

Enhancing Adults' Maltese Language Learning Through an App Powered by Game and Mobile-Based Learning


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Research Article

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Abstract

Adult brains are more implicit, lack neuroplasticity and hence, are less capable of change and new learning than children, who have a sponge-like approach to acquiring knowledge and information, making learning a second language (L2) more challenging in adulthood. In the digital era, game and mobile-based learning are fundamental tools for assisting adults to acquire an L2. The EULALIA (**E**nhancing **U**niversity **L**anguage courses with an **A**pp powered by game-based **L**earning and tangible user **I**nterfaces **A**ctivities) project aimed to enhance the learning methodologies of four university language courses for Erasmus students in Italy, Malta, Poland and Spain by developing innovative and effective learning tools based on mobile and game-based learning paradigms, and the use of tangible user interfaces. This study focuses on Malta by providing an in-depth view of the impact of game-based applications on enhancing international adult learning of Maltese as a second language (ML2). The findings are set to encourage international adult students in learning ML2 through the game-based application to aid in increasing cultural awareness and better communication with the locals. As part of the methodology, pre-surveys and post-surveys were used on a test group comprising of 28 pre-surveyed and nine post-surveyed ML2 adult learners who used the app, and a reference group of 24 pre-surveyed and 23 post-surveyed ML2 learners who did not. The results revealed that game-based learning improved cognitive function since the learners were more engaged in language activities, thereby promoting the ability to process and absorb a wider range of information.

Introduction

The phrase ‘information technology’ (IT), in its contemporary definition, first appeared in a 1958 article published in the Harvard Business Review (Leavitt & Whisler, 1958). The invention of IT was a major turning point in the history of education. Game and mobile-based learning have contributed to a world-changing effect within the realm of systematic instruction and acquisition of knowledge (Braun, März, Mertens & Nisser, 2020).

The advent of the digital era introduced new modes of teaching as a means to keep up with the growing need and use of digital technologies (Braun et al., 2020). As a result, educators and software engineers have combined to produce learning applications to improve the overall teaching process and work shoulder to shoulder with the ever-growing use of IT.

The EULALIA (**E**nhancing **U**niversity **L**anguage courses with an **A**pp powered by game-based **L**earning and tangible user **I**nterfaces **A**ctivities) project aimed to improve the teaching techniques of four university language courses for Erasmus students in Italy, Malta, Poland and Spain by designing advanced and efficient learning tools based on mobile-based learning and game-based learning frameworks, as well as the use of tangible user interfaces. The current research focuses on the benefits and applications of game and mobile-based technology, more specifically for international adult learners of Maltese as a second language (ML2). This article will cover a summary of the research and supporting evidence regarding game-based learning, a review of methodology to analyse the feasibility of game-

based technology, an analysis based on the findings, recommendations for future applications and an app review.

Background Information

Digital game-based language learning has revolutionised learning and numerous cutting-edge applications have been developed for online gaming and have been assimilated for second-language (L2) learning. Game-based learning techniques take on two forms, namely traditional or digital games. Traditional games engage learners within the real-life setting. Digital games apply IT to attain desirable learning outcomes and higher levels of achievement (Zeynep, 2018). This study focuses on digital game-based applications for second-language acquisition (SLA) as a means to offset adults' challenges experienced in learning ML2 (Żammit, 2021a; Żammit, 2021b) or any other L2.

Literature Review

Definition

Game-based learning encompasses utilising gaming principles and directly applying them to real-life activities and settings to engage the end-users. According to Hartt, Hosseini and Mostafapour (2020), game-based learning is an emergent learning technique that has the capacity to increase student motivation, emotional engagement and enjoyment. Students engage in more active learning and the theory and practice of gamification are more suited within the education sector as far as planning and teaching are concerned.

Game-based teaching provides a deeper emphasis on guided discovery (Hartt et al., 2020). The active environment created by gaming applications alludes to practising the right way to do things; hence, creating an effective learning approach (Papadakis, 2018). Student motivation plays a fundamental role in knowledge acquisition, especially when it comes to learning a new language in adulthood. Attracting and maintaining student motivation is one of the main challenges for teachers in a traditional classroom setting. This approach to teaching allows adult learners to explore the relevant aspects of gaming concepts in a learning context formulated by the accordant educators. The digital gaming platforms provide and create virtual environments that are familiar and can easily be translated into real-life environments. According to Molin (2017), game-based learning is designed to strike a balance between the subject matter, content to be learned, gameplay and the future capacity for the user to retain and apply information in the real-world setting. These cognitive capabilities are very important for adult learners especially in retaining and applying the new L2 knowledge that is being learned (Żammit, 2021a; Żammit, 2021b).

Advantages of Game and Mobile-Based Learning

Digital games have been associated with improved language acquisition because games provide a vehicle for learners to improve their comprehension skills (Hung, Yang, Hwang, Chu & Wang, 2018).

Gamifying language acquisition facilitates language self-efficacy and enhances mastery of a language (Dixon, Dixon & Jordan, 2022). Research on this topic shows that interactive and entertaining games effectively promote language acquisition, especially when the in-game interactions seem authentic.

Mobile-based digital language learning can be applied to older adults (Blume, 2020). Learners are expected to benefit significantly from improved working memory, a wider vocabulary and self-confidence in expressing themselves in the L2 as a result of practice and cues from mobile-based applications (Klimova, 2020). Furthermore, comprehension is one of the main factors that contributes to effective SLA (Qureshi & Aljanadbah, 2021). Games enhance language learners' ability to understand the meaning of different words, phrases, word units and sentences in a more interactive and engaging manner (Purgina, Mozgovoy & Blake, 2019). Gaming applications for learning promote language comprehension in terms of the different elements used in spoken and written language as they provide the building blocks for word forms and sentences (Purgina et al., 2019).

Oral and written communication plays a vital role in teaching and learning. L2 communication skills involve active listening, speaking, reading and writing. These skills serve as the foundation that assists in expressing thoughts, information and feelings in some cases (Abdikarimova, Tashieva, Tashbolot kyzy & Abdullaeva, 2021). Game-based tasks support collaborative learning through socialisation and active participation amongst language learners (Kukulska-Hulme & Viberg, 2018). Communication skills are enhanced through prompt feedback and peer coaching that creates an avenue for collaboration in game-based language learning. The digital application enables learners to achieve constructive dialogue on their own and amongst their peers, improving mastery of the L2 and thoughtful communication.

Orthographic awareness in language learning contributes to the development of word-specific representations in memory (Zarić, Hasselhorn & Nagler, 2021). Orthography defines the recognition of similar letter patterns, positions and combinations that create words and word groups. Orthographic awareness provides the underpinnings for spellings and sounding words. Mobile game-based interventions allow the development of phonics, which in turn have a positive effect on orthographic skills (Holz, Beuttler & Ninaus, 2018). Innovative technology is used in game-based learning to enhance orthography skills. According to Soltanlou, Jung, Roesch, Ninaus, Brandelik, Heller and Moeller (2017), games promote individual learning and reveal promising learning effects, more specifically for orthography.

Understanding semantics is a fundamental pillar in learning an L2 (Fernández-Fontecha, 2021). Interpretation of words, phrases, symbols and sentences comprises semantics, logic and references. The grasp of semantics improves a learners' ability to understand the contexts of words, sentence relationships, word meanings and discourse (Alsayed, 2019). Game-based learning reinforces semantics and allows the mastery of an L2 (Idris, Said & Tan, 2020). Game-based learning applications provide an enjoyable and effective environment through visual images that represent semantic concepts such as vocabulary, making L2 teaching more effective (Gozcu & Caganaga, 2016). Research on online game-

based platforms showcased proof of concept as an effective and engaging way for L2 learners to understand semantics (Usai, O'Neil & Newman, 2017).

Game-based learning improves memory capacity as it provides longer-lasting benefits for cognitive processes (Chang, Warden, Liang & Lin, 2018). Memory allows for encoding, storing and retrieval of information (Chang et al., 2018). Memory possesses a three-pronged significance in language learning. Working memory contributes to language comprehension, language production and vocabulary acquisition (Schwering & MacDonald, 2020). Game-based learning contributes to improvements in working memory. According to Wu and Huang (2017), mobile and game-based tools enhance memory and familiarity with the language while instilling both motivation and interest in the language. Learning through games thereby provides a visual interface that boosts the formation and maintenance of memories. Learners are fortified with the language knowledge for a longer period of time (Wu & Huang, 2017).

Xu, Banerjee, Ramirez, Zhu and Wijekumar (2019) purport that teachers utilise commercial online games for language-learning purposes because such tools are formulated specifically for the achievement and understanding of predetermined language skills and offer platforms that combine the pedagogical and gaming. Pedagogy comprises the techniques educators use to pass on information to learners both theoretically and practically. Game-based learning platforms allow teachers to gain benefits from both traditional and digital techniques of teaching, creating lasting and synergistic benefits for both parties, which is the teacher and the learner. Learners are exposed to the language from two different perspectives, reinforcing what is learned in the traditional classroom setting (Xu et al., 2019).

Digital learning games lay the groundwork that fosters a socio-cognitive process for L2 acquisition. According to Dowell, Nixon and Graesser (2019), learning is a social process that can be enhanced through game-based learning. Game-based learning platforms integrate a process that goes beyond the traditional domains of engagement through the promotion of the participatory learning approach through the provision of feedback. This point of view places SLA under the situated cognition theory, which argues that learning takes place in a context, which happens when learners are able to solve a problem (Auer & Tsiatsos, 2020). Through digital games, learners are able to solve problems that are embedded in the gaming challenges as they approach the game with the language used in the game and the learning outcomes in mind. Moreover, games provide learners with authentic content, especially when such games are created specifically for SLA. Content formation plays a critical role in the absorption and regurgitation of information relating to a new language (Short, 2017).

According to Coleman and Money (2020), digital gaming and learning platforms provide for the integration of reflective thinking and problem-solving skills in the learning process, thereby imparting learners with the opportunities to learn an L2 and improve their information communication technology (ICT) skills. This concept is based on the fact that educational pressures around the world are compelling learners to learn for the sake of global competitiveness, which means that it is no longer enough to learn just to perform well in examinations but also to gain skills that can increase one's competitiveness in the

global arena. As such, digital games increase the ICT literacy of learners while increasing their language-learning skills to meet the fundamental goals of effective learning (Coleman & Money, 2020).

Digital game-based learning creates a wider range of interactive negotiations, thereby allowing students to gain opportunities for accessing numerous comprehensible inputs, improving L2 acquisition. Breien and Wasson (2021) suggest that game-based learning has a positive effect on engagement since learners are motivated by the interfaces and design of the games based on likes and preferences, gaming habits and informational interests. This technology provides learners with more opportunities for the negotiation of their social learning contexts and interactive communication, compared with the traditional language-learning setting provided by classrooms (Breien & Wasson, 2021).

Reinders (2017) explains that utilising digital games has a direct influence on the number of behavioural, cognitive, perceptual, motivational and effective outcomes in learners. Additionally, studies reveal the positive effects of digital-based learning on the motivations of learners and their willingness to use the target language for socialisation, their willingness to communicate and other elements (Reinders, 2017).

According to Alyaz and Genc (2016), digital game-based language learning has changed language-learning contexts as millions of applications have been developed for online gaming activities in both mobile and web versions, some of which are integrated for SLA processes. Globalisation and the advancement of technology globally have also increased the demand for SLA, which necessitates innovative and inspiring teaching and learning methods stimulated by various technological applications to meet the ever-increasing demand (Aqib, Eugster, Ho, Jaumotte, Osorio-Buitron & Piazza, 2018). The global arena provides an avenue for the use of online game-based learning as a means to connect various learner groups and teachers. Video games are examples of game-based learning that are not only entertaining but also have exciting features that are able to motivate and lure players to play more; hence, they can be utilised by language educators to enhance learning motivation (Anastasiadis, Lampropoulos & Siakas, 2018).

The implementation of IT has been reported to be the solution to the majority of challenges that are currently being experienced in the educational sector and especially in terms of language learning. With the adoption of game-based learning in the SLA context, the learners' needs are assessed, including consideration of the materials to purchase, distribution of the course content and materials, and development of educational games (Hung et al., 2018). In this context, the majority of schools depend on commercially produced games, and they are specifically designed to ensure the achievement of specific learning outcomes according to the levels of the learners. There are also digital games that use IT for the purpose of promoting the achievement of the desired learning outcomes (Anastasiadis, Lampropoulos & Siakas, 2018).

Disadvantages of Game and Mobile-Based Learning

The complexity of the game and mobile-based learning applications poses a threat that may stifle positive educational outcomes for students. Users may become heavily focused on the working of the

software rather than the main goal, in this case, L2 learning. Games could present a distraction that takes away from the pedagogical process, putting language learners in a worse position than where they were in their L2 level (Ebrahimzadeh & Alavi, 2017). According to Akçayır M. and Akçayır G. (2017), a large number of challenges come about as a result of the difficulty in using game-based learning applications. The level of complexity of game-based applications instils a potential pitfall for the language-learning process.

From a financial standpoint, computer games are expensive to develop, purchase, use and maintain. Additionally, materials required to use learning software can be costly and constantly require consistent technical support that is compounded in the long run (Fotaris, Pellas, Kazanidis & Smith, 2017). Over time, the costs associated with game-based applications become too expensive for institutions, teachers or students to bear. Game-based learning requires a high cost to run a myriad of learning activities, which constantly require expensive learning materials (Fotaris et al., 2017). Institutions are opposed to game-based learning as it requires additional human and non-human resources (Pinto & Ferreira, 2017). The application of large-scale digital games for students remains an expensive prospect for most schools, especially for L2 learning. Zhang, Zhang, Chang, Aziz, Esche and Chassapis (2018) purport that game-based applications in the educational domain are still a rather expensive proposition to produce and maintain. Evidence suggests that game-based learning is not yet fully acceptable within mainstream education since its integration and utility are expensive (Shi, Wang & Ding, 2019).

The use of game and mobile-based learning for language promotes the creation of a digital divide. Learning software applications possess the potential to create a huge rift between students who have access to computers and digital networks and those who do not. Game-based learning platforms require consistent access to modern information and communications technology for their use (Walker, Hefner, Fareed, Huerta & McAlearney, 2020). As such, an element of social inequality is created since digital resources for learning cannot be distributed evenly to all learners. Regional and demographic differences have a direct effect on learning due to the digital divide created through game-based language-learning applications (Chen, Liu & Huang, 2019). Walker et al. (2020) explain that game-based learning applications may contribute to the expansion of the digital divide.

Game-based learning is centred on key features ranging from learning in varying and attractive scenarios, overcoming various problems to creating a positive and interesting environment (Govender & Arnedo-Moreno, 2021). Thus, the development of efficient and effective digital learning platforms requires considerable time and financial investment. Digital gaming applications require the intake of a collection of articles, videos and traditional classroom concepts and merging all the relevant factors with gaming principles. According to Govender and Arnedo-Moreno (2021), digital game-based language learning involves the use of feedback, themes and points that boost vocabulary acquisition and retention for learners. As a result, formulators encounter deficiencies in efficacy patterns due to the large amounts of information received and utilised in the development stages, calling for the use of error detection that slows down and creates a more tedious game creation (Govender & Arnedo-Moreno, 2021).

Application of Tangible and Non-Tangible User Interface Activities in SLA

A tangible user interface (TUI) is a digital user interface whereby an individual interacts directly with the physical environment and physical objects. According to Bong, Chen and Bergland (2018), TUIs play a major role in providing both physical representations and controls necessary for the interaction of digital information. On the flip side, non-tangible user interaction does not include a physical presence, and the user cannot physically touch and interact directly with the software application. Suhardi and Rizkavirwan (2021) explain that non-tangible elements of interaction are commonly utilised in creating a virtual application with the intention to provide a response without physical contact.

TUIs allow the user to manipulate physical objects, enhance learning initiatives as they promote active learning, student engagement, multisensory and collaborative interaction when used alongside traditional classroom teaching (De Raffaele, Smith, Gemikonakli & Nygaard, 2017). TUIs have attracted widespread interest but have not yet been implemented widely for learning due to a gap in research and knowledge (De Raffaele et al., 2017). Theoretical perspective points towards the beneficial nature of merging physical interaction with learning as a means of creating deeper learning that students can use to supplement classroom learning. According to Jafri, Aljuhani and Ali (2017), the learning process is improved through the spatial awareness that TUIs create for concepts and subconcepts. Spatial awareness is critical for L2 adult learning as it provides the cognitive triggers that enhance SLA (Korman, Weiss, Hochhauser & Kizony, 2019). Jafri et al. (2017) point out that TUIs reinforce the elements of spatial awareness and shape the perception necessary for language learning.

The EULALIA initiative, founded in 2019, integrates elements of TUIs as a means to create and improve international language learning for adults. This initiative merges the concepts of mobile and game-based learning with TUIs as part of a methodology which in turn promotes the development of observable output. The outputs include the development of TUIs and mobile-based learning for use in SLA production of authoring tools for previously developed interfaces, creation of hybrid games and applications for SLA, creation of a multi-linguistic library of applications, and promoting creativity and innovation in the realm of the game and mobile-based language learning. However, the app provided in this study did not use any TUI.

Research Questions

The following were the research questions for this study to understand the L2 learners' attitudes towards game-based learning, to explore if games can facilitate SLA for adults and enhance the users' knowledge of the L2 culture:

- i. What is the effect of the game and mobile-based applications for L2 adult learners?
- ii. How do digital tools enhance L2 teaching?
- iii. What effect does game-based language learning have on the evolution of digital skills?

Methodology

Research Design

The research methodology used took on a mixed approach of both qualitative and quantitative methods. Mixed methodology triangulates data from qualitative and quantitative sources and is commonly applied in linguistic research (Mackey & Bryfonski, 2018). The careful combination was selected to adequately decipher and answer the research question from two different perspectives. According to Ahmad, Wasim, Irfan, Gogoi, Srivastava and Farheen (2019), the qualitative side of research seeks to uncover an explanation of social phenomena in their natural everyday setting while quantitative research focuses on data represented in a numeric structure.

Participants

The participant pool consisted of 52 international students for the pre-survey and 32 students for the post-survey. The participants were chosen at random across a pool of international students. All the selected students were ML2 adult learners, as this was the main focus group for the study. The participants were divided into two groups. The first group comprised 28 students for the pre-survey and nine students for the post-survey, who were part of the test group, as they used the app. The second group referred to as the reference group, comprised 24 students for the pre-survey and 23 students for the post-survey, who did not use the app. The reason for the decline in participants, especially for the test group, could have been due to many factors such as the questionnaire being distributed at the end of the course and not during a lesson and some students may have withdrawn from the ML2 course or avoided participating in the surveys since participation was on a voluntary basis.

The app in question was designed by a group of educators who were coordinated by four EULALIA members from the University of Malta, to support L2 learning and teaching with the additional benefits of improving digital skills, understanding the Maltese culture at a deeper level, and motivating and engaging ML2 learners.

Data Collection

Pre-survey and post-survey methods were utilised for data collection. Both the reference and test groups were asked similar questions before and after the language course. The only difference between the groups was that the test group participants used the language-learning application alongside the course, while the reference group did not use the game-based language-learning application. A Likert scale assessing agreeableness, neutral and preferred, and a ten-point scale which were provided by EULALIA coordinators, were used for the questionnaires in both the pre-survey (see Appendix 1) and post-survey.

Similar questions were given to both the test and reference groups. The questions focused on the elements of culture learned by the end of the language course, the level of digital skills gained and the evolution of digital skills over the length of the language course. Similarly, the questions within the post-survey were based on either the ten-point Likert scale, measure of agreeableness, preference and simple yes or no answers, required for the responses. The pre and post-surveys were selected to critically assess the opinions and advancements of international students learning ML2. The questions were geared to assess and understand an in-depth view of the overall efficacy of digital tools in language learning. These questions were similar in order to offset time constraints, which might have affected the validity of the data collected.

All participants were asked for consent prior to the survey and the data provided were held with the strictest level of confidentiality since some personal information was collected. The personal information consisted of the age and the languages previously spoken, to identify any difference between the participants' age groups and attitudes towards modern digital tools, and the effect that a first language may have on learning an L2 in adult learners.

Justification Of Methodology

The mixed research design was purposely selected to provide a full view of formal and social assessments regarding the use of digital tools for language learning for adults. Mixed data sets assist in providing an in-depth understanding of a research problem by providing different forms of evidence necessary to validate or invalidate the research. Reliability is an additional aspect that mixed research provides to a study (Shorten & Smith, 2017).

Questionnaires were the most viable and reliable data collection method for this study. A questionnaire, as a mode of collection, is a fundamental way of gathering data within the linguistic spectre (Boberg, 2017). A myriad of advantages can be derived from questionnaires boosting the validation of the study. First, the questionnaires offset research expenses since they are affordable and inexpensive in nature to gather qualitative and quantitative data. Insights generated from questionnaires are quicker to generate in comparison to other forms of data collection, easing the overall research process (Boberg, 2017). The questionnaire technique provides an avenue to generate information from a large audience or a larger data set making it possible to gain the views of a large number of the international students participating in this study. The element of comparability that questionnaires contribute came in handy in investigating the effects digital tools have on students before and after the language course using the pre and post-survey.

Analysis And Discussion

Pre-Survey

The pre-survey was completed by 52 ML2 students from the University of Malta who were studying a variety of courses including Maltese as a foreign language. On a scale of 1–10, the 28 test group respondents who were studying Maltese at various levels ranging from A1 to B2 assessed their knowledge of Maltese culture at 6.04, but their digital skills at 7.37. There was no correlation between the degree of Maltese cultural knowledge or digital skills and their current level of ML2 competence (i.e. A1, A2, B1, B2, C1 or C2). Eight students at level A1 (6) evaluated their Maltese cultural knowledge almost the same as 17 students at level A2 (6.2), but higher than two students at level B1 (4.5). There was just one student at level B2 in the test group, and he or she did not rank their Maltese cultural knowledge. Students at level A1 evaluated their digital abilities higher than those at level A2 (6.82), while students at level A2 rated their digital skills higher than those at level B1 (5.0). The B2 student evaluated their digital abilities as the best, with a score of 9.0. (see Fig. 1).

The same trends were observed for the 24 reference group participants. The reference group respondents were learning Maltese at various levels ranging from A1 to C2 except level B2, who assessed their knowledge of Maltese culture at 7.0 on a scale of 1–10, while their digital skills were rated at 7.58. There was no correlation between the participants' level of Maltese culture awareness or digital abilities and their level of language competence. Seven level A1 students assessed their Maltese cultural knowledge at the same level as the 12 level A2 students (7.0) but higher than the three level B1 students (6.0). A student at level C1 evaluated their knowledge as the highest, with a score of 9.0, and another student at level C2 rated their knowledge as the highest runner-up, with a score of 8.0. Students at level A1 (8.57) evaluated their digital abilities higher than those at level A2 (7.17), while students at level A2 rated their digital skills higher than those at level B1 (6.3). A C1 student evaluated their digital abilities as the highest, with a score of 9.0 and a student at C2 rated their digital skills as a highest runner-up at 8.0 (see Fig. 2).

The participants were questioned about their expectations for the cultural components included in the ML2 course. The inclusion of the seven proposed cultural characteristics was supported by the majority of students in both the test and reference groups, with all aspects scoring more than 65% agree/strongly agree. History was the most preferred component by 25 of the 28 test group respondents, while sports was the least preferred by a total of 19 people. Sports was similarly identified as the least preferred component by 16 of the 24 reference group members, while literature and geography were chosen as the most preferred characteristics by 20 of the 24 reference group participants (see Tables 1 and 2).

Table 1
What the test group participants expected to be taught after their ML2 course

	Local cuisine	Geography	History	Literature	Sports	Values	Differences in pragmatics
Strongly agree	4	4	11	7	2	5	6
Agree	19	19	14	13	17	19	17
Neutral	3	3	1	6	8	3	4
Disagree	2	2	1	1	1	0	0
Strongly disagree	0	0	1	1	0	1	1
Total	28	28	28	28	28	28	28

Table 2
What the reference group participants expected to be taught after their ML2 course

	Local cuisine	Geography	History	Literature	Sports	Values	Differences in pragmatics
Strongly agree	6	8	10	5	3	8	8
Agree	13	12	8	15	13	11	10
Neutral	4	3	6	4	5	4	5
Disagree	1	1	0	0	2	1	0
Strongly disagree	0	0	0	0	1	0	1
Total	24	24	24	24	24	24	24

The participants were also asked to identify knowledge that they would acquire at course completion. The test group preferred navigation in Malta (93%), followed by famous persons (75%), university history (68%) and lastly, finding their way around the campus (61%). The reference group had comparable replies, with knowledge of famous persons (88%) being chosen above navigation in Malta (83%) (see Table 3).

Table 3
 Depicting the level of agreeableness over four areas before taking the
 ML2 course (pre-survey)

Element	Test group	Reference group
Navigation in Malta	93%	83%
Identify famous people	75%	88%
University history	68%	66%
Finding their way around campus	61%	51%

In terms of preferred learning styles, the test and reference groups diverged. The integrative strategy was chosen by the majority of the test group participants (15 out of 28), followed by the constructivist/constructionist approach (14), the collaborative approach (13) and lastly, the enquiry-based approach (12) (see Fig. 3).

The collaborative method (16 participants out of 24) was preferred by the reference group, followed by the inquiry-based approach (14), the integrative approach (13) and lastly, the constructivist/constructionist approach (12) (see Fig. 4). Both groups agreed with the introduction of digital tools to improve ML2 teaching and learning.

The test group was unanimous in their agreement, but just one respondent from the reference group marked indifferent, with the remainder picking agree/strongly agree. Both groups expected their digital abilities to improve throughout the course of the language-learning course (79%).

The Post-survey

Regarding the post-survey data, nine participants from the test group were willing to participate in the questionnaire. The test group's respondent knowledge of the Maltese culture stood at 7.89 after taking the language course, while their digital skills were at 9.2 on a scale of 1–10 by the end of the course. The student who was previously at level A1 rated their level of knowledge of the Maltese culture at 4.0, A2 students at 8.4 and C2 level at 8.0. Thus, there was a greater improvement of the Maltese culture for the students who were at levels A2 and C2. The student at level A1 rated their digital skills to be at 8.0, students at level A2 rated their digital skills at 9.4 and the C2 student rated his digital skills at 9.0. This trend revealed an overall improvement in digital skills.

The reference group, consisting of 23 participants, rated their knowledge of the Maltese culture at 7.1, while their digital skills stood at 7.1 after the language-learning course, revealing no correlation between the Maltese cultural knowledge and the level of proficiency in digital skills. A notable regression of 0.5 was experienced in terms of the level of proficiency of digital skills after the language course. Students at level A1 rated their knowledge of the Maltese culture at 8.75, A2 at 6.9, B1 and B2 at 6.25, and C1 and C2 at 8.0 by the end of the language course, showing little to no improvement overall. In terms of the level of

proficiency of digital skills by the end of the language course, A1 stood at 8.0, A2 stood at 6.1, B1 stood at 7.25, B2 stood at 6.0, and C1 and C2 stood at 8.0.

With reference to the knowledge acquired after course completion, out of the test group participants 75% were able to navigate in Malta, 77% were able to adequately find their way around campus, 44% were able to name at least one famous person from Malta and know about the Maltese university history. In the reference group, 66% agreed or strongly agreed that the language course improved their knowledge of the Maltese university history and finding their way around campus, and 57% agreed that the language course enabled them to navigate around Malta and name at least one famous person from the area (see Table 4).

Table 4
Illustration of the level of agreeableness after the language course
(post-survey)

Element	Test group	Reference group
Navigation in Malta	75%	57%
Identify a famous person	77%	57%
University history	44%	66%
Finding their way around campus	44%	66%

Sixty-seven per cent of the test group preferred the constructivism teaching approach, 55% preferred the collaborative method and 33% preferred the enquiry-based approach. In the reference group, 39% preferred to learn using the constructivism approach, 45% preferred the collaborative approach and 39% preferred the enquiry-based approach after taking the language course.

Eighty-eight per cent of the test group participants agreed that digital tools should be introduced to improve ML2 teaching and learning. One hundred per cent of the reference group agreed that digital tools are a good method to improve teaching and learning after taking on the Maltese language course.

Discussion

In the beginning of the language course, both groups, the test group and the reference group, showed the same level of cultural understanding. This result shows that language learning directly affects learning and becoming well-versed with the culture of the language (Moradi & Rahmani, 2017). Learning Maltese contributed to a deeper understanding of the culture across cuisine, sports, literature, history and geography. The test group showed a more significant improvement in cultural awareness and development of informational interests in comparison to the reference group. This result goes in tandem with Breien and Wasson's (2021) allusion that game-based learning boosts engagement since learners are motivated by the interfaces and design of the games based on likes and preferences and informational interests. The mobile-based application created a deeper understanding of cultural

differences and gave more insight regarding the local Maltese speakers. Understanding a language from a cultural context goes hand in hand with language proficiency. In fact, learning a language is linked to culture from a linguistic perspective and in an interactive manner (Moradi & Rahmani, 2017).

The game-based application improved language proficiency. The test group participants showed a greater level of proficiency at the end of the language course. The results are inextricably linked to the studies conducted by Idris et al. (2020) and Xu et al. (2019), who stipulated that game-based learning platforms assist in the direct mastery of an L2 and instil language skills. Consequently, the test group participants could apply language skills learned in their day to day lives more effectively than the reference group participants. The test group were more able than the reference group to learn about the university's history, find their way around the university, name more famous people and navigate their way within Malta after taking the Maltese language course that was coupled with game-based learning. This shows the effectiveness of game and mobile-based platforms for L2 learning, specifically for adults learning an L2.

The test and reference groups displayed a difference in their preferred learning modes. According to the findings, the test group preferred an integrative approach while the reference group preferred a collaborative approach. The test group participants were exposed to both the traditional classroom setting and the digital approach to learning ML2. The test group highly favoured the integrative approach due to the synergistic benefits of using two modes to facilitate language learning. For the test group, game-based learning supported the development of new knowledge and experiences.

On the other hand, the reference group favoured collaborative learning. The classroom setting promotes using groups to enhance learning through working collectively. Intellectual effort amongst the learners and teachers to actively solve problems encountered in the L2 classroom could explain why the reference group participants favoured the collaborative approach.

The reference group participants agreed that the digital approach could improve learning and teaching after going through the language-learning course. The reference group was not exposed to the game-based learning application during the Maltese course, but they still felt that a digital approach would contribute significantly. The students who formed the reference group felt the need for an additional form of digital learning as a means to improve their grasp of ML2 and learn it better. Thus, the study is hindsight merging the traditional and digital approach to language learning as brought forth by Dowell et al. (2019) and Xu et al. (2019), which gives importance to L2 game-based learning in a social process.

Similarly, the study revealed the pervasiveness of the social aspect when it comes to L2 learning. The test group favoured collaborative learning the most by the end of the language course. This effect stems from the fact that game-based learning provides learners with the capacity to achieve constructive dialogue on their own and amongst their peers, in turn, improving mastery of the L2 as elucidated by Kukulska-Hulme and Viberg (2018). Mobile and game-based applications promote collaborative learning, which is an essential pillar in SLA. It builds on the social and communication aspects that fortify SLA.

The Limitations of the Project

- i. The post-survey group of participants was less than the pre-survey participants, especially for the test group who were significantly fewer, skewing elements of data collection and analysis.
- ii. The anonymity of the surveys provided a reductive perception of who the participants really were, which could have aided in assessing personal characteristics that would have added more tangible information to the study.
- iii. Some of the test group participants did not have smartphones to effectively use the application and others had smartphones that are incompatible with the application.
- iv. One of the applications provided by the programmers only revealed one slide, yielding no benefit to the study.

Recommendations

- i. Future projects for game-based learning applications should include more devices other than smartphones.
- ii. Game and mobile-based learning should be integrated within the traditional classroom setting.
- iii. Universities that host international students should endeavour to utilise digital tools to enhance the L2 learning process and improve important aspects such as L2 vocabulary, grammar and culture as an added bonus.

Conclusion

The advent of the digital age calls for the use of game and mobile-based applications to improve both teaching and learning. According to research, digital learning tools complement and enhance SLA. For this study, two groups, a test group and a reference group, of international students learning Maltese were selected to participate. The test group comprised students who were learning Maltese and used the digital application, while the reference group took the Maltese language course without using the game-based learning tools. The results revealed that according to the test group participants who used the app, they improved their language skills and were provided with the additional benefit of cultural awareness. At the end of the language course, the reference group agreed, to a significant degree, that digital tools are necessary for improving both L2 teaching and learning. As a closing remark, mobile and game-based applications have a positive effect on SLA in adults.

Abbreviations

ICT – information communication technology

IT – information technology

L2 – second language

ML2 – Maltese as a second language

SLA – second-language acquisition

TUI – tangible user interface

Declarations

Ethics approval and consent to participate

The study was approved by the University of Malta's University Research Ethics Committee (UREC), and the committee's reference number is EDUC-2022-00075.

Availability of data and material

Please contact the author for data requests.

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Competing Interests

The author declares that she has no competing interests.

Author's contributions

JŻ discussed the results of this project, the project's limitations, recommendations, conclusions and wrote the paper.

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Figures

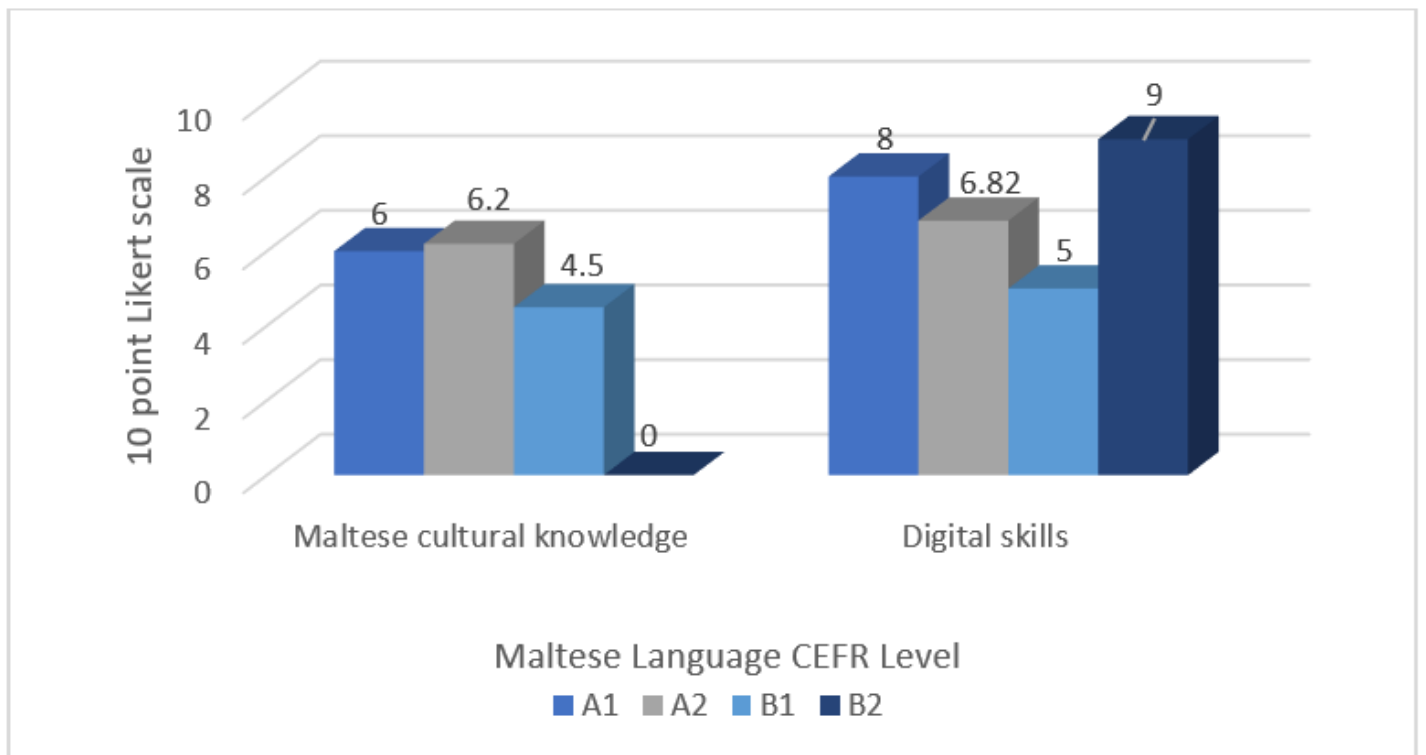


Figure 1

Current knowledge of Maltese culture and current digital skills of the test group pre-survey

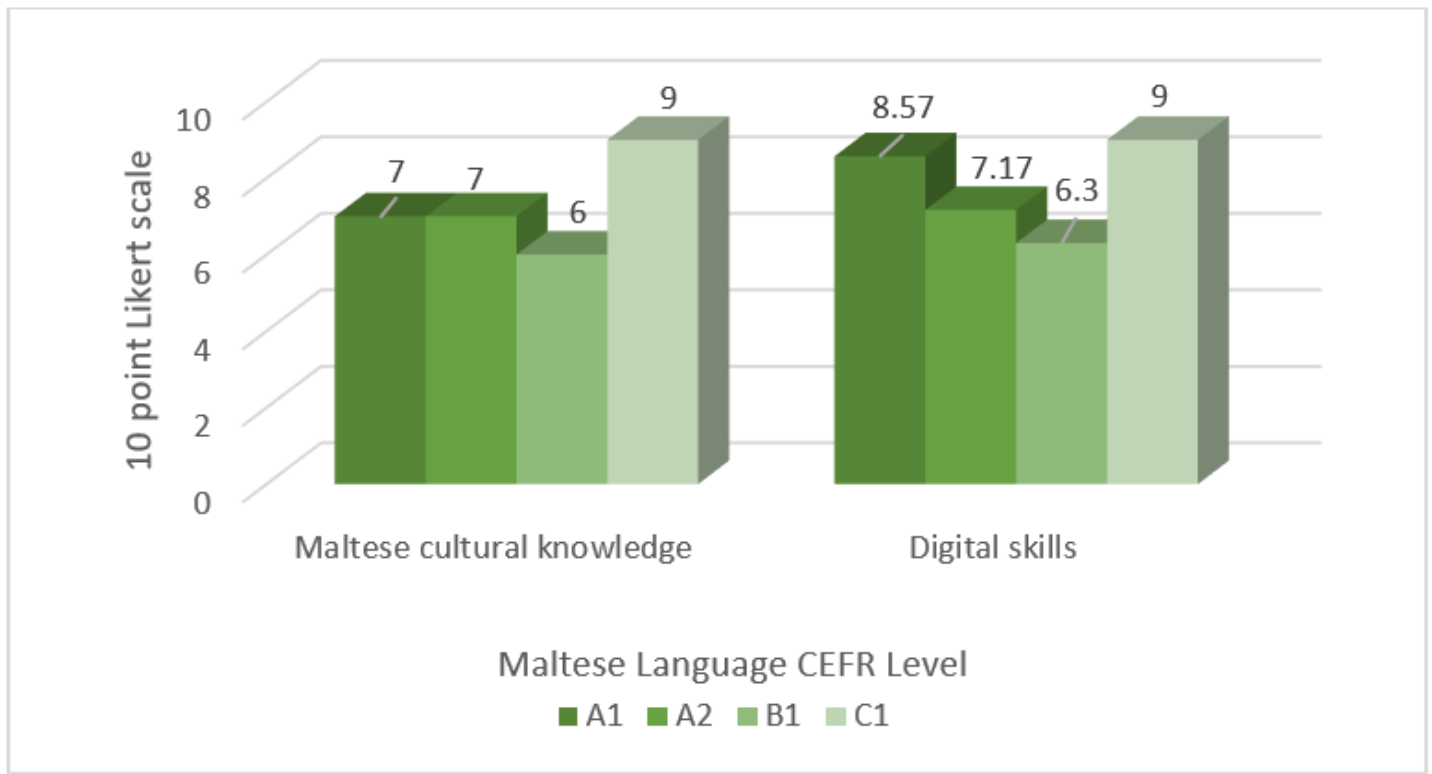


Figure 2

Current knowledge of Maltese culture and current digital skills of the reference group pre-survey.

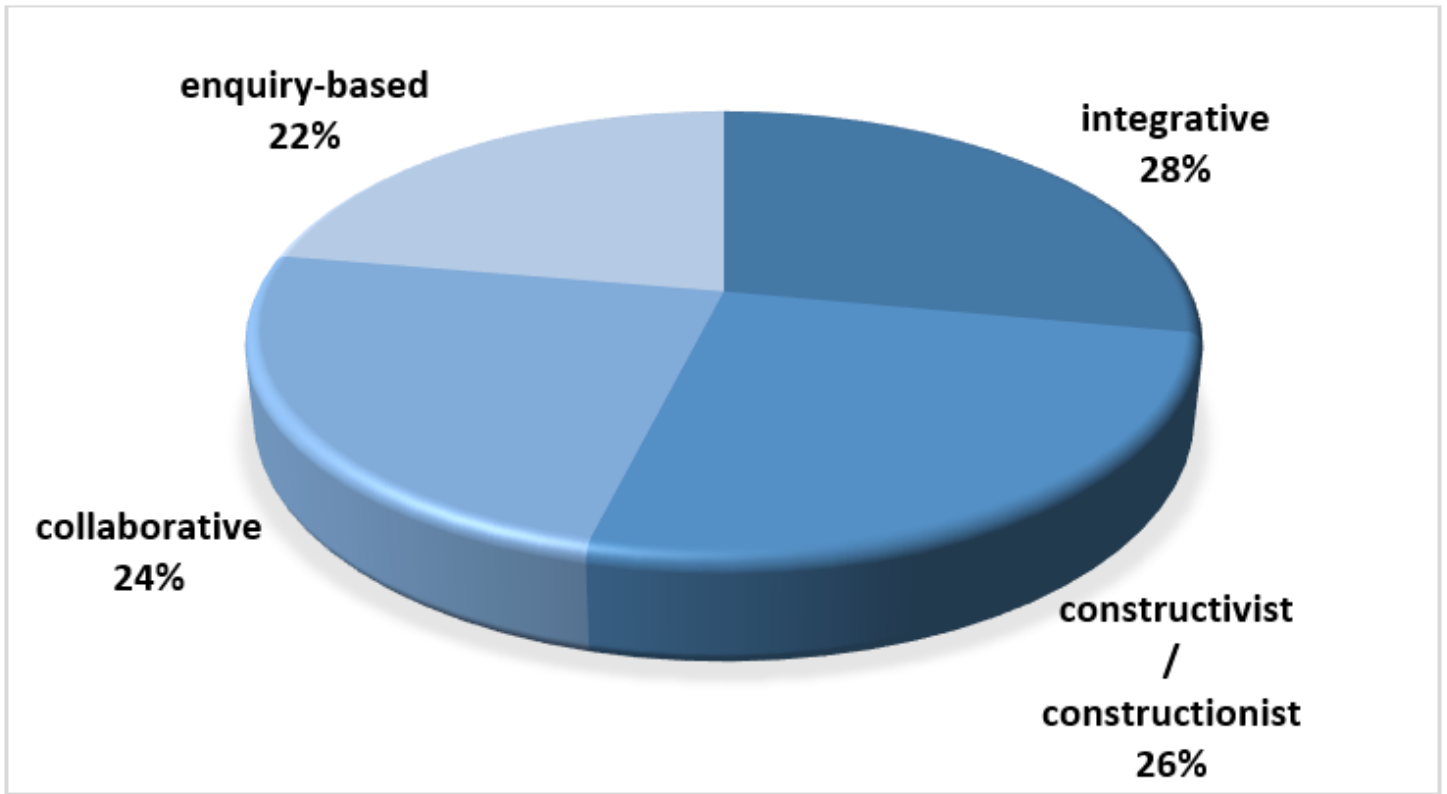


Figure 3

The preferred learning techniques for the test group

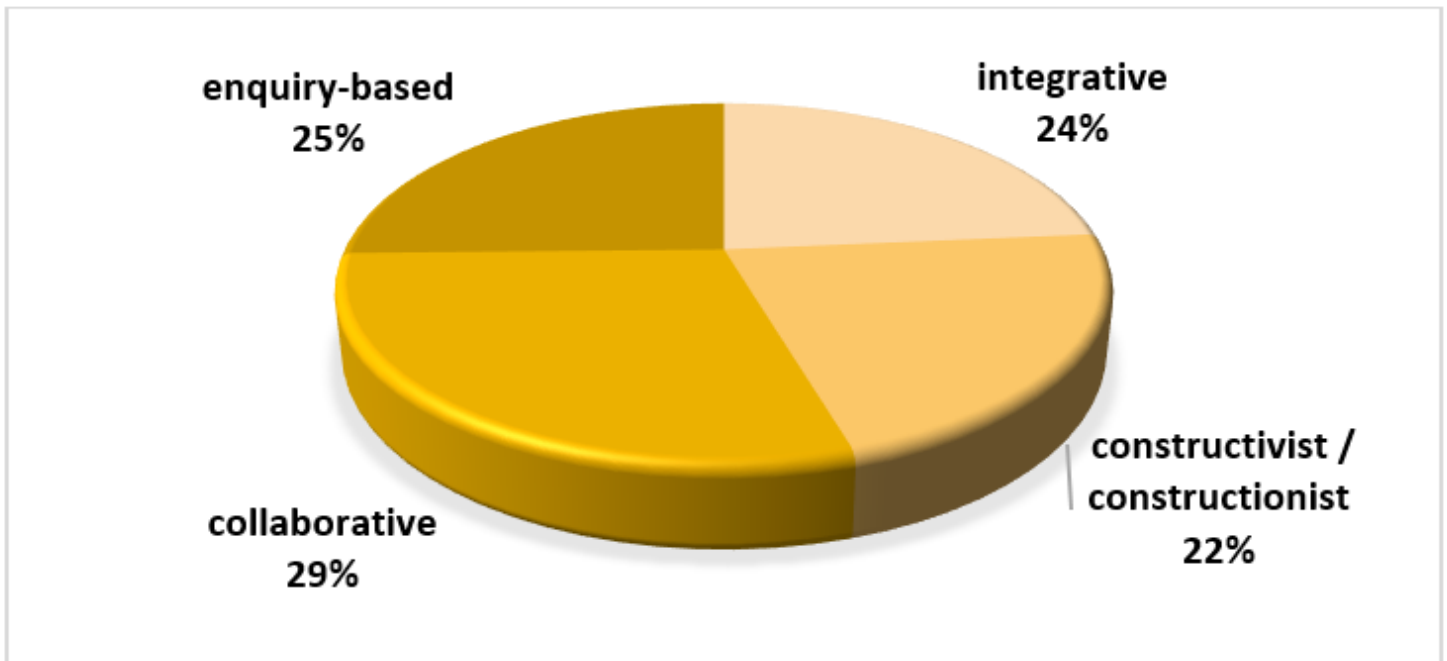


Figure 4

Supplementary Files

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