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Factors enabling the use of technology in subject teaching

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ABSTRACT

The importance of information and communication technologies in the teaching and learning process has been proven by many research studies to be an effective way of supporting teaching and learning. Although many teachers do not use new technologies as instructional tools, some are integrating information and communication technologies innovatively into their teaching. There are a number of factors which encourage these teachers to use information and communication technologies in the teaching and learning environment.

This article discusses the factors that encourage Turkish Cypriot teachers to integrate technology into the classroom. The data were gathered from seven volunteer subject teachers teaching Mathematics, Foreign Languages, Social Sciences, and Science. Qualitative research methods including semi-structured interviews were employed in the study. The findings indicate that in order to create an environment where technology is used frequently and effectively, it is important to support the needs of teachers in using technology in teaching and learning. In other words, it is important to attempt to remove the possible barriers that hinder frequent technology use and to identify the enablers that promote it. The enabling factors would help teachers to be motivated and enthusiastic users of ICT in education.

Keywords: *Teachers ICT use; ICT in subject teaching; enablers in ICT integration; secondary education; improving classroom teaching*

INTRODUCTION

Education and technology have become increasingly fundamental elements for the standard of living in the twenty-first century. Great importance is thus given to their development globally. It might be argued that innovations in technology have an effect on education and pedagogy, that is to say, on how information, knowledge, and culture are transferred (Tawalbeh, 2001). Over the last three decades, many developed and developing countries have been encouraging the use of new technologies in different subjects as teaching tools.

The main reasons for this intensive effort and attempt to integrate new technologies into teaching and learning probably is the rapid development in information and communication technologies (ICT) and their influence on people's, especially on students' life. Nowadays, many students are competent in using a number of ICT tools, like sophisticated mobile phones and Web 2.0 practices, in their everyday life (Davies and Merchant, 2009; Hutchby and Moran-Ellis, 2001). Thus, in order to take advantage of the intensive interaction between students and technology, it is important to successfully integrate ICT into education.

With the help of ICT, teachers may continue to pursue the aim of education beyond the classroom walls. Students and teachers can interact outside the classroom and outside specific classroom hours (Loveless and Ellis, 2001). The use of ICT could be helpful for teachers in reaching many goals of education and support teaching and learning in and outside the classroom. However, many teachers who are used to traditional teaching methods and do not want to change their teaching strategies may not believe in the benefits of ICT in education.

Moreover, as a result of many other factors, new technologies may not be integrated into the teaching environment by specific subject teachers. On the other hand, teachers in many countries attempt to make innovative use of these technologies since they believe in their benefits and positive effect on student learning or for other reasons. There appears to be numerous factors that influence teachers' use of ICT tools. The encouraging factors that influence teachers' innovative use of technology are discussed below. Although the process of integrating technology is moving slowly by Turkish Cypriot teachers, there are attempts to use different ICT resources in subject teaching. In the following section, the current situation regarding technology developments in Turkish Cypriot schools is discussed briefly.

NORTHERN CYPRUS CASE

Parallel to the evolution in education and technology around the world, there have been many developments in the Turkish Cypriot education system since 2000s. These changes were mainly aimed at enabling the community to take its rightful place among other communities in the information age and at establishing an educational system which is open to changes (Department of Educational Planning and Program Development, 2005). Moreover, there have been many investments on developing schools' ICT infrastructure. In general, secondary and high schools have two smart rooms that include an interactive whiteboard and scanner and almost all schools have an Internet connection. Of course, the quality of the Internet connection in many schools is still questionable.

In Turkish Cypriot schools, although the main technology resources are available, the quality and quantity of these resources may not be sufficient. In spite of this inadequacy of ICT resources, some teachers attempt to integrate the available technology into their teaching. Thus, within these school settings, it is important to understand the factors that help Turkish Cypriot teachers to use technology effectively. Although there were some research projects conducted previously, they were not sufficient to support the literature or to provide detailed information about the current situation in Northern Cyprus. It is hoped that the present study will contribute to the Turkish Cypriot literature and support further research and implementation in related areas. In addition, this study will help understand the enabling factors so that potential barriers can be removed in order to develop an educational environment for teachers that will motivate their frequent use of ICT.

Consequently, the objective of this study is to investigate the following research question: What are the factors that encourage use of ICT resources by teachers in subject teaching? How these factors can be divided?

BACKGROUND

Enablers

Some subject teachers, and perhaps a small number of teachers overall, make innovative use of ICT in their classrooms. What are the factors which facilitate the use of ICT in teaching and learning? The enabler factors are the factors that help and/or encourage teachers to integrate ICT into their teaching. In the light of the literature reviewed (Ertmer, 1999), the enablers are discussed under two sub-categories, namely, 'school factors' and 'teacher factors'.

School factors

These factors are related to the conditions and facilities supplied for teachers and which facilitate their use of ICT in teaching (Veen, 1993). There are many such factors (Scrimshaw, 2004). For example, teachers believe that if they have their own laptop and easy access to computers, this would encourage them to integrate ICT into their teaching (Scrimshaw, 2004). Cox, Preston & Cox (1999) also discovered that teachers are of the opinion that having their own computer is one of the positive factors that influence the perceived ease of ICT use. Abdullah, Abidin, Luan, Majid & Atan (2006) argued that providing teachers with a laptop, projector, and computer software would motivate not only students but also teachers in the teaching and learning process. When teachers have easy access to computers, this might give them sufficient time to prepare materials, search the Internet, and/or review the necessary software. Furthermore, teachers may make better use of ICT when they have the opportunity to use high quality resources and have full access to hardware and software (Forgasz, 2006; Scrimshaw, 2004).

One of the factors that prevent teachers' use of ICT, namely, technical problems and inadequate technical support, demonstrates that providing high level technical support whenever needed would enable teachers to use ICT (Forgasz, 2006; Lim and Khine, 2006; Scrimshaw, 2004;Yilmaz, 2011; Assan & Thomas, 2012). Moreover, it is important to be able to easily access the technology rooms and equipment available (Forgasz, 2006; Scrimshaw, 2004). Since, if teachers have the opportunity to access these tools and rooms at any time, they would be more eager to integrate them into their teaching (Scrimshaw, 2004).

The other most important factor that encourages teachers' technology use is adequate training on the use of ICT tools in teaching (Scrimshaw, 2004). The training should not only include basic technology skills but also provide training on improving pedagogical use of technology. This kind of training will help teachers feel confident and competent while using ICT at the right time and at the right opportunity. Moreover, when training offers real-life examples, it will help trainees to understand the best way and time to use ICT in teaching and learning. It is also discovered that commerce educators believe that professional support in teaching with ICT is also an important issue (Assan & Thomas, 2012).

Teachers also believed that having "whole school policies on using ICT across curriculum" is one of the school enablers for making effective use of ICT in the classroom (Scrimshaw 2004, p.9). The principal's positive attitude towards the use of ICT in teaching and learning and the school policy in this issue will be enablers for teachers (Forgasz, 2006; Veen, 1993). In Ertmer et al. (2012) research teachers mentioned that the support from the administrators is one of the most influential enablers in integrating technology. It could be argued that the enablers mentioned above are all interrelated with this one. This is because without a school-wide ICT policy, there would not be quality technical support, effective timetabling of ICT rooms and/or equipment, access to ICT resources, or training on the use of ICT in subject teaching.

Teacher Factors

The factors that enable teachers to use ICT are related to their own beliefs and skills (Veen, 1993), which is why they are identified as personal factors. Since they are intrinsic to teachers, these could be more effective in enabling the use of ICT in teaching and learning than school factors.

Some of the factors that influence the use of technology in teaching and learning are "teachers' attitude, teaching priority, computer skills and teaching preferences" (Bakar, 2007, p.29). Teachers' confidence in using ICT, experience, willingness, motivation, and the perceived usefulness of ICT in teaching and learning are some other important facilitators for the use of

technology in education (Cox *et al.*, 1999; ChanLin, Hong, Chang & Chu, 2006; Mumtaz, 2000). Drent and Meelissen (2008) discovered that having strong ICT competence is an important factor in innovatively using ICT in teaching, although not more important than other factors.

The level of teachers' pedagogical skills, that is to say, whether teachers are able to integrate ICT appropriately and know exactly how they will teach with ICT, is another major enabling factor (Veen, 1993). Of course, knowing how and when to use technology in teaching is related to having adequate training in the matter. Ertmer et al. (2012) also discovered that teachers' own attitudes, beliefs and knowledge and skills were mentioned as the biggest enablers in integrating technology.

The final but no less important personal enabling factor is teachers' awareness of the educational benefits of using ICT in their teaching. When a teacher is aware of the positive effects and benefits of a new method or tool for the students, s/he may become more eager to use it in teaching. It has been demonstrated that technology use in the teaching and learning environment motivates students (Abdullah *et al.*, 2006). In addition, some teachers are of the opinion that technology use is useful for lesson preparation as well as for actual teaching (Cox *et al.*, 1999). Being aware of all these benefits may thus promote the use of ICT in teaching.

Various factors encourage teachers' use of technology in their teaching as mentioned in many research studies. However, personal factors should be considered to matter more than the other factors since applying new technology is dependent on the teachers' positive attitudes and beliefs about its usefulness. Some of the enablers that promote the effective use of ICT in education as mentioned by teachers from a variety of countries were described here.

METHODODLOGY

In order to address the research question, a multiple case study approach was adopted for the aim of obtaining an in-depth description of experiences of particular cases in the integration of information and communication technologies into teaching and learning. The case study design can also integrate a variety of sources, research methods, and data in the investigation (Robson, 2002; Yin, 2003). The 'cases' for the study were seven volunteer secondary school teachers in Northern Cyprus. One of the reasons for choosing this secondary school was that the school was one of the public schools which have some ICT resources provided by the education authorities. Also, the researcher chose this school because of convenience. The school is located close to the researcher, so the data collection was more flexible. The participants of this study were all volunteer subject teacher. The subjects included High School Entrance Examination subjects, namely, Mathematics, Foreign Languages, Social Sciences, and Science. The subjects are all important core courses for secondary school students. There were two science teachers, two mathematics teachers, two English language teachers, and one social science teacher. The names of the teachers used throughout the article, Suzan, Veli, Ali, Filiz, Fatma, Ayşe, and Halil, are pseudonyms.

The research was done over two semesters. All seven volunteer teachers were interviewed at the beginning of the semester. The interviews took place in a quiet place and lasted approximately 30 minutes. With the participants' consent, each interview was tape-recorded and notes were taken during and after interviews in order to capture the non-verbal messages. The data gathered through these semi-structured interviews related to the factors that encourage teachers' technology use are presented here.

In the analysis of the data, the interview transcriptions and the notes that were taken during the interviews were used. The credibility was established by summarizing the interview notes to the

participants in order to check whether the results reflect what has been said (Mertens, 1998). Deductive and inductive approaches were employed in data analysis. Relating to the research question, some codes were obtained from the reviewed literature while others arose while reading the transcriptions. It was helpful to explore whether the Turkish Cypriot teachers have experienced enablers to the use of technology as identified in the literature by applying relevant codes deductively to the data. On the other hand, only using the codes obtained from the literature would not reflect all the findings of the research. Thus, the inductive approach was also used to understand the emerging themes.

FINDINGS AND DISCUSSION

The findings of this study are explored in three parts. These are 'school factors', 'teacher factors', and additional enablers which emerged as a result of the inductive analysis.

School Factors

The information presented in this part was gathered through the deductive approach. School factors are those facilities provided for teachers for their development and the common use of technology in their teaching (Veen, 1993).

Previous research indicated that teachers are of the opinion that having their own laptop is an enabler for the integration of technology into teaching (Cox et al., 1999). However, in this study, none of the participant teachers mentioned this as an enabler. This indicates that they may not believe that having their own laptop is a significant factor for the frequent use of technology in teaching. Moreover, many of teachers had already bought their own laptop but this did not positively affect their frequent use of technology in teaching. It may be the case that, instead of having their own laptop, they would prefer to have good and well-designed ICT infrastructure available to all in the school. The difference between these results and previous research results may be due to cultural differences and teachers' beliefs.

Since there is only one computer room in the school and it is generally assigned to IT lessons, other subject teachers did not have the opportunity to use this room whenever they want. Many of them believed that if they were given the chance, they would use this room more frequently. Teachers suggested that if there were an official booking system for the computer room and smart rooms, these rooms would be regularly used by many teachers:

> *The computer room or other ICT rooms are not being used regularly, because there is one computer room and two smart rooms and they are open to everyone, and there is no schedule or booking system. If there is only one or two rooms, then there should be a booking system so many teachers will have an opportunity to use them... (Ayşe)*

Consequently, the availability of and easy access to ICT rooms are major enablers that encouraged teachers' use of technology in their teaching. The availability of rooms provides an opportunity for the effective implementation of ICT (Forgasz, 2006; Scrimshaw, 2004). The participant teachers were of the opinion that if they were given an opportunity to access these rooms whenever needed, or at least through an advance booking system, they would have taken advantage of this opportunity.

Even though it is important to have access to computer rooms or smart rooms, it is also important to have access to other ICT resources that can be integrated in ICT-mediated lessons, like graphical calculator, the Internet, and a variety of software. One of the most important enablers mentioned by all teachers, confirmed by the literature (Forgasz, 2006; Scrimshaw, 2004) is

having the opportunity to access high quality resources and materials. Interviewees believe that materials and tools that enable ICT-integrated teaching, such as educational software, CDs, DVDs and ready curricula which cover ICT activities, would encourage their frequent or proper use of technology:

> *We need materials and resources… now we research these ourselves... Perhaps, if all schools had these materials and educational CDs, each teacher would get one depending on his topic and use it. But if the teacher has to do all this preparation and research, some will do it and some not. If they have access to these resources, technology would be used more in teaching…(Suzan)*

> *If an example of a teaching material were provided in the curriculum and it was mentioned that a certain topic could be taught in such and such a way, …this would encourage teachers to use the materials… (Veli)*

> *In my opinion, there should be ready CDs or DVDs that include various topics in geometry, like angles and solid objects, or there should be ready slides for teachers who prefer to use the OHP. This would positively affect the use of ICT tools…because teachers would be more relaxed since now they have to prepare all these materials themselves… (Ali)*

Teachers also believed that, besides providing high quality resources, it is also important to inform teachers about how they can obtain these resources.

Having adequate training on the use of ICT in teaching is another common enabler mentioned by many teachers, similarly to the data obtained by Scrimshaw (2004). Since inadequate training could be an important barrier to the integration of technology into teaching, when this barrier is removed it is possible that teachers will make an attempt to use ICT in their teaching. When a teacher is provided with high quality resources and well-designed ICT infrastructure, there may still be difficulties in successfully applying technology-based education. This is because teachers may not have sufficient training on how to integrate and use these resources and tools in teaching. As Fatma and Ayse commented:

> *As a society we are deprived of technology, I guess… so we really need encouragement. In-service training can be helpful for us (teachers). However, training should not be deductive teaching like the presenter presents and teachers listen because this is not helpful. I think when the training provides participants with the opportunity to be active and apply the information given, this would be helpful. After this kind of training we would be able to use technology more and effectively. (Ayşe)*

> *In order to be able to use new technologies appropriately in teaching, we need to have good in-service training… (Fatma)*

Training is a very important enabler, but it should consist not only of improving basic IT skills but also provide an opportunity to the teacher to learn pedagogical ways to use ICT in teaching through practice during the training. The style and aim of training is important in encouraging teachers and in improving their confidence in technology use.

It is not directly mentioned by all teachers that their principal's positive attitude would influence their frequency of technology use. However, they stated that with the help of the principal in making an ICT room available to them, they may use ICT in their teaching:

> *If I want to use the computer room, which is generally used by computer teachers only, the principal and vice-principals help me. They may swap the lessons and enable me to use this room… (Suzan)*

Of course, this kind of support is only helpful for those teachers who are already willing to integrate technology into their teaching. For the others, a governmental ICT policy which encourages support for every single teacher to integrate technology into their teaching is needed:

> *Our principal is very interested in technological innovations in education. He was the initiator for the wireless Internet connection for teachers in the school but he has a limited budget. I believe there should be a really good ICT policy in government. (Fatma)*

To summarize, although the principals' positive attitude promotes technology use in education, it is not adequate. As mentioned in the literature, there should be a general policy on the use of ICT (Forgasz, 2006; Veen, 1993).

In the case at hand, since the Cyprus Turkish education system is centralized, it is more important to have a governmental ICT policy throughout the country. Thus, this may apply to everyone and makes it easy to spread and increases the use of ICT in teaching and learning. There should not be a compulsion to use ICT. This is because it is not desired that teachers use technology in their teaching just for the sake of using it, but because of its benefits for students and themselves.

Teacher Factors

These enabling factors are more related to the teachers themselves, in other words, to the teachers' beliefs and those skills which enable them to use ICT (Veen, 1993).Having many technology resources and tools and a principle with positive attitudes towards technology use may not be sufficient for frequent use of ICT in teaching. It is because, if teachers' feelings and thoughts are negative towards the use of ICT in education, they cannot be expected to use technology frequently in their teaching. In the present study, some of the participants agreed that teachers' positive attitude towards technology may increase its use in education, another finding confirming the literature (Bakar, 2007):

> *Teachers' positive attitude towards and interest in technology (smart rooms, because that is what we have) may enable teachers' use of ICT in their teaching. (Veli)*

> *I think the enabler for ICT use in teaching and learning is loving technology, in other words, having a positive attitude towards technology … (Filiz)*

Teachers' confidence and their skills in ICT use was another teacher factor that may enhance teachers' use of technology in their teaching. If a teacher lacks ICT skills, s/he may not feel confident enough to integrate technology in teaching. In other words, teachers believed that if a person knows how to use technology in their personal life, this may lead him/her to use it in teaching as well:

> *The more a person is involved in technology, the more s/he will tend to use it even more and better. A person who does not know how to use technology (computers) will avoid using it... so, having technology (computer) skills is an enabler factor in integrating ICT into teaching. (Suzan)*

Having a positive attitude is an important factor enabling teachers' use of ICT but in order to have a positive attitude, a teacher may need to have some ICT skills and feel confident in using ICT

(Cox *et al*., 1999; ChanLin *et al*., 2006; Mumtaz, 2000).

Another encouraging factor, also compatible with the literature (Cox *et al*., 1999), is being aware of the educational benefits of using ICT for students and teachers. It is important to be conscious about the benefits of using an application. This is because it would help teachers not to use technology just for the sake of using it but because they realise that their students will benefit from it. The importance of being aware of the advantages and educational benefits of technology was mentioned by a participant who frequently uses technology: "*After realizing the advantages of technology, I could not give up using it in my lessons.*" (Filiz)

New technologies change the process of the lesson as well as the students' interest and motivation and knowing this may encourage teachers to use them in their teaching:

> *I am using new technologies; I was using video, TV, tapes, and the OHP but interactive whiteboards, computers, and the Internet!… I have been using these since last year and see many advantages to them. I do recommend them to all my colleagues; they really have a positive influence on the flow of the lesson. (Filiz)*

It is also believed that technology use increases students' motivation for learning and that they participate in the teaching and learning process without feeling bored and the learning becomes enjoyable (Abdullah *et al*., 2006). Thus, the identification of this and other benefits might encourage teachers to integrate ICT into their teaching. Teachers can be made aware of these benefits with the help of pre- and in-service training sessions and examples or samples.

Additional enablers emerging from inductive analysis

The enablers mentioned above confirm the literature reviewed. There are also some enabling factors that emerged from the inductive analysis. In this category, the first common enabler mentioned by the participants was the encouragement of teachers' motivation by the principal and the education authorities. Half of the participants interviewed believed that, the frequency of technology use in education may increase when there is encouragement and motivation directly from the education authorities and then from the principle. Subsequently, the frequent and successful use of technology could be rewarded at the end of the semester.

> *In order to make all teachers use ICT in their teaching, its use should be encouraged by the authorities and by the school administration. (Veli)*

In contrast to this kind of encouragement, it was also mentioned that ICT use in teaching could be made obligatory by the education authorities and monitored by inspectors. In other words, the authorities should put pressure on teachers to integrate technology into their teaching:

> *Furthermore, it would be used more and often if it were made compulsory by the inspectors and the school administration… Assuming the way and time of technology use were stated in the curriculum, the inspector would check whether or not it was applied by teachers and the principal would enter positive comments into the register. This would encourage many teachers to use ICT in their teaching. (Ayşe)*

Of course, pressure does not always work; however, making technology use compulsory while simultaneously providing high quality resources and training would positively encourage teachers to use ICT. Moreover, while teachers may use technology only because it is compulsory at the beginning, they may later come to realise its benefits for the students' learning and their own teaching. Furthermore, teachers stated that having access to examples of ICT usage and activities in their field would assist and encourage them to use technology. They were of the

opinion that, including possible examples and indications of the manner of teaching certain specific topics with ICT into curriculum would encourage all teachers, including the ones who already use and who have never used technology.

Another enabler is related to a barrier, which is the high number of students in the classrooms. It is difficult to use technology tools, like computers, in classrooms where the number of students is high since there are not enough computers for all the students. Having a high number of students in the classroom would also cause problems when moving students from their regular classroom to the smart room or computer room. Parallel to this barrier, the teachers were of the opinion that having a lower number of students in the classroom makes it easier to integrate technology into teaching, especially if they need to change rooms to use technology. Thus, teachers confirmed that having few students in the classroom was also an encouraging factor for ICT integration.

CONCLUSION

Globally, there are important developments in the way new technologies are used in teaching. It is also obvious that there are different kinds of new technologies that could be integrated into teaching and learning, helping teachers to reach students and continue teaching outside the classroom, like Web 2.0 technologies (Davies and Merchant, 2009). The literature shows that there are teachers all around the world implementing ICT and Web 2.0 technologies in their teaching. One of the reasons for this could be that ICT tools have a great potential in teaching and learning when they are used in a well-structured learning environment. It is argued that the use of ICT enables individualized instruction and collaborative learning (Trinidad, MacNish, Aldridge, Fraser & Wood, 2001).

The critical goal of the present study was to examine facilitators of technology integration for Turkish Cypriot teachers. The research aimed to gather qualitative data about the factors that promote Turkish Cypriot teachers' use of ICT in teaching secondary school subjects.

The findings indicate that teachers' positive attitudes towards technology use in teaching would also make possible the integration of technology into education. In other words, knowing and believing in the advantages and educational benefits of using technology tools would be encouraging factors for their frequent use. Furthermore, it is important to be able to integrate technology into a related activity in subject teaching. Teachers were also of the opinion that encouragement and motivation from the educational authorities and the principal may increase teachers' use of technology in teaching. There are a number of implications of this study. For example, educational authorities may consider setting up a promotion system for teachers based on the best usage of ICT resources. Moreover, principals should be encouraged to provide feedback or good references to teachers on their successful integration of technology into teaching.

The findings suggest that teachers are affected by similar enablers in integrating technology into teaching and learning whatever the culture, background, and country, although there are obviously context-specific issues to address. Much of the previous research in this area has been undertaken in the UK, Australia, USA and some northern European countries, including Finland and Norway. There is a need for similar research to be undertaken in other areas, which is a distinct contribution this study makes. There is now much evidence about how the use of ICT can be supported in the classroom. It is important that all countries identify how best to develop teachers' technological and pedagogical skills and positive attitudes towards technology use through well-designed training programmes that are sensitive to local needs.

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