ICT IN PRIMARY SCHOOLS: EXPLAINING THE INTEGRATION IN RELATION TO THE CONTEXT

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Abstract – *Even though large amounts of government budgets have been devoted to embedding Information and Communications Technology (ICT) in schools, teachers do not appear to use these to transform teaching and learning, a goal declared by policy agendas. Previous studies focused on the capacity of policy itself, and especially on the implementers to explain the level and outcomes of implementation. This paper turns the attention to the context in which implementation takes place and views implementation from an institutionalist perspective. Schools are seen as organisations within the broader educational system and therefore, the paper focuses on a specific case to explore implementation. This paper integrates the results of two studies looking at ICT implementation in the Cypriot centralised and bureaucratic educational system, and attempts to interpret them differently from previous studies. It is suggested that unless the system is transformed and modernised, the institutionalisation of innovations, such as ICT, faces the threat of failure.*

Introduction

In recent years we have experienced computer technology expansion in our daily life activities. As a result of the invasion of Information and Communications Technology (ICT) in society, new forms of work, communication and economic growth have emerged in what is today a global society. The education agendas of world organisations include the embedding of new technologies in schools and emphasise the role of Information Technology (IT) in transforming teaching and learning. A document of the Organisation for Economic Co-operation and Development (OECD) (2001) claims that 'perhaps the factor most identified as heralding fundamental change in the structure and organisation of schooling is the spreading impact of ICT on learning' (p. 66). Not only world organisations, but also global market companies, such as Microsoft, have joined the promotion of the embedding of ICT in education (Microsoft Corporation, 2005).

In this context, the way people learn and what they learn are different from what they used to be. The concept of literacy is changing to one that the New

London Group[1] calls Multiliteracy (see Cope & Kalantzis, 2000; also Jewitt, 2003; Kress, 2004). The assumptions ICT brings with it are related to transforming schooling through the flexibility and variety of learning choices it provides. Online learning resources created in a multidimensional space aim to involve audiovisual, textual and graphical stimuli that overrun the linearity of traditional textbooks. As a result of the push that modern society and world organisations give to national governments, many countries have attempted to introduce ICT in schools.

Many studies from different parts of the world (e.g., Cuban, 2000, 2001; Earle, 2002; Goddard, 2002; Zhu, 2003; Eteokleous, 2004; Angeli & Valanides, 2005) have examined and evaluated ICT integration in numerous varied educational settings. The question posed by previous studies is whether or not classroom teachers throughout the world possess the knowledge, skills, and attitudes, as well as the resources and the help needed to successfully and effectively implement the technologically oriented policies in ways that are helpful and valuable to students. Teachers or the policy capacity appear until now the ones to blame for the failure of using ICT to transform education. In addition, the majority of the studies that explore ICT integration in schools focus on the short-term incremental changes implemented or on measurable benchmarks – such as, computer-student ratio and technical assistance – which involve factors that are difficult to deal with, as technology evolves fast. In terms of long-term transformative changes – such as, change of teaching and learning strategies, development of new pedagogies based on new literacies and new curricula, training in the educational applications of ICT, and restructuring of schooling organisations – no explicit impact on education has been tracked.

The introduction of ICT to educational institutions proves to be difficult due to its fast evolving nature. For educators, ICT tools are not something novel, as unavoidably they have come across them outside school. However, ICT does become a problematic innovation when it is embedded in education. The influences that ICT tools will have on teaching, learning and schooling in general, are yet unknown both to policy-makers and to educators who often have to deal with this innovation without any sufficient empirical or cognitive guidance. Researchers have been studying the impact of ICT on teaching and learning even more during the last couple of decades. But research findings have not yet reached the stage of becoming normative guidelines for policy-makers and practitioners. There are ongoing debates among those who are pro or anti technologists – respectively, the techno positivists and the techno sceptics. While the former advocate optimistic beliefs regarding the relation between ICT and society, the latter (e.g., Robertson 2003) regard ICT tools and the web as new forms of labour and power. Companies in the technology market, such as Microsoft and Apple,

have only recently taken on board the development of information and communication tools of educational value. Previously, such companies had focused on the development of technology as business and industrial tool. The unfounded embedding of ICT in schools as a learning tool consequently has implications on the way that educators perceive and adopt them in different contexts.

The present paper will argue that even if teachers' will and positive attitudes and policy capacity are present, this does not necessarily lead to the institutionalisation of ICT as a transformative tool. In fact, in the case presented here, ICT is added to the existing curricula as another learning tool, such as the board or the textbook, and under these circumstances its potential is yet uncovered. The paper suggests that the context in which ICT is integrated is important, as it is one of the factors that influence implementation. By looking at the characteristics of the Cypriot educational system in relation to those factors that have been found to influence implementation, this paper illustrates how the context affects the ICT implementation process and outcomes.

This paper is based on two studies (i.e., Eteokleous, 2004; Hadjithoma, 2007) that explored, even if at different times, the Cypriot ICT policy and implementation in primary schools. More specifically, the two studies explored the factors that determine the level of ICT use in schools and identified influential factors on the embedding of ICT in school practices. This paper identifies the similarities in the results of the two studies and attempts to explain them from an institutionalist perspective – a theoretical framework that is different from those adopted previously in Cyprus and elsewhere to explain ICT integration.

The context of the study

This section presents the Cypriot educational system and ICT policy. This should enable the reader to gain a better understanding of the contextual characteristics of the study, and subsequently of the proposed interpretations drawn from the data.

The Cypriot educational system

The Greek Cypriot Ministry of Education and Culture (MOEC) follows a centralised approach to managing schools. Decentralisation is limited to giving authority to local School Boards to manage minor issues of infrastructure and

to school principals to manage issues that concern students' and teachers' behaviour in schools (Panayides, 2003). According to a report by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) (2005, p. 29), the Cypriot educational system is a good combination of centralisation (of management) and decentralisation (some autonomy to schools). The MOEC is thus responsible for formulating policy plans, which are then examined by the Planning Bureau before being finally approved by the Council of Ministers. The public education sector is supported financially primarily by the government, either directly or by allocating funds to the local School Boards. As a result of the centralised nature of the system, teachers' practices appear to be curriculum-driven and content-oriented, and teachers are loyal to the prescribed textbooks (Koutselini & Persianis, 2000). Centralisation is such that there is a constant and overwhelming flow of information and instructions from the government to the schools, which renders even more demanding the already multitasked role of the teacher. This is expected in turn to influence the implementation of a non-coercive policy, such as the ICT policy that is in focus of this paper.

The Cypriot ICT policy

The Cypriot MOEC launched an ICT policy in the early 1990s. At that time, some of the primary schools were equipped with computers as part of a piloting scheme. In addition, a departmental IT group was created within the Department for Programmes Development of the MOEC. At the end of the 1990s, the governmental Pedagogical Institute started offering optional IT training programmes for teachers.

Evagoras (see MOEC, 1999) – the first formal ICT policy document – describes the action plan for the embedding of new technologies in primary education from 2000 to 2005. It includes the economic, pedagogical and national reasons according to which the embedding of computers in education is necessary. *Evagoras* has five portals: (i) the update of the national curriculum that will include computer technology applications; (ii) teachers' professional development in three levels (i.e., computer literacy, use of computer applications as teaching and learning tools, and use of other technological methods and mediums; (iii) the use of computers for school management; (iv) the integration of Internet applications in primary education, and (v) the continuous provision of hardware and software, as well as the provision of support and maintenance within schools (MOEC, 1999). According to the *Evagoras* document, while teachers and students can use the computer as an educational tool in order to find information, to create materials for lessons and

to work in virtual learning environments, computer skills are taught as a subject only in the afternoon school.

A preliminary study (Hadjithoma, 2003) has shown that the implementation of *Evagoras* was partial and that some of its goals were postponed. The suggested reasons for this were the small number of ICT regional coordinators who undertook the implementation of the policy goals in schools, the lack of continuous technical and cognitive support within the schools, and the emphasis on equipment rather than on human resource. The primary focus on equipment provision, which also occurred in other countries, led to 'having a deserted full of dust computer in the corner of the classroom; an initiative that started by charging the public with a respected amount of money, without having teachers who know how to operate these machines' (Kazamias et al., 2004, p. 154).

Factors that influence the integration of computer technology

The literature separates the factors that influence teachers in integrating computers into two major categories – those that are external and those that are internal to teachers (or first-order and second-order factors respectively) (Ertmer, 1999).

Factors external to teachers

According to many studies, teachers report that continuous and adequate professional development and training is required. These studies suggest further that teachers' professional development training needs to go beyond simple computer skills and focus on computer curriculum-integration. Other teacher related factors include insufficient teacher understanding of methods for integrating technology into the curriculum, teacher coaching, and appropriate teacher evaluation (Carvin, 1999; Dexter, Ronald & Becker, 1999; Becker & Ravitz, 2001; Demetriadis et al., 2003; Smeets, 2005).

Other researchers (e.g., Meyer, 2001) emphasise the importance of leadership, arguing that it is the key point to successful technology integration, as it can influence other important factors in the process. Additionally, the literature indicates other important factors including a positive school environment, adequate school support and technology resources, access to hardware and software, basic technological equipment and facilities, technical support and assistants, time for planning, and sustained funding for technology (Sheingold & Hadley, 1990; Cuban & Pea, 1998; Dexter, Ronald & Becker, 1999; Ertmer, 1999; Becker & Ravitz, 2001; Earle, 2002; Demetriadis et al., 2003).

Factors internal to teachers

Researchers (Carvin, 1999; Dexter, Ronald & Becker, 1999; Becker & Reil, 2000; Becker & Ravitz, 2001) argue that teachers' instructional styles, attitudes toward learning, and teaching philosophies influence the way computers are integrated in the classroom. In fact, teachers who easily accept and incorporate new ideas, changes and reforms into their practices are more likely to integrate computer applications in their teaching (Dexter, Ronald & Becker, 1999). Moreover, teachers' interactions with peers may also shape behaviour. Teachers who maintain more frequent personal and professional contacts with their peers may be more likely to encourage students in similar ways through the use of computer applications (Berg et al., 1998; Carvin, 1999; Dexter, Ronald & Becker, 1999). Finally, teachers who feel that computers are good tools for promoting students' learning are also found to engage their students in using computers more than teachers who do not feel that way (Bielaczyc & Collins, 1999; Carvin, 1999; Demetriadis et al., 2003; Smeets, 2005).

The paper's main aim and research objectives

While the literature on ICT policy implementation considers personal (individuals' experience, attitudes and will) and professional factors (training/ resources), this paper suggests that beyond these factors there are institutional factors, related to the broader system, which may present constraints to the use of ICT by teachers.

Toward this end, the present paper integrates the results of the two studies on which it is based, to then focus on explaining the factors that were found to influence the adoption of ICT by educators from an institutionalist perspective. Specifically, it attempts to provide explanations of how a centralised school system and its bureaucratic characteristics constrain teachers in their efforts to integrate computers in their classroom practices. The paper consequently seeks to address the following objectives:

- to integrate the factors that, according to the two studies, affect implementation, and categorise them into personal, professional and policy related factors;
- to interpret the above factors from an institutionalist theoretical framework; and
- to discuss the implications for policy-makers and educators.

The first study: Eteokleous (2004)

Research methodology

A structured questionnaire was administered by post to a random sample of 500 Cypriot primary teachers during the scholastic year 2003-2004[2]. The response rate was 58.6%. The questionnaire consisted of the following 5 sections: (i) teachers and school demographics; (ii) teachers' computer use for different purposes (personal, organisational and instructional); (iii) students' computer use in their classroom (as assigned by their teachers); (iv) factors that influence teachers in integrating computers in their classrooms; and (v) an open-ended question for additional comments. Version 11 of the SPSS statistical package was used to analyse the quantitative data.

Independent and dependent variables were used in the analysis. There were two major categories of independent variables. The first was *teachers and school demographics*, which included the variables 'school region', 'teacher education', 'experience', 'age', 'gender', 'grade' and 'class size'. The second was *the factors that influence teachers' practices*, which included the variables 'school climate', 'teacher professional behaviour', 'teacher attitudes toward integrating computers in the classroom' and 'teacher approaches toward progressive instructional practices'. The three dependent variables were *teacher-reported computer use in general*, *teacher-reported student classroom computer use* and *teacher-reported student progressive classroom computer use*. Each of the above was calculated by summing teachers' responses to a number of statements, using a 5-point Likert scale[3].

Findings

The analysis of the descriptive statistics revealed that the majority of the teachers surveyed taught in urban schools (63%), taught in 5th grade (36%), were females (72%), used computer technology in their lives (94%), particularly at home (93%) and at school (82%), and had Internet connection at home (85%). With regard to their years of teaching experience, the teachers surveyed were evenly divided among the five provided categories (i.e., 1-4; 5-8; 9-12; 13-16; and 16+). As far as their teacher education went, all the participants held a bachelor's degree in Primary Education. In addition, 4% held a certificate, 22% held a master's degree and 0.7% held a doctorate.

The results indicated that while Cypriot teachers use computers rather extensively for their own purposes, they use them less frequently inside their classrooms. Moreover, when computers were used in class, this tended to be in a rather sporadic fashion, meant more as support or as fancy chalkboards.

The teachers also ranked the factors that were significant to them in terms of integrating computers in their classroom practices. Their resulting first three important factors were: (i) personal attitudes toward computer technology; (ii) college preparation in acquiring computer skills; and (iii) level of computer literacy. The two factors that appeared to have the least impact on teachers in applying computers in their classroom practices were: (i) the amount of support the principal provided to teachers in terms of integrating computers in class; and (ii) the amount of support and assistance they received from the district/local technology coordinator (see Table 1).

TABLE 1: Frequency distribution of statements ranked by teachers in terms of their importance regarding computer technology integration in the classroom

Factors	*M*	*SD*
College preparation in acquiring computer skills	2.72	1.67
Personal attitudes toward computer technology	2.98	1.93
Level of computer literacy	3.05	1.76
College preparation in integrating computers into the classroom or curriculum	3.18	1.55
Professional development activities in acquiring basic computer skills	3.20	1.40
Professional development activities in integrating computers into the curriculum	3.47	1.14
Having access to technology resources (software, hardware, etc.)	3.64	1.67
Evaluation for using computers in my classroom	4.38	1.81
The level of principal support in terms of integrating computers into the curriculum	4.83	1.14
The level of support and assistance from district/local technology coordinator	4.86	1.25

The first set of the regressions examined how teacher demographic characteristics and school factors influenced *teacher general computer use*, *student classroom computer use* and *student progressive classroom computer use*. The following demographic variables were used in the regression analysis: grade, years of experience, age, class size, and education. The results can be summarised as follows. Teachers' education has a positive significant link to all three kinds of uses. Teachers' age appeared to be a significant predictor (negative relationship) for *teacher general computer use* ($p < .01$). Finally, grade appeared to be a significant predictor (positive relationship) for *student progressive classroom computer use* ($p < .10$).

Teacher and school demographics were positively, but not highly, correlated with *teacher computer use in general*. Once again, teacher and school demographics had a positive, but relatively low, correlation with *student classroom computer usage in general*. Finally, correlation between teacher and school demographics and *student progressive classroom computer use* was positive and relatively very low (see Table 2).

TABLE 2: School and teacher demographics effects on teacher and student computer use

Variable	**Teacher general computer use**		**Student computer use in the classroom**		**Student progressive computer use in the classroom**	
	ß	Beta	ß	Beta	ß	Beta
Teacher education	3.94***	0.26***	3.83***	0.17***	0.89**	0.14**
Teacher years of experience	0.05	0.01	0.16	0.02	0.26	0.13
Grade	0.55	0.02	18.55	0.51	7.75*	0.73*
Class size	0.40	0.06	-0.64	-0.06	-0.12	-0.04
Teacher age	-2.12***	-0.28***	-0.38	-0.03	-0.37	-0.12
r^2	0.165		0.06		0.07	

* $p < .10$, ** $p < .05$, *** $p < .01$

The second set of regressions examined the effects of four variables (i.e., 'school climate', 'teacher professional behaviour', 'teacher approaches toward progressive instructional practices' and 'teacher attitudes toward the use of computers in education') on *student classroom computer use in general* and *student progressive classroom computer use*. The effect of teacher and school demographics, using the same variables as in the first set of the regressions, served as control variables.

In the first regression, *student classroom computer use* was the dependent variable. 'Grade', 'teacher professional behaviour' and 'teacher attitudes toward computer use in education' appeared to be significant predictors for *student classroom computer use* ($p < .01$). On the other hand, 'teacher education' and 'school climate' were found to be significant predictors at the .05 level. Finally, in the last regression, *student progressive classroom computer use* was the dependent variable. 'School climate', 'teacher professional behaviour' and 'teacher attitudes toward computer use' appeared to be significant at the .01 level. From the control variables, 'teacher education' and 'grade' appeared to be significant predictors at the .10 level. In all regressions, the link among the variables was positive (see Table 3).

The second study: Hadjithoma (2007)

Research methodology

The second study employed a survey questionnaire that was distributed by post to schools in all four educational districts regulated by the Republic of Cyprus (i.e., Nicosia, Limassol, Larnaka and Famagusta, Paphos). From the 348 public primary schools in Cyprus (2003-2004), 69 schools were randomly chosen to represent the educational districts and their rural/urban areas[4]. The questionnaire consisted of questions organised around the themes 'personal information', 'experience in using ICT', 'training in ICT', 'use of ICT at school' and 'ICT policy'. The response rates were 76.8% of the sample schools and 35.8% of individual teacher questionnaires. Four schools were then selected as case studies that included interviews with 16 teachers as well as school/classroom observations. EXCEL and SPSS (Version 11) software were used for data analysis. Correlation tests were run in order to identify the variables that have a significant relationship with the use of computer at school[5].

TABLE 3: Effects of 'school climate', 'teacher professional behaviour', 'teacher approaches toward progressive instructional practices' and 'teacher attitudes toward classroom computer use' on student computer use in the classroom

Variable	**Student classroom computer use in general**		**Student progressive computer use**	
Regression	I		II	
	ß	Beta	ß	Beta
Controls				
Teacher education	2.13**	0.09**	0.45*	0.07*
Teacher years of experience	0.24	0.03	0.28	0.14
Grade	3.36***	0.09***	1.06*	0.10*
Class size	-0.47	-0.04	-0.07	-0.02
Teacher age	-0.01	0.00	-0.26	0.08
Factors				
School climate	-1.73**	-0.12**	-0.57***	-0.15***
Teacher professional behaviour	0.98***	0.19***	0.25***	0.17***
Teacher approaches toward progressive instructional practices	0.55	0.04	0.17	0.05
Teacher attitudes toward the use of computers in education	1.35***	0.25***	0.37***	0.25***
r^2	0.16		0.20	

* $p < .10$, ** $p < .05$, *** $p < .01$

Findings

In the Hadjithoma (2007) study, 17.6% of the participants were males, 75.3% were females and the remaining 7.1% did not state their gender[6]. Age wise, 50.3% of the participants belonged to the 20-30 age group, 38.1% to the 31-40 age group, 7.4% to the 41-50 age group, and 3.2% to the 51-60 age group. The remaining 1% did not state their age[7]. While the mean number of teaching years for the teacher sample was 10 years, their mean number of years using the computer at school was 2.65 years. Most of the participating teachers (77.9%) had their own class[8].

The correlation tests indicated that the following variables related to teachers' skills and attitudes were significant in relation to the use of computer in class:

- *Self-evaluation as a user of computer* (not confident / developing confidence / confident / very confident) ($p < .05$, $df = 3$, $\chi^2 = 21.512$); and
- *Use of computer at home* (daily / weekly / monthly / every trimester / never) ($p < .05$, $df = 1$, $\chi^2 = 7.070$).

Although the correlation is not indicative of the strength or the kind of relationship that exists, it can be assumed that the more confident the teacher feels, the more possibilities there are that he or she would start using the computer in the classroom. Similarly, the use of computer at home may be assumed to have a positive relation with using the computer (and other ICT) at school. This is because the time to explore the hardware and software may be important for teachers in order to gain confidence to use ICT at school. At the same time, it was assumed that self-confidence might also be related to the use of computer at home. In fact, another chi-square test signalled this significant relationship ($p < .01$, $df = 1$, $\chi^2 = 18.693$). In order to check for the interrelation of all three variables a test was performed between 'use of computer at school' and 'self-evaluation as computer user' (confidence), with the variable 'use of computer at home' layered out. The test indicated that there still is a significant relationship between the first two variables. The same test was performed between 'use of computer at school' and 'use of computer at home', layering out 'self-evaluation'. It confirmed the above results.

One question that included statements regarding both attitudes and beliefs was included in the analysis. Each of these statements was analysed separately (in the correlation tests). The following were found to have a significant relation with the variable 'use of ICT at school':

- *ICT help me in teaching* ($p < .01$, $df = 1$, $\chi^2 = 11.320$); and
- *I don't know if they (ICT) are useful in teaching and learning* ($p < .01$, $df = 1$, $\chi^2 = 12.168$).

The support that ICT can offer teachers in the classroom and, on the other hand, the uncertainty about the usefulness of ICT in teaching and learning, are factors that influence teachers in their use of ICT at school. While the above factors can be considered as personal, there were a number of factors that were related to the teachers' professional environment. The following professional factors were found to be significant:

- *Having own class or teaching various classes* ($p < .05$, $df = 1$, $\chi^2 = 7.080$);
- *Use of computer lab* (yes / no / there is no computer lab) ($p < .05$, $df = 2$, $\chi^2 = 23.880$);
- *Use of software* (yes / no) ($p < .01$, $df = 1$, $\chi^2 = 13.987$); and
- *Evaluation of help by IT coordinator* (yes, it is important help / no, it is not important help) ($p < .05$, $df = 1$, $\chi^2 = 4.200$).

Finally, factors related to policy-making and policy distribution (i.e., ways of transferring policy decision to educators through the MOEC website or through ICT advisors visiting the schools), as well as offering guidance and directions on the use of computer in teaching and learning (IT committee website) were found to influence teachers' uptake of ICT in the classroom:

- *Use of MOEC website* (never / once or twice / often / very often) ($p < .01$, $df = 3$, $\chi^2 = 25.034$);
- *Using IT committee website* (never / once or twice / often / very often): ($p < .05$, $df = 3$, $\chi^2 = 15.216$); and
- *ICT advisor for the school* (yes, there is / no, there isn't / I don't know) ($p < .01$, $df = 2$, $\chi^2 = 13.022$).

Table 4 summarises the above results.

Integrating and categorising the significant factors

Using the existing literature to help integrate the results led to three categories of factors: professional factors (internal and external), attitudinal/personal factors (internal) and policy related factors (external). These factors are discussed below and the results are summarised in Table 5.

Professional factors

Professional factors are the ones related to educators' professional environment and their work. Along the same lines of the existing literature

TABLE 4: Correlation test results for the variable 'use of computer at school' with various significant factors

Factors	χ^2	*df*	*p*
Self-evaluation as a computer user	21.512	3	.000
Use of computer at home	7.070	1	.008
Use of MOEC website	25.034	3	.000
I don't know if they (ICT) are useful or not	12.168	1	.000
Teaching own class or not	7.080	1	.008
Use of computer lab	23.880	2	.000
Use of software	13.987	1	.000
They (ICT) help me in teaching	11.320	1	.001
Evaluation of help by IT coordinator (important/not important)	4.207	1	.040
Use of IT committee website	15.216	3	.002
ICT advisor at the school	13.022	2	.001

(see Carvin, 1999; Dexter, Ronald & Becker, 1999; Becker & Ravitz, 2001; Earle, 2002), teachers' experience (e.g., self-confidence in using ICT) was found to be important for employing ICT at school.

No correlation between training and use of computers in the classrooms was found. This may be explained in relation to the content of the training provided. At the time when the second study was conducted, the training still aimed at providing basic computer skills to the teachers who attended. It did not provide them with knowledge and skills regarding the educational applications of ICT. This could be related to the way the teachers used ICT at school – as 'extras' rather than learning tools according to the first study.

Furthermore, teachers' responsibilities (in own class/in the school) were also found to be important. Teachers who were more active, who assumed more responsibility in their school, and who maintain good relationships with their colleagues tended to use computers more frequently.

Support within the school (by IT coordinators) was found to be significant in terms of implementation, even if teachers appeared to get help also from outside their professional environment (friends/family).

Available resources (equipment, computer lab, software/hardware access) also emerged as being related to teachers' use of ICT at school.

In summary, it appears that experience in using ICT, help within and outside school, the responsibilities teachers have and the resources available are related to the adoption of ICT in school practices.

Attitudinal/personal factors

The results of the first study revealed that teacher attitudes toward the computer as a classroom tool was a significant predictor of classroom use. Teachers who expressed scepticism about the value of computers in the classroom tended to use them less frequently than other teachers. This is consistent with prior studies (see Berg et al., 1998; Carvin, 1999; Dexter, Ronald & Becker, 1999), and may help explain why classroom computer usage remains limited even in 'technology rich' schools (see Zhu, 2003).

Another important factor appears to be the way in which teachers evaluate themselves as computer users. Additional personal factors related to the use of computers in school by teachers are the number of the years they have been using computers, the use of computer at home, age and teachers' education beyond their bachelor's degree (i.e., certificate, master's degree and doctorate).

Policy related factors

The last category that has been found to influence computer use in primary classrooms is related to policy factors. As identified by both studies to some extent or other, the support and help regarding the use of computer that teachers receive from colleagues at school (including principals, IT coordinators and IT advisors) and from friends, family members and others outside school has been found to be important. Somewhat of a surprise in the first study, however, was the relatively low importance that teachers placed on the leadership of the principal as a factor in promoting classroom computer usage. This might suggest that principals are viewed more as managers than as instructional leaders and as having little relevance with regard to classroom instruction.

Guidance and advice from the policy level to educators in schools seem to be important. This emerged from factors such as 'use of the MOEC website' and 'the presence of a ministerial officer, the ICT advisor'.

TABLE 5: Factors that influence computer use in classrooms

Professional Factors	**Attitudinal/Personal Factors**	**Policy Related Factors**
Ineffective pre- and post-service training and development courses (computer skills and computer as a tool in classroom; help from within or outside school). Teachers' professional behaviour (more active and responsible in their school; maintain good relationships with their colleagues/ principal). Professional culture and school climate (professional or social networks in the school, either formal or informal; ICT level in the school; resources; ICT coordinators; etc.). Availability of resources (ICT level at school).	Teacher attitudes/ beliefs toward computer use. Self-evaluation as a computer user. General use of computer/computer use at home. Age (first study). Education (certificate, master's degree and doctorate).	Provision of structure and supportive agents (help by ICT coordinators and presence of ICT advisors). Clear policy goals communicated to teachers (instructions from the MOEC; use of MOEC website). Financial support and availability of resources (ICT level in the schools; computers in every class; computer lab; software and hardware).

Suggested theoretical framework for interpreting the findings

This paper uses institutionalist theory to understand how the characteristics of the system influence the implementation process. According to Steinmo (2001), institutionalists are those who think theoretically about institutions, about their impact on behaviour and outcomes. The institutional literature suggests that the coordination between actors, organisations, programmes and policy leads to successful implementation. This highlights the importance of taking into account not only the policy-making at the top and the implementers-actors, but also the context (organisations). A key theme that arises from New Institutionalism (see Hay, 2002) is that there are difficulties in reforming, transforming or replacing institutions due to their culture which is based on routine and convention. In line with these concepts, organisational analyses suggest that there are two types of social actors. First, the rational actor model describes people who think about the consequences of the different actions before they act (by making utility-maximising calculations) (Coleman, 1990; cited in Tolbert & Zucker, 1996). Second, the institutional model assumes that people follow social norms without questioning them or reflecting on them, and without choosing them according to their personal interests (Wrong, 1961; cited in Tolbert & Zucker, 1996). The institutional actor model is related to the logic of appropriateness. Its main idea is that 'humans maintain a repertoire of roles and identities, each providing rules of appropriate behaviour in situations for which they are relevant' (March & Olsen, 2004, p. 4). These concepts are helpful in terms of explaining how teachers behave within their professional environment. They assume that teachers' work is based on a repertoire of roles and identities, and that teachers follow the institutional actor model required within the educational institutions where they work.

In terms of the factors that influence educators in integrating ICT in their school practices, the institutionalist perspective turns the attention to the norms required by educators at their work, and relates these norms to the characteristics of the specific educational system. Thus, the centralised, curriculum-driven, content-oriented and bureaucratic nature of the Cypriot primary education system is assumed to be related to the institutional actor model that teachers follow. The arising questions thus are: When a new policy is transferred to the schools, how do teachers respond to it? Does the 'institutional actor model' prevent them from adopting ICT?

To describe the institutional model that applies to teachers, this paper employs the theory of street-level-bureaucracy (see Lipsky, 1980). In the specific context of the Cypriot educational system, the institutional model that can best describe teachers appears to be the one of street-level-bureaucrats. The street-level-bureaucrats (s-l-b) are 'public service workers who interact directly with citizens

in the course of their jobs, and who have substantial discretion in the execution of their work' (Lipsky, 1980, p. 3). The main characteristic of s-l-b is that 'Their work involves the built-in contradiction that, while expected to exercise discretion in response to individuals and individual cases, in practice, they must process people in terms of routines, stereotypes, and other mechanisms that facilitate work tasks' (Lipsky, 1980, p. 140).

Lipsky (1980) names a number of conditions in which people act as street-level-bureaucrats: s-l-b have high discretion in making decisions regarding the quality of services they provide, regarding the people who will receive or not these services, and their discretion increases when the rules about the services are contradictory or constantly change. The conditions of making decisions about the provision of services are restricted, however, by limited time and limited information about the case. The s-l-b usually have to deal with 'large case loads' in comparison to their ideal situation of providing services on individual basis. As Lipsky (1980) argues, 'the fundamental service dilemma of street-level bureaucracies is how to provide individual responses or treatment on mass basis' (p. 140). At their work, they have to deal with limited resources and they experience the ambiguity of their role and their goals. In order to cope with the difficulties and uncertainty of their work conditions, s-l-b create routines and simplifications regarding their work environment and work tasks.

The street-level-bureaucracy theory provides a framework that is useful for explaining the impact of teachers' work on the process of embedding ICT. The discretion that teachers are allowed as s-l-b can be related to the implementation of ICT in schools. Indeed, their work characteristics – such as, limited time, limited information, ambiguity of goals, large case loads and uncertainty – may explain the marginalised role of ICT tools in school practices.

Discussing the findings from an institutionalist framework

With respect to the integration of ICT in the curriculum, the findings indicate that ICT tools have as yet only partially been integrated in the primary education curriculum. This has resulted in the creation of gaps in the implementation process. While the educational system is curriculum driven, ICT were introduced to schools before the process of including learning goals for ICT in the curricula was completed. The implementation of *Evagoras* (2000-2005) was vague and was mostly based on the personal agency of the people involved, especially the ICT advisors, the ICT coordinators and the principals. In particular, the implementation action plan did not refer to any goals with regard to the role of educators in embedding ICT in schools. Consequently, the initiative for

employing ICT to improve and enrich teaching and learning was left in teachers' hands who, as pointed out in this paper, either adopted or not ICT in their classrooms without having, however, to face any consequences for their decision. The general and non-coercive character of *Evagoras* and the absence of specific guidance to educators generated various responses – each according to the individual's personal experience, knowledge, skills and personality – during the implementation process. Thus, the rational actor model can best describe the educators in terms of their response to embedding ICT. However, when it comes to the institutional actor model, the Cypriot teachers, as street-level-bureaucrats, appear to have constraints on their work because of the characteristics of the wider system. One of the most influential barriers facing teachers in their use of ICT during lessons appears to be the lack of time (in general, across all their responsibilities). This can be explained in relation to the bureaucratic educational system, the control over teachers' practices by the overloaded curricula, the evaluation of teachers' work by inspectors who exert pressure on content completion, and the lack of resources which necessitates time-consuming preparations by teachers. As Lipsky (1980) describes, the availability of resources (hardware/software) and information (including guidance by the MOEC or the ICT advisors) characterise teachers as street-level-bureaucrats. The institutional actor model that describes so well the Cypriot primary teachers, therefore, suggests that the institution itself poses constraints to the adoption of innovations, including ICT.

The three previously identified groups of factors – that is, the professional, the attitudinal/personal and the policy related factors – indicate the different reasons that influence the level of implementation. Although some of them could be related to individuals, they could be also seen from an institutionalist perspective. An explanation from this wider perspective positions these factors as characteristics of the broader educational system rather than as characteristics of smaller units (schools or individuals). More specifically, this paper argues that the phenomenon of sporadic adoption of ICT by educators at school cannot be solely attributed either to the attitudes of educators toward ICT in education or to the ICT policy capacity. This is not to say that personal factors (such as teacher attitudes or skills) are not regarded as being influential on ICT adoption by educators. This paper argues, however, that even if teachers' will and positive attitudes are present, this does not mean that ICT will be fully integrated and institutionalised in the educational system. Consequently, this paper suggests that factors which have been indicated by previous research (see Karagiorgi, 2000; Eteokleous, 2004;Angeli & Valanides, 2005) as possible explanations to the failure of educators to adopt ICT in their daily practice might be interpreted in a different way. In fact, the present paper shifts the focus from the individual

implementers to the broader system, the context and the institutional factors that may influence implementation.

The findings described above create a general picture that confirms the assumptions arising from the theoretical framework. Teachers, as street-level-bureaucrats, have discretion in decision-making with regard to implementation (i.e., to use or not to use the computer in their classroom, and in terms of how to use it). There are reasons to believe, based on the findings presented here, that ICT could be used as a tool for enhancing teachers' work. ICT can in fact support teachers by alleviating some of the difficulties that arise from the bureaucratic system in which they work.

Educational systems across the world have often been characterised as traditional 'hard to change' institutions. When attempting to integrate a modern learning tool in an old system, the institutions' characteristics become more obvious. This paper highlights the fact that the existing Cypriot bureaucratic system prohibits teachers from incorporating ICT as a transformational tool in their classroom. Teachers may be resistant to change, but they cannot take the full responsibility for the failure to implement ICT policy. Instead, they must share this responsibility with the constraints that the 'traditional' educational system poses on their work.

Implications for policy-makers and educators

The empirical evidence presented in this paper, although it concurs with the evidence produced by other studies, is interpreted however in a different manner. Indeed, the present interpretation seeks to answer the question of implementation not only from the implementers' or the policy-makers' perspectives, but also from the perspective of the system and its capacity. Describing the professional environment where teachers actually work, using the concepts provided by Lipsky's theory of street-level-bureaucracy, proved useful in this paper to explain teachers' responses toward the embedding of ICT integration in schools.

The findings of the two studies presented here, and consequently the interpretations made and the arising questions and dilemmas, call for immediate attention and follow-up action from policy-makers. The factors discussed above revealed problems that are related to the broader system. These factors and underlying difficulties cannot be addressed by the teachers themselves; policy-makers and educators at management level are also responsible. It is undeniable, however, that professional factors can be more easily addressed than the broader changes required in the system (e.g., the change of the curriculum), as the latter

imply long-term transformative changes. Institutionalisation is achieved through long-term changes at a slow pace, as it requires change of the institution's characteristics.

The government's approach toward the embedding of ICT should be modified from seeing ICT as just another educational tool to seeing ICT as a tool that will transform and change the system (e.g., by enabling administrative procedures, by transforming the mass-based classrooms to more individual-based learning, and by saving time and effort for the bureaucrat-teachers). Reform is needed to bring change in teachers' professional environment, so that teachers have more support in adopting innovative policies, including ICT. In summary, it may well be possible that ICT can generate new forms of schooling – something that should be considered further by policy-makers.

Limitations and further research

This paper has described two different studies that, even though conducted at different times, used similar methods. This helped to achieve the triangulation and validation of the findings. However, it is important to mention that quantitative data only do not provide the whole picture of ICT policy and implementation. These should be enhanced with evidence based on qualitative data, something that was not possible in this paper due to length limitations. Additionally, for reasons of convenience, only information gathered from teachers was used here. Students, parents, principals and government representatives could also be included in future studies.

Finally, an interesting question that could be addressed by future research would be: Is it possible to use the theoretical framework provided in this paper (i.e., institutionalist theory) to explain similar situations in other countries?

Notes

1. The New London Group – which takes its named after the place where they first met, in New London, New Hampshire, USA – comprises a group of academics who engage in a series of hypotheses about the directions literacy pedagogy might take in order to meet the radically transformed communication demands that students are likely to encounter in their near futures.
2. The research population of the study consisted of 4th, 5th and 6th grade teachers in Cypriot primary schools that had computers in their classrooms since 2000.
3. They were treated as continuous variables and centred around their means before being entered into the regression analysis.
4. Systematic random sampling was used to select an approximate equal number of schools (representing 14-21%) from each rural and each urban area of each district.

5. Not assuming a linear relationship between the variables, the chi-square test was judged to be the most appropriate in this case. Whenever the resulting categories of a variable contained small number of cases, which would return an invalid chi-square result, the data of that variable were re-grouped differently before applying the chi-square test. For instance, the variable 'use of computer at school' initially consisted of 5 categories (i.e., 'about daily', 'about weekly', 'about monthly', 'about every trimester' and 'never') and the last two categories had small number of cases. The five categories were consequently downsized to two: (i) about daily or about weekly; and (ii) about monthly, about every trimester or never.
6. This sample is considered to be representative of the target population in terms of gender, as the teacher population in Cypriot public primary schools was, according to a source from the Teachers' Union (POED), approximately 80% females and 20% males in 2003-2004.
7. In 2003-2004, according to a source from the MOEC, while 80% of the teachers in Cypriot public primary schools were younger than 41 years, the remaining 20% were aged between 41 and 60 years. As the mature teachers were underrepresented in the second study, no valid conclusions related to the 'age' variable could be drawn.
8. That is, the teacher teaches most of the curriculum subjects in one class, to one group of students. This is opposed to having the teacher teaching one or more subjects to different classes, and consequently to different groups of students.

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