPM Written at the EMASH Copy Neatly Subtest and its its Corresponding DASH Subtest

		EMASH Copy Neatly	DASH Copy Neatly
EMASH Copy Neatly	Pearson Correlation	1	0.814**
	Sig. (2-tailed)		0.000
	Sample Size	359	44
DASH Copy Neatly	Pearson Correlation	0.814**	1
	Sig. (2-tailed)	0.000	
	Sample Size	44	45

**. Correlation is significant at the 0.01 level (2-tailed).

Table AS2

Spearman Correlation Test for Mean Number of WPM Written at the English Copy Quickly EMASH Subtest and its Corresponding DASH Subtest

			EMASH Copy Quickly	DASH Copy Quickly
Spearman's rho	EMASH Copy Quickly	Correlation Coefficient	1.000	0.827**
		Sig. (2-tailed)	.	0.000
		Sample Size	359	44
	DASH Copy Quickly	Correlation Coefficient	0.827**	1.000
		Sig. (2-tailed)	0.000	.
		Sample Size	44	45

**. Correlation is significant at the 0.01 level (2-tailed).

Table AS3

Pearson Correlation Test for EMASH Graphic Speed Test and its Corresponding DASH Subtest

		EMASH Graphic Speed Test	DASH Graphic Speed Test
EMASH Graphic Speed Test	Pearson Correlation	1	0.719**
	Sig. (2-tailed)		0.000
	Sample Size	244	44
DASH Graphic Speed Test	Pearson Correlation	0.719**	1
	Sig. (2-tailed)	0.000	
	Sample Size	44	45

**. Correlation is significant at the 0.01 level (2-tailed).

Table AS4

Pearson Correlation Test for Mean Number of WPM Written at the EMASH Free Writing Subtest and its its Corresponding DASH Subtest

		EMASH Free Writing	DASH Free Writing
EMASH Free Writing	Pearson Correlation	1	0.837**
	Sig. (2-tailed)		0.000
	Sample Size	350	41
DASH Free Writing	Pearson Correlation	0.837**	1
	Sig. (2-tailed)	0.000	
	Sample Size	41	45

**. Correlation is significant at the 0.01 level (2-tailed).

Table AS5

Pearson Correlation Test for Mean Number of WPM Written at the EMASH Test and its Corresponding DASH Test

		EMASH Total Score	DASH Total Score
EMASH Total Score	Pearson Correlation	1	0.864**
	Sig. (2-tailed)		0.000
	Sample Size	44	44
DASH Total Score	Pearson Correlation	0.864**	1
	Sig. (2-tailed)	0.000	
	Sample Size	44	45

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix AT

Positive Relationships between the EMASH Subtests and Test and the Equivalent DASH Subtests and Test

Figure AT1

Positive Linear Relationship Between Mean WPM at the EMASH Copy Neatly Subtest and its Equivalent DASH Subtest

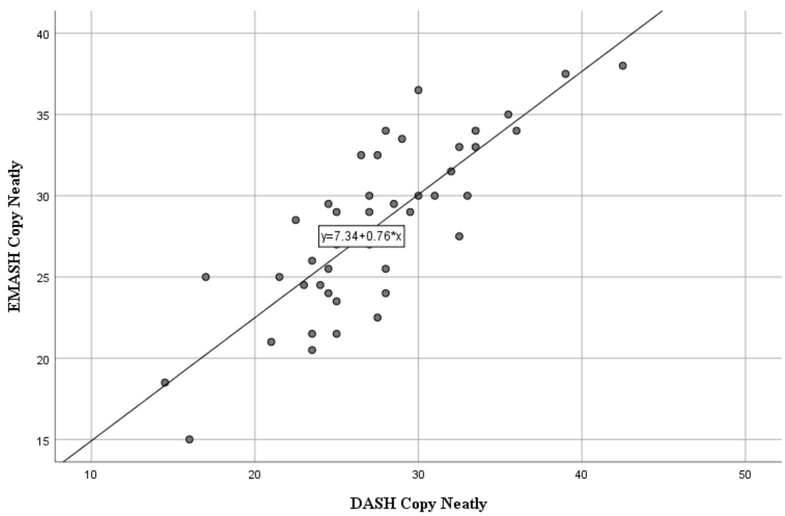


Figure AT2

Positive Monotonic Relationship Between mean WPM Written at the EMASH Copy Quickly and its Equivalent DASH Subtest

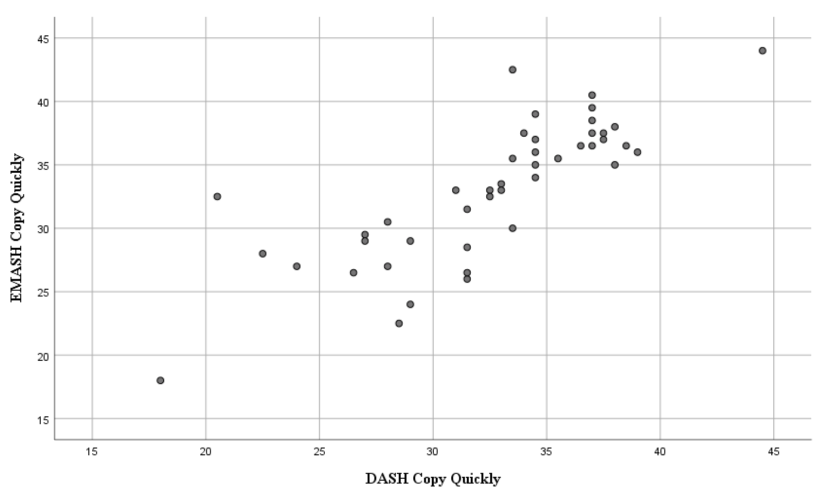


Figure AT3

Positive Linear Relationship Between the Correct Number of Crosses Drawn at the EMASH Graphic Speed subtest and its Equivalent DASH Subtest

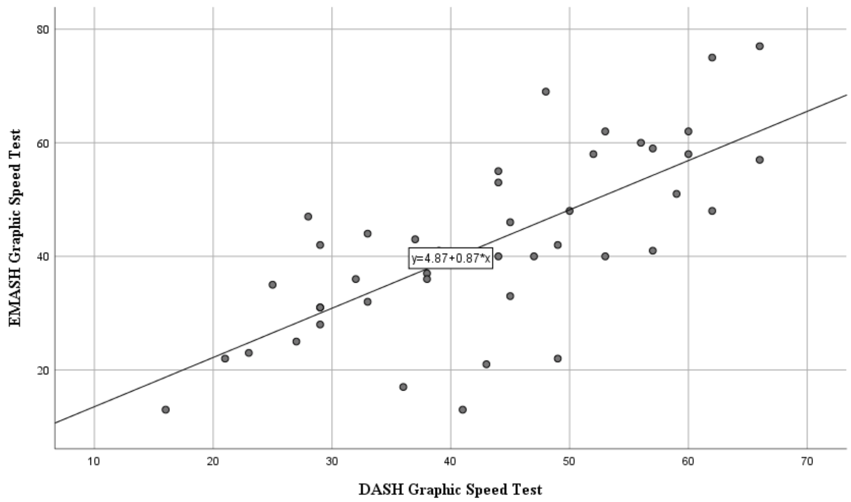


Figure AT4

Positive Linear Relationship Between mean WPM written at the EMASH Free Writing Subtest and its Equivalent DASH Subtest

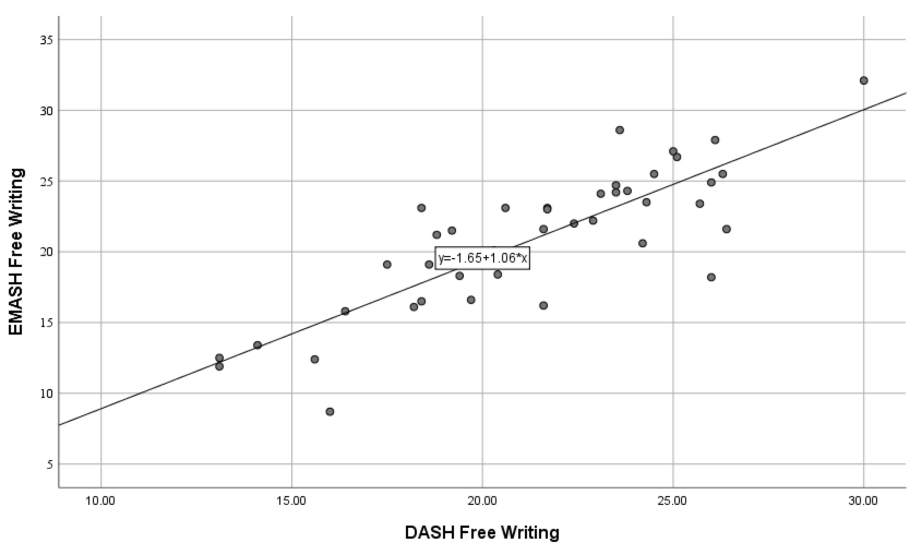
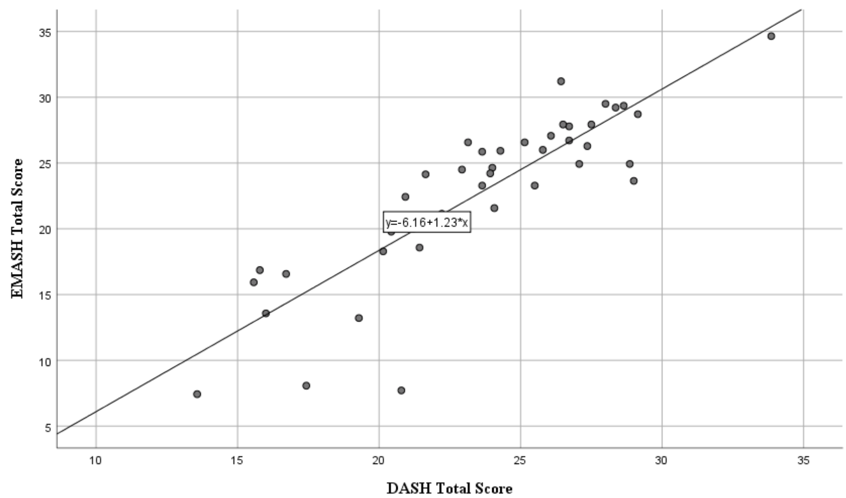


Figure AT5

Positive Linear Relationship Between the EMASH test and the Equivalent DASH Test



Appendix AU

Pearson Correlation Tests for the English EMASH Test and its Retest

Table AU1

Pearson Correlation Test for Mean Number of WPM Written in the English Copy Neatly Subtest and its Retest

		English Copy Neatly	Retest of English Copy Neatly
English Copy Neatly	Pearson Correlation	1	0.689**
	Sig. (2-tailed)		0.000
	Sample Size	359	35
Retest of English Copy Neatly	Pearson Correlation	0.689**	1
	Sig. (2-tailed)	0.000	
	Sample Size	35	35

**. Correlation is significant at the 0.01 level (2-tailed).

Table AU2

Pearson Correlation Test for Mean Number of WPM Written in the English Copy Quickly Subtest and its Retest

		English Copy Quickly	Retest of English Copy Quickly
English Copy Quickly	Pearson Correlation	1	0.808**
	Sig. (2-tailed)		0.000
	Sample Size	359	35
Retest of English Copy Quickly	Pearson Correlation	0.808**	1
	Sig. (2-tailed)	0.000	
	Sample Size	35	35

**. Correlation is significant at the 0.01 level (2-tailed).

Table AU3

Pearson Correlation test for Mean Number of WPM Written in the English Copy from the Board Subtest and its Retest

		English Copy from Board	Retest of English Copy from Board
English Copy from Board	Pearson Correlation	1	0.785**
	Sig. (2-tailed)		0.000
	Sample Size	359	35
Retest of English Copy from Board	Pearson Correlation	0.785**	1
	Sig. (2-tailed)	0.000	
	Sample Size	35	35

**. Correlation is significant at the 0.01 level (2-tailed).

Table AU4

Pearson Correlation Test for Mean Number of WPM Written in the English Free Writing Subtest and its Retest

		English Free Writing	Retest of English Free Writing
English Free Writing	Pearson Correlation	1	0.751**
	Sig. (2-tailed)		0.000
	Sample Size	350	35
Retest of English Free Writing	Pearson Correlation	0.751**	1
	Sig. (2-tailed)	0.000	
	Sample Size	35	35

**. Correlation is significant at the 0.01 level (2-tailed).

Table AU5

Pearson Correlation Test for the Number of Correct Crosses Drawn in the Graphic Speed Test and its Retest

		Graphic Speed Test	Retest of Graphic Speed
Graphic Speed Test	Pearson Correlation	1	0.583**
	Sig. (2-tailed)		0.000
	Sample Size	244	35
Retest of Graphic Speed Test	Pearson Correlation	0.583**	1
	Sig. (2-tailed)	0.000	
	Sample Size	35	35

**. Correlation is significant at the 0.01 level (2-tailed).

Table AU6

Pearson Correlation Test for Mean Number of WPM Written in the English EMASH Tests and its Retest

		Total English Score	Retest Total English Score
Retest Total English Score	Pearson Correlation	1	0.793**
	p-value (2-tailed)		0.000
	Sample Size	35	35
Total English Score	Pearson Correlation	0.793**	1
	Sig. (2-tailed)	0.000	
	Sample Size	35	360

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix AV

Positive Linear Relationships between the English EMASH Test and its Retest

Figure AV1

Positive Linear Relationship between mean WPM in the English Copy Neatly Subtest and its Retest

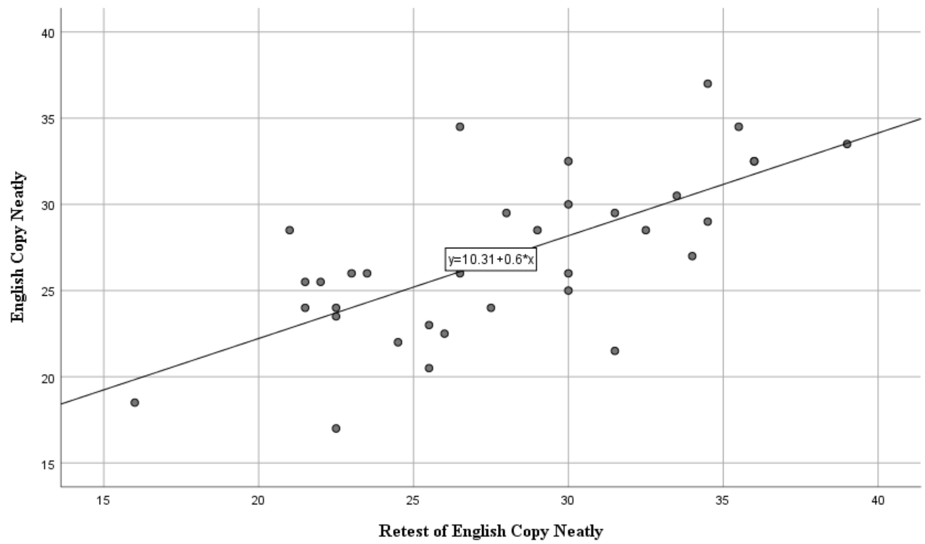


Figure AV2

Positive Linear Relationship between mean WPM in the English Copy Quickly Subtest and its Retest

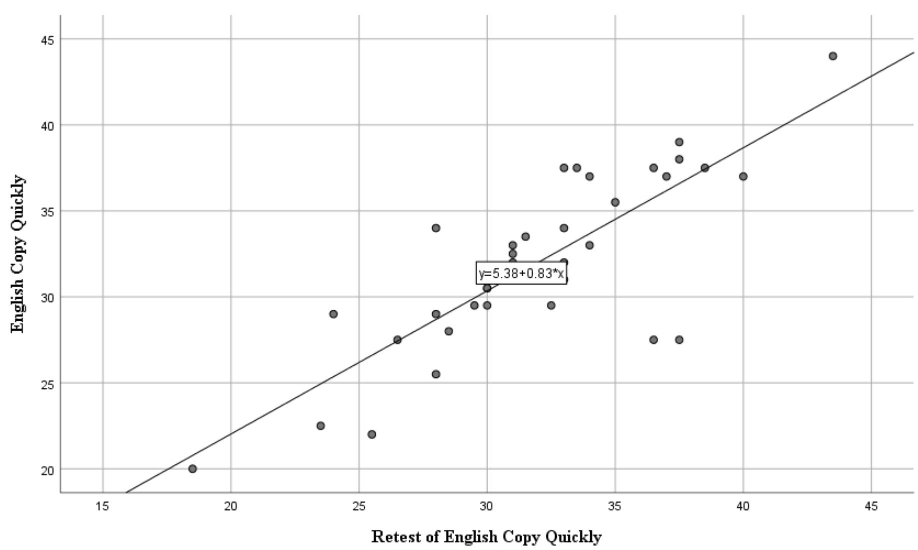


Figure AV3

Positive Linear Relationship between Mean WPM in the English Copy from the Board Subtest and its Retest

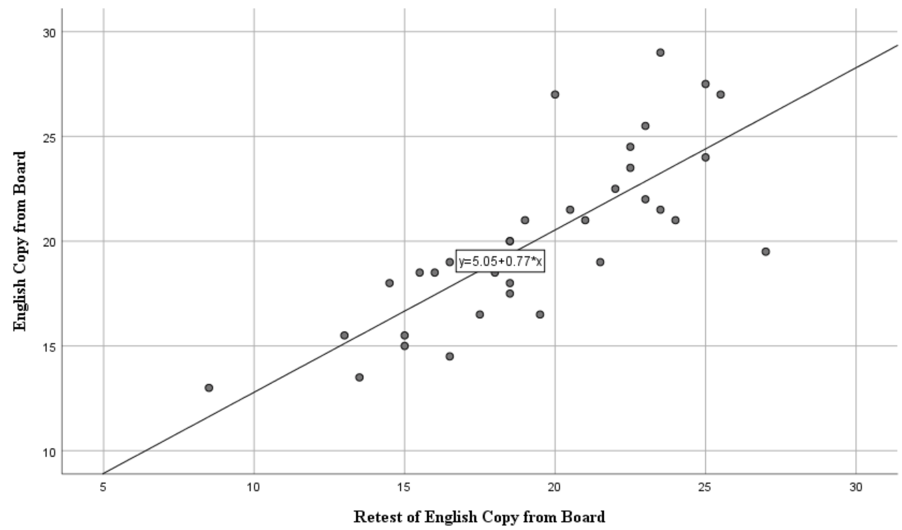


Figure AV4

Positive Linear Relationship between mean WPM in the English Free Writing Test and its Retest

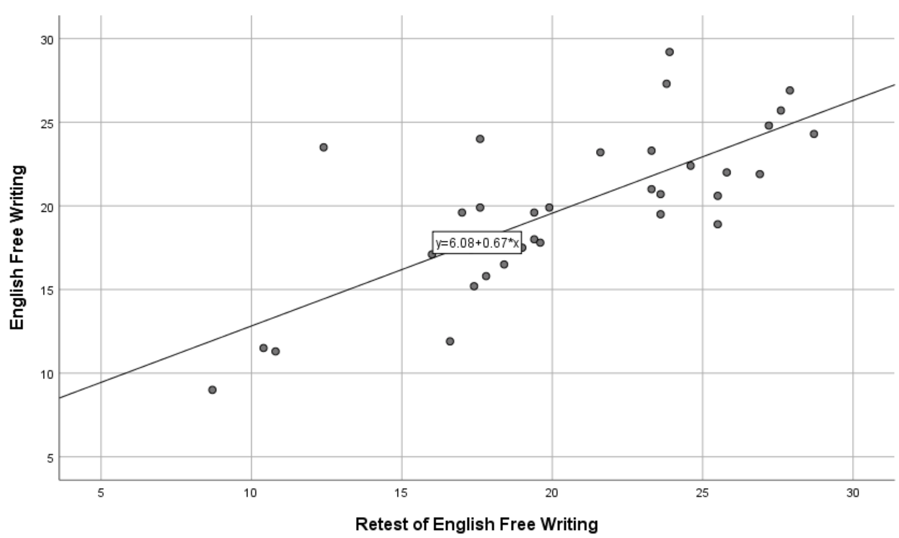


Figure AV5

Positive Linear Relationship between the Number in Correct Crosses in the Graphic Speed Test and its Retest

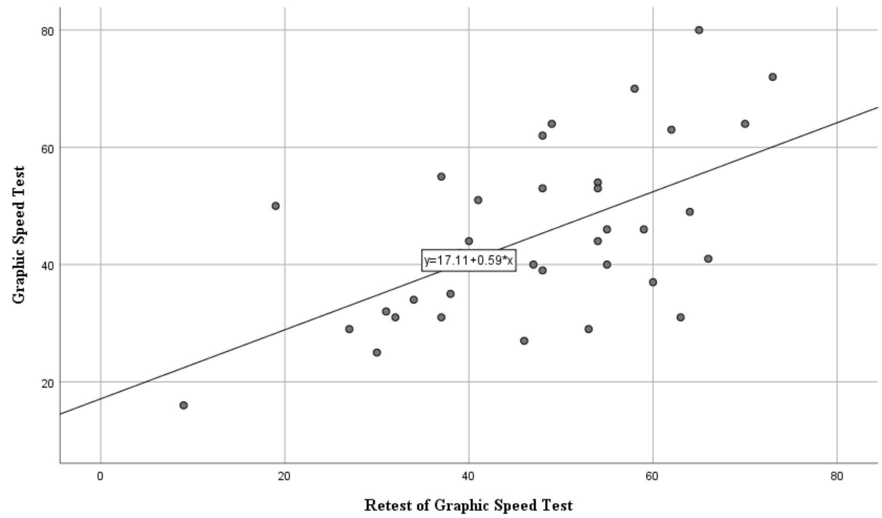
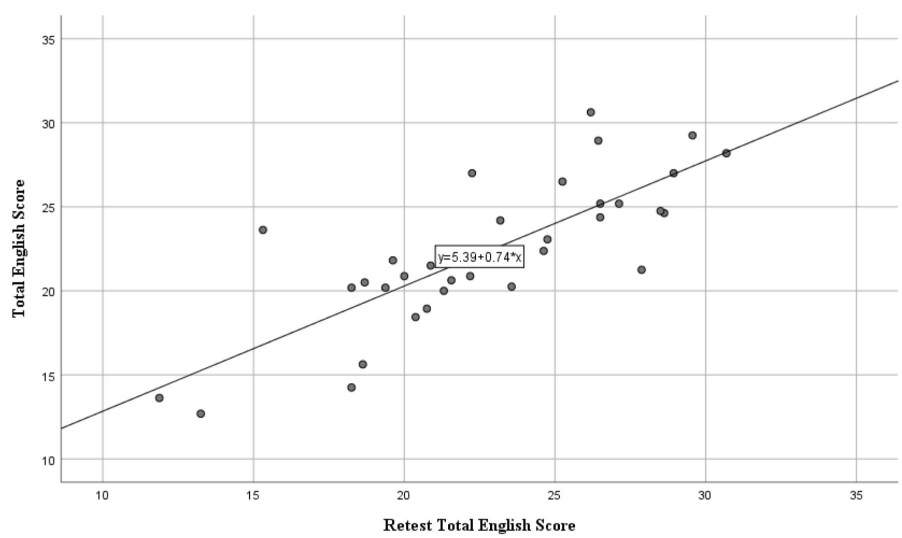


Figure AV6

Positive Linear Relationship between mean WPM in the Total English Score and its Retest



Appendix AW

Pearson Correlation Tests for the Maltese EMASH test and its Retest

Table AW1

Pearson Correlation Test for Mean Number of WPM Written in the Maltese Copy Neatly (Ikkopja Pulit) Subtest and its Retest

		Maltese Copy Neatly (Ikkopja Pulit)	Retest of Maltese Copy Neatly (Ikkopja Pulit)
Maltese Copy Neatly (Ikkopja Pulit)	Pearson Correlation	1	0.764**
	p-value. (2-tailed)		0.000
	Sample Size	342	55
Retest of Maltese Copy Neatly (Ikkopja Pulit)	Pearson Correlation	0.764**	1
	p-value (2-tailed)	0.000	
	Sample Size	55	56

**. Correlation is significant at the 0.01 level (2-tailed).

Table AW2

Pearson Correlation Test for Mean Number of WPM Written in the Maltese Copy Quickly (Ikkopja Malajr) Subtest and its Retest

		Maltese Copy Quickly (Ikkopja Malajr)	Retest of Maltese Copy Quickly (Ikkopja Malajr)
Maltese Copy Quickly (Ikkopja Malajr)	Pearson Correlation	1	0.831**
	p-value (2-tailed)		0.000
	Sample Size	340	55
Retest of Maltese Copy Quickly (Ikkopja Malajr)	Pearson Correlation	0.831**	1
	p-value (2-tailed)	0.000	
	Sample Size	55	56

**. Correlation is significant at the 0.01 level (2-tailed).

Table AW3

Pearson Correlation Test for Mean Number of WPM Written in the Maltese Copy from the Board (Ikkopja mill-Bord) Subtest and its Retest

		Retest of Maltese Copy from the Board (Ikkopja mill-Bord)	Maltese Copy from the Board (Ikkopja mill-Bord)
Retest of Maltese Copy from the Board (Ikkopja mill-Bord)	Pearson Correlation	1	0.821**
	p-value (2-tailed)		0.000
	Sample Size	56	55
Maltese Copy from the Board (Ikkopja mill-Bord)	Pearson Correlation	0.821**	1
	p-value (2-tailed)	0.000	
	Sample Size	55	339

**. Correlation is significant at the 0.01 level (2-tailed).

Table AW4

Pearson Correlation Test for Mean Number of WPM Written in the Maltese Free Writing (Kitba Kreattiva) Subtest and its Retest

		Maltese Free Writing (Kitba Kreattiva)	Retest of Maltese Free Writing (Kitba Kreattiva)
Maltese Free Writing (Kitba Kreattiva)	Pearson Correlation	1	0.807**
	Sig. (2-tailed)		0.000
	Sample Size	337	55
Retest of Maltese Free Writing (Kitba Kreattiva)	Pearson Correlation	0.807**	1
	Sig. (2-tailed)	0.000	
	Sample Size	55	56

**. Correlation is significant at the 0.01 level (2-tailed).

Table AW5

Pearson Correlation Test for Mean Number of WPM Written in the Maltese EMASH Tests and its Retest

		Total Maltese Score	Retest Total Maltese Score
Total Maltese Score	Pearson Correlation	1	0.881**
	p-value (2-tailed)		0.000
	Sample Size	342	55
Retest Total Maltese Score	Pearson Correlation	0.881**	1
	p-value (2-tailed)	0.000	
	Sample Size	55	56

** Correlation is significant at the 0.01 level (2-tailed).

Appendix AX

Positive Linear Relationships between the Maltese EMASH test and its Retest

Figure AX1

Positive Linear Relationship between mean WPM in the Maltese Copy Neatly (Ikkopja Pulit) Subtest and its Retest

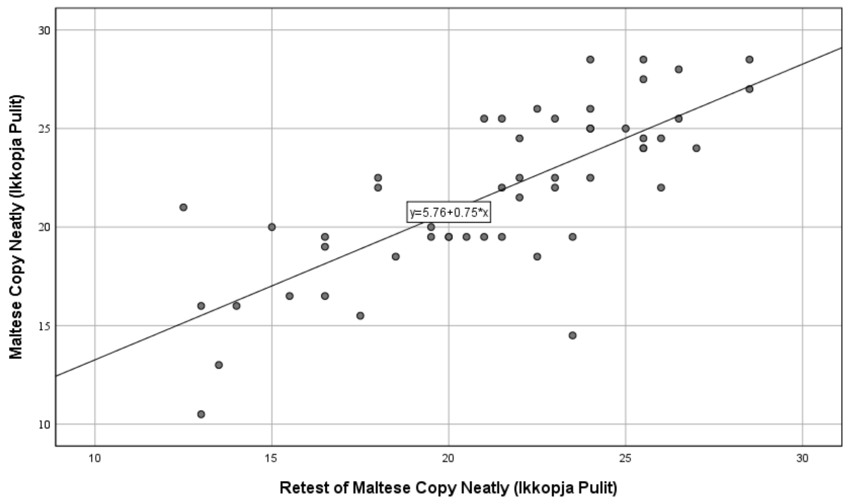


Figure AX2

Positive Linear Relationship between mean WPM in the Maltese Copy Quickly (Ikkopja Malajr) Subtest and its Retest

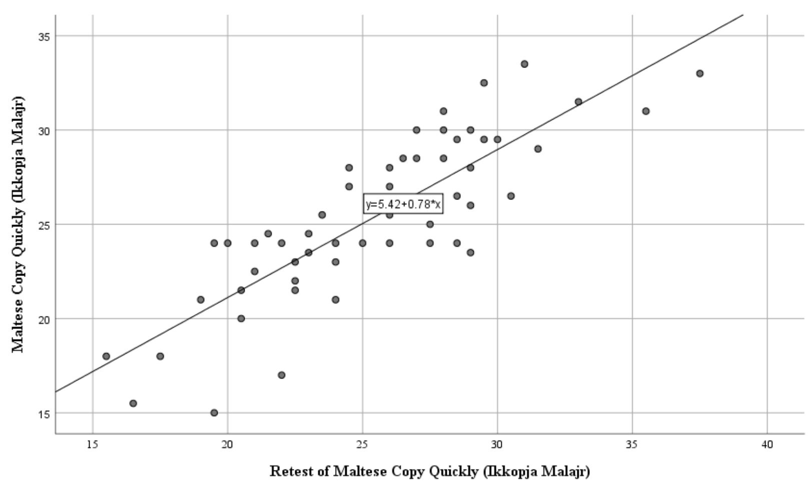


Figure AX3

Positive Linear Relationship between Mean WPM in the Maltese Copy from the Board (Ikkopja mill-Bord) Subtest and Retest

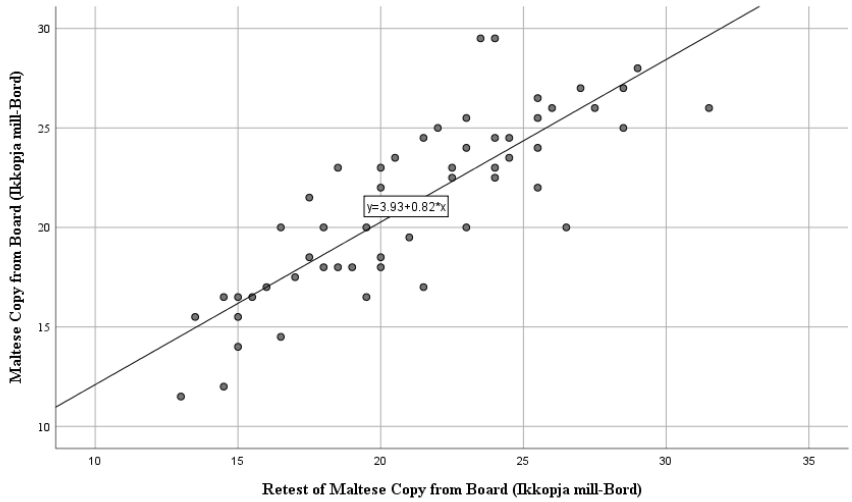


Figure AX4

Positive Linear Relationship between mean WPM in the Maltese Free Writing (Kitba Kreattiva) Test and its Retest

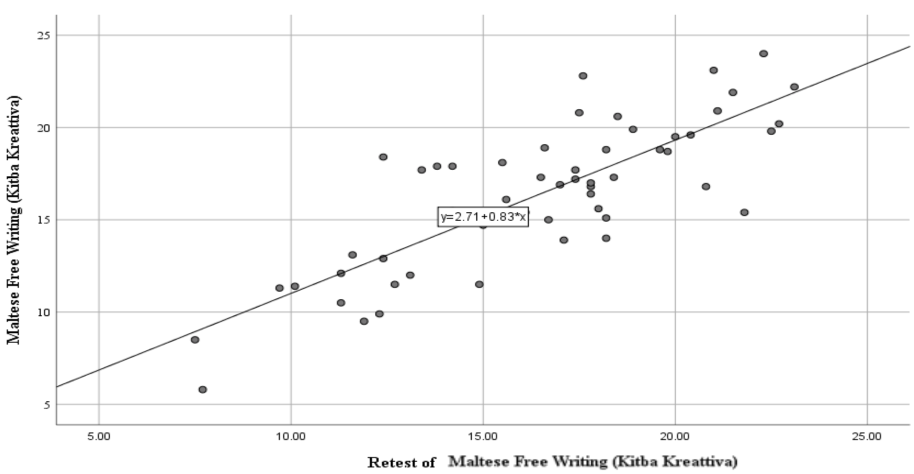
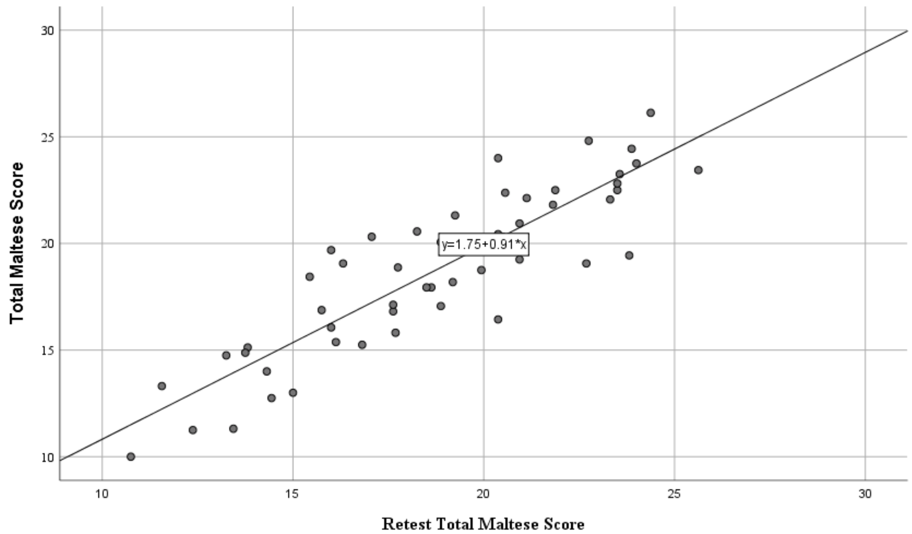


Figure AX5

Positive Linear Relationship between mean WPM in the Total Maltese Score and its Retest



Appendix AY

Box Plots Presenting the Distribution of Participants' Scores in each English Subtest, in WPM

Figure AY1

Distribution of Scores in the English Copy Neatly Subtest

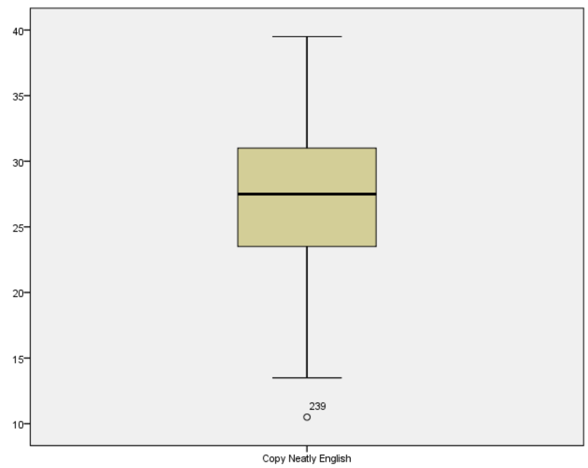


Figure AY2

Distribution of Scores in the English Copy Quickly Subtest

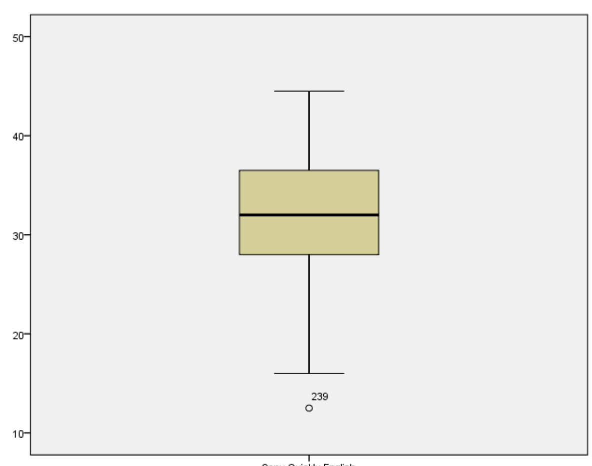


Figure AY3

Distribution of Scores in the English Copy from the Board Subtest

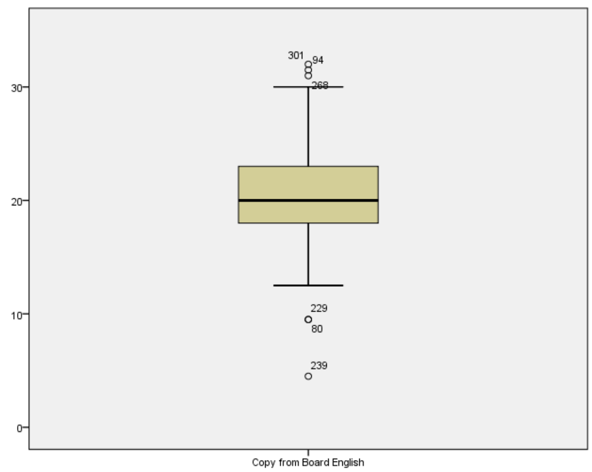
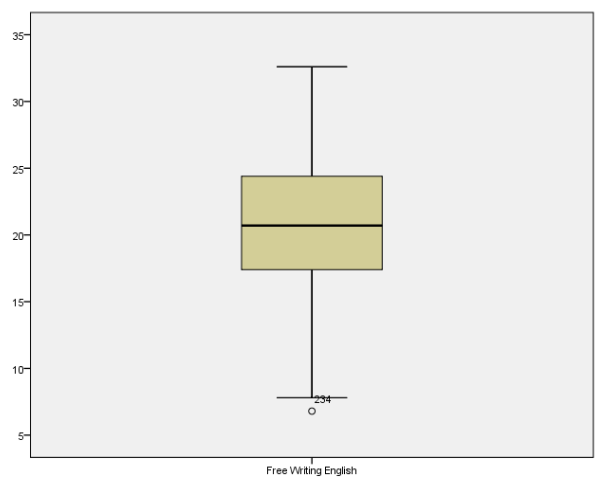


Figure AY4

Distribution of Scores in the English Free Writing Subtest



Appendix AZ

Box Plots Presenting the Distribution of Participants' Scores in each Maltese Subtest, in WPM

Figure AZ1

Distribution of Scores in the Maltese Copy Neatly (Ikkopja Pulit) Subtest

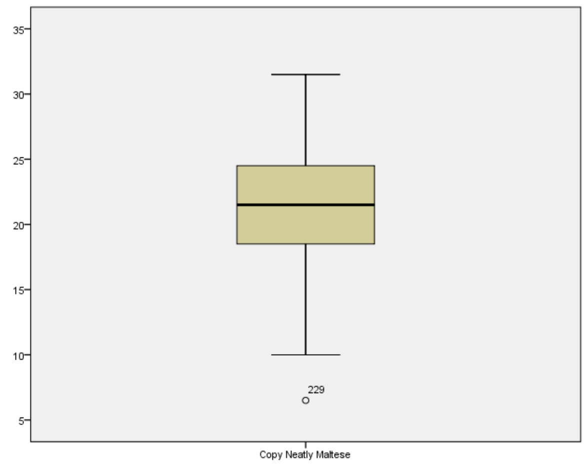


Figure AZ2

Distribution of Scores in the Maltese Copy Quickly (Ikkopja Malajr) Subtest

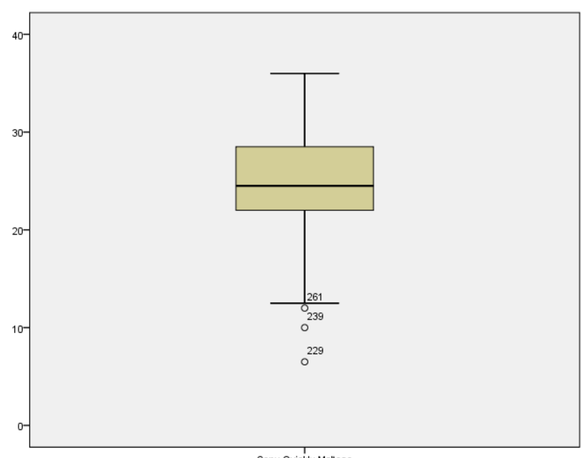


Figure AZ3

Distribution of Scores in the Maltese Copy from the Board (Ikkopja mill-Bord) Subtest

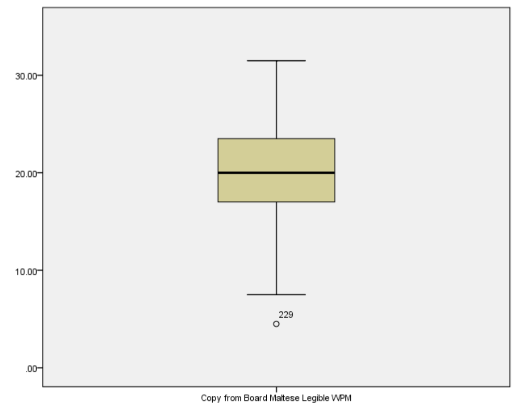
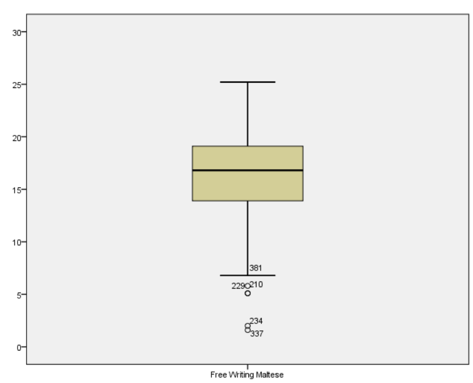


Figure AZ4

Distribution of Scores in the Maltese Free Writing (Kitba Kreattiva) Subtest



Appendix BA

Descriptive Statistics of the English Subtests, grouped by Independent Variables

Table BA1

Handedness

Subtest	Handedness	Statistics	
English Copy Neatly	Right	Mean	27.23
		Median	27.50
		Std. Deviation	5.71
		Minimum	10.50
		Maximum	41.00
	Left	Mean	27.87
		Median	27.00
		Std. Deviation	6.13
		Minimum	17.50
		Maximum	41.50
English Copy Quickly	Right	Mean	32.43
		Median	32.50
		Std. Deviation	5.59
		Minimum	12.50
		Maximum	56.00
	Left	Mean	32.65
		Median	32.50
		Std. Deviation	6.29
		Minimum	19.50
		Maximum	46.00
English Copy from Board	Right	Mean	20.09
		Median	20.00
		Std. Deviation	4.51
		Minimum	4.50
		Maximum	43.50
	Left	Mean	19.91
		Median	20.00
		Std. Deviation	4.54
		Minimum	13.00
		Maximum	32.50

English Free Writing	Right	Mean	21.12
		Median	21.15
		Std. Deviation	4.96
		Minimum	7.80
		Maximum	33.80
	Left	Mean	20.21
		Median	22.20
		Std. Deviation	5.43
		Minimum	6.80
		Maximum	28.80

Table BA2

Ability

Test	Ability	Statistics	
English Copy Neatly	Typically Developing	Mean	27.73
		Median	28.00
		Std. Deviation	5.62
		Minimum	12.50
		Maximum	41.50
	Learning Difficulties	Mean	25.11
		Median	25.00
		Std. Deviation	5.93
		Minimum	10.50
		Maximum	38.50
English Copy Quickly	Typically Developing	Mean	32.98
		Median	33.00
		Std. Deviation	5.42
		Minimum	20.50
		Maximum	56.00
	Learning Difficulties	Mean	29.73
		Median	29.25
		Std. Deviation	6.11
		Minimum	12.50
		Maximum	44.00
Copy from Board English	Typically Developing	Mean	20.53
		Median	20.50
		Std. Deviation	4.36
		Minimum	11.00
		Maximum	43.50
	Learning Difficulties	Mean	17.79
		Median	18.00
		Std. Deviation	4.51
		Minimum	4.50
		Maximum	31.50

English Free Writing	Typically Developing	Mean	21.42
		Median	21.50
		Std. Deviation	4.94
		Minimum	7.80
		Maximum	33.80
	Learning Difficulties	Mean	18.76
		Median	19.00
		Std. Deviation	4.97
		Minimum	6.80
		Maximum	32.10

Table BA3

Geographical Regions

Subtest	Regions	Statistics	
English Copy Neatly	Southern Harbour	Mean	25.56
		Median	25.00
		Std. Deviation	4.93
		Minimum	13.50
		Maximum	38.00
	Northern Harbour	Mean	26.75
		Median	27.25
		Std. Deviation	5.58
		Minimum	15.00
		Maximum	41.00
	South Eastern	Mean	27.41
		Median	27.50
		Std. Deviation	5.98
		Minimum	10.50
		Maximum	39.00
	Western	Mean	28.79
		Median	29.00
		Std. Deviation	5.61
		Minimum	16.50
		Maximum	40.50
	Northern	Mean	27.76
		Median	28.25
		Std. Deviation	6.25
		Minimum	12.50
		Maximum	41.50
	Gozo Region	Mean	27.02
		Median	26.50
		Std. Deviation	5.69
		Minimum	13.00
		Maximum	40.50

English Copy Quickly	Southern Harbour	Mean	30.32
		Median	30.00
		Std. Deviation	4.59
		Minimum	22.00
		Maximum	44.00
	Northern Harbour	Mean	32.15
		Median	33.00
		Std. Deviation	5.98
		Minimum	18.00
		Maximum	44.50
	South Eastern	Mean	32.54
		Median	33.00
		Std. Deviation	7.08
		Minimum	12.50
		Maximum	56.00
	Western	Mean	33.78
		Median	34.25
		Std. Deviation	5.25
		Minimum	21.00
		Maximum	43.00
	Northern	Mean	32.97
		Median	33.00
		Std. Deviation	5.62
		Minimum	23.00
		Maximum	50.50
	Gozo	Mean	32.58
		Median	32.50
		Std. Deviation	4.50
		Minimum	20.50
		Maximum	42.50

English Copy from Board	Southern Harbour	Mean	18.64
		Median	18.50
		Std. Deviation	4.01
		Minimum	12.50
		Maximum	31.00
	Northern Harbour	Mean	19.62
		Median	20.00
		Std. Deviation	3.87
		Minimum	9.50
		Maximum	27.00
	South Eastern	Mean	19.69
		Median	20.00
		Std. Deviation	4.66
		Minimum	4.50
		Maximum	29.00
	Western	Mean	21.85
		Median	22.00
		Std. Deviation	4.31
		Minimum	13.00
		Maximum	32.00
	Northern	Mean	20.53
		Median	20.50
		Std. Deviation	5.38
		Minimum	12.50
		Maximum	43.50
	Gozo	Mean	19.81
		Median	19.00
		Std. Deviation	3.95
		Minimum	11.00
		Maximum	30.50

English Free Writing	Southern Harbour	Mean	19.18
		Median	19.15
		Std. Deviation	4.44
		Minimum	8.00
		Maximum	32.10
	Northern Harbour	Mean	20.88
		Median	21.40
		Std. Deviation	4.92
		Minimum	7.80
		Maximum	33.70
	South Eastern	Mean	20.32
		Median	20.80
		Std. Deviation	5.43
		Minimum	6.80
		Maximum	33.80
	Western	Mean	22.09
		Median	22.85
		Std. Deviation	5.17
		Minimum	8.70
		Maximum	32.60
	Northern	Mean	21.89
		Median	21.65
		Std. Deviation	5.02
		Minimum	14.10
		Maximum	33.00
	Gozo	Mean	21.32
		Median	21.10
		Std. Deviation	4.67
		Minimum	10.70
		Maximum	32.30

Table BA4

Gender

Subtest	Gender	Statistics	
English Copy Neatly	Male	Mean	26.59
		Median	26.25
		Std. Deviation	5.43
		Minimum	13.00
		Maximum	39.00
	Female	Mean	28.03
		Median	28.50
		Std. Deviation	6.01
		Minimum	10.50
		Maximum	41.50
English Copy Quickly	Male	Mean	32.05
		Median	32.00
		Std. Deviation	5.67
		Minimum	16.00
		Maximum	56.00
	Female	Mean	32.86
		Median	33.00
		Std. Deviation	5.64
		Minimum	12.50
		Maximum	50.50
English Copy from Board	Male	Mean	19.79
		Median	19.25
		Std. Deviation	4.25
		Minimum	9.50
		Maximum	31.50
	Female	Mean	20.44
		Median	20.50
		Std. Deviation	4.75
		Minimum	4.50
		Maximum	43.50

English Free Writing	Male	Mean	20.04
		Median	19.80
		Std. Deviation	5.00
		Minimum	6.80
		Maximum	33.80
	Female	Mean	22.03
		Median	22.05
		Std. Deviation	4.88
		Minimum	7.80
		Maximum	33.70

Table BA5

Nationality

Subtest	Nationality	Statistics	
English Copy Neatly	Maltese	Mean	27.37
		Median	27.50
		Std. Deviation	5.76
		Minimum	10.50
		Maximum	41.50
	Foreign	Mean	25.57
		Median	25.50
		Std. Deviation	5.14
		Minimum	12.50
		Maximum	34.00
	Dual	Mean	34.00
		Median	32.00
		Std. Deviation	4.65
		Minimum	29.00
		Maximum	40.50
English Copy Quickly	Maltese	Mean	32.37
		Median	32.25
		Std. Deviation	5.79
		Minimum	12.50
		Maximum	56.00
	Foreign	Mean	32.61
		Median	33.00
		Std. Deviation	4.50
		Minimum	23.00
		Maximum	40.00
	Dual	Mean	35.90
		Median	36.00
		Std. Deviation	4.45
		Minimum	29.00
		Maximum	40.50

English Copy from Board	Maltese	Mean	20.05
		Median	20.00
		Std. Deviation	4.60
		Minimum	4.50
		Maximum	43.50
	Foreign	Mean	19.76
		Median	20.00
		Std. Deviation	3.45
		Minimum	13.00
		Maximum	27.00
	Dual	Mean	23.30
		Median	22.50
		Std. Deviation	4.31
		Minimum	19.00
		Maximum	30.50
English Free Writing	Maltese	Mean	20.92
		Median	21.00
		Std. Deviation	5.00
		Minimum	6.80
		Maximum	33.80
	Foreign	Mean	21.15
		Median	22.10
		Std. Deviation	5.25
		Minimum	8.10
		Maximum	30.10
	Dual	Mean	23.84
		Median	22.50
		Std. Deviation	6.10
		Minimum	16.10
		Maximum	31.10

Table BA6

Age

Subtest	Birth Range	Statistics	
English Copy Neatly	January to June	Mean	27.78
		Median	28.00
		Std. Deviation	5.71
		Minimum	10.50
		Maximum	41.50
	July to December	Mean	26.86
		Median	26.75
		Std. Deviation	5.78
		Minimum	12.50
		Maximum	40.50
English Copy Quickly	January to June	Mean	32.83
		Median	33.00
		Std. Deviation	5.73
		Minimum	12.50
		Maximum	46.00
	July to December	Mean	32.12
		Median	31.50
		Std. Deviation	5.61
		Minimum	16.00
		Maximum	56.00

English Copy from Board	January to June	Mean	20.57
		Median	20.50
		Std. Deviation	4.81
		Minimum	4.50
		Maximum	43.50
	July to December	Mean	19.67
		Median	19.50
		Std. Deviation	4.20
		Minimum	9.50
		Maximum	32.00
English Free Writing	January to June	Mean	21.23
		Median	21.60
		Std. Deviation	5.32
		Minimum	6.80
		Maximum	33.70
	July to December	Mean	20.78
		Median	20.80
		Variance	23.26
		Std. Deviation	4.81
		Minimum	8.00
		Maximum	33.80

Table BA7

School Type

Subtest	School Type	Statistics	
English Copy Neatly	State	Mean	26.92
		Median	26.50
		Std. Deviation	5.85
		Minimum	10.50
		Maximum	41.50
	Independent	Mean	28.86
		Median	29.00
		Std. Deviation	5.80
		Minimum	18.00
		Maximum	39.50
	Boys' church	Mean	26.81
		Median	27.00
		Std. Deviation	5.48
		Minimum	13.00
		Maximum	38.00
	Girls' church	Mean	29.05
		Median	29.00
		Std. Deviation	5.35
		Minimum	19.00
		Maximum	41.00
English Copy Quickly	State	Mean	31.79
		Median	31.00
		Std. Deviation	5.89
		Minimum	12.50
		Maximum	56.00
	Independent	Mean	34.47
		Median	35.00
		Std. Deviation	5.00

		Minimum	23.00
		Maximum	43.00
	Boys' church	Mean	32.94
		Median	33.00
		Std. Deviation	4.76
		Minimum	20.50
		Maximum	44.00
	Girls' church	Mean	33.92
		Median	33.50
		Std. Deviation	5.83
		Minimum	22.50
		Maximum	50.50
English Copy from Board	State	Mean	19.80
		Median	20.00
		Std. Deviation	4.70
		Minimum	4.50
		Maximum	43.50
	Independent	Mean	21.26
		Median	21.50
		Std. Deviation	4.62
		Minimum	13.00
		Maximum	32.00
	Boys' church	Mean	20.56
		Median	20.00
		Std. Deviation	3.99
		Minimum	13.00
		Maximum	29.50
	Girls' church	Mean	19.57
		Median	19.00
		Std. Deviation	3.91
		Minimum	13.00
		Maximum	31.50

English Free Writing	State	Mean	20.42
		Median	20.50
		Std. Deviation	5.00
		Minimum	6.80
		Maximum	33.80
	Independent	Mean	22.74
		Median	23.40
		Std. Deviation	5.12
		Minimum	8.70
		Maximum	32.60
	Boys' church	Mean	20.83
		Median	20.60
		Std. Deviation	4.96
		Minimum	9.00
		Maximum	32.30
	Girls' church	Mean	23.46
		Median	22.90
		Std. Deviation	4.39
		Minimum	12.30
		Maximum	33.70

Table BA8

School Language

Subtest	School Language	Statistics	
English Copy Neatly	Dominant Maltese	Mean	27.11
		Median	27.00
		Std. Deviation	5.49
		Minimum	10.50
		Maximum	40.50
	Dominant English	Mean	28.76
		Median	29.00
		Std. Deviation	5.74
		Minimum	18.00
		Maximum	39.50
	Mixed	Mean	27.13
		Median	27.75
		Std. Deviation	6.23
		Minimum	12.50
		Maximum	41.50
English Copy Quickly	Dominant Maltese	Mean	31.95
		Median	31.50
		Std. Deviation	5.61
		Minimum	12.50
		Maximum	56.00
	Dominant English	Mean	34.36
		Median	35.00
		Std. Deviation	4.97
		Minimum	23.00
		Maximum	43.00

	Mixed	Mean	32.78
		Variance	34.63
		Std. Deviation	5.85
		Minimum	18.00
		Maximum	50.50
English Copy from Board	Dominant Maltese	Mean	19.81
		Median	19.50
		Std. Deviation	4.28
		Minimum	4.50
		Maximum	31.50
	Dominant English	Mean	21.17
		Median	21.50
		Std. Deviation	4.59
		Minimum	13.00
		Maximum	32.00
	Mixed	Mean	20.21
		Median	20.25
		Std. Deviation	4.86
		Minimum	9.50
		Maximum	43.50
English Free Writing	Dominant Maltese	Mean	20.72
		Median	20.65
		Std. Deviation	4.82
		Minimum	6.80
		Maximum	33.80
	Dominant English	Mean	22.64
		Median	23.40
		Std. Deviation	5.07
		Minimum	8.70
		Maximum	32.60

	Mean	21.03
	Median	21.55
Mixed	Std. Deviation	5.38
	Minimum	7.80
	Maximum	33.70

Table BA9

Writing Style

Subtest	Writing Style	Statistics	
English Copy Neatly	Cursive	Mean	28.50
		Median	28.50
		Std. Deviation	3.54
		Minimum	24.00
		Maximum	33.50
	Print	Mean	25.46
		Median	25.50
		Std. Deviation	5.74
		Minimum	10.50
		Maximum	41.50
	Mixed mostly cursive	Mean	29.42
		Median	29.50
		Std. Deviation	5.46
		Minimum	20.50
		Maximum	41.00
	Mixed mostly print	Mean	28.37
		Median	28.75
		Std. Deviation	5.45
		Minimum	12.50
		Maximum	40.50
English Copy Quickly	Cursive	Mean	33.08
		Median	34.25
		Std. Deviation	4.32
		Minimum	26.50
		Maximum	37.50
	Print	Mean	30.80
		Median	30.50
		Std. Deviation	5.94

		Minimum	12.50
		Maximum	45.00
	Mixed mostly cursive	Mean	33.78
		Median	33.50
		Std. Deviation	5.18
		Minimum	25.50
		Maximum	50.50
	Mixed mostly print	Mean	33.59
		Median	33.50
		Std. Deviation	5.20
		Minimum	23.00
		Maximum	56.00
English Copy from Board	Cursive	Mean	21.17
		Median	22.00
		Std. Deviation	3.40
		Minimum	16.00
		Maximum	25.50
	Print	Mean	19.51
		Median	19.00
		Std. Deviation	5.20
		Minimum	4.50
		Maximum	43.50
	Mixed mostly cursive	Mean	20.81
		Median	21.00
		Std. Deviation	4.11
		Minimum	13.00
		Maximum	31.50
	Mixed mostly print	Mean	20.34
		Median	20.00
		Std. Deviation	3.84
		Minimum	11.00
		Maximum	32.00

English Free Writing	Cursive	Mean	23.40
		Median	23.30
		Std. Deviation	1.48
		Minimum	21.50
		Maximum	25.70
	Print	Mean	19.83
		Median	19.60
		Std. Deviation	5.36
		Minimum	6.80
		Maximum	33.80
	Mixed mostly cursive	Mean	22.68
		Median	22.10
		Std. Deviation	5.15
		Minimum	11.30
		Maximum	33.70
	Mixed mostly print	Mean	21.53
		Median	21.50
		Std. Deviation	4.51
		Minimum	10.70
		Maximum	32.60

Table BA10

Socio Economic Status

Subtest	SES	Statistics	
English Copy Neatly	Low SES	Mean	27.41
		Median	28.00
		Std. Deviation	6.00
		Minimum	10.50
		Maximum	41.50
	Middle SES	Mean	26.17
		Median	26.00
		Std. Deviation	5.47
		Minimum	12.50
		Maximum	39.00
	High SES	Mean	29.17
		Median	30.00
		Std. Deviation	5.45
		Minimum	18.00
		Maximum	41.00
English Copy Quickly	Low SES	Mean	32.16
		Median	32.00
		Std. Deviation	6.25
		Minimum	12.50
		Maximum	56.00
	Middle SES	Mean	31.88
		Median	31.50
		Std. Deviation	5.32
		Minimum	16.00
		Maximum	45.00

	High SES	Mean	33.82
		Median	34.00
		Std. Deviation	5.28
		Minimum	22.50
		Maximum	50.50
English Copy from Board	Low SES	Mean	20.30
		Median	20.00
		Std. Deviation	5.28
		Minimum	4.50
		Maximum	43.50
	Middle SES	Mean	19.37
		Median	19.00
		Std. Deviation	3.90
		Minimum	9.50
		Maximum	28.50
	High SES	Mean	21.05
		Median	21.50
		Std. Deviation	4.25
		Minimum	13.00
		Maximum	32.00
English Free Writing	Low SES	Mean	20.38
		Median	20.60
		Std. Deviation	4.87
		Minimum	10.50
		Maximum	32.10
	Middle SES	Mean	20.70
		Median	20.55
		Std. Deviation	4.87
		Minimum	6.80
		Maximum	33.80

High SES	Mean	22.30
	Median	22.60
	Std. Deviation	5.36
	Minimum	8.70
	Maximum	33.70

Table BA11

First Language

Subtest	First Language	Statistics	
English Copy Neatly	Dominant Maltese	Mean	27.14
		Median	27.00
		Std. Deviation	5.69
		Minimum	10.50
		Maximum	41.50
	Dominant English	Mean	29.37
		Median	29.50
		Std. Deviation	6.01
		Minimum	18.00
		Maximum	41.00
	Mixed	Mean	27.44
		Median	27.50
		Std. Deviation	5.94
		Minimum	15.00
		Maximum	40.50
	Foreign	Mean	25.73
		Median	25.00
		Std. Deviation	5.35
		Minimum	12.50
		Maximum	34.00
English Copy Quickly	Dominant Maltese	Mean	32.19
		Median	32.00
		Std. Deviation	5.58
		Minimum	12.50
		Maximum	56.00

	Dominant English	Mean	34.05
		Median	34.75
		Std. Deviation	6.27
		Minimum	20.00
		Maximum	44.50
	Mixed	Mean	32.84
		Median	33.75
		Std. Deviation	6.16
		Minimum	19.50
		Maximum	50.50
	Foreign	Mean	32.46
		Median	31.50
		Std. Deviation	4.40
		Minimum	25.50
		Maximum	39.50
English Copy from Board	Dominant Maltese	Mean	19.91
		Median	19.50
		Std. Deviation	4.59
		Minimum	4.50
		Maximum	43.50
	Dominant English	Mean	21.20
		Median	21.25
		Std. Deviation	4.95
		Minimum	13.00
		Maximum	32.00
	Mixed	Mean	20.49
		Median	20.25
		Std. Deviation	4.29
		Minimum	13.00
		Maximum	31.50

	Foreign	Mean	19.54
		Median	20.00
		Std. Deviation	2.89
		Minimum	13.00
		Maximum	25.00
English Free Writing	Dominant Maltese	Mean	20.59
		Median	20.60
		Std. Deviation	4.79
		Minimum	7.80
		Maximum	33.80
	Dominant English	Mean	23.55
		Median	23.40
		Std. Deviation	5.43
		Minimum	12.50
		Maximum	33.70
	Mixed	Mean	21.65
		Median	22.15
		Std. Deviation	5.26
		Minimum	6.80
		Maximum	33.00
	Foreign	Mean	20.90
		Median	21.70
		Std. Deviation	5.77
		Minimum	8.10
		Maximum	30.10

Appendix BB

Descriptive Statistics of the Maltese Subtests, Grouped by Independent Variables

Table BB1

Handedness

Test	Handedness	Statistics	
Maltese Copy Neatly (Ikkopja Pulit)	Right	Mean	20.81
		Median	21.00
		Std. Deviation	4.47
		Minimum	6.50
		Maximum	32.00
	Left	Mean	20.75
		Median	21.50
		Std. Deviation	4.90
		Minimum	10.50
		Maximum	30.00
Maltese Copy Quickly (Ikkopja Malajr)	Right	Mean	24.64
		Median	24.50
		Std. Deviation	4.57
		Minimum	6.50
		Maximum	36.00
	Left	Mean	24.20
		Median	24.50
		Std. Deviation	5.28
		Minimum	12.50
		Maximum	34.00
Maltese Copy from Board (Ikkopja mill-Bord)	Right	Mean	20.08
		Median	20.00
		Std. Deviation	4.87
		Minimum	4.50
		Maximum	31.50

	Left	Mean	19.99
		Median	20.00
		Std. Deviation	4.90
		Minimum	9.50
		Maximum	28.00
Maltese Free Writing (Kitba Kreattiva)	Right	Mean	16.18
		Median	16.50
		Std. Deviation	4.42
		Minimum	1.80
		Maximum	27.00
	Left	Mean	16.53
		Median	17.45
		Std. Deviation	5.35
		Minimum	1.60

Table BB2

Gender

Subtest	Gender	Statistics	
Maltese Copy Neatly (Ikkopja Pulit)	Male	Mean	20.12
		Median	20.00
		Std. Deviation	4.44
		Minimum	6.50
		Maximum	32.00
	Female	Mean	21.51
		Median	22.50
		Std. Deviation	4.49
		Minimum	10.00
		Maximum	31.50
Maltese Copy Quickly (Ikkopja Malajr)	Male	Mean	23.88
		Median	24.00
		Std. Deviation	4.57
		Minimum	6.50
		Maximum	34.50
	Female	Mean	25.31
		Median	25.50
		Std. Deviation	4.65
		Minimum	10.00
		Maximum	36.00
Maltese Copy from Board (Ikkopja mill-Bord)	Male	Mean	19.52
		Median	19.00
		Std. Deviation	4.86
		Minimum	4.50
		Maximum	31.00
	Female	Mean	20.64
		Median	20.50
		Std. Deviation	4.81
		Minimum	7.50
		Maximum	31.50

Maltese Free Writing (Kitba Kreattiva)	Male	Mean	15.51
		Median	15.70
		Std. Deviation	4.63
		Minimum	1.60
		Maximum	27.00
	Female	Mean	16.96
		Median	17.60
		Std. Deviation	4.37
		Minimum	1.80
		Maximum	28.50

Table BB3

Geographical Regions

Subtest	Geographical Region	Statistics	
Maltese Copy Neatly (Ikkopja Pulit)	Southern Harbour	Mean	19.16
		Median	19.50
		Std. Deviation	3.83
		Minimum	10.50
		Maximum	28.50
	Northern Harbour	Mean	20.74
		Median	21.50
		Std. Deviation	4.58
		Minimum	10.50
		Maximum	28.50
	South Eastern	Mean	20.15
		Median	21.00
		Std. Deviation	4.95
		Minimum	6.50
		Maximum	31.50
	Western	Mean	22.73
		Median	22.50
		Std. Deviation	4.42
		Minimum	9.50
		Maximum	31.50
	Northern	Mean	21.43
		Median	21.00
		Std. Deviation	3.92
		Minimum	13.50
		Maximum	30.00
	Gozo	Mean	20.30
		Median	20.25
		Std. Deviation	4.30
		Minimum	10.50
		Maximum	32.00

Maltese Copy Quickly (Ikkopja Malajr)	Southern Harbour	Mean	22.40
		Median	22.75
		Std. Deviation	4.05
		Minimum	12.00
		Maximum	31.00
	Northern Harbour	Mean	24.72
		Median	24.00
		Std. Deviation	4.77
		Minimum	15.00
		Maximum	36.00
	South Eastern	Mean	24.38
		Median	24.75
		Std. Deviation	5.59
		Minimum	6.50
		Maximum	34.50
	Western	Mean	25.81
		Median	25.50
		Std. Deviation	4.39
		Minimum	12.50
		Maximum	35.50
	Northern	Mean	25.27
		Median	24.00
		Std. Deviation	4.20
		Minimum	16.50
		Maximum	34.50
	Gozo Region	Mean	24.38
		Median	24.50
		Std. Deviation	3.94
		Minimum	16.00
		Maximum	30.50
Maltese Copy from Board (Ikkopja mill-Bord)	Southern Harbour	Mean	18.83
		Median	17.50
		Variance	23.69
		Std. Deviation	4.64
		Minimum	11.50
		Maximum	29.50

	Northern Harbour	Mean	20.28
		Median	21.00
		Std. Deviation	4.18
		Minimum	11.50
		Maximum	27.00
	South Eastern	Mean	19.60
		Median	20.00
		Std. Deviation	5.08
		Minimum	4.50
		Maximum	29.50
	Western	Mean	21.92
		Median	23.00
		Std. Deviation	4.83
		Minimum	10.50
		Maximum	31.50
	Northern	Mean	19.35
		Median	19.50
		Std. Deviation	4.86
		Minimum	10.50
		Maximum	31.00
	Gozo	Mean	19.96
		Median	19.50
		Std. Deviation	4.91
		Minimum	9.50
		Maximum	31.00
Maltese Free Writing (Kitba Kreattiva)	Southern Harbour	Mean	14.73
		Median	14.20
		Std. Deviation	3.51
		Minimum	8.80
		Maximum	22.90
	Northern Harbour	Mean	16.25
		Median	17.05
		Std. Deviation	4.27
		Minimum	2.00
		Maximum	24.10

	South Eastern	Mean	15.98
		Median	16.40
		Std. Deviation	5.18
		Minimum	1.60
		Maximum	28.50
	Western	Mean	17.77
		Median	18.50
		Std. Deviation	3.62
		Minimum	8.50
		Maximum	25.20
	Northern	Mean	14.74
		Median	15.20
		Std. Deviation	5.12
		Minimum	1.80
		Maximum	26.20
	Gozo	Mean	16.78
		Median	16.50
		Std. Deviation	4.50
		Minimum	7.80
		Maximum	27.00

Table BB4

Student's Nationality

Subtest	Nationality	Statistics	
Maltese Copy Neatly (Ikkopja Pulit)	Maltese	Mean	20.90
		Median	21.00
		Std. Deviation	4.51
		Minimum	6.50
		Maximum	32.00
	Foreign	Mean	18.70
		Median	18.50
		Std. Deviation	4.18
		Minimum	12.00
		Maximum	25.50
	Dual	Mean	25.00
		Median	25.50
		Std. Deviation	1.80
		Minimum	23.00
		Maximum	26.50
Maltese Copy Quickly (Ikkopja Malajr)	Maltese	Mean	24.66
		Median	24.50
		Std. Deviation	4.65
		Minimum	6.50
		Maximum	36.00
	Foreign	Mean	22.85
		Median	23.50
		Std. Deviation	4.48
		Minimum	16.00
		Maximum	31.00
	Dual	Mean	28.50
		Median	29.50
		Std. Deviation	2.65
		Minimum	25.50
		Maximum	30.50

Maltese Copy from Board (Ikkopja mill-Bord)	Maltese	Mean	20.25
		Median	20.00
		Std. Deviation	4.84
		Minimum	4.50
		Maximum	31.50
	Foreign	Mean	16.95
		Median	15.50
		Std. Deviation	4.48
		Minimum	10.50
		Maximum	25.00
	Dual	Mean	23.00
		Median	23.50
		Std. Deviation	1.80
		Minimum	21.00
		Maximum	24.50
Maltese Free Writing (Kitba Kreattiva)	Maltese	Mean	16.56
		Median	16.80
		Std. Deviation	4.22
		Minimum	1.60
		Maximum	28.50
	Foreign	Mean	10.09
		Median	9.90
		Std. Deviation	5.79
		Minimum	1.80
		Maximum	20.70
	Dual	Mean	17.10
		Median	17.20
		Std. Deviation	2.85
		Minimum	14.20
		Maximum	19.90

Table BB5

Age

Subtest	Birth Range	Statistic	
Maltese Copy Neatly (Ikkopja Pulit)	January to June	Mean	21.41
		Median	22
		Std. Deviation	4.51
		Minimum	9.50
		Maximum	31.50
	July to December	Mean	20.39
		Median	20.5
		Std. Deviation	4.46
		Minimum	6.50
		Maximum	32.00
Maltese Copy Quickly (Ikkopja Malajr)	January to June	Mean	25.34
		Median	25.5
		Std. Deviation	4.82
		Minimum	10.00
		Maximum	36.00
	July to December	Mean	23.99
		Median	24
		Std. Deviation	4.48
		Minimum	6.50
		Maximum	35.50
Maltese Copy from Board (Ikkopja mill-Bord)	January to June	Mean	20.93
		Median	21.5
		Std. Deviation	4.84
		Minimum	7.50
		Maximum	31.00

	July to December	Mean	19.43
		Median	19.5
		Std. Deviation	4.82
		Minimum	4.50
		Maximum	31.50
Maltese Free Writing (Kitba Kreattiva)	January to June	Mean	17.02
		Median	17.8
		Std. Deviation	4.45
		Minimum	1.60
		Maximum	25.20
	July to December	Mean	15.60
		Median	15.6
		Std. Deviation	4.58
		Minimum	1.80
		Maximum	28.50

Table BB6

School Type

Subtest	School Type	Statistics	
Maltese Copy Neatly (Ikkopja Pulit)	State	Mean	20.77
		Median	21.00
		Std. Deviation	4.79
		Minimum	6.50
		Maximum	31.50
	Independent	Mean	20.91
		Median	20.50
		Std. Deviation	4.17
		Minimum	11.00
		Maximum	29.50
	Boys' church	Mean	20.74
		Median	21.25
		Std. Deviation	4.26
		Minimum	10.50
		Maximum	32.00
	Girls' church	Mean	21.07
		Median	22.00
		Std. Deviation	3.76
		Minimum	11.50
		Maximum	28.50
Maltese Copy Quickly (Ikkopja Malajr)	State	Mean	24.52
		Median	24.50
		Std. Deviation	4.96
		Minimum	6.50
		Maximum	36.00
	Independent	Mean	25.46
		Median	26.00
		Std. Deviation	4.20
		Minimum	16.50
		Maximum	33.50

	Boys' church	Mean	24.55
		Median	24.50
		Std. Deviation	3.93
		Minimum	16.00
		Maximum	31.50
	Girls' church	Mean	24.39
		Median	24.00
		Std. Deviation	4.54
		Minimum	12.50
		Maximum	34.50
Maltese Copy from Board (Ikkopja mill-Bord)	State	Mean	19.64
		Median	20.00
		Std. Deviation	4.95
		Minimum	4.50
		Maximum	31.50
	Independent	Mean	21.82
		Median	21.50
		Std. Deviation	5.02
		Minimum	11.50
		Maximum	31.00
	Boys' church	Mean	20.50
		Median	20.50
		Std. Deviation	4.95
		Minimum	9.50
		Maximum	31.00
	Girls' church	Mean	20.37
		Median	20.00
		Std. Deviation	3.89
		Minimum	10.50
		Maximum	28.50
	State	Mean	15.80
		Median	16.10
		Std. Deviation	4.77
		Minimum	1.60
		Maximum	28.50
	Independent	Mean	16.29
		Median	17.15
		Std. Deviation	3.58

Maltese Free Writing (Kitba Kreattiva)		Minimum	9.60
		Maximum	22.30
	Boys' church	Mean	16.32
		Median	16.35
		Std. Deviation	4.66
		Minimum	5.80
		Maximum	27.00
	Girls' church	Mean	17.93
		Median	18.20
		Std. Deviation	3.46
		Minimum	9.00
		Maximum	26.20

Table BB7

School Language

Subtest	School Language	Statistics	
Maltese Copy Neatly (Ikkopja Pulit)	Dominant Maltese	Mean	20.71
		Median	21.00
		Std. Deviation	4.69
		Minimum	6.50
		Maximum	32.00
	Dominant English	Mean	20.95
		Median	20.50
		Std. Deviation	4.10
		Minimum	11.00
		Maximum	29.50
	Mixed	Mean	20.99
		Median	21.50
		Std. Deviation	4.26
		Minimum	10.50
		Maximum	30.00
Maltese Copy Quickly (Ikkopja Malajr)	Dominant Maltese	Mean	24.47
		Median	24.50
		Std. Deviation	4.81
		Minimum	6.50
		Maximum	36.00
	Dominant English	Mean	25.43
		Median	26.00
		Std. Deviation	4.13
		Minimum	16.50
		Maximum	33.50
	Mixed	Mean	24.59
		Median	24.00
		Std. Deviation	4.46
		Minimum	13.00
		Maximum	34.50

Maltese Copy from Board (Ikkopja mill-Bord)	Dominant Maltese	Mean	19.90
		Median	20.00
		Std. Deviation	4.92
		Minimum	4.50
		Maximum	31.50
	Dominant English	Mean	21.69
		Median	21.50
		Std. Deviation	4.98
		Minimum	11.50
		Maximum	31.00
	Mixed	Mean	19.98
		Median	20.00
		Std. Deviation	4.65
		Minimum	10.50
		Maximum	29.50
Maltese Free Writing (Kitba Kreattiva)	Dominant Maltese	Mean	16.55
		Median	16.70
		Std. Deviation	4.48
		Minimum	1.60
		Maximum	28.50
	Dominant English	Mean	16.32
		Median	17.30
		Std. Deviation	3.52
		Minimum	9.60
		Maximum	22.30
	Mixed	Mean	15.38
		Median	15.80
		Std. Deviation	4.93
		Minimum	1.80
		Maximum	26.20

Table BB8

Writing Style

Subtest	Writing Style	Statistics	
Maltese Copy Neatly (Ikkopja Pulit)	Cursive	Mean	22.57
		Median	24.00
		Std. Deviation	2.78
		Minimum	18.00
		Maximum	25.00
	Print	Mean	19.91
		Median	20.00
		Std. Deviation	4.99
		Minimum	6.50
		Maximum	31.50
	Mixed mostly cursive	Mean	21.24
		Median	21.50
		Std. Deviation	4.10
		Minimum	9.50
		Maximum	32.00
	Mixed mostly print	Mean	21.43
		Median	22.00
		Std. Deviation	4.09
		Minimum	11.50
		Maximum	31.50
Maltese Copy Quickly (Ikkopja Malajr)	Cursive	Mean	26.64
		Median	27.50
		Std. Deviation	3.51
		Minimum	22.00
		Maximum	30.50
	Print	Mean	23.58
		Median	24.00
		Std. Deviation	5.28
		Minimum	6.50
		Maximum	35.50

	Mixed mostly cursive	Mean	25.34
		Median	25.50
		Std. Deviation	3.55
		Minimum	18.00
		Maximum	34.50
	Mixed mostly print	Mean	25.22
		Median	25.00
		Std. Deviation	4.17
		Minimum	13.00
		Maximum	36.00
Maltese Copy from Board (Ikkopja mill-Bord)	Cursive	Mean	22.00
		Median	23.50
		Std. Deviation	4.18
		Minimum	17.00
		Maximum	27.50
	Print	Mean	19.21
		Median	18.50
		Std. Deviation	5.34
		Minimum	4.50
		Maximum	31.50
	Mixed mostly cursive	Mean	20.77
		Median	21.00
		Std. Deviation	4.43
		Minimum	12.00
		Maximum	31.00
	Mixed mostly print	Mean	20.61
		Median	20.50
		Std. Deviation	4.43
		Minimum	10.50
		Maximum	31.00
	Cursive	Mean	18.57
		Median	18.90
		Std. Deviation	4.12
		Minimum	13.20
		Maximum	24.40
	Print	Mean	15.37
		Median	15.70
		Std. Deviation	4.79

		Minimum	1.60
		Maximum	27.00
Maltese Free Writing (Kitba Kreattiva)	Mixed mostly cursive	Mean	16.88
		Median	16.50
		Std. Deviation	3.99
		Minimum	8.50
		Maximum	26.20
	Mixed mostly print	Mean	16.66
		Median	17.00
		Std. Deviation	4.39
		Minimum	1.80
		Maximum	28.50

Table BB9

Ability

Subtest	Ability	Statistics	
Maltese Copy Neatly (Ikkopja Pulit)	Typically Developing	Mean	21.23
		Median	21.50
		Std. Deviation	4.38
		Minimum	10.50
		Maximum	32.00
	Learning Difficulties	Mean	18.54
		Median	19.00
		Std. Deviation	4.58
		Minimum	6.50
		Maximum	30.50
Maltese Copy Quickly (Ikkopja Malajr)	Typically Developing	Mean	25.09
		Median	25.00
		Std. Deviation	4.39
		Minimum	12.00
		Maximum	36.00
	Learning Difficulties	Mean	21.88
		Median	22.50
		Std. Deviation	5.13
		Minimum	6.50
		Maximum	34.50
Maltese Copy from Board (Ikkopja mill-Bord)	Typically Developing	Mean	20.59
		Median	20.50
		Std. Deviation	4.62
		Minimum	9.50
		Maximum	31.50
	Learning Difficulties	Mean	17.21
		Median	17.25
		Std. Deviation	5.20
		Minimum	4.50
		Maximum	30.00

Maltese Free Writing (Kitba Kreattiva)	Typically Developing	Mean	16.58
		Median	16.80
		Std. Deviation	4.49
		Minimum	1.80
		Maximum	28.50
	Learning Difficulties	Mean	14.16
		Median	14.60
		Std. Deviation	4.37
		Minimum	1.60
		Maximum	20.70

Table BB10

Socio Economic Status

Subtest	SES	Statistics	
Maltese Copy Neatly (Ikkopja Pulit)	Low SES	Mean	20.89
		Median	21.00
		Std. Deviation	4.54
		Minimum	10.00
		Maximum	30.50
	Middle SES	Mean	20.19
		Median	20.50
		Std. Deviation	4.52
		Minimum	6.50
		Maximum	31.50
	High SES	Mean	21.95
		Median	22.50
		Std. Deviation	4.29
		Minimum	9.50
		Maximum	32.00
Maltese Copy Quickly (Ikkopja Malajr)	Low SES	Mean	24.76
		Median	24.00
		Std. Deviation	4.91
		Minimum	10.00
		Maximum	36.00
	Middle SES	Mean	24.06
		Median	24.50
		Std. Deviation	4.69
		Minimum	6.50
		Maximum	35.50
	High SES	Mean	25.42
		Median	25.50
		Std. Deviation	4.09
		Minimum	16.50
		Maximum	34.50

Maltese Copy from Board (Ikkopja mill-Bord)	Low SES	Mean	20.13
		Median	20.00
		Std. Deviation	5.33
		Minimum	7.50
		Maximum	31.00
	Middle SES	Mean	19.18
		Median	18.50
		Std. Deviation	4.60
		Minimum	4.50
		Maximum	31.50
	High SES	Mean	21.86
		Median	22.00
		Std. Deviation	4.22
		Minimum	11.50
		Maximum	31.00
Maltese Free Writing (Kitba Kreattiva)	Low SES	Mean	16.14
		Median	16.60
		Std. Deviation	4.65
		Minimum	4.30
		Maximum	28.50
	Middle SES	Mean	15.98
		Median	16.15
		Std. Deviation	4.59
		Minimum	1.60
		Maximum	25.40
	High SES	Mean	16.72
		Median	17.20
		Std. Deviation	4.37
		Minimum	1.80
		Maximum	27.00

Table BB11

First Language

Test	First Language	Statistic	
Maltese Copy Neatly (Ikkopja Pulit)	Dominant Maltese	Mean	20.90
		Median	21.00
		Std. Deviation	4.42
		Minimum	6.50
		Maximum	32.00
	Dominant English	Mean	21.59
		Median	22.00
		Std. Deviation	4.67
		Minimum	11.00
		Maximum	29.50
	Mixed	Mean	20.57
		Median	22.50
		Std. Deviation	4.91
		Minimum	9.50
		Maximum	29.50
	Foreign	Mean	17.96
		Median	18.00
		Std. Deviation	3.80
		Minimum	12.00
		Maximum	24.00
Maltese Copy Quickly (Ikkopja Malajr)	Dominant Maltese	Mean	24.55
		Median	24.50
		Std. Deviation	4.62
		Minimum	6.50
		Maximum	36.00
	Dominant English	Mean	25.72
		Median	25.50
		Std. Deviation	4.50
		Minimum	16.50
		Maximum	33.50

	Mixed	Mean	24.90
		Median	25.50
		Std. Deviation	4.98
		Minimum	12.50
		Maximum	34.50
	Foreign	Mean	22.14
		Median	23.50
		Std. Deviation	4.08
		Minimum	16.00
		Maximum	29.50
Maltese Copy from Board (Ikkopja mill-Bord)	Dominant Maltese	Mean	20.18
		Median	20.00
		Std. Deviation	4.77
		Minimum	4.50
		Maximum	31.50
	Dominant English	Mean	20.72
		Median	19.50
		Std. Deviation	5.44
		Minimum	11.50
		Maximum	31.00
	Mixed	Mean	20.33
		Median	20.50
		Std. Deviation	4.78
		Minimum	9.50
		Maximum	29.50
	Foreign	Mean	15.93
		Median	15.00
		Std. Deviation	4.29
		Minimum	10.50
		Maximum	25.00
Maltese Free Writing (Kitba Kreattiva)	Dominant Maltese	Mean	16.43
		Median	16.45
		Std. Deviation	4.17
		Minimum	5.10
		Maximum	28.50

Dominant English	Mean	17.04
	Median	18.50
	Std. Deviation	3.87
	Minimum	5.10
	Maximum	22.30
	Mean	16.95
	Median	18.10
Mixed	Std. Deviation	4.61
	Minimum	1.60
	Maximum	26.20
	Mean	7.52
	Median	6.60
Foreign	Std. Deviation	4.63
	Minimum	1.80
	Maximum	19.00

Appendix BC

Distribution of Scores per Subtest - English

Figure BC1

Score Distribution of English Copy Neatly

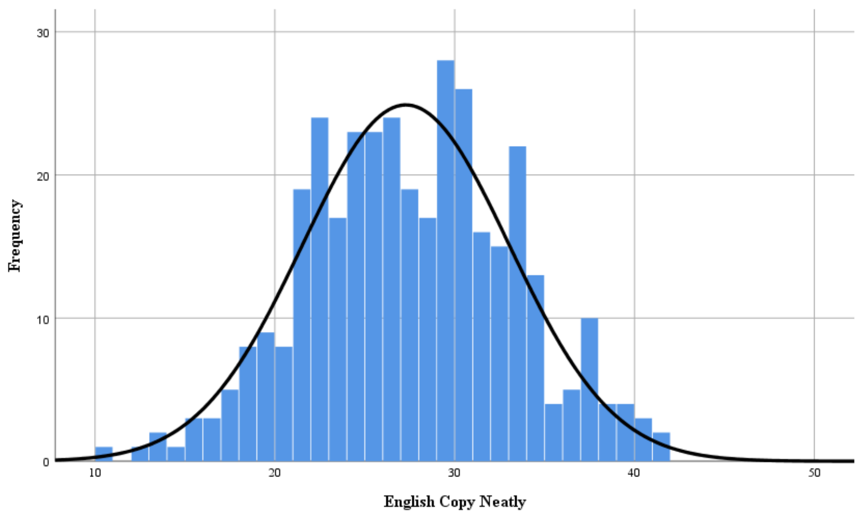


Figure BC2

Score Distribution of English Copy Quickly

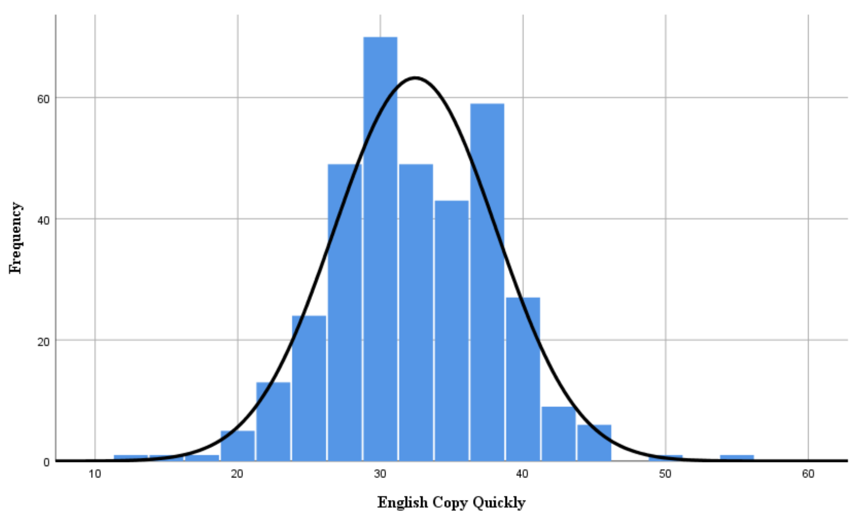


Figure BC3

Score Distribution of English Copy from Board

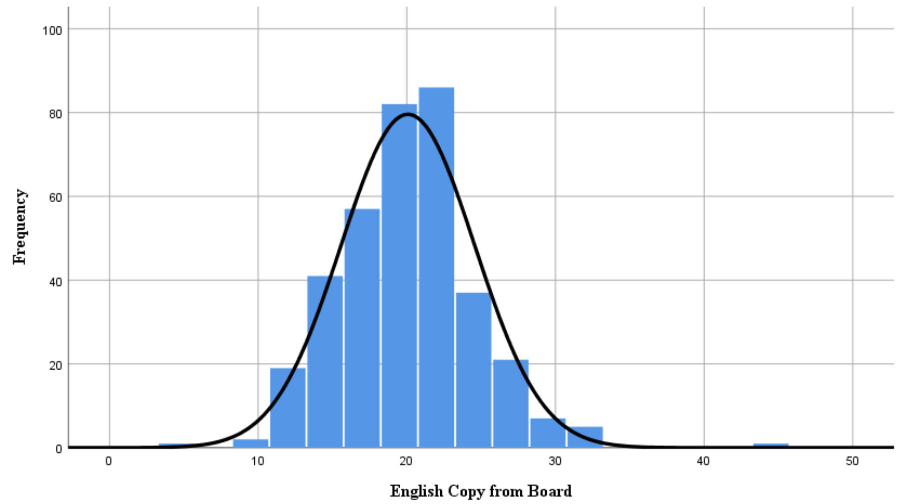
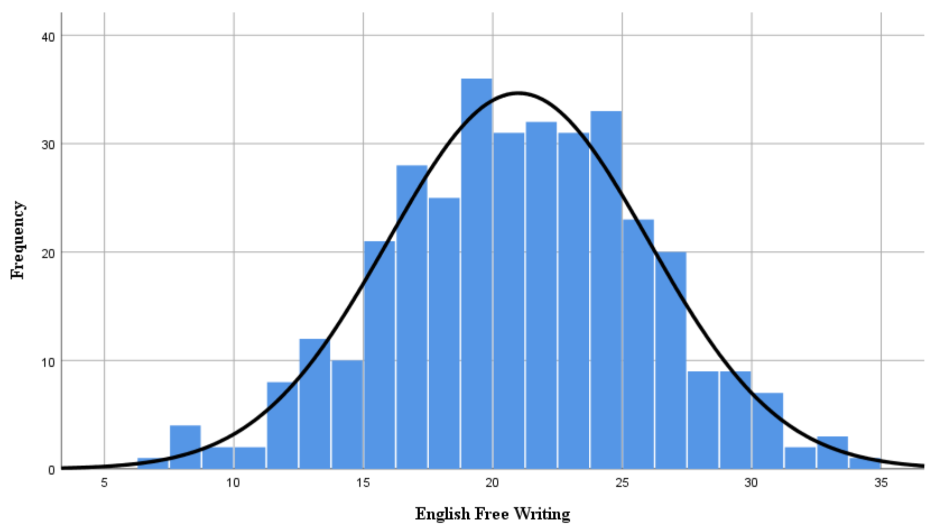


Figure BC4

Score Distribution of English Free Writing



Appendix BD

Distribution of Scores per Subtest - Maltese

Figure BD1

Score Distribution of Maltese Copy Neatly (Ikkopja Pulit)

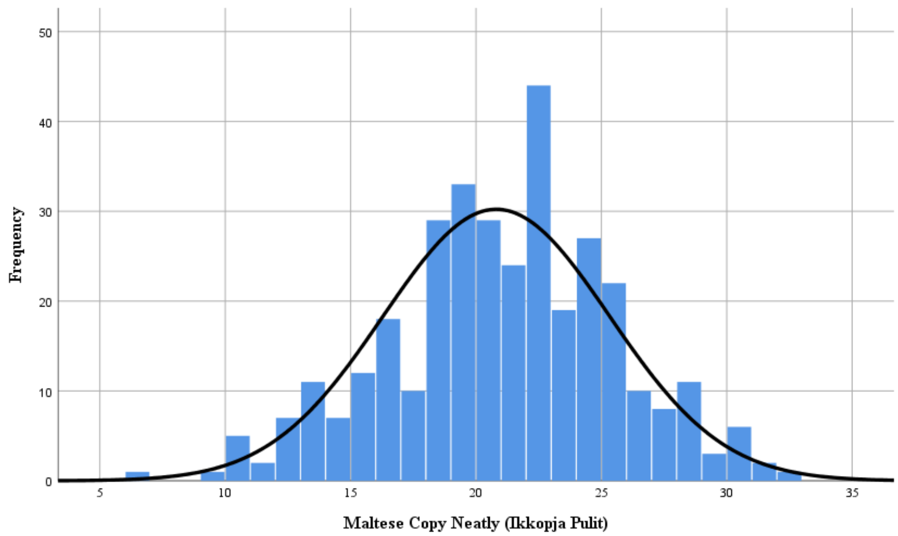


Figure BD2

Score Distribution of Maltese Copy Quickly (Ikkopja Malajr)

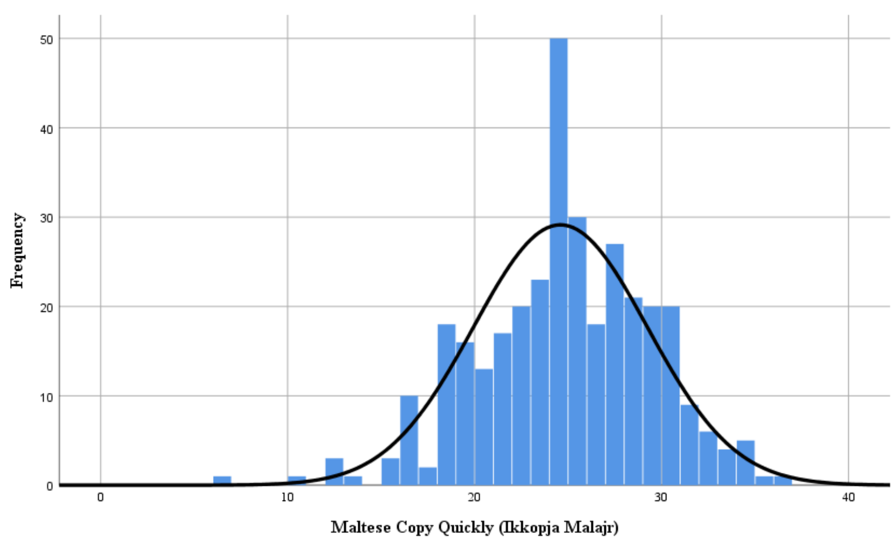


Figure BD3

Score Distribution of Maltese Copy from Board (Ikkopja mill-Bord)

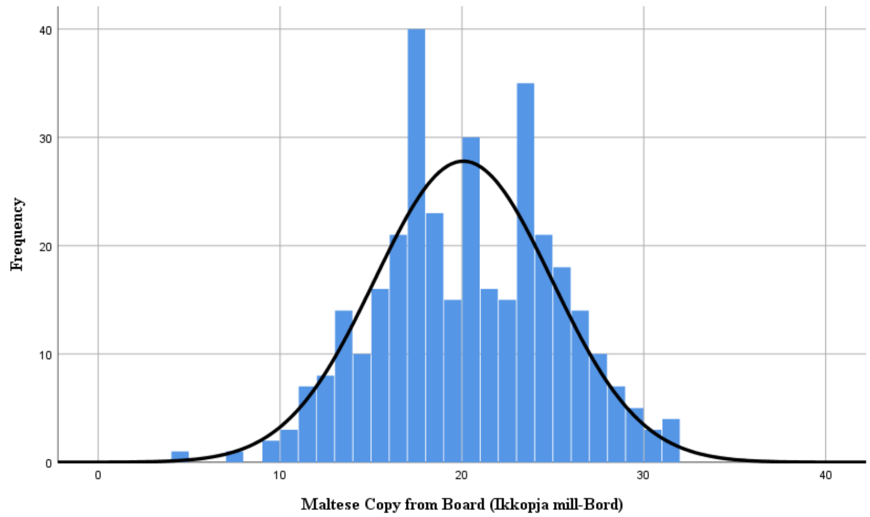
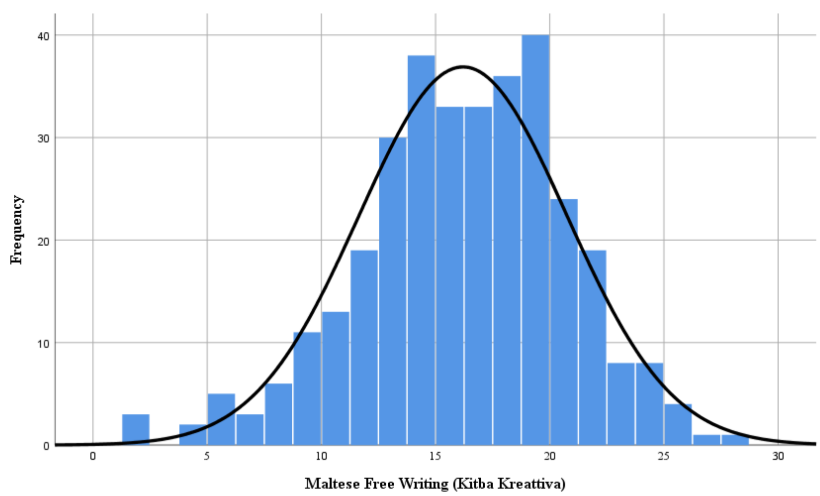


Figure BD4

Score Distribution of Maltese Free Writing (Kitba Kreattiva)



Appendix BE

Regression Analysis - English

Table BE1

Regression Analysis for English Copy Neatly before Backward Procedure

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	2344.188[a]	24	97.674	3.557	0.000
Intercept	15578.040	1	15578.040	567.254	0.000
Handedness	0.069	1	0.069	0.003	0.960
Gender	17.558	1	17.558	0.639	0.425
Geographical Regions	214.794	5	42.959	1.564	0.170
Students' Nationality	238.902	2	119.451	4.350	0.014
Age	41.891	1	41.891	1.525	0.218
School	63.380	3	21.127	0.769	0.512
School Language	31.595	2	15.798	0.575	0.563
Ability	239.354	1	239.354	8.716	0.003
Writing Style	492.654	3	164.218	5.980	0.001
SES	318.673	2	159.337	5.802	0.003
First Language	6.978	3	2.326	0.085	0.968
Error	8897.755	324	27.462		
Total	272403.000	349			
Corrected Total	11241.943	348			

a. R Squared = 0.209 (Adjusted R Squared = 0.150)

Table BE2

Regression Analysis for English Copy Quickly before Backward Procedure

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1684.920[a]	24	70.205	2.541	0.000
Intercept	20473.454	1	20473.454	740.956	0.000
Handedness	3.479	1	3.479	0 .126	0.723
Gender	17.956	1	17.956	0.650	0.421
Geographical Regions	295.708	5	59.142	2.140	0.060
Students' Nationality	30.319	2	15.160	0.549	0.578
Age	8.998	1	8.998	0.326	0.569
School	87.675	3	29.225	1.058	0.367
School Language	91.984	2	45.992	1.664	0.191
Ability	398.268	1	398.268	14.414	0.000
Writing Style	278.731	3	92.910	3.363	0.019
SES	104.817	2	52.408	1.897	0.152
First Language	16.700	3	5.567	0.201	0.895
Error	8952.487	324	27.631		
Total	381319.000	349			
Corrected Total	10637.407	348			

a. R Squared = 0.158 (Adjusted R Squared = 0.096)

Table BE3

Regression Analysis for English Copy from the Board before Backward Procedure

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1063.603[a]	24	44.317	2.499	0.000
Intercept	7896.307	1	7896.307	445.236	0.000
Ability	247.564	1	247.564	13.959	0.000
Writing Style	33.589	3	11.196	0.631	0.595
Handedness	8.536	1	8.536	0.481	0.488
Gender	35.442	1	35.442	1.998	0.158
Geographical Regions	270.837	5	54.167	3.054	0.010
Students' Nationality	51.117	2	25.559	1.441	0.238
Age	40.304	1	40.304	2.273	0.133
School	73.301	3	24.434	1.378	0.249
School Language	9.436	2	4.718	0.266	0.767
SES	148.361	2	74.181	4.183	0.016
First Language	19.074	3	6.358	0.358	0.783
Error	5746.174	324	17.735		
Total	148719.250	349			
Corrected Total	6809.777	348			

a. R Squared = 0.156 (Adjusted R Squared = 0.094)

Table BE4

Regression Analysis for English Free Writing before Backward Procedure

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1621.550[a]	24	67.565	3.088	0.000
Intercept	8963.926	1	8963.926	409.661	0.000
Writing Style	212.633	3	70.878	3.239	0.022
Students' Nationality	15.664	2	7.832	0.358	0.699
School	112.288	3	37.429	1.711	0.165
School Language	13.444	2	6.722	0.307	0.736
Handedness	73.954	1	73.954	3.380	0.067
Gender	142.617	1	142.617	6.518	0.011
Geographical Regions	232.045	5	46.409	2.121	0.063
Age	5.560	1	5.560	0.254	0.615
Ability	235.285	1	235.285	10.753	0.001
SES	10.796	2	5.398	0.247	0.782
First Language	40.207	3	13.402	0.612	0.607
Error	6892.613	315	21.881		
Total	159000.660	340			
Corrected Total	8514.163	339			

a. R Squared = 0.190 (Adjusted R Squared = 0.129)

Table BE5

Regression Analysis for Total English Score before Backward Procedure

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1645.645[a]	24	68.569	2.956	0.000
Intercept	10555.831	1	10555.831	455.109	0.000
Writing Style	139.716	3	46.572	2.008	0.113
School	85.525	3	28.508	1.229	0.299
Gender	78.233	1	78.233	3.373	0.067
Ability	453.187	1	453.187	19.539	0.000
Handedness	12.151	1	12.151	0.524	0.470
Geographical Regions	333.736	5	66.747	2.878	0.015
Students' Nationality	61.406	2	30.703	1.324	0.268
Age	1.933	1	1.933	0.083	0.773
School Language	27.775	2	13.887	0.599	0.550
SES	80.388	2	40.194	1.733	0.178
First Language	13.588	3	4.529	0.195	0.900
Error	7538.076	325	23.194		
Total	190464.277	350			
Corrected Total	9183.721	349			

a. R Squared = 0.179 (Adjusted R Squared = 0.119)

Appendix BF

Regression Analysis - Maltese

Table BF1

Regression Analysis for Maltese Copy Neatly (Ikkopja Pulit) Before Backward Procedure

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1228.207[a]	24	51.175	2.958	0.000
Intercept	5958.893	1	5958.893	344.459	0.000
Writing Style	150.421	3	50.140	2.898	0.035
Gender	90.745	1	90.745	5.246	0.023
Ability	105.004	1	105.004	6.070	0.014
Geographical Regions	327.226	5	65.445	3.783	0.002
Handedness	3.222	1	3.222	0.186	0.666
Students' Nationality	55.110	2	27.555	1.593	0.205
Age	45.468	1	45.468	2.628	0.106
School	49.476	3	16.492	0.953	0.415
School Language	10.489	2	5.244	0.303	0.739
SES	70.037	2	35.019	2.024	0.134
First Language	58.091	3	19.364	1.119	0.341
Error	5293.574	306	17.299		
Total	151235.500	331			
Corrected Total	6521.781	330			

a. R Squared = 0.188 (Adjusted R Squared = 0.125)

Table BF2

Regression Analysis for Maltese Copy Quickly (Ikkopja Malajr) Before Backward Procedure

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1304.131[a]	24	54.339	2.931	0.000
Intercept	7837.409	1	7837.409	422.758	0.000
Writing Style	165.880	3	55.293	2.983	0.032
Gender	127.153	1	127.153	6.859	0.009
Ability	192.608	1	192.608	10.389	0.001
Geographical Regions	261.424	5	52.285	2.820	0.017
Students' Nationality	31.602	2	15.801	0.852	0.427
Handedness	30.429	1	30.429	1.641	0.201
Age	86.815	1	86.815	4.683	0.031
School	28.267	3	9.422	0.508	0.677
School Language	1.776	2	.888	0.048	0.953
SES	87.132	2	43.566	2.350	0.097
First Language	40.651	3	13.550	0.731	0.534
Error	5654.321	305	18.539		
Total	207942.500	330			
Corrected Total	6958.452	329			

a. R Squared = 0.187 (Adjusted R Squared = 0.123)

Table BF3

Regression Analysis for Maltese Copy from the Board (Ikkopja mill-Bord) Before backward procedure

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1486.638[a]	24	61.943	3.079	0.000
Intercept	4895.887	1	4895.887	243.322	0.000
Writing Style	79.725	3	26.575	1.321	0.268
Gender	66.712	1	66.712	3.316	0.070
Ability	251.914	1	251.914	12.520	0.000
Geographical Regions	241.123	5	48.225	2.397	0.037
DOB	85.011	1	85.011	4.225	0.041
SES	175.858	2	87.929	4.370	0.013
Handedness	10.145	1	10.145	0.504	0.478
Students’ Nationality	11.444	2	5.722	0.284	0.753
School	10.712	3	3.571	0.177	0.912
School Language	31.111	2	15.556	0.773	0.462
First Language	79.405	3	26.468	1.315	0.269
Error	6116.782	304	20.121		
Total	141574.000	329			
Corrected Total	7603.419	328			

a. R Squared = 0.196 (Adjusted R Squared = 0.132)

Table BF4

Regression Analysis for Maltese Free Writing (Kitba Kreattiva) Before Backward Procedure

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	2067.729[a]	24	86.155	5.630	0.000
Intercept	2316.884	1	2316.884	151.398	0.000
Ability	302.353	1	302.353	19.757	0.000
DOB	22.204	1	22.204	1.451	0.229
SES	34.235	2	17.118	1.119	0.328
First Language	316.999	3	105.666	6.905	0.000
Handedness	0.907	1	0.907	0.059	0.808
Gender	30.327	1	30.327	1.982	0.160
Geographical Regions	348.247	5	69.649	4.551	0.001
Students' Nationality	29.432	2	14.716	0.962	0.383
School	83.018	3	27.673	1.808	0.146
School Language	7.411	2	3.706	0.242	0.785
Writing Style	67.884	3	22.628	1.479	0.220
Error	4606.299	301	15.303		
Total	93038.130	326			
Corrected Total	6674.028	325			

a. R Squared = 0.310 (Adjusted R Squared = 0.255)

Table BF5

Regression Analysis for Total Maltese Score Before Backward Procedure

Source	Type III Sum of Squares	df	Mean Square	F	p-value
Corrected Model	1752.065[a]	24	73.003	5.040	0.000
Intercept	3648.558	1	3648.558	251.901	0.000
Ability	227.131	1	227.131	15.681	0.000
First Language	198.388	3	66.129	4.566	0.004
Gender	65.234	1	65.234	4.504	0.035
Geographical Regions	414.194	5	82.839	5.719	0.000
Handedness	3.475	1	3.475	0.240	0.625
Students' Nationality	8.609	2	4.305	0.297	0.743
DOB	12.891	1	12.891	0.890	0.346
School	45.566	3	15.189	1.049	0.371
School Language	3.375	2	1.687	0.117	0.890
Writing Style	93.793	3	31.264	2.159	0.093
SES	63.423	2	31.712	2.189	0.114
Error	4432.138	306	14.484		
Total	116010.816	331			
Corrected Total	6184.202	330			

a. R Squared = 0.283 (Adjusted R Squared = 0.227)

Appendix BG

Raw Scores, Standard Scores and Z-scores of Total English Score

Total English Score (WPM)	Standard Scores	Z-scores
8.63	55.85	-2.94
8.81	56.42	-2.9
9.06	57.2	-2.85
9.69	59.13	-2.72
10.00	60.09	-2.66
10.75	62.41	-2.51
10.88	62.8	-2.48
11.06	63.38	-2.44
11.19	63.76	-2.42
12.69	68.4	-2.11
13.00	69.36	-2.04
13.13	69.75	-2.02
13.50	70.91	-1.94
13.94	72.26	-1.85
14.25	73.22	-1.79
14.50	73.99	-1.73
15.06	75.73	-1.62
15.13	75.93	-1.6
15.56	77.28	-1.51
15.63	77.47	-1.5
15.88	78.24	-1.45
16.00	78.63	-1.42
16.06	78.82	-1.41
16.13	79.01	-1.4
16.31	79.59	-1.36
16.63	80.56	-1.3
16.69	80.75	-1.28
17.06	81.91	-1.21
17.13	82.1	-1.19
17.19	82.3	-1.18
17.25	82.49	-1.17
17.44	83.07	-1.13
17.50	83.26	-1.12
17.63	83.65	-1.09
17.69	83.84	-1.08
17.81	84.23	-1.05
17.88	84.42	-1.04

17.94	84.61	-1.03
18.00	84.81	-1.01
18.06	85	-1
18.13	85.19	-0.99
18.19	85.39	-0.97
18.25	85.58	-0.96
18.31	85.77	-0.95
18.38	85.96	-0.94
18.44	86.16	-0.92
18.50	86.35	-0.91
18.69	86.93	-0.87
18.75	87.12	-0.86
18.94	87.7	-0.82
19.13	88.28	-0.78
19.19	88.47	-0.77
19.25	88.67	-0.76
19.31	88.86	-0.74
19.38	89.05	-0.73
19.50	89.44	-0.7
19.56	89.63	-0.69
19.63	89.83	-0.68
19.69	90.02	-0.67
19.75	90.21	-0.65
19.88	90.6	-0.63
19.94	90.79	-0.61
20.00	90.98	-0.6
20.06	91.18	-0.59
20.13	91.37	-0.58
20.19	91.56	-0.56
20.25	91.76	-0.55
20.44	92.34	-0.51
20.50	92.53	-0.5
20.56	92.72	-0.49
20.63	92.92	-0.47
20.75	93.3	-0.45
20.88	93.69	-0.42
20.94	93.88	-0.41
21.00	94.07	-0.39
21.13	94.46	-0.37
21.19	94.65	-0.36
21.25	94.85	-0.34
21.44	95.43	-0.3
21.50	95.62	-0.29

21.56	95.81	-0.28
21.63	96	-0.27
21.69	96.2	-0.25
21.75	96.39	-0.24
21.81	96.58	-0.23
21.88	96.78	-0.21
21.94	96.97	-0.2
22.00	97.16	-0.19
22.13	97.55	-0.16
22.19	97.74	-0.15
22.25	97.94	-0.14
22.31	98.13	-0.12
22.38	98.32	-0.11
22.44	98.51	-0.1
22.50	98.71	-0.09
22.56	98.9	-0.07
22.63	99.09	-0.06
22.75	99.48	-0.03
22.81	99.67	-0.02
22.94	100.06	0
23.00	100.25	0.02
23.06	100.45	0.03
23.19	100.83	0.06
23.25	101.02	0.07
23.44	101.6	0.11
23.50	101.8	0.12
23.56	101.99	0.13
23.63	102.18	0.15
23.69	102.38	0.16
23.75	102.57	0.17
23.81	102.76	0.18
23.94	103.15	0.21
24.00	103.34	0.22
24.06	103.53	0.24
24.13	103.73	0.25
24.19	103.92	0.26
24.25	104.11	0.27
24.31	104.31	0.29
24.38	104.5	0.3
24.50	104.89	0.33
24.56	105.08	0.34
24.63	105.27	0.35
24.69	105.47	0.36

24.75	105.66	0.38
24.81	105.85	0.39
24.88	106.04	0.4
25.00	106.43	0.43
25.06	106.62	0.44
25.13	106.82	0.45
25.19	107.01	0.47
25.25	107.2	0.48
25.31	107.4	0.49
25.38	107.59	0.51
25.50	107.98	0.53
25.63	108.36	0.56
25.69	108.55	0.57
25.75	108.75	0.58
25.81	108.94	0.6
25.94	109.33	0.62
26.06	109.71	0.65
26.19	110.1	0.67
26.31	110.48	0.7
26.38	110.68	0.71
26.44	110.87	0.72
26.50	111.06	0.74
26.56	111.26	0.75
26.63	111.45	0.76
26.69	111.64	0.78
26.75	111.84	0.79
26.81	112.03	0.8
26.94	112.42	0.83
27.00	112.61	0.84
27.13	112.99	0.87
27.19	113.19	0.88
27.31	113.57	0.9
27.50	114.15	0.94
27.63	114.54	0.97
27.69	114.73	0.98
27.75	114.93	1
27.88	115.31	1.02
27.94	115.5	1.03
28.00	115.7	1.05
28.13	116.08	1.07
28.19	116.28	1.09
28.25	116.47	1.1
28.31	116.66	1.11

28.38	116.86	1.12
28.50	117.24	1.15
28.63	117.63	1.18
28.75	118.01	1.2
28.94	118.59	1.24
29.06	118.98	1.27
29.19	119.37	1.29
29.25	119.56	1.3
29.63	120.72	1.38
29.69	120.91	1.39
29.94	121.68	1.45
30.06	122.07	1.47
30.13	122.26	1.48
30.19	122.46	1.5
30.38	123.03	1.54
30.44	123.23	1.55
30.63	123.81	1.59
31.19	125.54	1.7
31.25	125.74	1.72
31.50	126.51	1.77
31.63	126.9	1.79
31.81	127.48	1.83
31.88	127.67	1.84
31.94	127.86	1.86
32.19	128.63	1.91
32.69	130.18	2.01
33.25	131.92	2.13
33.56	132.88	2.19
34.63	136.16	2.41
34.81	136.74	2.45
35.75	139.64	2.64

Appendix BH

Raw Scores in WPM, Standard Scores and Z-scores of Total Maltese Score

Total Maltese Score (WPM)	Standard Scores	Z-scores
3.81	49.81	-3.35
5.06	54.17	-3.06
7.00	60.93	-2.6
7.19	61.58	-2.56
7.44	62.45	-2.5
7.75	63.54	-2.43
8.19	65.07	-2.33
8.31	65.5	-2.3
9.19	68.55	-2.1
9.56	69.86	-2.01
9.63	70.08	-1.99
9.81	70.73	-1.95
9.94	71.17	-1.92
10.00	71.39	-1.91
10.63	73.57	-1.76
10.69	73.78	-1.75
10.94	74.66	-1.69
11.06	75.09	-1.66
11.13	75.31	-1.65
11.19	75.53	-1.63
11.69	77.27	-1.52
11.88	77.93	-1.47
11.94	78.14	-1.46
12.00	78.36	-1.44
12.50	80.1	-1.33
12.69	80.76	-1.28
12.75	80.98	-1.27
12.81	81.19	-1.25
13.00	81.85	-1.21
13.06	82.07	-1.2
13.13	82.28	-1.18
13.25	82.72	-1.15
13.31	82.94	-1.14
13.44	83.37	-1.11
13.50	83.59	-1.09
13.56	83.81	-1.08
13.63	84.03	-1.06
13.69	84.25	-1.05

14.00	85.33	-0.98
14.06	85.55	-0.96
14.13	85.77	-0.95
14.19	85.99	-0.93
14.25	86.21	-0.92
14.38	86.64	-0.89
14.63	87.51	-0.83
14.69	87.73	-0.82
14.75	87.95	-0.8
14.81	88.17	-0.79
14.88	88.39	-0.77
14.94	88.6	-0.76
15.00	88.82	-0.75
15.06	89.04	-0.73
15.13	89.26	-0.72
15.19	89.48	-0.7
15.25	89.69	-0.69
15.38	90.13	-0.66
15.44	90.35	-0.64
15.81	91.65	-0.56
15.88	91.87	-0.54
16.00	92.31	-0.51
16.06	92.53	-0.5
16.13	92.74	-0.48
16.38	93.62	-0.43
16.44	93.83	-0.41
16.50	94.05	-0.4
16.56	94.27	-0.38
16.63	94.49	-0.37
16.69	94.71	-0.35
16.75	94.92	-0.34
16.81	95.14	-0.32
16.88	95.36	-0.31
16.94	95.58	-0.29
17.00	95.79	-0.28
17.06	96.01	-0.27
17.13	96.23	-0.25
17.19	96.45	-0.24
17.25	96.67	-0.22
17.31	96.88	-0.21
17.38	97.1	-0.19
17.44	97.32	-0.18
17.50	97.54	-0.16

17.56	97.76	-0.15
17.63	97.97	-0.14
17.75	98.41	-0.11
17.81	98.63	-0.09
17.88	98.85	-0.08
17.94	99.06	-0.06
18.00	99.28	-0.05
18.13	99.72	-0.02
18.19	99.94	0
18.25	100.15	0.01
18.31	100.37	0.02
18.44	100.81	0.05
18.50	101.03	0.07
18.56	101.24	0.08
18.63	101.46	0.1
18.69	101.68	0.11
18.75	101.9	0.13
18.88	102.33	0.16
18.94	102.55	0.17
19.00	102.77	0.18
19.06	102.99	0.2
19.19	103.42	0.23
19.25	103.64	0.24
19.38	104.08	0.27
19.44	104.29	0.29
19.50	104.51	0.3
19.69	105.17	0.34
19.88	105.82	0.39
19.94	106.04	0.4
20.00	106.26	0.42
20.06	106.47	0.43
20.13	106.69	0.45
20.19	106.91	0.46
20.25	107.13	0.48
20.31	107.34	0.49
20.38	107.56	0.5
20.44	107.78	0.52
20.50	108	0.53
20.56	108.22	0.55
20.63	108.43	0.56
20.69	108.65	0.58
20.75	108.87	0.59
20.81	109.09	0.61

20.88	109.31	0.62
20.94	109.52	0.63
21.13	110.18	0.68
21.19	110.4	0.69
21.25	110.61	0.71
21.31	110.83	0.72
21.38	111.05	0.74
21.44	111.27	0.75
21.56	111.7	0.78
21.63	111.92	0.79
21.75	112.36	0.82
21.81	112.57	0.84
21.94	113.01	0.87
22.00	113.23	0.88
22.06	113.45	0.9
22.13	113.66	0.91
22.19	113.88	0.93
22.25	114.1	0.94
22.31	114.32	0.95
22.38	114.54	0.97
22.44	114.75	0.98
22.50	114.97	1
22.63	115.41	1.03
22.81	116.06	1.07
22.88	116.28	1.09
23.13	117.15	1.14
23.19	117.37	1.16
23.25	117.59	1.17
23.31	117.81	1.19
23.44	118.24	1.22
23.50	118.46	1.23
23.75	119.33	1.29
23.81	119.55	1.3
24.00	120.2	1.35
24.06	120.42	1.36
24.25	121.07	1.4
24.31	121.29	1.42
24.38	121.51	1.43
24.44	121.73	1.45
24.69	122.6	1.51
24.75	122.82	1.52
24.81	123.04	1.54
24.94	123.47	1.56

25.06	123.91	1.59
25.31	124.78	1.65
25.56	125.65	1.71
25.63	125.87	1.72
25.81	126.52	1.77
25.88	126.74	1.78
25.94	126.96	1.8
26.06	127.39	1.83
26.13	127.61	1.84
27.31	131.75	2.12
27.50	132.41	2.16
27.81	133.5	2.23
28.19	134.8	2.32

Appendix BI

Raw Scores in WPM, Standard Scores and Z-scores of English *Copy Neatly* Subtest

English Copy Neatly (WPM)	Standard Scores	Z-scores
10.5	55.02	-3
12.5	60.35	-2.64
13	61.68	-2.55
13.5	63.01	-2.47
15	67.01	-2.2
16	69.67	-2.02
16.5	71	-1.93
17	72.33	-1.84
17.5	73.67	-1.76
18	75	-1.67
18.5	76.33	-1.58
19	77.66	-1.49
19.5	78.99	-1.4
20	80.33	-1.31
20.5	81.66	-1.22
21	82.99	-1.13
21.5	84.32	-1.05
22	85.65	-0.96
22.5	86.98	-0.87
23	88.32	-0.78
23.5	89.65	-0.69
24	90.98	-0.6
24.5	92.31	-0.51
25	93.64	-0.42
25.5	94.98	-0.33
26	96.31	-0.25
26.5	97.64	-0.16
27	98.97	-0.07
27.5	100.3	0.02
28	101.64	0.11
28.5	102.97	0.2
29	104.3	0.29
29.5	105.63	0.38
30	106.96	0.46
30.5	108.3	0.55
31	109.63	0.64
31.5	110.96	0.73
32	112.29	0.82

32.5	113.62	0.91
33	114.95	1
33.5	116.29	1.09
34	117.62	1.17
34.5	118.95	1.26
35	120.28	1.35
35.5	121.61	1.44
36	122.95	1.53
36.5	124.28	1.62
37	125.61	1.71
37.5	126.94	1.8
38	128.27	1.88
38.5	129.61	1.97
39	130.94	2.06
39.5	132.27	2.15
40.5	134.93	2.33
41	136.27	2.42
41.5	137.6	2.51

Appendix BJ

Raw Scores in WPM, Standard Scores and Z-scores of English *Copy Quickly* Subtest

English Copy Quickly (WPM)	Standard Scores	Z-scores
12.5	45.54	-3.63
19.5	64.55	-2.36
20	65.91	-2.27
20.5	67.26	-2.18
21	68.62	-2.09
22	71.34	-1.91
22.5	72.69	-1.82
23	74.05	-1.73
23.5	75.41	-1.64
24	76.77	-1.55
24.5	78.13	-1.46
25	79.48	-1.37
25.5	80.84	-1.28
26	82.2	-1.19
26.5	83.56	-1.1
27	84.91	-1.01
27.5	86.27	-0.92
28	87.63	-0.82
28.5	88.99	-0.73
29	90.34	-0.64
29.5	91.7	-0.55
30	93.06	-0.46
30.5	94.42	-0.37
31	95.77	-0.28
31.5	97.13	-0.19
32	98.49	-0.1
32.5	99.85	-0.01
33	101.2	0.08
33.5	102.56	0.17
34	103.92	0.26
34.5	105.28	0.35
35	106.63	0.44
35.5	107.99	0.53
36	109.35	0.62
36.5	110.71	0.71
37	112.06	0.8
37.5	113.42	0.89

38	114.78	0.99
38.5	116.14	1.08
39	117.49	1.17
39.5	118.85	1.26
40	120.21	1.35
40.5	121.57	1.44
41	122.92	1.53
41.5	124.28	1.62
42.5	127	1.8
43	128.35	1.89
44	131.07	2.07
44.5	132.43	2.16
45	133.78	2.25
46	136.5	2.43
50.5	148.72	3.25
56	163.65	4.24

Appendix BK

Raw Scores in WPM, Standard Scores and Z-scores of English *Copy from the Board* Subtest

English Copy from the Board (WPM)	Standard Scores	Z-scores
4.5	46.23	-3.58
11	68.53	-2.1
12.5	73.67	-1.76
13	75.39	-1.64
13.5	77.1	-1.53
14	78.82	-1.41
14.5	80.53	-1.3
15	82.25	-1.18
15.5	83.96	-1.07
16	85.68	-0.95
16.5	87.39	-0.84
17	89.11	-0.73
17.5	90.82	-0.61
18	92.54	-0.5
18.5	94.25	-0.38
19	95.97	-0.27
19.5	97.68	-0.15
20	99.39	-0.04
20.5	101.11	0.07
21	102.82	0.19
21.5	104.54	0.3
22	106.25	0.42
22.5	107.97	0.53
23	109.68	0.65
23.5	111.4	0.76
24	113.11	0.87
24.5	114.83	0.99
25	116.54	1.1
25.5	118.26	1.22
26	119.97	1.33
26.5	121.69	1.45
27	123.4	1.56
27.5	125.12	1.67
28	126.83	1.79
28.5	128.55	1.9
29	130.26	2.02
29.5	131.98	2.13
30	133.69	2.25

31	137.12	2.48
31.5	138.84	2.59
32	140.55	2.7
32.5	142.27	2.82
43.5	180	5.33

Appendix BL

Raw Scores in WPM, Standard Scores and Z-scores of English *Free Writing* Subtest

English Free Writing (WPM)	Standard Scores	Z-scores
6.8	56.36	-2.91
7.8	59.41	-2.71
8	60.02	-2.67
8.1	60.33	-2.64
9	63.08	-2.46
9.3	63.99	-2.4
10.5	67.66	-2.16
10.7	68.27	-2.12
11.3	70.1	-1.99
11.9	71.93	-1.87
12.3	73.15	-1.79
12.5	73.76	-1.75
12.6	74.07	-1.73
12.8	74.68	-1.69
13	75.29	-1.65
13.2	75.9	-1.61
13.4	76.51	-1.57
13.5	76.82	-1.55
13.6	77.12	-1.53
14.1	78.65	-1.42
14.2	78.95	-1.4
14.4	79.57	-1.36
14.5	79.87	-1.34
14.7	80.48	-1.3
14.8	80.79	-1.28
14.9	81.09	-1.26
15.2	82.01	-1.2
15.3	82.31	-1.18
15.4	82.62	-1.16
15.5	82.92	-1.14
15.8	83.84	-1.08
15.9	84.15	-1.06
16	84.45	-1.04
16.1	84.76	-1.02
16.2	85.06	-1
16.3	85.37	-0.98
16.5	85.98	-0.93
16.6	86.28	-0.91

16.8	86.89	-0.87
16.9	87.2	-0.85
17	87.5	-0.83
17.1	87.81	-0.81
17.2	88.12	-0.79
17.3	88.42	-0.77
17.4	88.73	-0.75
17.5	89.03	-0.73
17.7	89.64	-0.69
17.8	89.95	-0.67
17.9	90.25	-0.65
18	90.56	-0.63
18.2	91.17	-0.59
18.3	91.47	-0.57
18.4	91.78	-0.55
18.5	92.09	-0.53
18.7	92.7	-0.49
18.8	93	-0.47
18.9	93.31	-0.45
19	93.61	-0.43
19.1	93.92	-0.41
19.2	94.22	-0.39
19.3	94.53	-0.36
19.4	94.83	-0.34
19.5	95.14	-0.32
19.6	95.44	-0.3
19.7	95.75	-0.28
19.9	96.36	-0.24
20	96.67	-0.22
20.1	96.97	-0.2
20.2	97.28	-0.18
20.3	97.58	-0.16
20.4	97.89	-0.14
20.5	98.19	-0.12
20.6	98.5	-0.1
20.7	98.8	-0.08
20.8	99.11	-0.06
21	99.72	-0.02
21.1	100.02	0
21.2	100.33	0.02
21.3	100.64	0.04
21.4	100.94	0.06
21.5	101.25	0.08

21.6	101.55	0.1
21.7	101.86	0.12
21.8	102.16	0.14
21.9	102.47	0.16
22	102.77	0.18
22.1	103.08	0.21
22.2	103.38	0.23
22.3	103.69	0.25
22.4	103.99	0.27
22.5	104.3	0.29
22.6	104.61	0.31
22.8	105.22	0.35
22.9	105.52	0.37
23	105.83	0.39
23.1	106.13	0.41
23.2	106.44	0.43
23.3	106.74	0.45
23.4	107.05	0.47
23.5	107.35	0.49
23.6	107.66	0.51
23.7	107.96	0.53
23.8	108.27	0.55
23.9	108.57	0.57
24	108.88	0.59
24.1	109.19	0.61
24.2	109.49	0.63
24.3	109.8	0.65
24.4	110.1	0.67
24.5	110.41	0.69
24.7	111.02	0.73
24.8	111.32	0.75
24.9	111.63	0.78
25.1	112.24	0.82
25.3	112.85	0.86
25.4	113.16	0.88
25.5	113.46	0.9
25.6	113.77	0.92
25.7	114.07	0.94
25.8	114.38	0.96
26	114.99	1
26.1	115.29	1.02
26.2	115.6	1.04
26.4	116.21	1.08

26.5	116.51	1.1
26.6	116.82	1.12
26.7	117.13	1.14
26.8	117.43	1.16
26.9	117.74	1.18
27	118.04	1.2
27.1	118.35	1.22
27.3	118.96	1.26
27.4	119.26	1.28
27.9	120.79	1.39
28	121.09	1.41
28.2	121.71	1.45
28.3	122.01	1.47
28.4	122.32	1.49
28.6	122.93	1.53
28.8	123.54	1.57
28.9	123.84	1.59
29.1	124.45	1.63
29.2	124.76	1.65
29.4	125.37	1.69
29.6	125.98	1.73
30.1	127.51	1.83
30.2	127.81	1.85
30.7	129.34	1.96
30.9	129.95	2
31	130.26	2.02
32.1	133.61	2.24
32.3	134.23	2.28
32.6	135.14	2.34
33	136.36	2.42
33.7	138.5	2.57
33.8	138.81	2.59

Appendix BM

Raw Scores, Standard Scores and Z-scores of the Graphic Speed Test

Graphic Speed Test (Correct No. of Crosses)	Standard Scores	Z-scores
0	52.25	-3.18
13	66.97	-2.20
14	68.10	-2.13
15	69.23	-2.05
17	71.50	-1.90
19	73.76	-1.75
20	74.90	-1.67
21	76.03	-1.60
22	77.16	-1.52
23	78.29	-1.45
24	79.42	-1.37
25	80.56	-1.30
26	81.69	-1.22
27	82.82	-1.15
28	83.95	-1.07
29	85.08	-0.99
30	86.22	-0.92
31	87.35	-0.84
32	88.48	-0.77
33	89.61	-0.69
34	90.75	-0.62
35	91.88	-0.54
36	93.01	-0.47
37	94.14	-0.39
38	95.27	-0.32
39	96.41	-0.24
40	97.54	-0.16
41	98.67	-0.09
42	99.80	-0.01
43	100.94	0.06
44	102.07	0.14
45	103.20	0.21
46	104.33	0.29
47	105.46	0.36
48	106.60	0.44
49	107.73	0.52
50	108.86	0.59

51	109.99	0.67
52	111.12	0.74
53	112.26	0.82
54	113.39	0.89
55	114.52	0.97
57	116.79	1.12
58	117.92	1.19
59	119.05	1.27
60	120.18	1.35
61	121.31	1.42
62	122.45	1.50
63	123.58	1.57
64	124.71	1.65
67	128.11	1.87
68	129.24	1.95
69	130.37	2.02
70	131.50	2.10
72	133.77	2.25
75	137.16	2.48
76	138.30	2.55
77	139.43	2.63
80	142.83	2.86

Appendix BN

Raw Scores, Standard Scores and Z-scores of Maltese Copy Neatly (Ikkopja Pulit) Subtest

Maltese Copy Neatly (Ikkopja Pulit) (WPM)	Standard Scores	Z-scores
9.5	60.77	-2.62
10	62.49	-2.5
10.5	64.2	-2.39
11	65.92	-2.27
11.5	67.63	-2.16
12	69.35	-2.04
12.5	71.07	-1.93
13	72.78	-1.81
13.5	74.5	-1.7
14	76.22	-1.59
14.5	77.93	-1.47
15	79.65	-1.36
15.5	81.37	-1.24
16	83.08	-1.13
16.5	84.8	-1.01
17	86.51	-0.9
17.5	88.23	-0.78
18	89.95	-0.67
18.5	91.66	-0.56
19.5	95.1	-0.33
20	96.81	-0.21
20.5	98.53	-0.1
21	100.25	0.02
21.5	101.96	0.13
22	103.68	0.25
22.5	105.39	0.36
23	107.11	0.47
23.5	108.83	0.59
24	110.54	0.7
24.5	112.26	0.82
25	113.98	0.93
25.5	115.69	1.05
26	117.41	1.16
26.5	119.13	1.27
27	120.84	1.39
27.5	122.56	1.5
28	124.27	1.62

28.5	125.99	1.73
29	127.71	1.85
29.5	129.42	1.96
30	131.14	2.08
30.5	132.86	2.19
31.5	136.29	2.42
32	138	2.53

Appendix BO

Raw Scores, Standard Scores and Z-scores of Maltese Copy Quickly (Ikkopja Malajr) Subtest

Maltese Copy Quickly (Ikkopja Malajr) (WPM)	Standard Scores	Z-score
10	50.56	-3.3
12	57.29	-2.85
12.5	58.97	-2.74
13	60.65	-2.62
15	67.38	-2.17
16	70.74	-1.95
16.5	72.43	-1.84
17	74.11	-1.73
18	77.47	-1.5
18.5	79.15	-1.39
19	80.84	-1.28
19.5	82.52	-1.17
20	84.2	-1.05
20.5	85.88	-0.94
21	87.56	-0.83
21.5	89.25	-0.72
22	90.93	-0.6
22.5	92.61	-0.49
23	94.29	-0.38
23.5	95.97	-0.27
24	97.66	-0.16
24.5	99.34	-0.04
25	101.02	0.07
25.5	102.7	0.18
26	104.38	0.29
26.5	106.07	0.4
27	107.75	0.52
27.5	109.43	0.63
28	111.11	0.74
28.5	112.79	0.85
29	114.48	0.97
29.5	116.16	1.08
30	117.84	1.19
30.5	119.52	1.3
31	121.2	1.41
31.5	122.89	1.53
32	124.57	1.64

32.5	126.25	1.75
33	127.93	1.86
33.5	129.61	1.97
34	131.3	2.09
34.5	132.98	2.2
35.5	136.34	2.42
36	138.02	2.53

Appendix BP

Raw Scores, Standard Scores and Z-scores of Maltese Copy from the Board (Ikkopja mill-Bord) Subtest

Maltese Copy from the Board (Ikkopja mill-Bord) (WPM)	Standard Scores	Z-scores
7.5	59.98	-2.67
9.5	66.3	-2.25
10.5	69.46	-2.04
11	71.04	-1.93
11.5	72.61	-1.83
12	74.19	-1.72
12.5	75.77	-1.62
13	77.35	-1.51
13.5	78.93	-1.4
14	80.51	-1.3
14.5	82.09	-1.19
15	83.67	-1.09
15.5	85.25	-0.98
16	86.83	-0.88
16.5	88.41	-0.77
17	89.99	-0.67
17.5	91.57	-0.56
18	93.15	-0.46
18.5	94.73	-0.35
19	96.31	-0.25
19.5	97.88	-0.14
20	99.46	-0.04
20.5	101.04	0.07
21	102.62	0.17
21.5	104.2	0.28
22	105.78	0.39
22.5	107.36	0.49
23	108.94	0.6
23.5	110.52	0.7
24	112.1	0.81
24.5	113.68	0.91
25	115.26	1.02
25.5	116.84	1.12
26	118.42	1.23
26.5	120	1.33
27	121.58	1.44

27.5	123.15	1.54
28	124.73	1.65
28.5	126.31	1.75
29	127.89	1.86
29.5	129.47	1.96
30	131.05	2.07
31	134.21	2.28
31.5	135.79	2.39

Appendix BQ

Raw Scores, Standard Scores and Z-scores of Maltese Free Writing (Kitba Kreattiva) Subtest

Maltese Free Writing (Kitba Kreattiva) (WPM)	Standard Scores	Z-scores
1.6	51.64	-3.22
1.8	52.3	-3.18
2	52.96	-3.14
4.3	60.55	-2.63
4.7	61.87	-2.54
5.1	63.19	-2.45
5.8	65.5	-2.3
6.2	66.82	-2.21
6.6	68.14	-2.12
6.8	68.8	-2.08
7.8	72.1	-1.86
8	72.76	-1.82
8.1	73.09	-1.79
8.4	74.08	-1.73
8.5	74.41	-1.71
8.6	74.74	-1.68
8.8	75.4	-1.64
8.9	75.73	-1.62
9	76.06	-1.6
9.4	77.38	-1.51
9.5	77.71	-1.49
9.6	78.04	-1.46
9.8	78.7	-1.42
9.9	79.03	-1.4
10	79.36	-1.38
10.1	79.69	-1.35
10.2	80.02	-1.33
10.3	80.35	-1.31
10.4	80.68	-1.29
10.6	81.34	-1.24
10.9	82.32	-1.18
11	82.65	-1.16
11.2	83.31	-1.11
11.3	83.64	-1.09
11.4	83.97	-1.07
11.5	84.3	-1.05
11.6	84.63	-1.02

11.8	85.29	-0.98
11.9	85.62	-0.96
12	85.95	-0.94
12.1	86.28	-0.91
12.2	86.61	-0.89
12.3	86.94	-0.87
12.4	87.27	-0.85
12.5	87.6	-0.83
12.6	87.93	-0.8
12.7	88.26	-0.78
12.8	88.59	-0.76
12.9	88.92	-0.74
13	89.25	-0.72
13.1	89.58	-0.69
13.2	89.91	-0.67
13.3	90.24	-0.65
13.4	90.57	-0.63
13.5	90.9	-0.61
13.6	91.23	-0.58
13.7	91.56	-0.56
13.8	91.89	-0.54
13.9	92.22	-0.52
14	92.55	-0.5
14.1	92.88	-0.47
14.2	93.21	-0.45
14.3	93.54	-0.43
14.4	93.87	-0.41
14.5	94.2	-0.39
14.6	94.53	-0.36
14.7	94.86	-0.34
14.8	95.19	-0.32
14.9	95.52	-0.3
15	95.85	-0.28
15.1	96.18	-0.25
15.2	96.51	-0.23
15.3	96.84	-0.21
15.4	97.17	-0.19
15.5	97.5	-0.17
15.6	97.83	-0.14
15.7	98.16	-0.12
15.8	98.49	-0.1
16	99.15	-0.06
16.1	99.48	-0.03

16.2	99.81	-0.01
16.3	100.14	0.01
16.4	100.47	0.03
16.5	100.8	0.05
16.6	101.13	0.08
16.8	101.79	0.12
16.9	102.12	0.14
17	102.45	0.16
17.1	102.78	0.19
17.2	103.11	0.21
17.3	103.44	0.23
17.5	104.1	0.27
17.6	104.43	0.3
17.7	104.76	0.32
17.9	105.42	0.36
18	105.75	0.38
18.1	106.08	0.41
18.2	106.41	0.43
18.3	106.74	0.45
18.4	107.07	0.47
18.5	107.4	0.49
18.6	107.73	0.52
18.7	108.06	0.54
18.8	108.39	0.56
18.9	108.72	0.58
19	109.05	0.6
19.1	109.38	0.63
19.2	109.71	0.65
19.3	110.04	0.67
19.5	110.7	0.71
19.6	111.03	0.74
19.7	111.36	0.76
19.8	111.69	0.78
19.9	112.02	0.8
20	112.35	0.82
20.2	113.01	0.87
20.3	113.34	0.89
20.4	113.67	0.91
20.6	114.33	0.96
20.7	114.66	0.98
20.8	114.99	1
20.9	115.32	1.02
21	115.65	1.04

21.1	115.98	1.07
21.3	116.64	1.11
21.4	116.97	1.13
21.5	117.3	1.15
21.6	117.63	1.18
21.9	118.62	1.24
22	118.95	1.26
22.2	119.61	1.31
22.3	119.94	1.33
22.4	120.27	1.35
22.6	120.93	1.39
22.8	121.59	1.44
22.9	121.92	1.46
23.1	122.58	1.5
23.4	123.56	1.57
23.5	123.89	1.59
24	125.54	1.7
24.1	125.87	1.72
24.2	126.2	1.75
24.4	126.86	1.79
24.6	127.52	1.83
24.7	127.85	1.86
24.9	128.51	1.9
25.1	129.17	1.94
25.2	129.5	1.97
25.4	130.16	2.01
26.2	132.8	2.19
27	135.44	2.36
28.5	140.39	2.69

Appendix BR

Scatter Plots Showing a Linear Relationship between the Raw Scores in WPM of the English Subtests, and the Total of all Subtests, and their Standard Scores

Figure BR1

Total English Score

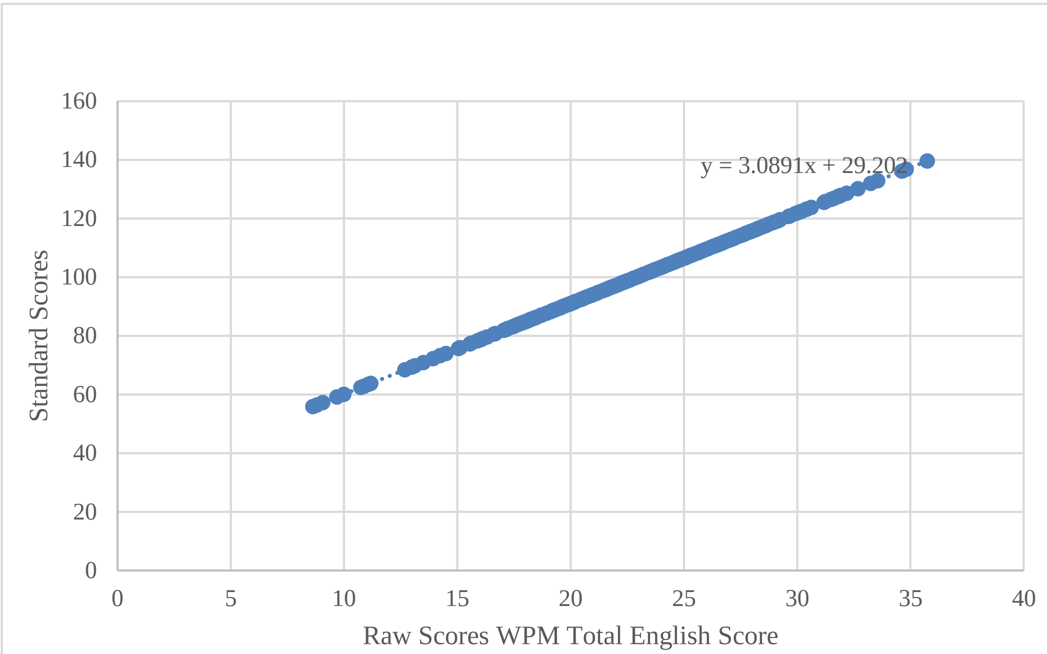


Table BR2

English Copy Neatly Subtest

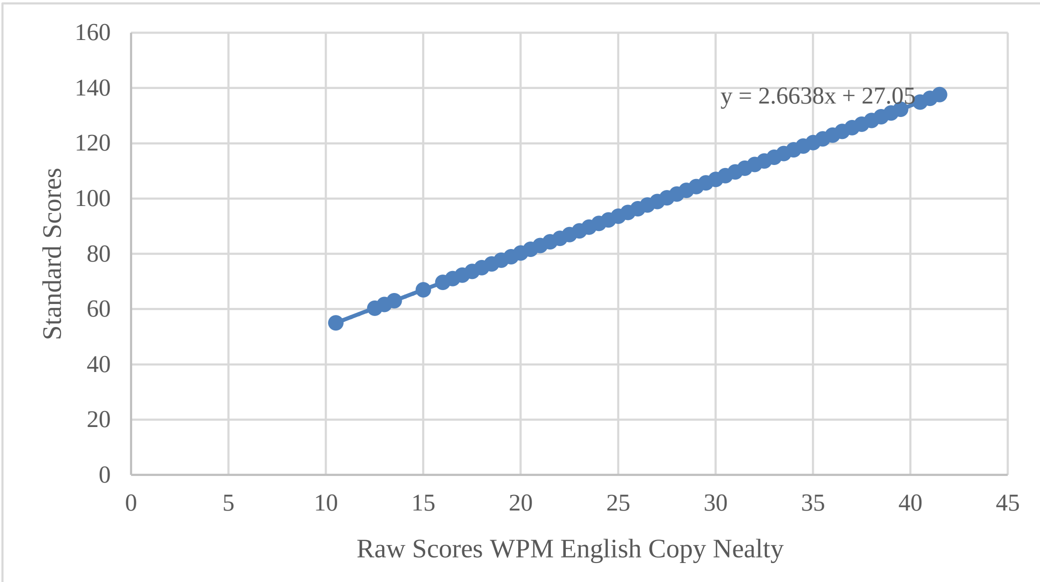


Figure BR3

English Copy Quickly Subtest

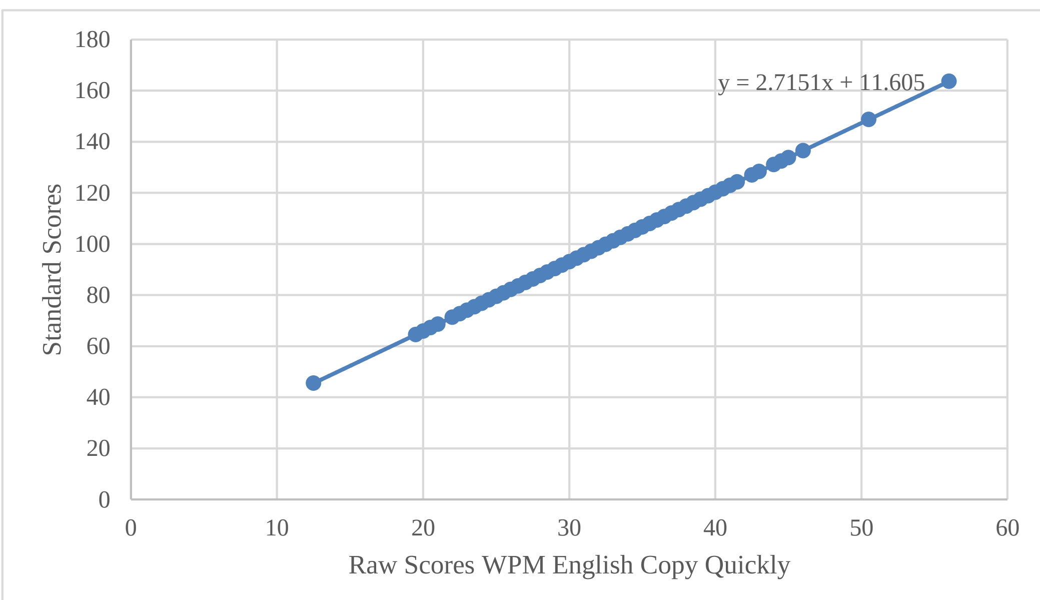


Figure BR4

Graphic Speed Test

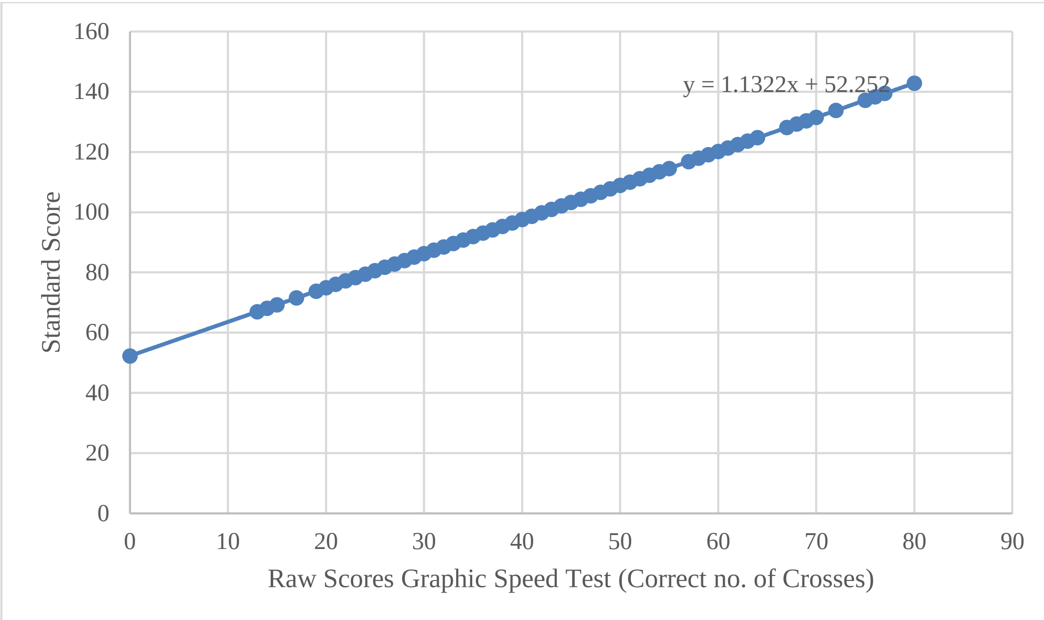


Figure BR5

English Copy from the Board Subtest

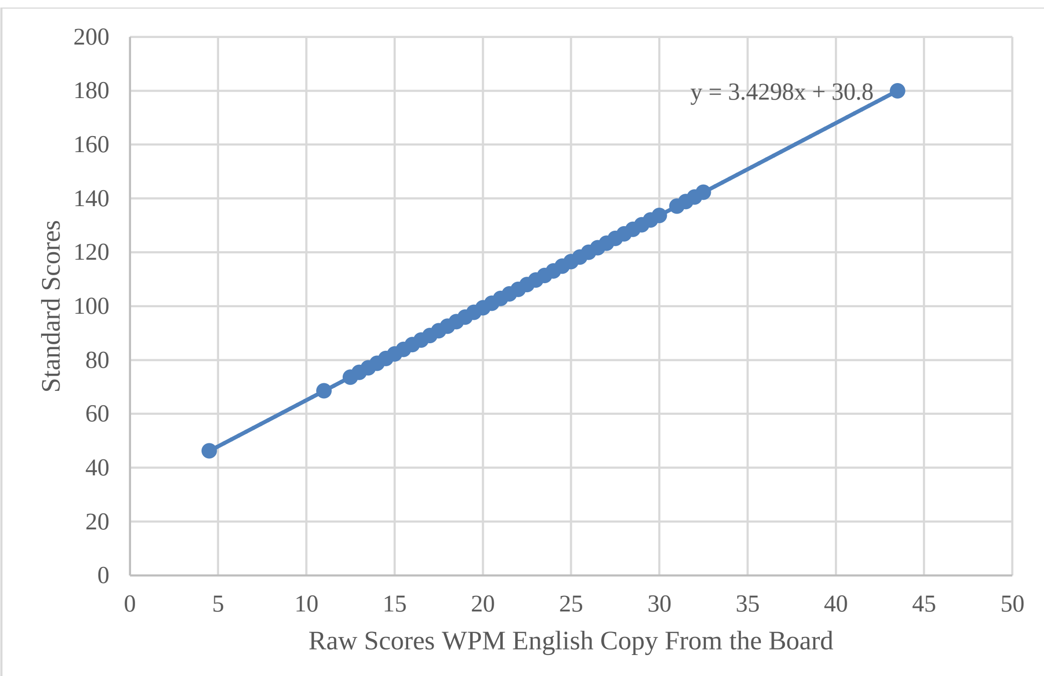
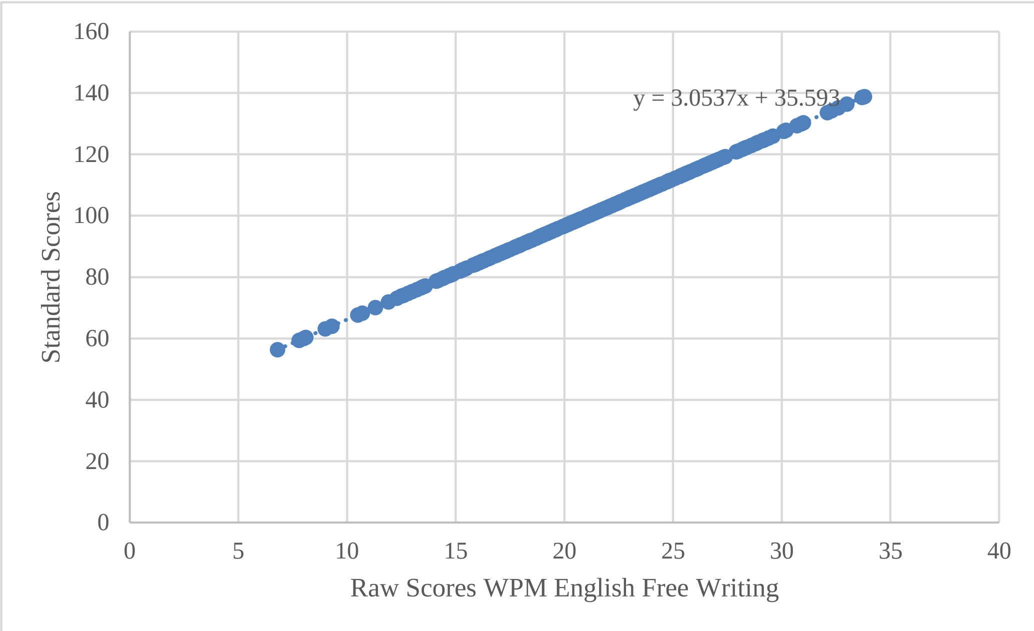


Figure BR6

English Free Writing Subtest



Appendix BS

Scatter Plots Showing Linear Relationships between Raw Scores in WPM of the Maltese Subtests, and the Total of all Subtests, and their Standard Scores

Figure BS1

Total Maltese Score

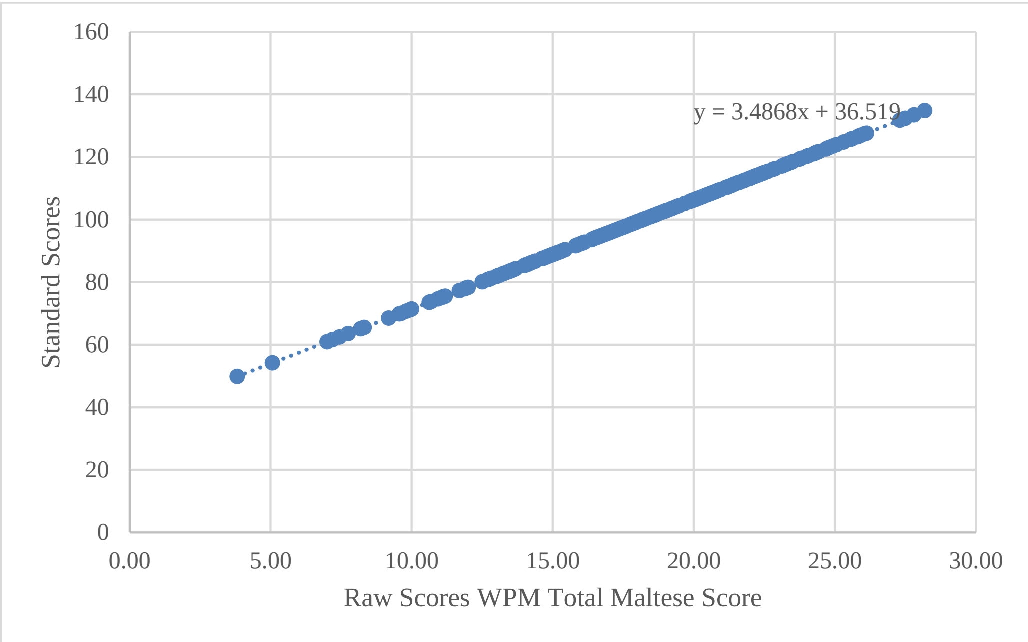


Figure BS2

Maltese *Copy Neatly (Ikkopja Pulit)* Subtest

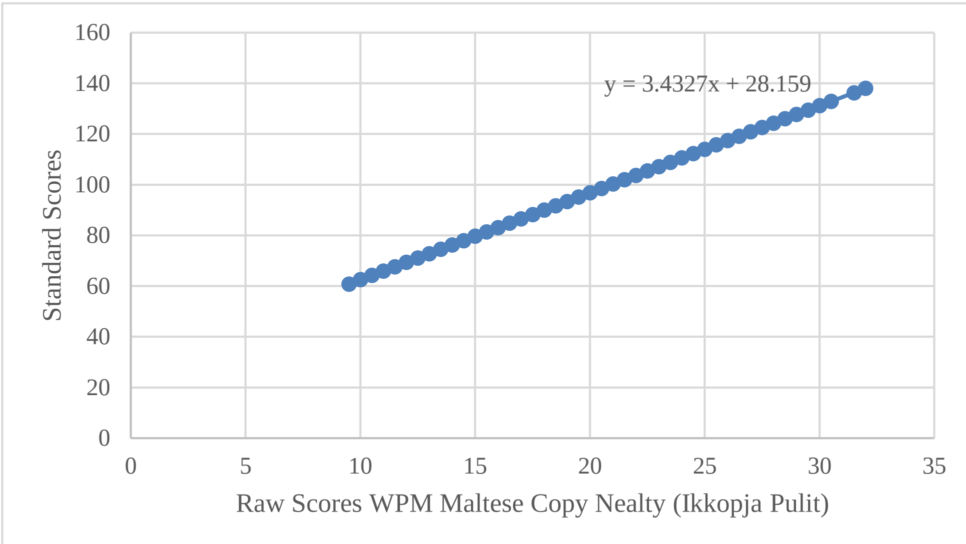


Figure BS3

Scatter Plot of the Maltese Copy Quickly (Ikkopja Malajr) Subtest

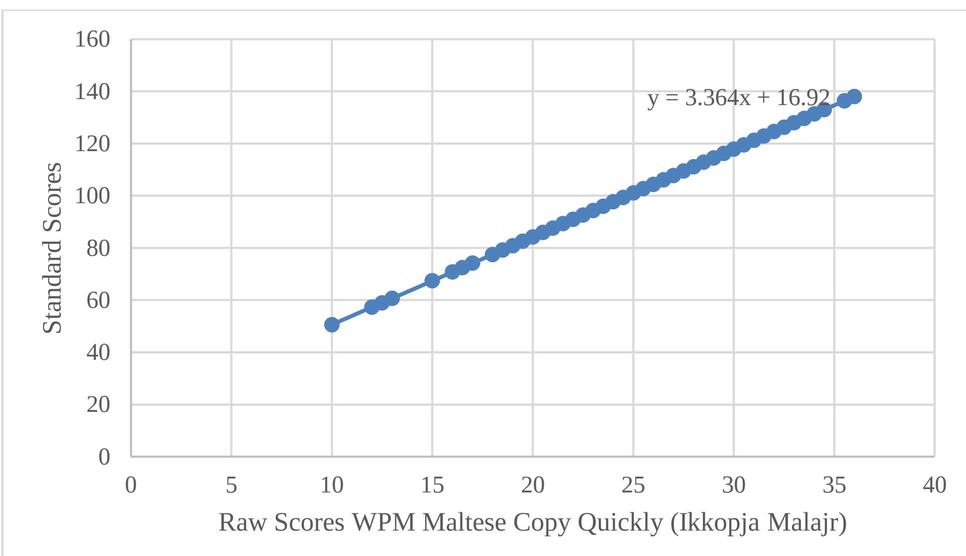


Figure BS4

Maltese Copy from the Board (Ikkopja mill-Bord) Subtest

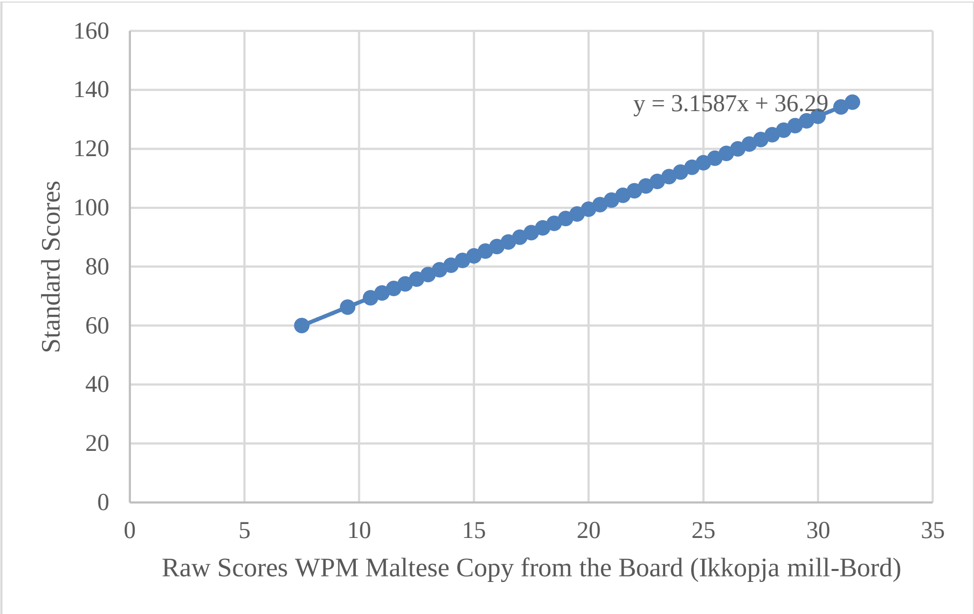
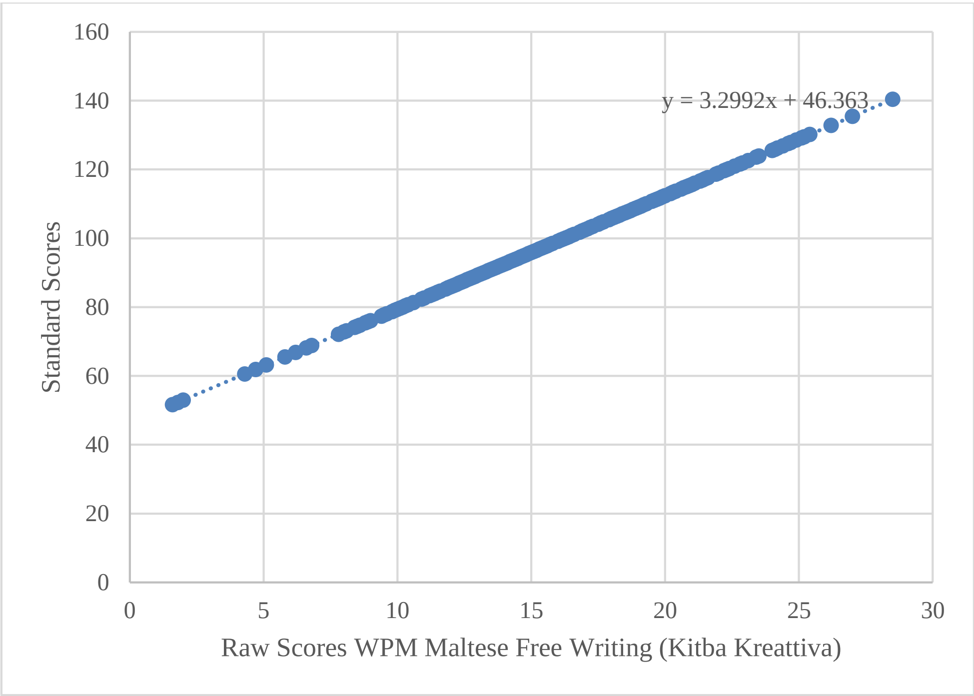


Figure BS5

Maltese Free Writing (Kitba Kreattiva) Subtest



Appendix BT

Final Conversion Tables Displaying Raw Scores, Standard Scores and Z-scores of English Subtests

Table BT1

Raw Scores in WPM, Standard Scores and Z-scores of English Copy Neatly Subtest

English Copy Neatly (WPM)	Standard Scores	Z-scores	Percentile Rank
10.5	55	-3.00	1
11	56	-2.91	3
11.5	58	-2.82	4
12	59	-2.73	6
12.5	60	-2.64	7
13	62	-2.55	9
13.5	63	-2.47	10
14	64	-2.38	12
14.5	66	-2.29	13
15	67	-2.20	15
15.5	68	-2.11	16
16	70	-2.02	18
16.5	71	-1.93	19
17	72	-1.84	21
17.5	74	-1.76	22
18	75	-1.67	24
18.5	76	-1.58	25
19	78	-1.49	26
19.5	79	-1.40	28
20	80	-1.31	29
20.5	82	-1.22	31
21	83	-1.13	32
21.5	84	-1.05	34
22	86	-0.96	35
22.5	87	-0.87	37
23	88	-0.78	38
23.5	90	-0.69	40
24	91	-0.60	41
24.5	92	-0.51	43
25	94	-0.42	44
25.5	95	-0.33	46
26	96	-0.25	47

26.5	98	-0.16	49
27	99	-0.07	50
27.5	100	0.02	51
28	102	0.11	53
28.5	103	0.20	54
29	104	0.29	56
29.5	106	0.38	57
30	107	0.46	59
30.5	108	0.55	60
31	110	0.64	62
31.5	111	0.73	63
32	112	0.82	65
32.5	114	0.91	66
33	115	1.00	68
33.5	116	1.09	69
34	118	1.17	71
34.5	119	1.26	72
35	120	1.35	74
35.5	122	1.44	75
36	123	1.53	76
36.5	124	1.62	78
37	126	1.71	79
37.5	127	1.80	81
38	128	1.88	82
38.5	130	1.97	84
39	131	2.06	85
40	134	2.24	87
40.5	135	2.33	88
41	136	2.42	90
41.5	138	2.51	91
42	139	2.60	93
42.5	140	2.68	94
43	142	2.77	96
43.5	143	2.86	97
44	144	2.95	99
44.5	146	3.04	100

Table BT2

Raw Scores in WPM, Standard Scores and Z-scores of English Copy Quickly Subtest

English Copy Quickly (WPM)	Standard Score	Z-Scores	Percentile Rank
16	55	-3.00	2
16.5	56	-2.91	3
17	58	-2.82	5
17.5	59	-2.73	6
18	60	-2.63	8
18.5	62	-2.54	9
19	63	-2.45	11
19.5	65	-2.36	13
20	66	-2.27	14
20.5	67	-2.18	16
21	69	-2.09	17
22	71	-1.91	19
22.5	73	-1.82	20
23	74	-1.73	22
23.5	75	-1.64	23
24	77	-1.55	25
24.5	78	-1.46	27
25	79	-1.37	28
25.5	81	-1.28	30
26	82	-1.19	31
26.5	84	-1.10	33
27	85	-1.01	34
27.5	86	-0.92	36
28	88	-0.82	38
28.5	89	-0.73	39
29	90	-0.64	41
29.5	92	-0.55	42
30	93	-0.46	44
30.5	94	-0.37	45
31	96	-0.28	47
31.5	97	-0.19	48
32	98	-0.10	50
32.5	100	-0.01	52
33	101	0.08	53
33.5	103	0.17	55
34	104	0.26	56
34.5	105	0.35	58

35	107	0.44	59
35.5	108	0.53	61
36	109	0.62	63
36.5	111	0.71	64
37	112	0.80	66
37.5	113	0.89	67
38	115	0.99	69
38.5	116	1.08	70
39	117	1.17	72
39.5	119	1.26	73
40	120	1.35	75
40.5	122	1.44	77
41	123	1.53	78
41.5	124	1.62	80
42.5	127	1.80	81
43	128	1.89	83
44	131	2.07	84
44.5	132	2.16	86
45	134	2.25	88
45.5	135	2.34	89
46	137	2.43	91
46.5	138	2.52	92
47	139	2.61	94
47.5	141	2.70	95
48	142	2.80	97
48.5	143	2.89	98
49	145	2.98	100

Table BT3

Raw Scores, Standard Scores and Z-scores of the Graphic Speed Test

Graphic Speed Test (Correct no. of Crosses)	Standard Score	Z-Scores	Percentile Rank
1	53	-3.11	1
2	55	-3.03	3
3	56	-2.96	4
4	57	-2.88	6
5	58	-2.81	7
6	59	-2.73	8
7	60	-2.65	10
8	61	-2.58	11
9	62	-2.50	13
10	64	-2.43	14
11	65	-2.35	15
12	66	-2.28	17
13	67	-2.20	18
14	68	-2.13	19
15	69	-2.05	21
17	71	-1.90	22
19	74	-1.75	24
20	75	-1.67	25
21	76	-1.60	26
22	77	-1.52	28
23	78	-1.45	29
24	79	-1.37	31
25	81	-1.30	32
26	82	-1.22	33
27	83	-1.15	35
28	84	-1.07	36
29	85	-0.99	38
30	86	-0.92	39
31	87	-0.84	40
32	88	-0.77	42
33	90	-0.69	43
34	91	-0.62	44
35	92	-0.54	46
36	93	-0.47	47
37	94	-0.39	49
38	95	-0.32	50
39	96	-0.24	51

40	98	-0.16	53
41	99	-0.09	54
42	100	-0.01	56
43	101	0.06	57
44	102	0.14	58
45	103	0.21	60
46	104	0.29	61
47	105	0.36	63
48	107	0.44	64
49	108	0.52	65
50	109	0.59	67
51	110	0.67	68
52	111	0.74	69
53	112	0.82	71
54	113	0.89	72
55	115	0.97	74
57	117	1.12	75
58	118	1.19	76
59	119	1.27	78
60	120	1.35	79
61	121	1.42	81
62	122	1.50	82
63	124	1.57	83
64	125	1.65	85
67	128	1.87	86
68	129	1.95	88
69	130	2.02	89
70	132	2.10	90
72	134	2.25	92
75	137	2.48	93
76	138	2.55	94
77	139	2.63	96
80	143	2.86	97
81	144	2.93	99
82	145	3.01	100

Table BT4

Raw Scores in WPM, Standard Scores and Z-scores of English Copy from the Board Subtest

English Copy from the Board (WPM)	Standard Scores	Z-scores	Percentile Rank
7	55	-3.01	2
7.5	57	-2.90	4
8	58	-2.78	6
8.5	60	-2.67	8
9	62	-2.56	10
9.5	63	-2.44	12
10	65	-2.33	14
10.5	67	-2.21	16
11	69	-2.10	18
12.5	74	-1.76	20
13	75	-1.64	22
13.5	77	-1.53	24
14	79	-1.41	25
14.5	81	-1.30	27
15	82	-1.18	29
15.5	84	-1.07	31
16	86	-0.95	33
16.5	87	-0.84	35
17	89	-0.73	37
17.5	91	-0.61	39
18	93	-0.50	41
18.5	94	-0.38	43
19	96	-0.27	45
19.5	98	-0.15	47
20	99	-0.04	49
20.5	101	0.07	51
21	103	0.19	53
21.5	105	0.30	55
22	106	0.42	57
22.5	108	0.53	59
23	110	0.65	61
23.5	111	0.76	63
24	113	0.87	65
24.5	115	0.99	67
25	117	1.10	69
25.5	118	1.22	71
26	120	1.33	73

26.5	122	1.45	75
27	123	1.56	76
27.5	125	1.67	78
28	127	1.79	80
28.5	129	1.90	82
29	130	2.02	84
29.5	132	2.13	86
30	134	2.25	88
31	137	2.47	90
31.5	139	2.59	92
32	141	2.70	94
32.5	142	2.82	96
33	144	2.93	98
33.5	146	3.05	100

Table BT5

Raw Scores in WPM, Standard Scores and Z-scores of English Free Writing Subtest

English Free Writing (WPM)	Standard Scores	Z-scores	Percentile Rank
6.5	55	-2.97	2
7	57	-2.87	3
7.5	59	-2.77	5
8	60	-2.67	7
8.5	62	-2.56	8
9	63	-2.46	10
9.5	65	-2.36	12
10	66	-2.26	13
10.5	68	-2.16	15
11	69	-2.05	17
11.5	71	-1.95	18
12	72	-1.85	20
12.5	74	-1.75	22
13	75	-1.65	23
13.5	77	-1.55	25
14	78	-1.44	27
14.5	80	-1.34	28
15	81	-1.24	30
15.5	83	-1.14	32
16	84	-1.04	33
16.5	86	-0.93	35
17	88	-0.83	37
17.5	89	-0.73	38
18	91	-0.63	40
18.5	92	-0.53	42
19	94	-0.43	43
19.5	95	-0.32	45
20	97	-0.22	47
20.5	98	-0.12	48
21	100	-0.02	50
21.5	101	0.08	52
22	103	0.18	53
22.5	104	0.29	55
23	106	0.39	57
23.5	107	0.49	58

24	109	0.59	60
24.5	110	0.69	62
25	112	0.80	63
25.5	113	0.90	65
26	115	1.00	67
26.5	117	1.10	68
27	118	1.20	70
27.5	120	1.30	72
28	121	1.41	73
28.5	123	1.51	75
29	124	1.61	77
29.5	126	1.71	78
30	127	1.81	80
30.5	129	1.92	82
31	130	2.02	83
31.5	132	2.12	85
32	133	2.22	87
32.5	135	2.32	88
33	136	2.42	90
33.5	138	2.53	92
34	139	2.63	93
34.5	141	2.73	95
35	142	2.83	97
35.5	144	2.93	98
36	146	3.04	100

Appendix BU

Final Conversion Tables Displaying Raw Scores, Standard Scores and Z-scores of Maltese Subtests

Table BU1

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Copy Neatly Subtest

Maltese Copy Neatly (Ikkopja Pulit) (WPM)	Standard Scores	Z-Scores	Percentile Rank
8	56	-2.96	2
8.5	57	-2.84	4
9	59	-2.73	6
9.5	61	-2.62	8
10	62	-2.50	9
10.5	64	-2.39	11
11	66	-2.27	13
11.5	68	-2.16	15
12	69	-2.04	17
12.5	71	-1.93	19
13	73	-1.81	21
13.5	75	-1.70	23
14	76	-1.59	25
14.5	78	-1.47	26
15	80	-1.36	28
15.5	81	-1.24	30
16	83	-1.13	32
16.5	85	-1.01	34
17	87	-0.90	36
17.5	88	-0.78	38
18	90	-0.67	40
18.5	92	-0.56	42
19	93	-0.44	43
19.5	95	-0.33	45
20	97	-0.21	47
20.5	99	-0.10	49
21	100	0.02	51
21.5	102	0.13	53
22	104	0.25	55
22.5	105	0.36	57
23	107	0.47	58
23.5	109	0.59	60

24	111	0.70	62
24.5	112	0.82	64
25	114	0.93	66
25.5	116	1.05	68
26	117	1.16	70
26.5	119	1.28	72
27	121	1.39	74
27.5	123	1.50	75
28	124	1.62	77
28.5	126	1.73	79
29	128	1.85	81
29.5	129	1.96	83
30	131	2.08	85
30.5	133	2.19	87
31	135	2.30	89
31.5	136	2.42	91
32	138	2.53	92
32.5	140	2.65	94
33	141	2.76	96
33.5	143	2.88	98
34	145	2.99	100

Table BU2

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Copy Quickly Subtest

Maltese Copy Quickly (Ikkopja Malajr) (WPM)	Standard Scores	Z-Scores	Percentile Rank
11.5	56	-2.96	2
12	57	-2.85	4
12.5	59	-2.74	6
13	61	-2.62	7
13.5	62	-2.51	9
14	64	-2.40	11
14.5	66	-2.29	13
15	67	-2.17	15
15.5	69	-2.06	17
16	71	-1.95	19
16.5	72	-1.84	20
17	74	-1.73	22
17.5	76	-1.61	24
18	77	-1.50	26
18.5	79	-1.39	28
19	81	-1.28	30
19.5	83	-1.17	31
20	84	-1.05	33
20.5	86	-0.94	35
21	88	-0.83	37
21.5	89	-0.72	39
22	91	-0.60	41
22.5	93	-0.49	43
23	94	-0.38	44
23.5	96	-0.27	46
24	98	-0.16	48
24.5	99	-0.04	50
25	101	0.07	52
25.5	103	0.18	54
26	104	0.29	56
26.5	106	0.40	57
27	108	0.52	59
27.5	109	0.63	61
28	111	0.74	63
28.5	113	0.85	65

29	114	0.97	67
29.5	116	1.08	69
30	118	1.19	70
30.5	120	1.30	72
31	121	1.41	74
31.5	123	1.53	76
32	125	1.64	78
32.5	126	1.75	80
33	128	1.86	81
33.5	130	1.97	83
34	131	2.09	85
34.5	133	2.20	87
35	135	2.31	89
35.5	136	2.42	91
36	138	2.53	93
36.5	140	2.65	94
37	141	2.76	96
37.5	143	2.87	98
38	145	2.98	100

Table BU3

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Copy from the Board Subtest

Maltese Copy from the Board (Ikkopja mill-Bord) (WPM)	Standard Scores	Z-scores	Percentile Rank
6	55	-2.98	2
6.5	57	-2.88	3
7	58	-2.77	5
7.5	60	-2.67	7
8	62	-2.56	9
8.5	63	-2.46	10
9	65	-2.35	12
9.5	66	-2.25	14
10	68	-2.14	16
10.5	69	-2.04	17
11	71	-1.93	19
11.5	73	-1.83	21
12	74	-1.72	22
12.5	76	-1.62	24
13	77	-1.51	26
13.5	79	-1.40	28
14	81	-1.30	29
14.5	82	-1.19	31
15	84	-1.09	33
15.5	85	-0.98	34
16	87	-0.88	36
16.5	88	-0.77	38
17	90	-0.67	40
17.5	92	-0.56	41
18	93	-0.46	43
18.5	95	-0.35	45
19	96	-0.25	47
19.5	98	-0.14	48
20	99	-0.04	50
20.5	101	0.07	52
21	103	0.17	53
21.5	104	0.28	55
22	106	0.39	57
22.5	107	0.49	59
23	109	0.60	60
23.5	111	0.70	62
24	112	0.81	64

24.5	114	0.91	66
25	115	1.02	67
25.5	117	1.12	69
26	118	1.23	71
26.5	120	1.33	72
27	122	1.44	74
27.5	123	1.54	76
28	125	1.65	78
28.5	126	1.75	79
29	128	1.86	81
29.5	129	1.96	83
30	131	2.07	84
30.5	133	2.18	86
31	134	2.28	88
31.5	136	2.39	90
32	137	2.49	91
32.5	139	2.60	93
33	141	2.70	95
33.5	142	2.81	97
34	144	2.91	98
34.5	145	3.02	100

Table BU4

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Free Writing Subtest

Maltese Free Writing (Kitba Kreattiva) (WPM)	Standard Scores	Z-Score	Percentile Rank
2.5	55	-3.36	2
3	56	-3.25	4
3.5	58	-3.14	5
4	60	-3.03	7
4.5	61	-2.92	9
5	63	-2.81	11
5.5	65	-2.70	13
6	66	-2.59	14
6.5	68	-2.48	16
7	69	-2.37	18
7.5	71	-2.26	20
8	73	-2.15	21
8.5	74	-2.04	23
9	76	-1.93	25
9.5	78	-1.82	27
10	79	-1.71	29
10.5	81	-1.60	30
11	83	-1.49	32
11.5	84	-1.38	34
12	86	-1.27	36
12.5	88	-1.16	38
13	89	-1.05	39
13.5	91	-0.94	41
14	93	-0.83	43
14.5	94	-0.72	45
15	96	-0.61	46
15.5	98	-0.50	48
16	99	-0.39	50
16.5	101	-0.28	52
17	102	-0.17	54
17.5	104	-0.06	55
18	106	0.05	57
18.5	107	0.16	59
19	109	0.27	61
19.5	111	0.38	63
20	112	0.49	64
20.5	114	0.60	66

21	116	0.71	68
21.5	117	0.82	70
22	119	0.93	71
22.5	121	1.04	73
23	122	1.15	75
23.5	124	1.26	77
24	126	1.37	79
24.5	127	1.48	80
25	129	1.59	82
25.5	130	1.70	84
26	132	1.81	86
26.5	134	1.92	88
27	135	2.03	89
27.5	137	2.14	91
28	139	2.25	93
28.5	140	2.36	95
29	142	2.47	96
29.5	144	2.58	98
30	145	2.69	100

Appendix BV

Final Conversion Table Displaying Raw Scores in WPM, Standard Scores and Z-scores of Total English Score

Total English Score (WPM)	Standard Score	Z-score	Percentile Rank
8	54	-3.07	2
8.5	55	-2.97	3
9	57	-2.87	5
9.5	59	-2.76	7
10	60	-2.66	8
10.5	62	-2.56	10
11	63	-2.45	12
11.5	65	-2.35	13
12	66	-2.25	15
12.5	68	-2.15	17
13	69	-2.04	18
13.5	71	-1.94	20
14	72	-1.84	22
14.5	74	-1.73	23
15	76	-1.63	25
15.5	77	-1.53	27
16	79	-1.42	28
16.5	80	-1.32	30
17	82	-1.22	32
17.5	83	-1.12	33
18	85	-1.01	35
18.5	86	-0.91	37
19	88	-0.81	38
19.5	89	-0.70	40
20	91	-0.60	42
20.5	93	-0.50	43
21	94	-0.40	45
21.5	96	-0.29	47
22	97	-0.19	48
22.5	99	-0.09	50
23	100	0.02	52
23.5	102	0.12	53
24	103	0.22	55
24.5	105	0.33	57

25	106	0.43	58
25.5	108	0.53	60
26	110	0.63	62
26.5	111	0.74	63
27	113	0.84	65
27.5	114	0.94	67
28	116	1.05	68
28.5	117	1.15	70
29	119	1.25	72
29.5	120	1.36	73
30	122	1.46	75
30.5	123	1.56	77
31	125	1.66	78
31.5	127	1.77	80
32	128	1.87	82
32.5	130	1.97	83
33	131	2.08	85
33.5	133	2.18	87
34	134	2.28	88
34.5	136	2.39	90
35	137	2.49	92
35.5	139	2.59	93
36	140	2.69	95
36.5	142	2.80	97
37	143	2.90	98
37.5	145	3.00	100

Appendix BW

Final Conversion Table Displaying Raw Scores in WPM, Standard Scores and Z-scores of Total Maltese Score

Total Maltese Score (WPM)	Standard Scores	Z-scores	Percentile Rank
5	54	-3.07	2
5.5	56	-2.95	4
6	57	-2.84	6
6.5	59	-2.72	8
7	61	-2.60	9
7.5	63	-2.49	11
8	64	-2.37	13
8.5	66	-2.26	15
9	68	-2.14	17
9.5	70	-2.02	19
10	71	-1.91	21
10.5	73	-1.79	23
11	75	-1.68	25
11.5	77	-1.56	26
12	78	-1.44	28
12.5	80	-1.33	30
13	82	-1.21	32
13.5	84	-1.09	34
14	85	-0.98	36
14.5	87	-0.86	38
15	89	-0.75	40
15.5	91	-0.63	42
16	92	-0.51	43
16.5	94	-0.40	45
17	96	-0.28	47
17.5	98	-0.16	49
18	99	-0.05	51
18.5	101	0.07	53
19	103	0.18	55
19.5	105	0.30	57
20	106	0.42	58
20.5	108	0.53	60
21	110	0.65	62
21.5	111	0.77	64

22	113	0.88	66
22.5	115	1.00	68
23	117	1.11	70
23.5	118	1.23	72
24	120	1.35	74
24.5	122	1.46	75
25	124	1.58	77
25.5	125	1.70	79
26	127	1.81	81
26.5	129	1.93	83
27	131	2.04	85
27.5	132	2.16	87
28	134	2.28	89
28.5	136	2.39	91
29	138	2.51	92
29.5	139	2.63	94
30	141	2.74	96
30.5	143	2.86	98
31	145	2.97	100

Appendix BX

Comparison of Raw Scores and Standard Scores of Total English Score and Total Maltese Score

Total English Score			Total Maltese Score		
Raw Score (WMP)	Standard Score	Z-score	Raw Score (WMP)	Standard Score	Z-scores
8	54	-3.07	5	54	-3.07
8.5	55	-2.97	5.5	56	-2.95
9	57	-2.87	6	57	-2.84
9.5	59	-2.76	6.5	59	-2.72
10	60	-2.66	7	61	-2.60
10.5	62	-2.56	7.5	63	-2.49
11	63	-2.45	8	64	-2.37
11.5	65	-2.35	8.5	66	-2.26
12	66	-2.25	9	68	-2.14
12.5	68	-2.15	9.5	70	-2.02
13	69	-2.04	10	71	-1.91
13.5	71	-1.94	10.5	73	-1.79
14	72	-1.84	11	75	-1.68
14.5	74	-1.73	11.5	77	-1.56
15	76	-1.63	12	78	-1.44
15.5	77	-1.53	12.5	80	-1.33
16	79	-1.42	13	82	-1.21
16.5	80	-1.32	13.5	84	-1.09
17	82	-1.22	14	85	-0.98
17.5	83	-1.12	14.5	87	-0.86
18	85	-1.01	15	89	-0.75
18.5	86	-0.91	15.5	91	-0.63
19	88	-0.81	16	92	-0.51
19.5	89	-0.70	16.5	94	-0.40
20	91	-0.60	17	96	-0.28
20.5	93	-0.50	17.5	98	-0.16
21	94	-0.40	18	99	-0.05
21.5	96	-0.29	18.5	101	0.07
22	97	-0.19	19	103	0.18
22.5	99	-0.09	19.5	105	0.30
23	100	0.02	20	106	0.42
23.5	102	0.12	20.5	108	0.53
24	103	0.22	21	110	0.65

24.5	105	0.33	21.5	111	0.77
25	106	0.43	22	113	0.88
25.5	108	0.53	22.5	115	1.00
26	110	0.63	23	117	1.11
26.5	111	0.74	23.5	118	1.23
27	113	0.84	24	120	1.35
27.5	114	0.94	24.5	122	1.46
28	116	1.05	25	124	1.58
28.5	117	1.15	25.5	125	1.70
29	119	1.25	26	127	1.81
29.5	120	1.36	26.5	129	1.93
30	122	1.46	27	131	2.04
30.5	123	1.56	27.5	132	2.16
31	125	1.66	28	134	2.28
31.5	127	1.77	28.5	136	2.39
32	128	1.87	29	138	2.51
32.5	130	1.97	29.5	139	2.63
33	131	2.08	30	141	2.74
33.5	133	2.18	30.5	143	2.86
34	134	2.28	31	145	2.97
34.5	136	2.39			
35	137	2.49			
35.5	139	2.59			
36	140	2.69			
36.5	142	2.80			
37	143	2.90			
37.5	145	3.00			

Appendix BY

Comparison of English Subtests and Maltese Subtests

Table BY1

Comparison of Raw Scores and Standard Scores of English Copy Neatly and Maltese Copy Neatly (Ikkopja Pulit)

English Copy Neatly			Maltese Copy Neatly (Ikkopja Pulit)		
Raw Score (WPM)	Standard Score	Z-score	Raw Score (WPM)	Standard Score	Z-Score
10.5	55	-3.00	8	56	-2.96
11	56	-2.91	8.5	57	-2.84
11.5	58	-2.82	9	59	-2.73
12	59	-2.73	9.5	61	-2.62
12.5	60	-2.64	10	62	-2.50
13	62	-2.55	10.5	64	-2.39
13.5	63	-2.47	11	66	-2.27
14	64	-2.38	11.5	68	-2.16
14.5	66	-2.29	12	69	-2.04
15	67	-2.20	12.5	71	-1.93
15.5	68	-2.11	13	73	-1.81
16	70	-2.02	13.5	75	-1.70
16.5	71	-1.93	14	76	-1.59
17	72	-1.84	14.5	78	-1.47
17.5	74	-1.76	15	80	-1.36
18	75	-1.67	15.5	81	-1.24
18.5	76	-1.58	16	83	-1.13
19	78	-1.49	16.5	85	-1.01
19.5	79	-1.40	17	87	-0.90
20	80	-1.31	17.5	88	-0.78
20.5	82	-1.22	18	90	-0.67
21	83	-1.13	18.5	92	-0.56
21.5	84	-1.05	19	93	-0.44
22	86	-0.96	19.5	95	-0.33
22.5	87	-0.87	20	97	-0.21
23	88	-0.78	20.5	99	-0.10
23.5	90	-0.69	21	100	0.02
24	91	-0.60	21.5	102	0.13
24.5	92	-0.51	22	104	0.25
25	94	-0.42	22.5	105	0.36

25.5	95	-0.33
26	96	-0.25
26.5	98	-0.16
27	99	-0.07
27.5	100	0.02
28	102	0.11
28.5	103	0.20
29	104	0.29
29.5	106	0.38
30	107	0.46
30.5	108	0.55
31	110	0.64
31.5	111	0.73
32	112	0.82
32.5	114	0.91
33	115	1.00
33.5	116	1.09
34	118	1.17
34.5	119	1.26
35	120	1.35
35.5	122	1.44
36	123	1.53
36.5	124	1.62
37	126	1.71
37.5	127	1.80
38	128	1.88
38.5	130	1.97
39	131	2.06
40	134	2.24
40.5	135	2.33
41	136	2.42
41.5	138	2.51
42	139	2.60
42.5	140	2.68
43	142	2.77
43.5	143	2.86
44	144	2.95
44.5	146	3.04

23	107	0.47
23.5	109	0.59
24	111	0.70
24.5	112	0.82
25	114	0.93
25.5	116	1.05
26	117	1.16
26.5	119	1.28
27	121	1.39
27.5	123	1.50
28	124	1.62
28.5	126	1.73
29	128	1.85
29.5	129	1.96
30	131	2.08
30.5	133	2.19
31	135	2.30
31.5	136	2.42
32	138	2.53
32.5	140	2.65
33	141	2.76
33.5	143	2.88
34	145	2.99

Table BY2

Comparison of Raw Scores and Standard Scores of English Copy Quickly and Maltese Copy Quickly (Ikkopja Malajr)

English Copy Quickly			Maltese Copy Quickly (Ikkopja Malajr)		
Raw Score (WMP)	Standard Score	Z-Score	Raw Score (WMP)	Standard Score	Z-Score
16	55	-3.00	11.5	56	-2.96
16.5	56	-2.91	12	57	-2.85
17	58	-2.82	12.5	59	-2.74
17.5	59	-2.73	13	61	-2.62
18	60	-2.63	13.5	62	-2.51
18.5	62	-2.54	14	64	-2.40
19	63	-2.45	14.5	66	-2.29
19.5	65	-2.36	15	67	-2.17
20	66	-2.27	15.5	69	-2.06
20.5	67	-2.18	16	71	-1.95
21	69	-2.09	16.5	72	-1.84
22	71	-1.91	17	74	-1.73
22.5	73	-1.82	17.5	76	-1.61
23	74	-1.73	18	77	-1.50
23.5	75	-1.64	18.5	79	-1.39
24	77	-1.55	19	81	-1.28
24.5	78	-1.46	19.5	83	-1.17
25	79	-1.37	20	84	-1.05
25.5	81	-1.28	20.5	86	-0.94
26	82	-1.19	21	88	-0.83
26.5	84	-1.10	21.5	89	-0.72
27	85	-1.01	22	91	-0.60
27.5	86	-0.92	22.5	93	-0.49
28	88	-0.82	23	94	-0.38
28.5	89	-0.73	23.5	96	-0.27
29	90	-0.64	24	98	-0.16
29.5	92	-0.55	24.5	99	-0.04
30	93	-0.46	25	101	0.07
30.5	94	-0.37	25.5	103	0.18
31	96	-0.28	26	104	0.29
31.5	97	-0.19	26.5	106	0.40
32	98	-0.10	27	108	0.52
32.5	100	-0.01	27.5	109	0.63
33	101	0.08	28	111	0.74

33.5	103	0.17	28.5	113	0.85
34	104	0.26	29	114	0.97
34.5	105	0.35	29.5	116	1.08
35	107	0.44	30	118	1.19
35.5	108	0.53	30.5	120	1.30
36	109	0.62	31	121	1.41
36.5	111	0.71	31.5	123	1.53
37	112	0.80	32	125	1.64
37.5	113	0.89	32.5	126	1.75
38	115	0.99	33	128	1.86
38.5	116	1.08	33.5	130	1.97
39	117	1.17	34	131	2.09
39.5	119	1.26	34.5	133	2.20
40	120	1.35	35	135	2.31
40.5	122	1.44	35.5	136	2.42
41	123	1.53	36	138	2.53
41.5	124	1.62	36.5	140	2.65
42.5	127	1.80	37	141	2.76
43	128	1.89	37.5	143	2.87
44	131	2.07	38	145	2.98
44.5	132	2.16			
45	134	2.25			
45.5	135	2.34			
46	137	2.43			
46.5	138	2.52			
47	139	2.61			
47.5	141	2.70			
48	142	2.80			
48.5	143	2.89			
49	145	2.98			

Table BY3

Comparison of Raw Scores and Standard Scores of English Copy from Board and Maltese Copy from Board (Ikkopja mill-Bord)

English *Copy from the Board*			Maltese Copy from the Board (Ikkopja mill-Bord)		
Raw Scores (WMP)	Standard Scores	Z-scores	Raw Scores (WPM)	Standard Scores	Z-scores
7	55	-3.01	6	55	-2.98
7.5	57	-2.90	6.5	57	-2.88
8	58	-2.78	7	58	-2.77
8.5	60	-2.67	7.5	60	-2.67
9	62	-2.56	8	62	-2.56
9.5	63	-2.44	8.5	63	-2.46
10	65	-2.33	9	65	-2.35
10.5	67	-2.21	9.5	66	-2.25
11	69	-2.10	10	68	-2.14
12.5	74	-1.76	10.5	69	-2.04
13	75	-1.64	11	71	-1.93
13.5	77	-1.53	11.5	73	-1.83
14	79	-1.41	12	74	-1.72
14.5	81	-1.30	12.5	76	-1.62
15	82	-1.18	13	77	-1.51
15.5	84	-1.07	13.5	79	-1.40
16	86	-0.95	14	81	-1.30
16.5	87	-0.84	14.5	82	-1.19
17	89	-0.73	15	84	-1.09
17.5	91	-0.61	15.5	85	-0.98
18	93	-0.50	16	87	-0.88
18.5	94	-0.38	16.5	88	-0.77
19	96	-0.27	17	90	-0.67
19.5	98	-0.15	17.5	92	-0.56
20	99	-0.04	18	93	-0.46
20.5	101	0.07	18.5	95	-0.35
21	103	0.19	19	96	-0.25
21.5	105	0.30	19.5	98	-0.14
22	106	0.42	20	99	-0.04
22.5	108	0.53	20.5	101	0.07
23	110	0.65	21	103	0.17
23.5	111	0.76	21.5	104	0.28
24	113	0.87	22	106	0.39
24.5	115	0.99	22.5	107	0.49

25	117	1.10	23	109	0.60
25.5	118	1.22	23.5	111	0.70
26	120	1.33	24	112	0.81
26.5	122	1.45	24.5	114	0.91
27	123	1.56	25	115	1.02
27.5	125	1.67	25.5	117	1.12
28	127	1.79	26	118	1.23
28.5	129	1.90	26.5	120	1.33
29	130	2.02	27	122	1.44
29.5	132	2.13	27.5	123	1.54
30	134	2.25	28	125	1.65
31	137	2.47	28.5	126	1.75
31.5	139	2.59	29	128	1.86
32	141	2.70	29.5	129	1.96
32.5	142	2.82	30	131	2.07
33	144	2.93	30.5	133	2.18
33.5	146	3.05	31	134	2.28
			31.5	136	2.39
			32	137	2.49
			32.5	139	2.60
			33	141	2.70
			33.5	142	2.81
			34	144	2.91
			34.5	145	3.02

Table BY4

Comparison of Raw Scores and Standard Scores of English Free Writing and Maltese Free Writing (Kitba Kreattiva)

English Free Writing			Maltese Free Writing (Kitba Kreattiva)		
Raw Scores (WMP)	Standard Scores	Z-scores	Raw Scores (WPM)	Standard Scores	Z-Score
6.5	55	-2.97	2.5	55	-3.36
7	57	-2.87	3	56	-3.25
7.5	59	-2.77	3.5	58	-3.14
8	60	-2.67	4	60	-3.03
8.5	62	-2.56	4.5	61	-2.92
9	63	-2.46	5	63	-2.81
9.5	65	-2.36	5.5	65	-2.70
10	66	-2.26	6	66	-2.59
10.5	68	-2.16	6.5	68	-2.48
11	69	-2.05	7	69	-2.37
11.5	71	-1.95	7.5	71	-2.26
12	72	-1.85	8	73	-2.15
12.5	74	-1.75	8.5	74	-2.04
13	75	-1.65	9	76	-1.93
13.5	77	-1.55	9.5	78	-1.82
14	78	-1.44	10	79	-1.71
14.5	80	-1.34	10.5	81	-1.60
15	81	-1.24	11	83	-1.49
15.5	83	-1.14	11.5	84	-1.38
16	84	-1.04	12	86	-1.27
16.5	86	-0.93	12.5	88	-1.16
17	88	-0.83	13	89	-1.05
17.5	89	-0.73	13.5	91	-0.94
18	91	-0.63	14	93	-0.83
18.5	92	-0.53	14.5	94	-0.72
19	94	-0.43	15	96	-0.61
19.5	95	-0.32	15.5	98	-0.50
20	97	-0.22	16	99	-0.39
20.5	98	-0.12	16.5	101	-0.28
21	100	-0.02	17	102	-0.17
21.5	101	0.08	17.5	104	-0.06
22	103	0.18	18	106	0.05
22.5	104	0.29	18.5	107	0.16

23	106	0.39	19	109	0.27
23.5	107	0.49	19.5	111	0.38
24	109	0.59	20	112	0.49
24.5	110	0.69	20.5	114	0.60
25	112	0.80	21	116	0.71
25.5	113	0.90	21.5	117	0.82
26	115	1.00	22	119	0.93
26.5	117	1.10	22.5	121	1.04
27	118	1.20	23	122	1.15
27.5	120	1.30	23.5	124	1.26
28	121	1.41	24	126	1.37
28.5	123	1.51	24.5	127	1.48
29	124	1.61	25	129	1.59
29.5	126	1.71	25.5	130	1.70
30	127	1.81	26	132	1.81
30.5	129	1.92	26.5	134	1.92
31	130	2.02	27	135	2.03
31.5	132	2.12	27.5	137	2.14
32	133	2.22	28	139	2.25
32.5	135	2.32	28.5	140	2.36
33	136	2.42	29	142	2.47
33.5	138	2.53	29.5	144	2.58
34	139	2.63	30	145	2.69
34.5	141	2.73			
35	142	2.83			
35.5	144	2.93			
36	146	3.04			

Appendix BZ

Final Conversion Tables Displaying Raw Scores, Standard Scores and Z-scores of English and Maltese Total Scores, for Males

Table BZ1

Raw Scores in WPM, Standard Scores and Z-scores of Total English Score

Total English Score (WPM)	Standard Scores	Z-Scores	Percentile Rank
8.5	54.54	-3.0	2
9	56.19	-2.9	4
9.5	57.84	-2.8	5
10	59.49	-2.7	7
10.5	61.15	-2.6	9
11	62.80	-2.5	11
11.5	64.45	-2.4	13
12	66.10	-2.3	14
12.5	67.75	-2.1	16
13	69.41	-2.0	18
13.5	71.06	-1.9	20
14	72.71	-1.8	21
14.5	74.36	-1.7	23
15	76.01	-1.6	25
15.5	77.67	-1.5	27
16	79.32	-1.4	29
16.5	80.97	-1.3	30
17	82.62	-1.2	32
17.5	84.27	-1.0	34
18	85.93	-0.9	36
18.5	87.58	-0.8	38
19	89.23	-0.7	39
19.5	90.88	-0.6	41
20	92.53	-0.5	43
20.5	94.19	-0.4	45
21	95.84	-0.3	46
21.5	97.49	-0.2	48
22	99.14	-0.1	50
22.5	100.79	0.1	52
23	102.45	0.2	54
23.5	104.10	0.3	55

24	105.75	0.4	57
24.5	107.40	0.5	59
25	109.05	0.6	61
25.5	110.71	0.7	63
26	112.36	0.8	64
26.5	114.01	0.9	66
27	115.66	1.0	68
27.5	117.31	1.2	70
28	118.97	1.3	71
28.5	120.62	1.4	73
29	122.27	1.5	75
29.5	123.92	1.6	77
30	125.57	1.7	79
30.5	127.23	1.8	80
31	128.88	1.9	82
31.5	130.53	2.0	84
32	132.18	2.1	86
32.5	133.83	2.3	88
33	135.49	2.4	89
33.5	137.14	2.5	91
34	138.79	2.6	93
34.5	140.44	2.7	95
35	142.09	2.8	96
35.5	143.75	2.9	98
36	145.40	3.0	100

Table BZ2

Raw Scores in WPM, Standard Scores and Z-scores of Total Maltese Score

Total Maltese Score (WPM)	Standard Scores	Z-Scores	Percentile Rank
4	54.22	-3.1	2
4.5	55.92	-2.9	4
5	57.61	-2.8	5
5.5	59.31	-2.7	7
6	61.01	-2.6	9
6.5	62.70	-2.5	11
7	64.40	-2.4	13
7.5	66.10	-2.3	15
8	67.79	-2.1	16
8.5	69.49	-2.0	18
9	71.19	-1.9	20
9.5	72.89	-1.8	22
10	74.58	-1.7	24
10.5	76.28	-1.6	25
11	77.98	-1.5	27
11.5	79.67	-1.4	29
12	81.37	-1.2	31
12.5	83.07	-1.1	33
13	84.76	-1.0	35
13.5	86.46	-0.9	36
14	88.16	-0.8	38
14.5	89.85	-0.7	40
15	91.55	-0.6	42
15.5	93.25	-0.5	44
16	94.94	-0.3	45
16.5	96.64	-0.2	47
17	98.34	-0.1	49
17.5	100.03	0.0	51
18	101.73	0.1	53
18.5	103.43	0.2	55
19	105.13	0.3	56
19.5	106.82	0.5	58
20	108.52	0.6	60
20.5	110.22	0.7	62
21	111.91	0.8	64
21.5	113.61	0.9	65

22	115.31	1.0	67
22.5	117.00	1.1	69
23	118.70	1.2	71
23.5	120.40	1.4	73
24	122.09	1.5	75
24.5	123.79	1.6	76
25	125.49	1.7	78
25.5	127.18	1.8	80
26	128.88	1.9	82
26.5	130.58	2.0	84
27	132.27	2.2	85
27.5	133.97	2.3	87
28	135.67	2.4	89
28.5	137.37	2.5	91
29	139.06	2.6	93
29.5	140.76	2.7	95
30	142.46	2.8	96
30.5	144.15	2.9	98
31	145.85	3.1	100

Appendix CA

Final Conversion Tables Displaying Raw Scores, Standard Scores and Z-scores of English and Maltese Total Scores, for Females

Table CA1

Raw Scores in WPM, Standard Scores and Z-scores of Total English Score

Total English Score (WPM)	Standard Scores	Z-Scores	Percentile Rank
8.5	55.41	-3.0	2
9	56.89	-2.9	3
9.5	58.36	-2.8	5
10	59.83	-2.7	6
10.5	61.31	-2.6	8
11	62.78	-2.5	10
11.5	64.25	-2.4	11
12	65.73	-2.3	13
12.5	67.20	-2.2	15
13	68.67	-2.1	16
13.5	70.15	-2.0	18
14	71.62	-1.9	19
14.5	73.09	-1.8	21
15	74.57	-1.7	23
15.5	76.04	-1.6	24
16	77.52	-1.5	26
16.5	78.99	-1.4	27
17	80.46	-1.3	29
17.5	81.94	-1.2	31
18	83.41	-1.1	32
18.5	84.88	-1.0	34
19	86.36	-0.9	35
19.5	87.83	-0.8	37
20	89.30	-0.7	39
20.5	90.78	-0.6	40
21	92.25	-0.5	42
21.5	93.72	-0.4	44
22	95.20	-0.3	45
22.5	96.67	-0.2	47
23	98.14	-0.1	48

23.5	99.62	0.0	50
24	101.09	0.1	52
24.5	102.56	0.2	53
25	104.04	0.3	55
25.5	105.51	0.4	56
26	106.99	0.5	58
26.5	108.46	0.6	60
27	109.93	0.7	61
27.5	111.41	0.8	63
28	112.88	0.9	65
28.5	114.35	1.0	66
29	115.83	1.1	68
29.5	117.30	1.2	69
30	118.77	1.3	71
30.5	120.25	1.3	73
31	121.72	1.4	74
31.5	123.19	1.5	76
32	124.67	1.6	77
32.5	126.14	1.7	79
33	127.61	1.8	81
33.5	129.09	1.9	82
34	130.56	2.0	84
34.5	132.03	2.1	85
35	133.51	2.2	87
35.5	134.98	2.3	89
36	136.46	2.4	90
36.5	137.93	2.5	92
37	139.40	2.6	94
37.5	140.88	2.7	95
38	142.35	2.8	97
38.5	143.82	2.9	98
39	145.30	3.0	100

Table CA2

Raw Scores in WPM, Standard Scores and Z-scores of Total Maltese Score

Total Maltese Score (WPM)	Standard Scores	Z-Scores	Percentile Rank
6.5	54.08	-3.1	2
7	55.92	-2.9	4
7.5	57.77	-2.8	6
8	59.62	-2.7	8
8.5	61.47	-2.6	10
9	63.31	-2.4	12
9.5	65.16	-2.3	14
10	67.01	-2.2	16
10.5	68.86	-2.1	18
11	70.70	-2.0	20
11.5	72.55	-1.8	22
12	74.40	-1.7	24
12.5	76.24	-1.6	26
13	78.09	-1.5	28
13.5	79.94	-1.3	30
14	81.79	-1.2	32
14.5	83.63	-1.1	34
15	85.48	-1.0	36
15.5	87.33	-0.8	38
16	89.18	-0.7	40
16.5	91.02	-0.6	42
17	92.87	-0.5	44
17.5	94.72	-0.4	46
18	96.56	-0.2	48
18.5	98.41	-0.1	50
19	100.26	0.0	52
19.5	102.11	0.1	54
20	103.95	0.3	56
20.5	105.80	0.4	58
21	107.65	0.5	60
21.5	109.50	0.6	62
22	111.34	0.8	64
22.5	113.19	0.9	66
23	115.04	1.0	68
23.5	116.89	1.1	70
24	118.73	1.2	72
24.5	120.58	1.4	74

25	122.43	1.5	76
25.5	124.27	1.6	78
26	126.12	1.7	80
26.5	127.97	1.9	82
27	129.82	2.0	84
27.5	131.66	2.1	86
28	133.51	2.2	88
28.5	135.36	2.4	90
29	137.21	2.5	92
29.5	139.05	2.6	94
30	140.90	2.7	96
30.5	142.75	2.8	98
31	144.59	3.0	100

Appendix CB

Final Conversion Tables Displaying Raw Scores, Standard Scores and Z-scores of English Subtests, for Males

Table CB1

Raw Scores in WPM, Standard Scores and Z-scores of English Copy Neatly Subtest

English Copy Neatly (WPM)	Standard Scores	Z-Scores	Percentile Rank
11	55.51	-3.0	2
11.5	56.93	-2.9	3
12	58.35	-2.8	5
12.5	59.77	-2.7	6
13	61.19	-2.6	8
13.5	62.61	-2.5	9
14	64.03	-2.4	11
14.5	65.45	-2.3	13
15	66.88	-2.2	14
15.5	68.30	-2.1	16
16	69.72	-2.0	17
16.5	71.14	-1.9	19
17	72.56	-1.8	20
17.5	73.98	-1.7	22
18	75.40	-1.6	23
18.5	76.82	-1.5	25
19	78.24	-1.5	27
19.5	79.66	-1.4	28
20	81.08	-1.3	30
20.5	82.50	-1.2	31
21	83.92	-1.1	33
21.5	85.34	-1.0	34
22	86.76	-0.9	36
22.5	88.18	-0.8	38
23	89.60	-0.7	39
23.5	91.02	-0.6	41
24	92.44	-0.5	42
24.5	93.86	-0.4	44
25	95.28	-0.3	45
25.5	96.70	-0.2	47
26	98.13	-0.1	48
26.5	99.55	0.0	50
27	100.97	0.1	52

27.5	102.39	0.2	53
28	103.81	0.3	55
28.5	105.23	0.3	56
29	106.65	0.4	58
29.5	108.07	0.5	59
30	109.49	0.6	61
30.5	110.91	0.7	63
31	112.33	0.8	64
31.5	113.75	0.9	66
32	115.17	1.0	67
32.5	116.59	1.1	69
33	118.01	1.2	70
33.5	119.43	1.3	72
34	120.85	1.4	73
34.5	122.27	1.5	75
35	123.69	1.6	77
35.5	125.11	1.7	78
36	126.53	1.8	80
36.5	127.95	1.9	81
37	129.38	2.0	83
37.5	130.80	2.1	84
38	132.22	2.1	86
38.5	133.64	2.2	88
39	135.06	2.3	89
39.5	136.48	2.4	91
40	137.90	2.5	92
40.5	139.32	2.6	94
41	140.74	2.7	95
41.5	142.16	2.8	97
42	143.58	2.9	98
42.5	145.00	3.0	100

Table CB2

Raw Scores in WPM, Standard Scores and Z-scores of English Copy Quickly Subtest

English Copy Quickly (WPM)	Standard Scores	Z-Scores	Percentile Rank
15.5	54.62	-3.0	1
16	55.98	-2.9	3
16.5	57.35	-2.8	4
17	58.71	-2.8	6
17.5	60.07	-2.7	7
18	61.44	-2.6	9
18.5	62.80	-2.5	10
19	64.16	-2.4	12
19.5	65.53	-2.3	13
20	66.89	-2.2	15
20.5	68.25	-2.1	16
21	69.62	-2.0	18
21.5	70.98	-1.9	19
22	72.35	-1.8	21
22.5	73.71	-1.8	22
23	75.07	-1.7	24
23.5	76.44	-1.6	25
24	77.80	-1.5	27
24.5	79.16	-1.4	28
25	80.53	-1.3	30
25.5	81.89	-1.2	31
26	83.25	-1.1	33
26.5	84.62	-1.0	34
27	85.98	-0.9	36
27.5	87.35	-0.8	37
28	88.71	-0.8	39
28.5	90.07	-0.7	40
29	91.44	-0.6	42
29.5	92.80	-0.5	43
30	94.16	-0.4	45
30.5	95.53	-0.3	46
31	96.89	-0.2	48
31.5	98.25	-0.1	49
32	99.62	0.0	51
32.5	100.98	0.1	52
33	102.35	0.2	54
33.5	103.71	0.2	55

34	105.07	0.3	57
34.5	106.44	0.4	58
35	107.80	0.5	60
35.5	109.16	0.6	61
36	110.53	0.7	63
36.5	111.89	0.8	64
37	113.25	0.9	66
37.5	114.62	1.0	67
38	115.98	1.1	69
38.5	117.35	1.2	70
39	118.71	1.2	72
39.5	120.07	1.3	73
40	121.44	1.4	75
40.5	122.80	1.5	76
41	124.16	1.6	78
41.5	125.53	1.7	79
42	126.89	1.8	81
42.5	128.25	1.9	82
43	129.62	2.0	84
43.5	130.98	2.1	85
44	132.35	2.2	87
44.5	133.71	2.2	88
45	135.07	2.3	90
45.5	136.44	2.4	91
46	137.80	2.5	93
46.5	139.16	2.6	94
47	140.53	2.7	96
47.5	141.89	2.8	97
48	143.25	2.9	99
48.5	144.62	3.0	100

Table CB3

Raw Scores in WPM, Standard Scores and Z-scores of English Copy from Board Subtest

English Copy from Board (WPM)	Standard Scores	Z-Scores	Percentile Rank
7.5	54.63	-3.0	2
8	56.47	-2.9	4
8.5	58.31	-2.8	6
9	60.15	-2.7	8
9.5	61.99	-2.5	10
10	63.82	-2.4	12
10.5	65.66	-2.3	14
11	67.50	-2.2	16
11.5	69.34	-2.0	18
12	71.18	-1.9	20
12.5	73.01	-1.8	22
13	74.85	-1.7	24
13.5	76.69	-1.6	26
14	78.53	-1.4	28
14.5	80.37	-1.3	30
15	82.21	-1.2	32
15.5	84.04	-1.1	34
16	85.88	-0.9	36
16.5	87.72	-0.8	38
17	89.56	-0.7	40
17.5	91.40	-0.6	42
18	93.24	-0.5	44
18.5	95.07	-0.3	46
19	96.91	-0.2	48
19.5	98.75	-0.1	50
20	100.59	0.0	52
20.5	102.43	0.2	54
21	104.26	0.3	56
21.5	106.10	0.4	58
22	107.94	0.5	60
22.5	109.78	0.7	62
23	111.62	0.8	64
23.5	113.46	0.9	66
24	115.29	1.0	68
24.5	117.13	1.1	70
25	118.97	1.3	72
25.5	120.81	1.4	74

26	122.65	1.5	76
26.5	124.49	1.6	78
27	126.32	1.8	80
27.5	128.16	1.9	82
28	130.00	2.0	84
28.5	131.84	2.1	86
29	133.68	2.2	88
29.5	135.51	2.4	90
30	137.35	2.5	92
30.5	139.19	2.6	94
31	141.03	2.7	96
31.5	142.87	2.9	98
32	144.71	3.0	100

Table CB4

Raw Scores in WPM, Standard Scores and Z-scores of English Free Writing Subtest

English Free Writing (WPM)	Standard Scores	Z-Scores	Percentile Rank
5.5	54.60	-3.0	2
6	56.15	-2.9	3
6.5	57.70	-2.8	5
7	59.25	-2.7	7
7.5	60.80	-2.6	8
8	62.35	-2.5	10
8.5	63.90	-2.4	12
9	65.44	-2.3	14
9.5	66.99	-2.2	15
10	68.54	-2.1	17
10.5	70.09	-2.0	19
11	71.64	-1.9	20
11.5	73.19	-1.8	22
12	74.74	-1.7	24
12.5	76.29	-1.6	25
13	77.84	-1.5	27
13.5	79.39	-1.4	29
14	80.94	-1.3	31
14.5	82.49	-1.2	32
15	84.04	-1.1	34
15.5	85.59	-1.0	36
16	87.14	-0.9	37
16.5	88.69	-0.8	39
17	90.24	-0.7	41
17.5	91.79	-0.5	42
18	93.34	-0.4	44
18.5	94.89	-0.3	46
19	96.44	-0.2	47
19.5	97.99	-0.1	49
20	99.54	0.0	51
20.5	101.09	0.1	53
21	102.64	0.2	54
21.5	104.18	0.3	56
22	105.73	0.4	58
22.5	107.28	0.5	59
23	108.83	0.6	61
23.5	110.38	0.7	63

24	111.93	0.8	64
24.5	113.48	0.9	66
25	115.03	1.0	68
25.5	116.58	1.1	69
26	118.13	1.2	71
26.5	119.68	1.3	73
27	121.23	1.4	75
27.5	122.78	1.5	76
28	124.33	1.6	78
28.5	125.88	1.7	80
29	127.43	1.8	81
29.5	128.98	1.9	83
30	130.53	2.0	85
30.5	132.08	2.1	86
31	133.63	2.2	88
31.5	135.18	2.3	90
32	136.73	2.4	92
32.5	138.28	2.6	93
33	139.83	2.7	95
33.5	141.38	2.8	97
34	142.92	2.9	98
34.5	144.47	3.0	100

Appendix CC

Final Conversion Tables Displaying Raw Scores, Standard Scores and Z-scores of Maltese Subtests, for Males

Table CC1

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Copy Neatly Subtest

Maltese Copy Neatly (Ikkopja Pulit) (WPM)	Standard Scores	Z-Scores	Percentile Rank
7	54.02	-3.1	2
7.5	55.77	-2.9	4
8	57.51	-2.8	6
8.5	59.26	-2.7	8
9	61.00	-2.6	9
9.5	62.74	-2.5	11
10	64.49	-2.4	13
10.5	66.23	-2.3	15
11	67.98	-2.1	17
11.5	69.72	-2.0	19
12	71.47	-1.9	21
12.5	73.21	-1.8	23
13	74.95	-1.7	25
13.5	76.70	-1.6	26
14	78.44	-1.4	28
14.5	80.19	-1.3	30
15	81.93	-1.2	32
15.5	83.67	-1.1	34
16	85.42	-1.0	36
16.5	87.16	-0.9	38
17	88.91	-0.7	40
17.5	90.65	-0.6	42
18	92.40	-0.5	43
18.5	94.14	-0.4	45
19	95.88	-0.3	47
19.5	97.63	-0.2	49
20	99.37	0.0	51
20.5	101.12	0.1	53
21	102.86	0.2	55
21.5	104.60	0.3	57
22	106.35	0.4	58

22.5	108.09	0.5	60
23	109.84	0.7	62
23.5	111.58	0.8	64
24	113.33	0.9	66
24.5	115.07	1.0	68
25	116.81	1.1	70
25.5	118.56	1.2	72
26	120.30	1.4	74
26.5	122.05	1.5	75
27	123.79	1.6	77
27.5	125.53	1.7	79
28	127.28	1.8	81
28.5	129.02	1.9	83
29	130.77	2.1	85
29.5	132.51	2.2	87
30	134.26	2.3	89
30.5	136.00	2.4	91
31	137.74	2.5	92
31.5	139.49	2.6	94
32	141.23	2.7	96
32.5	142.98	2.9	98
33	144.72	3.0	100

Table CC2

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Copy Quickly Subtest

Maltese Copy Quickly (Ikkopja Malajr) (WPM)	Standard Scores	Z-Scores	Percentile Rank
11	54.65	-3.0	2
11.5	56.40	-2.9	4
12	58.15	-2.8	6
12.5	59.90	-2.7	8
13	61.64	-2.6	9
13.5	63.39	-2.4	11
14	65.14	-2.3	13
14.5	66.89	-2.2	15
15	68.64	-2.1	17
15.5	70.38	-2.0	19
16	72.13	-1.9	21
16.5	73.88	-1.7	23
17	75.63	-1.6	25
17.5	77.38	-1.5	26
18	79.13	-1.4	28
18.5	80.87	-1.3	30
19	82.62	-1.2	32
19.5	84.37	-1.0	34
20	86.12	-0.9	36
20.5	87.87	-0.8	38
21	89.62	-0.7	40
21.5	91.36	-0.6	42
22	93.11	-0.5	43
22.5	94.86	-0.3	45
23	96.61	-0.2	47
23.5	98.36	-0.1	49
24	100.10	0.0	51
24.5	101.85	0.1	53
25	103.60	0.2	55
25.5	105.35	0.4	57
26	107.10	0.5	58
26.5	108.85	0.6	60
27	110.59	0.7	62
27.5	112.34	0.8	64
28	114.09	0.9	66
28.5	115.84	1.1	68

29	117.59	1.2	70
29.5	119.34	1.3	72
30	121.08	1.4	74
30.5	122.83	1.5	75
31	124.58	1.6	77
31.5	126.33	1.8	79
32	128.08	1.9	81
32.5	129.83	2.0	83
33	131.57	2.1	85
33.5	133.32	2.2	87
34	135.07	2.3	89
34.5	136.82	2.5	91
35	138.57	2.6	92
35.5	140.31	2.7	94
36	142.06	2.8	96
36.5	143.81	2.9	98
37	145.56	3.0	100

Table CC3

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Copy from Board Subtest

Maltese Copy from Board (Ikkopja mill-Bord) (WPM)	Standard Scores	Z-Scores	Percentile Rank
5.5	54.87	-3.0	2
6	56.47	-2.9	4
6.5	58.07	-2.8	5
7	59.67	-2.7	7
7.5	61.27	-2.6	9
8	62.87	-2.5	11
8.5	64.47	-2.4	12
9	66.07	-2.3	14
9.5	67.67	-2.2	16
10	69.26	-2.0	18
10.5	70.86	-1.9	19
11	72.46	-1.8	21
11.5	74.06	-1.7	23
12	75.66	-1.6	25
12.5	77.26	-1.5	26
13	78.86	-1.4	28
13.5	80.46	-1.3	30
14	82.06	-1.2	32
14.5	83.66	-1.1	33
15	85.26	-1.0	35
15.5	86.86	-0.9	37
16	88.45	-0.8	39
16.5	90.05	-0.7	40
17	91.65	-0.6	42
17.5	93.25	-0.4	44
18	94.85	-0.3	46
18.5	96.45	-0.2	47
19	98.05	-0.1	49
19.5	99.65	0.0	51
20	101.25	0.1	53
20.5	102.85	0.2	54
21	104.45	0.3	56
21.5	106.04	0.4	58
22	107.64	0.5	60
22.5	109.24	0.6	61
23	110.84	0.7	63
23.5	112.44	0.8	65

24	114.04	0.9	67
24.5	115.64	1.0	68
25	117.24	1.1	70
25.5	118.84	1.3	72
26	120.44	1.4	74
26.5	122.04	1.5	75
27	123.64	1.6	77
27.5	125.23	1.7	79
28	126.83	1.8	81
28.5	128.43	1.9	82
29	130.03	2.0	84
29.5	131.63	2.1	86
30	133.23	2.2	88
30.5	134.83	2.3	89
31	136.43	2.4	91
31.5	138.03	2.5	93
32	139.63	2.6	95
32.5	141.23	2.7	96
33	142.83	2.9	98
33.5	144.42	3.0	100

Table CC4

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Free Writing Subtest

Maltese Free Writing (Kitba Kreattiva) (WPM)	Standard Scores	Z-Scores	Percentile Rank
1.5	54.22	-3.1	2
2	55.85	-2.9	4
2.5	57.47	-2.8	5
3	59.10	-2.7	7
3.5	60.73	-2.6	9
4	62.35	-2.5	11
4.5	63.98	-2.4	12
5	65.61	-2.3	14
5.5	67.23	-2.2	16
6	68.86	-2.1	18
6.5	70.49	-2.0	19
7	72.11	-1.9	21
7.5	73.74	-1.8	23
8	75.37	-1.6	25
8.5	77.00	-1.5	26
9	78.62	-1.4	28
9.5	80.25	-1.3	30
10	81.88	-1.2	32
10.5	83.50	-1.1	33
11	85.13	-1.0	35
11.5	86.76	-0.9	37
12	88.38	-0.8	39
12.5	90.01	-0.7	40
13	91.64	-0.6	42
13.5	93.26	-0.4	44
14	94.89	-0.3	46
14.5	96.52	-0.2	47
15	98.15	-0.1	49
15.5	99.77	0.0	51
16	101.40	0.1	53
16.5	103.03	0.2	54
17	104.65	0.3	56
17.5	106.28	0.4	58
18	107.91	0.5	60
18.5	109.53	0.6	61
19	111.16	0.7	63
19.5	112.79	0.9	65

20	114.41	1.0	67
20.5	116.04	1.1	68
21	117.67	1.2	70
21.5	119.29	1.3	72
22	120.92	1.4	74
22.5	122.55	1.5	75
23	124.18	1.6	77
23.5	125.80	1.7	79
24	127.43	1.8	81
24.5	129.06	1.9	82
25	130.68	2.0	84
25.5	132.31	2.2	86
26	133.94	2.3	88
26.5	135.56	2.4	89
27	137.19	2.5	91
27.5	138.82	2.6	93
28	140.44	2.7	95
28.5	142.07	2.8	96
29	143.70	2.9	98
29.5	145.33	3.0	100

Appendix CD

Final Conversion Tables Displaying Raw Scores, Standard Scores and Z-scores of English Subtests, for Females

Table CD1

Raw Scores in WPM, Standard Scores and Z-scores of English Copy Neatly Subtest

English Copy Neatly (WPM)	Standard Scores	Z-Scores	Percentile Rank
10.5	55.10	-3.0	1
11	56.37	-2.9	3
11.5	57.64	-2.8	4
12	58.92	-2.7	6
12.5	60.19	-2.7	7
13	61.46	-2.6	8
13.5	62.73	-2.5	10
14	64.00	-2.4	11
14.5	65.27	-2.3	13
15	66.54	-2.2	14
15.5	67.81	-2.1	15
16	69.08	-2.1	17
16.5	70.36	-2.0	18
17	71.63	-1.9	19
17.5	72.90	-1.8	21
18	74.17	-1.7	22
18.5	75.44	-1.6	24
19	76.71	-1.6	25
19.5	77.98	-1.5	26
20	79.25	-1.4	28
20.5	80.53	-1.3	29
21	81.80	-1.2	31
21.5	83.07	-1.1	32
22	84.34	-1.0	33
22.5	85.61	-1.0	35
23	86.88	-0.9	36
23.5	88.15	-0.8	38
24	89.42	-0.7	39
24.5	90.69	-0.6	40
25	91.97	-0.5	42
25.5	93.24	-0.5	43

26	94.51	-0.4	44
26.5	95.78	-0.3	46
27	97.05	-0.2	47
27.5	98.32	-0.1	49
28	99.59	0.0	50
28.5	100.86	0.1	51
29	102.14	0.1	53
29.5	103.41	0.2	54
30	104.68	0.3	56
30.5	105.95	0.4	57
31	107.22	0.5	58
31.5	108.49	0.6	60
32	109.76	0.7	61
32.5	111.03	0.7	63
33	112.31	0.8	64
33.5	113.58	0.9	65
34	114.85	1.0	67
34.5	116.12	1.1	68
35	117.39	1.2	69
35.5	118.66	1.2	71
36	119.93	1.3	72
36.5	121.20	1.4	74
37	122.47	1.5	75
37.5	123.75	1.6	76
38	125.02	1.7	78
38.5	126.29	1.8	79
39	127.56	1.8	81
39.5	128.83	1.9	82
40	130.10	2.0	83
40.5	131.37	2.1	85
41	132.64	2.2	86
41.5	133.92	2.3	88
42	135.19	2.3	89
42.5	136.46	2.4	90
43	137.73	2.5	92
43.5	139.00	2.6	93
44	140.27	2.7	94
44.5	141.54	2.8	96
45	142.81	2.9	97
45.5	144.08	2.9	99
46	145.36	3.0	100

Table CD2

Raw Scores in WPM, Standard Scores and Z-scores of English Copy Quickly Subtest

English Copy Quickly (WPM)	Standard Scores	Z-Scores	Percentile Rank
16.5	55.22	-3.0	1
17	56.57	-2.9	3
17.5	57.93	-2.8	4
18	59.29	-2.7	6
18.5	60.64	-2.6	7
19	62.00	-2.5	9
19.5	63.35	-2.4	10
20	64.71	-2.4	12
20.5	66.07	-2.3	13
21	67.42	-2.2	15
21.5	68.78	-2.1	16
22	70.14	-2.0	18
22.5	71.49	-1.9	19
23	72.85	-1.8	21
23.5	74.20	-1.7	22
24	75.56	-1.6	24
24.5	76.92	-1.5	25
25	78.27	-1.4	27
25.5	79.63	-1.4	28
26	80.99	-1.3	30
26.5	82.34	-1.2	31
27	83.70	-1.1	33
27.5	85.05	-1.0	34
28	86.41	-0.9	36
28.5	87.77	-0.8	37
29	89.12	-0.7	39
29.5	90.48	-0.6	40
30	91.84	-0.5	42
30.5	93.19	-0.5	43
31	94.55	-0.4	45
31.5	95.90	-0.3	46
32	97.26	-0.2	48
32.5	98.62	-0.1	49
33	99.97	0.0	51
33.5	101.33	0.1	52
34	102.69	0.2	54
34.5	104.04	0.3	55

35	105.40	0.4	57
35.5	106.75	0.5	58
36	108.11	0.5	60
36.5	109.47	0.6	61
37	110.82	0.7	63
37.5	112.18	0.8	64
38	113.54	0.9	66
38.5	114.89	1.0	67
39	116.25	1.1	69
39.5	117.60	1.2	70
40	118.96	1.3	72
40.5	120.32	1.4	73
41	121.67	1.4	75
41.5	123.03	1.5	76
42	124.39	1.6	78
42.5	125.74	1.7	79
43	127.10	1.8	81
43.5	128.45	1.9	82
44	129.81	2.0	84
44.5	131.17	2.1	85
45	132.52	2.2	87
45.5	133.88	2.3	88
46	135.24	2.3	90
46.5	136.59	2.4	91
47	137.95	2.5	93
47.5	139.30	2.6	94
48	140.66	2.7	96
48.5	142.02	2.8	97
49	143.37	2.9	99
49.5	144.73	3.0	100

Table CD3

Raw Scores in WPM, Standard Scores and Z-scores of English Copy from Board Subtest

English Copy from Board (WPM)	Standard Scores	Z-Scores	Percentile Rank
6.5	54.71	-3.0	2
7	56.32	-2.9	4
7.5	57.94	-2.8	5
8	59.55	-2.7	7
8.5	61.16	-2.6	9
9	62.77	-2.5	11
9.5	64.39	-2.4	12
10	66.00	-2.3	14
10.5	67.61	-2.2	16
11	69.23	-2.1	18
11.5	70.84	-1.9	19
12	72.45	-1.8	21
12.5	74.06	-1.7	23
13	75.68	-1.6	25
13.5	77.29	-1.5	26
14	78.90	-1.4	28
14.5	80.52	-1.3	30
15	82.13	-1.2	32
15.5	83.74	-1.1	33
16	85.35	-1.0	35
16.5	86.97	-0.9	37
17	88.58	-0.8	39
17.5	90.19	-0.7	40
18	91.81	-0.5	42
18.5	93.42	-0.4	44
19	95.03	-0.3	46
19.5	96.65	-0.2	47
20	98.26	-0.1	49
20.5	99.87	0.0	51
21	101.48	0.1	53
21.5	103.10	0.2	54
22	104.71	0.3	56
22.5	106.32	0.4	58
23	107.94	0.5	60
23.5	109.55	0.6	61
24	111.16	0.7	63
24.5	112.77	0.9	65

25	114.39	1.0	67
25.5	116.00	1.1	68
26	117.61	1.2	70
26.5	119.23	1.3	72
27	120.84	1.4	74
27.5	122.45	1.5	75
28	124.06	1.6	77
28.5	125.68	1.7	79
29	127.29	1.8	81
29.5	128.90	1.9	82
30	130.52	2.0	84
30.5	132.13	2.1	86
31	133.74	2.2	88
31.5	135.35	2.4	89
32	136.97	2.5	91
32.5	138.58	2.6	93
33	140.19	2.7	95
33.5	141.81	2.8	96
34	143.42	2.9	98
34.5	145.03	3.0	100

Table CD4

Raw Scores in WPM, Standard Scores and Z-scores of English Free Writing Subtest

English Free Writing (WPM)	Standard Scores	Z-Scores	Percentile Rank
7.5	54.19	-3.1	2
8	55.75	-2.9	3
8.5	57.32	-2.8	5
9	58.88	-2.7	7
9.5	60.45	-2.6	8
10	62.01	-2.5	10
10.5	63.58	-2.4	12
11	65.15	-2.3	14
11.5	66.71	-2.2	15
12	68.28	-2.1	17
12.5	69.84	-2.0	19
13	71.41	-1.9	20
13.5	72.97	-1.8	22
14	74.54	-1.7	24
14.5	76.11	-1.6	25
15	77.67	-1.5	27
15.5	79.24	-1.4	29
16	80.80	-1.3	31
16.5	82.37	-1.2	32
17	83.93	-1.1	34
17.5	85.50	-1.0	36
18	87.07	-0.9	37
18.5	88.63	-0.8	39
19	90.20	-0.7	41
19.5	91.76	-0.5	42
20	93.33	-0.4	44
20.5	94.89	-0.3	46
21	96.46	-0.2	47
21.5	98.03	-0.1	49
22	99.59	0.0	51
22.5	101.16	0.1	53
23	102.72	0.2	54
23.5	104.29	0.3	56
24	105.86	0.4	58
24.5	107.42	0.5	59
25	108.99	0.6	61
25.5	110.55	0.7	63

26	112.12	0.8	64
26.5	113.68	0.9	66
27	115.25	1.0	68
27.5	116.82	1.1	69
28	118.38	1.2	71
28.5	119.95	1.3	73
29	121.51	1.4	75
29.5	123.08	1.5	76
30	124.64	1.6	78
30.5	126.21	1.7	80
31	127.78	1.9	81
31.5	129.34	2.0	83
32	130.91	2.1	85
32.5	132.47	2.2	86
33	134.04	2.3	88
33.5	135.60	2.4	90
34	137.17	2.5	92
34.5	138.74	2.6	93
35	140.30	2.7	95
35.5	141.87	2.8	97
36	143.43	2.9	98
36.5	145.00	3.0	100

Appendix CE

Final Conversion Tables Displaying Raw Scores, Standard Scores and Z-scores of Maltese Subtests, for Females

Table CE1

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Copy Neatly Subtest

Maltese Copy Neatly (Ikkopja Pulit) (WPM)	Standard Scores	Z-Scores	Percentile Rank
8.5	54.20	-3.1	2
9	55.94	-2.9	4
9.5	57.67	-2.8	6
10	59.41	-2.7	8
10.5	61.15	-2.6	9
11	62.88	-2.5	11
11.5	64.62	-2.4	13
12	66.35	-2.2	15
12.5	68.09	-2.1	17
13	69.83	-2.0	19
13.5	71.56	-1.9	21
14	73.30	-1.8	23
14.5	75.03	-1.7	25
15	76.77	-1.5	26
15.5	78.51	-1.4	28
16	80.24	-1.3	30
16.5	81.98	-1.2	32
17	83.72	-1.1	34
17.5	85.45	-1.0	36
18	87.19	-0.9	38
18.5	88.92	-0.7	40
19	90.66	-0.6	42
19.5	92.40	-0.5	43
20	94.13	-0.4	45
20.5	95.87	-0.3	47
21	97.60	-0.2	49
21.5	99.34	0.0	51
22	101.08	0.1	53
22.5	102.81	0.2	55
23	104.55	0.3	57
23.5	106.28	0.4	58
24	108.02	0.5	60
24.5	109.76	0.7	62

25	111.49	0.8	64
25.5	113.23	0.9	66
26	114.97	1.0	68
26.5	116.70	1.1	70
27	118.44	1.2	72
27.5	120.17	1.3	74
28	121.91	1.5	75
28.5	123.65	1.6	77
29	125.38	1.7	79
29.5	127.12	1.8	81
30	128.85	1.9	83
30.5	130.59	2.0	85
31	132.33	2.2	87
31.5	134.06	2.3	89
32	135.80	2.4	91
32.5	137.53	2.5	92
33	139.27	2.6	94
33.5	141.01	2.7	96
34	142.74	2.8	98
34.5	144.48	3.0	100

Table CE2

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Copy Quickly Subtest

Maltese Copy Quickly (Ikkopja Malajr) (WPM)	Standard Scores	Z-Scores	Percentile Rank
12	55.40	-3.0	2
12.5	57.06	-2.9	4
13	58.72	-2.8	5
13.5	60.38	-2.6	7
14	62.04	-2.5	9
14.5	63.69	-2.4	11
15	65.35	-2.3	13
15.5	67.01	-2.2	15
16	68.67	-2.1	16
16.5	70.33	-2.0	18
17	71.99	-1.9	20
17.5	73.65	-1.8	22
18	75.31	-1.6	24
18.5	76.97	-1.5	25
19	78.63	-1.4	27
19.5	80.29	-1.3	29
20	81.95	-1.2	31
20.5	83.61	-1.1	33
21	85.27	-1.0	35
21.5	86.92	-0.9	36
22	88.58	-0.8	38
22.5	90.24	-0.7	40
23	91.90	-0.5	42
23.5	93.56	-0.4	44
24	95.22	-0.3	45
24.5	96.88	-0.2	47
25	98.54	-0.1	49
25.5	100.20	0.0	51
26	101.86	0.1	53
26.5	103.52	0.2	55
27	105.18	0.3	56
27.5	106.84	0.5	58
28	108.50	0.6	60
28.5	110.15	0.7	62
29	111.81	0.8	64
29.5	113.47	0.9	65
30	115.13	1.0	67

30.5	116.79	1.1	69
31	118.45	1.2	71
31.5	120.11	1.3	73
32	121.77	1.5	75
32.5	123.43	1.6	76
33	125.09	1.7	78
33.5	126.75	1.8	80
34	128.41	1.9	82
34.5	130.07	2.0	84
35	131.73	2.1	85
35.5	133.38	2.2	87
36	135.04	2.3	89
36.5	136.70	2.4	91
37	138.36	2.6	93
37.5	140.02	2.7	95
38	141.68	2.8	96
38.5	143.34	2.9	98
39	145.00	3.0	100

Table CE3

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Copy from Board Subtest

Maltese Copy from Board (Ikkopja mill-Bord) (WPM)	Standard Scores	Z-Scores	Percentile Rank
6.5	55.03	-3.0	2
7	56.61	-2.9	3
7.5	58.19	-2.8	5
8	59.77	-2.7	7
8.5	61.35	-2.6	9
9	62.93	-2.5	10
9.5	64.51	-2.4	12
10	66.08	-2.3	14
10.5	67.66	-2.2	16
11	69.24	-2.1	17
11.5	70.82	-1.9	19
12	72.40	-1.8	21
12.5	73.98	-1.7	22
13	75.56	-1.6	24
13.5	77.14	-1.5	26
14	78.72	-1.4	28
14.5	80.29	-1.3	29
15	81.87	-1.2	31
15.5	83.45	-1.1	33
16	85.03	-1.0	34
16.5	86.61	-0.9	36
17	88.19	-0.8	38
17.5	89.77	-0.7	40
18	91.35	-0.6	41
18.5	92.93	-0.5	43
19	94.51	-0.4	45
19.5	96.08	-0.3	47
20	97.66	-0.2	48
20.5	99.24	-0.1	50
21	100.82	0.1	52
21.5	102.40	0.2	53
22	103.98	0.3	55
22.5	105.56	0.4	57
23	107.14	0.5	59
23.5	108.72	0.6	60
24	110.29	0.7	62
24.5	111.87	0.8	64

25	113.45	0.9	66
25.5	115.03	1.0	67
26	116.61	1.1	69
26.5	118.19	1.2	71
27	119.77	1.3	72
27.5	121.35	1.4	74
28	122.93	1.5	76
28.5	124.51	1.6	78
29	126.08	1.7	79
29.5	127.66	1.8	81
30	129.24	1.9	83
30.5	130.82	2.1	84
31	132.40	2.2	86
31.5	133.98	2.3	88
32	135.56	2.4	90
32.5	137.14	2.5	91
33	138.72	2.6	93
33.5	140.29	2.7	95
34	141.87	2.8	97
34.5	143.45	2.9	98
35	145.03	3.0	100

Table CE4

Raw Scores in WPM, Standard Scores and Z-scores of Maltese Free Writing Subtest

Maltese Free Writing (Kitba Kreattiva) (WPM)	Standard Scores	Z-Scores	Percentile Rank
3.5	54.04	-3.1	2
4	55.75	-2.9	4
4.5	57.46	-2.8	6
5	59.17	-2.7	7
5.5	60.88	-2.6	9
6	62.59	-2.5	11
6.5	64.29	-2.4	13
7	66.00	-2.3	15
7.5	67.71	-2.2	17
8	69.42	-2.0	19
8.5	71.13	-1.9	20
9	72.84	-1.8	22
9.5	74.54	-1.7	24
10	76.25	-1.6	26
10.5	77.96	-1.5	28
11	79.67	-1.4	30
11.5	81.38	-1.2	31
12	83.09	-1.1	33
12.5	84.80	-1.0	35
13	86.50	-0.9	37
13.5	88.21	-0.8	39
14	89.92	-0.7	41
14.5	91.63	-0.6	43
15	93.34	-0.4	44
15.5	95.05	-0.3	46
16	96.75	-0.2	48
16.5	98.46	-0.1	50
17	100.17	0.0	52
17.5	101.88	0.1	54
18	103.59	0.2	56
18.5	105.30	0.4	57
19	107.01	0.5	59
19.5	108.71	0.6	61
20	110.42	0.7	63
20.5	112.13	0.8	65
21	113.84	0.9	67

21.5	115.55	1.0	69
22	117.26	1.2	70
22.5	118.96	1.3	72
23	120.67	1.4	74
23.5	122.38	1.5	76
24	124.09	1.6	78
24.5	125.80	1.7	80
25	127.51	1.8	81
25.5	129.21	1.9	83
26	130.92	2.1	85
26.5	132.63	2.2	87
27	134.34	2.3	89
27.5	136.05	2.4	91
28	137.76	2.5	93
28.5	139.47	2.6	94
29	141.17	2.7	96
29.5	142.88	2.9	98
30	144.59	3.0	100

Appendix CF

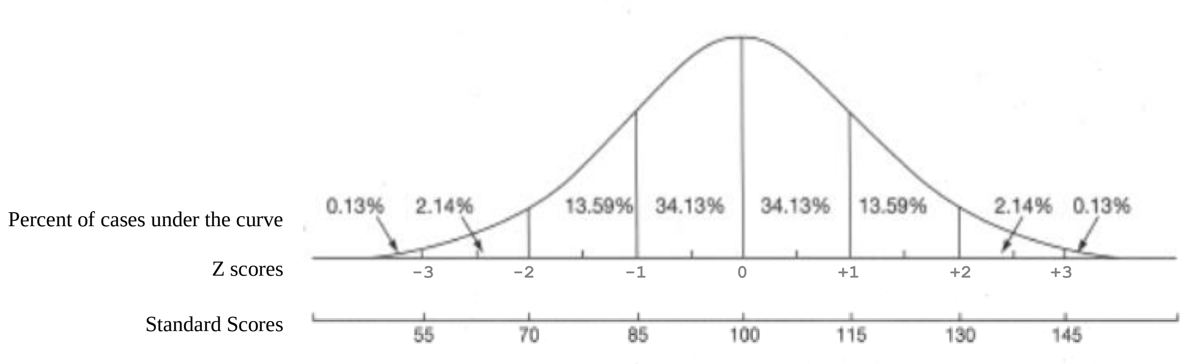
Instructions for Test Users on How to Interpret and Use the Standardised Tables

Since all the raw scores have a 0.5 scale, test users are to round their raw scores up or down and find the nearest raw score in the standardization tables. For instance, if the raw score at the *Free Writing* subtest is 15.4, this may be rounded up to 15.5. From the raw score, the Standard Score and the Z-score may be identified. For instance, if a student attained a raw score of 21.5 WPM in the English *Copy from the Board* Subtest (see Table BT4 in Appendix BT, highlighted), this is equivalent to a Standard Score of 105, and a Z-score of 0.3. This places the student slightl5y above the mean, which is indicated by the Z-score 0 (see Figure CF1). To determine the Z-score of a student in the English or Maltese assessment battery, testers refer to the tables in Appendix BU and BW, for the English and Maltese Total Scores, respectively. To determine the Z-score of a student in any of the English or Maltese subtests, testers refer to the tables in Appendix BT and BU, respectively.

Z-scores are useful in calculating percentile ranks. Percentile ranks allow the comparison of a participant's performance in relation to other candidates. On the scale in Figure CF1, if a student obtained a Standard Score of 85, then the Z-score is -1, and the percentile rank is approximatley 16% (0.13% + 2.14% + 13.59% = 15.86%). This imples that the student is amongst the bottom 16% of his peers (Logsdon, 2020; L. Camilleri, personal correspondence, July 13th, 2019). If a student's Standard Score is 130, then the Z-score is 2. So the percentile rank of the students is approximately 98% (0.13% + 2.14% +13.59% + 34.13% + 34.13% + 13.59% = 97.71%), implying that the student is among the top 2% of his peers.

Figure CF1

The Normal Curve and EMASH Standard Scores and Z-scores



Note: Source: Barnett et al., 2001

Appendix CG

Copy Speed Difference Between English *Copy Quickly* and English *Copy Neatly* Subtests

English Copy Quickly WPM	English Copy Neatly English WMP	Copy Speed Difference WPM
12.5	10.5	2
19.5	19	0.5
20	25.5	-5.5
20.5	16.5	4
21	19	2
22	17	5
22.5	18	4.5
22.5	19	3.5
22.5	20.5	2
22.5	24.5	-2
23	21.5	1.5
23	17.5	5.5
23	13.5	9.5
23.5	19	4.5
23.5	18.5	5
23.5	22	1.5
23.5	22.5	1
24	21	3
24	23.5	0.5
24.5	21.5	3
24.5	15	9.5
24.5	19.5	5
25	21.5	3.5
25	25	0
25.5	20.5	5
25.5	21	4.5
25.5	24.5	1
25.5	17.5	8
25.5	22	3.5
25.5	23	2.5
25.5	21.5	4
25.5	24	1.5
26	13	13
26	24	2
26	27.5	-1.5

26	23.5	2.5
26	25.5	0.5
26	18	8
26.5	24	2.5
26.5	25.5	1
26.5	21.5	5
26.5	22.5	4
27	18	9
27	25.5	1.5
27	25	2
27	21.5	5.5
27.5	28.5	-1
27.5	27	0.5
27.5	23	4.5
27.5	26	1.5
27.5	29	-1.5
27.5	23.5	4
27.5	22.5	5
27.5	21.5	6
28	20	8
28	22.5	5.5
28	26.5	1.5
28	18.5	9.5
28	28	0
28	24	4
28	25	3
28	22	6
28	23.5	4.5
28	21	7
28.5	19.5	9
28.5	21	7.5
28.5	24.5	4
28.5	30	-1.5
28.5	23	5.5
28.5	17	11.5
28.5	27	1.5
28.5	16.5	12
28.5	26	2.5
28.5	21.5	7
28.5	22	6.5
28.5	23.5	5

28.5	24	4.5
28.5	22.5	6
29	29	0
29	25	4
29	21.5	7.5
29	20.5	8.5
29	26.5	2.5
29	22	7
29	26	3
29	25.5	3.5
29	24	5
29.5	28	1.5
29.5	26.5	3
29.5	27.5	2
29.5	22	7.5
29.5	29.5	0
29.5	12.5	17
29.5	24.5	5
29.5	21.5	8
29.5	30	-0.5
29.5	27	2.5
29.5	26	3.5
30	20.5	9.5
30	26	4
30	29	1
30	23	7
30	28	2
30	31	-1
30	28.5	1.5
30	22.5	7.5
30	29.5	0.5
30	24	6
30	25	5
30	27.5	2.5
30.5	24	6.5
30.5	28.5	2
30.5	19.5	11
30.5	32	-1.5
30.5	27.5	3
30.5	26	4.5
30.5	23	7.5

30.5	21	9.5
30.5	30	0.5
30.5	25.5	5
31	25.5	5.5
31	23.5	7.5
31	30	1
31	36	-5
31	24	7
31	26	5
31	22.5	8.5
31	27	4
31	23	8
31.5	26.5	5
31.5	29.5	2
31.5	30	1.5
31.5	33	-1.5
31.5	30.5	1
31.5	20.5	11
31.5	28.5	3
31.5	25	6.5
32	25.5	6.5
32	26.5	5.5
32	30	2
32	28.5	3.5
32	29.5	2.5
32.5	29	3.5
32.5	31	1.5
32.5	24	8.5
32.5	27	5.5
32.5	26	6.5
32.5	18.5	14
33	31	2
33	29.5	3.5
33	22	11
33	27.5	5.5
33	32	1
33	28.5	4.5
33	29	4
33	27	6
33	23	10
33	15	18

33	30	3
33	25	8
33	24	9
33	32.5	0.5
33.5	26.5	7
33.5	26	7.5
33.5	27.5	6
33.5	33.5	0
33.5	30	3.5
33.5	29	4.5
33.5	29.5	4
34	30	4
34	27.5	6.5
34	32	2
34	29.5	4.5
34	26.5	7.5
34.5	26.5	8
34.5	31	3.5
34.5	38.5	-4
34.5	26	8.5
34.5	27.5	7
35	26.5	8.5
35	31.5	3.5
35	29.5	5.5
35	32	3
35	33	2
35	19	16
35	29	6
35	27.5	7.5
35.5	24.5	11
35.5	32	3.5
35.5	30	5.5
35.5	32.5	3
35.5	22	13.5
35.5	25.5	10
35.5	37.5	-2
35.5	26	9.5
35.5	33.5	2
35.5	28.5	7
36	31.5	4.5
36	31	5

36	29	7
36	28.5	7.5
36	35	1
36	30	6
36	21.5	14.5
36.5	29.5	7
36.5	28.5	8
36.5	33.5	3
36.5	24	12.5
36.5	34	2.5
36.5	33	3.5
36.5	20.5	16
36.5	27	9.5
36.5	22.5	14
36.5	35.5	1
36.5	29	7.5
36.5	30	6.5
37	33.5	3.5
37	30	7
37	34	3
37	41.5	-4.5
37	33	4
37	36	1
37	24	13
37	32.5	4.5
37	29	8
37.5	31	6.5
37.5	28.5	9
37.5	33	4.5
37.5	30.5	7
37.5	37	0.5
37.5	31.5	6
37.5	32.5	5
37.5	34	3.5
37.5	25.5	12
37.5	36	1.5
37.5	34.5	3
37.5	33.5	4
38	16	22
38	33.5	4.5
38	31	7

38	32.5	5.5
38	36.5	1.5
38.5	37	1.5
38.5	36	2.5
38.5	37.5	1
38.5	38	0.5
38.5	35	3.5
38.5	28.5	10
38.5	21	17.5
39	34.5	4.5
39	31	8
39	32.5	6.5
39	37	2
39	29.5	9.5
39	27	12
39.5	35.5	4
39.5	22	17.5
39.5	37.5	2
39.5	33.5	6
39.5	30.5	9
39.5	32	7.5
40	27	13
40	34.5	5.5
40	34	6
40	33	7
40	28.5	11.5
40.5	40.5	0
40.5	34	6.5
40.5	37.5	3
40.5	30.5	10
40.5	39	1.5
41	33	8
41	37	4
41.5	34	7.5
41.5	33	8.5
42.5	34.5	8
42.5	39.5	3
42.5	33	9.5
43	41	2
43	39	4
43	38.5	4.5

44	34.5	9.5
44	38	6
44.5	31.5	13
44.5	33	11.5
45	30	15
46	40.5	5.5
50.5	39	11.5
56	31	25

Appendix CH

Copy Speed Difference Between Maltese *Copy Quickly (Ikkopja Malajr)* and Maltese *Copy Neatly (Ikkopja Pulit)* Subtests

Maltese Copy Quickly (Ikkopja Malajr) WPM	Maltese Copy Neatly (Ikkopja Pulit) WMP	Copy Speed Difference WPM
10	10	0
12	13.5	-1.5
12.5	10.5	2
13	13.5	-0.5
15	19.5	-4.5
16	12	4
16	13	3
16.5	10.5	6
16.5	15	1.5
16.5	14.5	2
16.5	18	-1.5
16.5	23	-6.5
16.5	12	4.5
17	15.5	1.5
17	13	4
18	17.5	0.5
18	15	3
18	13	5
18	18	0
18	13.5	4.5
18	12.5	5.5
18	16.5	1.5
18	16	2
18.5	14	4.5
18.5	18	0.5
18.5	19.5	-1
18.5	16.5	2
18.5	13.5	5
19	15	4
19	14.5	4.5
19	18	1
19.5	12	7.5
19.5	21	-1.5
19.5	16	3.5
19.5	15.5	4
19.5	21.5	-2

19.5	14.5	5
19.5	17	2.5
19.5	18.5	1
19.5	18	1.5
20	18	2
20	13.5	6.5
20	9.5	10.5
20	15.5	4.5
20	20	0
20	11.5	8.5
20.5	20.5	0
20.5	19.5	1
20.5	15	5.5
20.5	13.5	7
20.5	17	3.5
20.5	18.5	2
21	17	4
21	18	3
21	19.5	1.5
21	16.5	4.5
21	19	2
21	20	1
21.5	17	4.5
21.5	19.5	2
21.5	20.5	1
21.5	18.5	3
21.5	16.5	5
21.5	18	3.5
21.5	22.5	-1
21.5	11	10.5
22	22.5	-0.5
22	18	4
22	19	3
22	15	7
22	21	1
22.5	19.5	3
22.5	16.5	6
22.5	20.5	2
22.5	17.5	5
22.5	21	1.5
22.5	16	6.5
22.5	22.5	0
23	19.5	3.5

23	20.5	2.5
23	23.5	-0.5
23	20	3
23	18.5	4.5
23	24.5	-1.5
23	23	0
23	17.5	5.5
23.5	22.5	1
23.5	18.5	5
23.5	24	-0.5
23.5	20	3.5
23.5	19.5	4
23.5	18	5.5
23.5	22	1.5
23.5	23	0.5
24	23	1
24	24	0
24	20.5	3.5
24	19.5	4.5
24	15.5	8.5
24	24.5	-0.5
24	18.5	5.5
24	18	6
24	21	3
24	14	10
24	19	5
24	25.5	-1.5
24	20	4
24	22.5	1.5
24	21.5	2.5
24	14.5	9.5
24	13	11
24	22	2
24.5	20.5	4
24.5	23	1.5
24.5	13	11.5
24.5	24	0.5
24.5	22	2.5
24.5	22.5	2
24.5	17	7.5
24.5	26	-1.5
24.5	16	8.5
24.5	21	3.5

25	20	5
25	18	7
25	23.5	1.5
25	21	4
25	22.5	2.5
25	19.5	5.5
25	16.5	8.5
25.5	22.5	3
25.5	20	5.5
25.5	19.5	6
25.5	23.5	2
25.5	23	2.5
25.5	18.5	7
25.5	22	3.5
25.5	19	6.5
25.5	21.5	4
25.5	21	4.5
25.5	24	1.5
26	21	5
26	19	7
26	23	3
26	22.5	3.5
26	19.5	6.5
26	25.5	0.5
26.5	22	4.5
26.5	24.5	2
26.5	23	3.5
26.5	18	8.5
26.5	28.5	-2
26.5	22.5	4
26.5	24	2.5
27	24	3
27	21	6
27	22	5
27	30	-3
27	25	2
27	19.5	7.5
27	26.5	0.5
27	12.5	14.5
27	22.5	4.5
27	29.5	-2.5
27.5	21	6.5
27.5	23	4.5

27.5	25	2.5
27.5	32	-4.5
27.5	24.5	3
27.5	26	1.5
27.5	18	9.5
27.5	24	3.5
27.5	19.5	8
27.5	22.5	5
27.5	20.5	7
27.5	20	7.5
28	22.5	5.5
28	15.5	12.5
28	27.5	0.5
28	24.5	3.5
28	23	5
28	26	2
28.5	22.5	6
28.5	23	5.5
28.5	22	6.5
28.5	24	4.5
28.5	21.5	7
28.5	25	3.5
29	22.5	6.5
29	18.5	10.5
29	23.5	5.5
29	25	4
29	26	3
29	24	5
29	27	2
29	25.5	3.5
29	27.5	1.5
29	20	9
29.5	26	3.5
29.5	25.5	4
29.5	24	5.5
29.5	23	6.5
29.5	25	4.5
30	25.5	4.5
30	22.5	7.5
30	24	6
30	28	2
30	28.5	1.5
30	29.5	0.5

30	27.5	2.5
30	22	8
30.5	29	1.5
30.5	26.5	4
30.5	25	5.5
30.5	22.5	8
30.5	20.5	10
31	28	3
31	26.5	4.5
31	18.5	12.5
31	25.5	5.5
31	26	5
31.5	28	3.5
31.5	22.5	9
31.5	25.5	6
31.5	25	6.5
32	25	7
32	24.5	7.5
32.5	24.5	8
32.5	28.5	4
32.5	30	2.5
32.5	27	5.5
33	27	6
33.5	31.5	2
33.5	28	5.5
33.5	28.5	5
34	30	4
34.5	28.5	6
34.5	30.5	4
34.5	30	4.5
35.5	31.5	4
36	27.5	8.5

Appendix CI

In order to have a cross-sectional representation, free-writing samples of a male and a female participant from each school were selected randomly (see Table CI1). The researcher tried to select the same written content for each participant. This was possible, as though the titles of the *Free Writing* samples were different (*My Life* in English and *Xi Nħobb Nagħmel* (What I like to Do) in Maltese), the writing prompts were similar, thus permitting participants to write equivalent content.

Table CI1

Selected Free Writing Samples used for a Morpheme Count in English and Maltese

School Type	Language	Gender	Free Writing sample	Transcript	No. of words	No. Of Morphemes
Girls' church school	English	Female	I don't like dancing or singing though I like to listen to music, modern music. I love sports I love athletics and volleyball. I have a sister, Illona and my mum and dad.		33	37
	Maltese		Jien ma nħobbx la nkanta jew niżfen, iżda nħobb ħafna l-isport bħal l-atletika u għawm. Jien għandi oħti kbira jisimha Illona niġġieldu ħafna iżda nħobbu lil xulxin.	*I don't like singing or dancing, but I like sports, like athletics and swimming. I have an elder sister called Illona we quarrel a lot but we love each other.*	29	43

Boys' church school	English	Male	My hobby is football. I like to play football with my friends at school. I watch sports on the television and the most sports that I watch is football.		29	32
	Maltese		Jien inħobb ħafna nilgħab il-futbol huwa l-passatemp favorit tiegħi. Nara ħafna futbol fuq it-televizjoni u l-aktar tim għal qalbi huwa t-tim tal-Barċellona.	*I love playing football it's my favourite passtime. I watch a lot of football on televison and my favourite team is Barcellona.*	28	37
State school	English	Female	In the holidays I like to go abroad and visit a new country. During the holidays I like to spend time with my family and friends.		26	29
	Maltese		Fil-vaganzi jien inħobb noqgħod fuq il-kompjuter u nilgħab ukoll ikun hemm drabi li nsiefer. Jien inħobb insiefer ħafna speċjalment mal-familja. Nixtieq inmur l-Ingilterra.	*During my holidays I like to play on my computer and there are times when I go abroad. I like to go aborad a lot, especially with my faimily. I would like to go to England.*	27	41
	English	Male	My hobbies are playing along with my pets and playing football and basket ball. My pets are Browney the dog and Mikey and Kitty my cats.		26	31
	Maltese		Il-passatempi tiegħi huma li nilgħab ma l-animali, futbol u basketball. Jien l-annimali kienu jogħġbuni minn	*My hobbies are playing with animals, football and basketball. I have always liked animals and*	26	44

			dejjem u kont ħadt grazzja speċjalmet mal-klieb.	*I fell in love particularly with dogs.*		
Independent school	English	Female	In the weekend I like to relax by watching TV or reading but as the ‘O’ levels are close by all I’am doing is studing, doing homework and read.		29	35
	Maltese		It-tmiem il-ġimgħa tiegħi inħobb nirrilassa ftit billi naqra xi ktieb t’avventura imma sfortunatament ta l-*mocks* qedin joqorbu ftit li xejn qeda nirrilassa. Minflokk nistudja u nagħmel ix-xogħol tad-dar.	*On weekends I like to relax a little by reading an adventure book but unfortuantlly becasue the mocks are approaching I relax very little. Instead I study, and do my homework.*	33	48
	English	Male	My family consists of 4 people: mum, dad, brother and I. My favourite hobbies are football and handball and I like listening to music. My favourte band is the Chainsnakers.		30	33
	Maltese		Jien inħobb nilgħab il-futball u l-basketball. Inħobb nisma l-musika u l-grupp favorit tiegħi huma Chainsnakers. Jien il-familja tiegħi qedin erbgħa, jien, ommi, misieri u ħija.	*I like playing football and basketball. I like listening to music and my favourite group is Chainsnakers. My family we are four, me, my mother, my father and my brother.*	30	42

Appendix CJ

Mean Length Utterance (MLU) Index – Maltese

Nouns

In cases where a noun can be both masculine and feminine, the masculine-singular noun is considered the base form and the feminine and plural forms (which are derived from the masculine-singular) have been considered marked forms. The addition of the morpheme denoting number or gender is counted.

Table CJ1

Method for Counting Change in Nouns

Singular (base) form	Number of morphemes counted	Plural form	Number of morphemes counted
dar (house)	1	djar (houses)	house+ plural = 2 morphemes
tifel (boy)	1	tifla (girl)	boy + feminine = 2 morphemes

Adjectives

The masculine/feminine singular adjective is considered the base form, and their plural forms are considered marked forms. The same process is applied for change in gender.

Table CJ2

Method for Counting Change in Adjectives

Singular (base) form	Number of morphemes counted	Derived form	Number of morphemes counted
ikrah (ugly)	1	koroh (plural)	ugly + plural = 2 morphemes
ikrah (masculine)	1	kerha (feminine)	ugly + feminine = 2 morphemes

In the case of degree, such as sabiħ, isbaħ, l-isbaħ (nice, nicer, nicest) the change from the first to the second degree is taken into consideration.

Table CJ3

Method for Counting Degree in Adjectives

Base form	Number of morphemes counted	First change in degree	Number of morphemes counted	Second change in degree	Number of morphemes counted
twil (tall)	1	itwal (taller)	2	l-itwal (tallest)	3

Verbs

For the present, person is being counted in all the cases since it is a distinguishing factor for all persons. Number for the first, second and third person singular is not being counted, but it is being counted for first, second and third person plural since it is a distinguishing factor. Gender for third person singular is being considered marked since it is a distinguishing factor for the masculine and feminine forms.

For the past, person, number and gender are marked as for the present, but the past is also counted. For the future, person, number and gender are marked as for the present, but the future is also counted. For the present continuous, person, number and gender are marked as for the present, but the present continuous is also counted.

Table CJ4

Method for Verbs

Singular (base) form	Explanantion	Number of morphemes counted
nagħmel (I do)	għamel (to do) + person (1st person)	2 morphemes
tagħmel (she does)	għamel (to do) + person (3rd person) + gender (female)	3 morphemes
għamel (he did)	għamel (to do) + person (3rd person) + gender (female) + time (past)	4 morphemes
għamlu (they did)	għamel (to do) + person (3rd person) + number (plural) + time (past)	4 morphemes
se tagħmel (you will do)	għamel (to do) + person (2nd person) + time (future)	3 morphemes
se nagħmlu (we will do)	għamel (to do) + person (3rd person) + number (plural) + time (future)	4 morphemes
qed nagħmel (I am doing)	għamel (to do) + person (1st person) + time (future)	3 morphemes
qed nagħmlu (we are doing)	għamel (to do) + person (1st person) + number (plural) + time (future)	4 morphemes

Objects

The object is the thing/person that the action is done to. In Maltese, the object (masculine singular, feminine singular and plural) is commonly presented attached to the verb. The object can be marked for gender, number and person. In the case of number, the singular is being taken as the unmarked form and only the plural morpheme is counted. The object is here marked for plural. In the case of gender, both the masculine and the feminine object are being considered marked, because one has to be aware of the gender of the direct object to use the correct form. In the case of person, since the object is always in the 3rd person, it is being considered as unmarked.

Table CJ5

Method for Counting Objects Linked to Verbs

Example	Explanation	Number of morphemes counted
nagħmilha (I will do it)	għamel (base form) + pronoun + gender (feminine)	3 morphemes (number for 1st person singular is not counted)
nagħmluha (we will do it)	għamel (base form) + person (1st person plural) + pronoun + gender (feminine)	4 morphemes
jagħmluha (they will do it)	għamel (base form) + person (3rd person plural) + pronoun + gender (feminine)	4 morphemes
jagħmluh (they will do it)	għamel (base form) + person (3rd person plural) + pronoun + gender (masculine)	4 morphemes
tagħmilhom	għamel (base form) + pronoun number (plural)	3 morphemes (number for 2nd person singular is not counted)
jagħmluhom (they will do them)	għamel (base form) + person (3rd person plural) + pronoun + number (plural)	5 morphemes

Pronouns

In the case of personal pronouns and demonstrative pronouns, the personal pronouns I and you are considered the base forms. The change in gender and number are counted. In the third person singular (he & she), masculine and feminine are distinguished, and therefore the morpheme is counted. Number (as in we, you - pl., they) is a distinguishing factor in first, second and third person plural, and is therefore also counted.

Table CJ6

Method for Counting Morphemes for Personal and Demonstrative Pronouns

Class	Example	Explanation	Number of morphemes counted
personal pronoun	int (you)	you	1 morpheme (number for 1st person singular is not counted)
personal pronoun	aħna	we + plural	2 morphemes
demostrative pronoun	din	this + feminine	2 morphemes
demostrative pronoun	dawn	those + plural	2 morphemes

In the case of suffixed pronouns (with nouns and with verbs), both the noun and the pronoun are counted. The gender and number represented by the morpheme are also counted. For the pronoun, the singular is considered the base form, so the change in number is counted.

In the case of gender, both masculine and feminine are counted since one must clearly distinguish between the two to use the right morpheme.

Table CJ7

Method for Counting Morphemes for Suffixed Pronouns

Example	Explanation	Number of morphemes counted
xagħri (my hair)	hair + pronoun	2 morphemes (number for 1st person singular is not counted)
idha (her hand)	hand + pronoun + gender	3 morphemes (number for 3rd person singular is not counted)
djarna (our houses)	house + number (plural) + pronoun + person (3rd person plural)	4 morphemes

Other Classes

In the case of prepositions, articles, negatives, pronouns and interrogatives, the meanings represented by every word or morpheme is counted.

Table CJ8

Method for Counting Morphemes for Prepositions, Articles, Negatives, Pronouns and Interrogatives

Class	Example	Explanation	Number of morphemes counted
preposition + noun	ma' kelb	with + dog	2 morphemes
preposition + article + noun	mal-kelb	with the dog	3 morphemes

prepositions + pronoun	miegħi (with me)	with + pronounoun	2 morphemes (number for 1st person singular is not counted)
prepositions + pronoun	magħna (with us)	with + pronounoun + number (plural)	3 morphemes
negative	ma tistax (I cannot)	ma + tista’ (base form) = negative	3 morphemes (number for 2nd person singular is not counted)
negative	ma jistgħux (they cannot)	ma + tista’ (base form) + negative + number (plural)	4 morphemes
interrogatives	x’inhu	to be (base form) + question + gender (masculine)	3 morphemes
interrogatives	x’inhi	to be (base form) + question + gender (feminine)	3 morphemes