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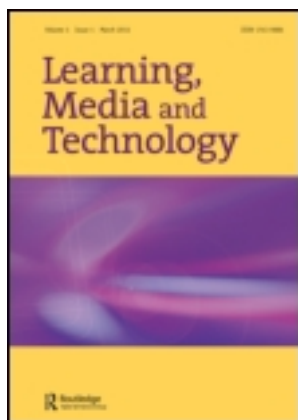
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The effects of case-based learning on early childhood pre-service teachers' beliefs about the pedagogical uses of ICT

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The effects of case-based learning on early childhood pre-service teachers' beliefs about the pedagogical uses of ICT

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The study examined the extent to which case-based learning could have an effect on pre-service teachers' beliefs about the pedagogical uses of ICT in the classroom. One hundred second year early childhood pre-service teachers enrolled in an ICT course participated in the study. Research data were collected with a questionnaire, reflection papers, course evaluations and focus interviews. The findings showed that initially the majority of pre-service teachers had negative beliefs and certain misconceptions regarding the pedagogical uses of ICT and that case-based learning effected their beliefs and conceptions. Future research studies should examine the extent to which a case-based learning approach for the teaching of ICT in pre-service teacher training can actually have an effect on appropriately integrating ICT into real classroom practices.

Introduction

Countries from all over the world attribute a significant role to information and communication technology (ICT)[1] in improving education and reforming curricula (Pelgrum, 2001; Kozma & Anderson, 2002). Thus, schools have made major investments, and continue to invest heavily, in increasing the number of computers and the networking of classrooms (Pelgrum, 2001). However, according to the Second Instructional Technology in Education Study, Module 2, most countries 'have a relatively small number of schools and teachers who are taking the lead in using technology to make changes in pedagogical practices that prepare students for the future' (Kozma & Anderson, 2002, p. 387).

Recent research (Beaver, 1992; Oliver, 1994; Wild, 1995; Yaghi, 1997; Yildirim & Kiraz, 1999; Mumtaz, 2000) showed that a factor influencing beginning teachers' uptake of computers is the limited amount and inadequacy of pre-service teacher training. It seems that the training of pre-service teachers will be pivotal in determining the future role of ICT in elementary and secondary education (Murphy & Greenwood, 1998; Wedman & Diggs, 2001; Wheeler, 2001). Consequently, teacher

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education departments should undertake the responsibility of effectively training prospective teachers to integrate ICT in teaching and learning (Wedman & Diggs, 2001; Dexter & Riedel, 2003; Russel *et al.*, 2003).

There is also research evidence (Cuban, 1986, 2000; Darling-Hammond, 1990; Bosch & Cardinale, 1993; Ely, 1995; Hunt & Bohlin, 1995; Brush, 1998; Becker & Ravitz, 1999) which shows that several other factors, besides the inadequacy of pre-service teacher training, may also contribute to the failure of technology reform efforts. For example, lack of strategic vision, lack of technical support, fear of innovation and teachers' beliefs have all been identified as factors that may also play a role in school reform efforts (Cuban, 1986, 2000). Shahan (1976) argues that one important concept of school reform is the human element, which embraces emotions, feelings, needs, beliefs and pedagogical assumptions. Fullan's (1982, 1991, 2000) theory of school change emphasizes that the alteration of mindsets, such as pedagogical assumptions, values and beliefs, is a key factor to any educational change effort.

Watt (1980) also states that beliefs play a fundamental role in the way that teachers deal with ICT in the classroom. In other words, dealing effectively with ICT relates not only to knowledge of the capability, limitations, applications and implications of ICT, but also to individuals' beliefs and perceptions towards ICT tools. Levine and Donitsa-Schmidt (1998) stated that the effective implementation of ICT depends upon users having a positive attitude towards it. Similarly, Veen (1993) showed that schools can go only so far to encourage ICT use and that actual take-up depends largely on teachers' personal feelings, skills and beliefs. This implies that teachers who have positive attitudes towards ICT and perceive it to be useful in promoting learning will evidently integrate ICT into their classrooms more easily than others (Sandholtz *et al.*, 1997; Cox *et al.*, 1999; Pedretti *et al.*, 1999; Becker & Riel, 2001).

In a study conducted to study UK primary teachers' perceptions and use of computers in the classroom (Drenoyianni & Selwood, 1998), an association between teachers' beliefs about computer use and teachers' patterns of actual computer use was found. 'Teachers' rationales for computer use are "transformed" into sets of goals and objectives; these in turn become decisions about the software they will use and the way they will use it; the issues they will consider prior to implementing computer activities and the role they will adopt during children's computer interactions' (Drenoyianni & Selwood, 1998, p. 96). Similarly, Russel *et al.* (2003) found in their research that teachers' beliefs are good predictors of nearly all types of ICT uses. 'Quite simply, changing teachers' use of technology requires changing their beliefs about technology' (Russel *et al.*, 2003, p. 307). Myhre (1998) argues that it is not easy to alter beliefs within a short amount of time, but, nonetheless, learners' beliefs can be confronted through purposeful instruction. The use of ICT in relation to pre-service teachers' beliefs, Myrhe (1998) continues, must be considered in teacher education courses if changes are to take place in the classroom. Thus teacher educators should employ instructional approaches to help pre-service teachers become more reflective and evaluative of what they believe about the pedagogical uses of ICT in the classroom.

In most teacher education institutions ICT courses are designed to teach pre-service teachers basic computing skills (Wild, 1996; Lee, 1997; Selinger, 2001),

introduce them to various common computer applications, such as Word, Excel, Powerpoint and Email, and teach them how to integrate these applications into classroom teaching (Yildirim & Kiraz, 1999; Becker, 2002). Nevertheless, as Yildirim (2000) argues, the focus of ICT courses should not only be on skills, but also on how pre-service teachers' beliefs about the pedagogical uses of ICT can be affected and changed appropriately.

Russel *et al.* (2003) suggest that teacher preparation can be enhanced by providing students with cases of teachers who have experience in integrating ICT into the curriculum and classroom. A case-based learning approach is considered good modelling for pre-service teachers, because it situates learning in 'real-life' practice and presents an authentic picture of the teaching profession (Shulman, 1992; Lundeberg *et al.*, 1999; Jonassen *et al.*, 2003). Jonassen *et al.* (2003) support the idea that 'stories told by teachers about their experiences with integrating technologies in the classroom can be used to help other teachers learn how to use technology' (p. 550) and that transfer is more direct when using a case-based approach than a traditional deductive approach. Learners can vicariously experience through the cases what really works and, consequently, apply the lessons learned from others' experiences to their own situations. Another study, commissioned by the Milken Exchange on Education Technology and conducted by the International Society for Technology in Education (1999), also recommended that examples of effective ICT integration should be disseminated on an ongoing basis in teacher education programmes.

Moreover, Russel *et al.* (2003) argue that efforts to bring the practices employed by teachers into the vision of teaching pre-service teachers have the potential to influence pre-service teachers' initial beliefs about ICT tools and, ultimately, their ICT practices in a real classroom. According to Bransford *et al.* (2001), students' initial conceptions create a framework for understanding new information and the process of learning depends on the extent to which an individual's initial conceptions integrate with new information. A case-based approach fosters reflection and, thus, as has been argued by several researchers (Harrington, 1996; International Society for Technology in Education, 1999), has the potential to trigger a re-evaluation of learners' initial beliefs in the light of new information.

Therefore, within this framework, the present study was designed to investigate the effects of case-based learning on pre-service teachers' beliefs about the pedagogical uses of ICT. In particular, a case-based learning approach was adopted for the teaching of an ICT course in a teacher education department, and the study was designed to examine the extent to which a case-based approach would instigate evaluation and, ultimately, change in pre-service teachers' beliefs about the pedagogical uses of ICT in the classroom.

Methodology

The context of the study

One hundred second year early childhood pre-service teachers enrolled in an ICT course participated in the study. Participants were admitted in an early childhood

teacher education programme preparing students to teach in pre-primary and lower primary education. The author of this paper taught four sections of the same ICT course, two in the autumn of 2000 and two in the spring of 2001. Prior to this course, students completed a basic computing course in which they learned Word, Excel, PowerPoint and use of the Internet. The main objective of the basic computing course was to promote students' skill level. The ICT course was designed around three major objectives:

(a) to familiarize students with current practices of teachers experienced in ICT integration;
(b) to provide students with opportunities to reflect upon and reassess their current state of beliefs about the pedagogical uses of ICT;
(c) to provide students with hands-on experiences regarding the integration of certain educational software in pre-primary and lower primary education.

Procedures

There were 13 60 minute lecture meetings and 13 75 minute laboratory meetings for each section of the course during each semester. During the laboratory meetings students were introduced to several types of educational software and learned how to evaluate and integrate them into the curriculum and the classroom. During the first three lectures the instructor introduced and discussed theoretical issues related to ICT integration, such as teaching methods, learning theories and lesson plan design. These introductory lectures were considered necessary prior to discussing and analysing real cases of teachers who integrated ICT tools into their classrooms, because students had no previous knowledge of teaching methodology. In the third lecture a questionnaire was also administered to students. It consisted of only two statements, namely (a) I am interested in teaching with ICT and (b) I am skeptical about teaching with ICT. They were also asked to explain in writing their position and reasons for holding that point of view about integrating ICT into K-3 classroom environments. Eliciting students' beliefs at the beginning of a course is considered important (Bell, 1985) because (a) students become aware of their current state of beliefs and (b) teachers become aware of what each student believes and knows.

In the remaining lectures 10 cases of teachers who had integrated ICT in teaching and learning were presented, discussed and analysed. Students were initially presented with a case of a teacher who integrated ICT into his or her classroom and were asked to discuss and analyse the case. Discussions about each case were guided to (a) challenge students' beliefs about teaching with ICT by raising questions concerning the value of ICT tools and (b) analyse issues relevant to integrating ICT, such as teachers' pedagogical beliefs and values, teaching methods, technology infrastructure, help and support from the school environment and the community and educational software design that was further clarified and discussed with specific examples during the laboratory meetings.

Four different types of cases were presented to students:

(a) cases of teachers who initially held negative beliefs and successfully integrated ICT into their classrooms;
(b) cases of teachers who initially held negative beliefs and failed to successfully integrate ICT into their classrooms;
(c) cases of teachers who initially held positive beliefs and successfully integrated ICT into their classrooms;
(d) cases of teachers who initially held positive beliefs and failed to successfully integrate ICT into their classrooms.

For each case students were provided with rich descriptions of its context (school environment, school climate, infrastructure, etc.), so that students could have a realistic picture of the factors inhibiting or facilitating the integration of ICT into the school classroom.

At the end of each semester, students were asked to write reflection papers explaining their beliefs before and after completing the course and evaluation essays stating their perceptions of the case-based approach. Lastly, there were 20 semi-structured focus interviews, 10 of which were conducted one month after the autumn semester ended and the other 10 one month after the spring semester ended. The instructor of the course conducted all interviews. According to Merriam (1988), semi-structured interviews are guided by a list of questions or issues to be explored, but neither the exact wording nor the order of the questions is determined ahead of time. 'This format allows the researcher to respond to the situation at hand, to the emerging worldview of the respondent, and to new ideas on the topic' (Merriam, 1988, p. 74). During the interviews students were asked to comment on any aspect of the course they wanted and to compare and contrast the beliefs they had at the beginning of the course with their beliefs after completing the course. Thus, the purpose of the interviews was to investigate the validity of the information students wrote in their reflection papers and evaluation essays and to further explore how the course affected their beliefs about the pedagogical uses of ICT in K-3 education.

The use of multiple methods to collect data is a form of triangulation (Denzin, 1970). Triangulation combines different methods for collecting data to study the same unit. 'The rationale for this strategy is that the flaws of one method are often the strengths of another, and by combining methods, observers can achieve the best of each, while overcoming their unique deficiencies' (Denzin, 1970, p. 308).

Results

Research data were analysed qualitatively into categories and themes (Lincoln & Guba, 1985; Merriam, 1988). The results from the analyses of the questionnaires and students' explanations, as well as the results from analysing the reflection and evaluation papers, are presented in Figure 1. As shown in Figure 1, the categories that emerged from the analyses were not mutually exclusive, as participants' responses covered a breadth of ideas expressed in various categories.

Figure 1. Categories of students' responses to different instruments

Instrument	Category of response	n	Category of response	n
Questionnaire data	I am interested in teaching with ICT	36[a]	I am skeptical about teaching with ICT	64[a]
	ICT can be used to present information in different and better ways	24	ICT promotes passive learning	30
	ICT, such as the Internet, can be used for searching and finding materials	36	ICT isolates children from the social milieu	28
	ICT can facilitate effectively and efficiently the preparation of instructional materials	15	ICT limits children's fantasy and creativity	15
			ICT provides canned knowledge to students	62
			I am afraid to apply ICT in teaching, because I do not know how children will react	55
Reflection papers		36[a]		64[a]
	Lacking appropriate technical skills	3	Lacking appropriate technical skills	10
	Not informed about ICT's potential in teaching and learning	25	Not informed about ICT's potential in teaching and learning	58
	Lacking knowledge and appropriate skills of how ICT should be integrated	28	Lacking knowledge and appropriate skills of how ICT should be integrated	62
			Negative attitudes (fear, etc.)	55
Evaluation papers		36[a]		64[a]
	The course was different from other courses	27	The course was different from other courses	50
	The content was challenging	23	The content was challenging	43
	The materials were related to the teaching profession	33	The materials were related to the teaching profession	55
	The discussions were interesting	27	The discussions were interesting	51
	We could express and clarify our own ideas	30	We could express and clarify our own ideas	56

[a]Responses to each category were not mutually exclusive.

Pre-service teachers' initial beliefs

The questionnaire data were collected prior to the presentation, analysis and discussion of the 10 cases regarding ICT integration into early childhood education. Of the 100 participants, 36 of them stated that they were interested in teaching with ICT, because they could use ICT to (a) present information to learners in different and better ways (24), (b) find curriculum materials on the World Wide Web (36) and (c) prepare instructional materials (15). Thus, although all of them stated that they could use ICT to find curriculum materials on the World Wide Web, only 24 of them were aware of the potential of ICT to present information in better ways and most of them (21) did not recognize the potential of ICT in preparing instructional materials.

The remaining participants (64) stated that they were sceptical about the value of ICT in early childhood education. In their explanations they argued that learning with ICT contradicts fundamental principles of early childhood learning. Specifically, students stated that ICT (a) promotes passive learning (30), (b) isolates children from the social milieu (28), (c) limits children's fantasy and creativity (15) and (d) provides canned knowledge to children (62). Moreover, the majority of the 64 students (55) attributed their scepticism and reluctance to use ICT in the classroom to fear, because they did not know how children would react to using ICT tools in the classroom.

Pre-service teachers' reflections on their initial beliefs

According to the thematic analysis of students' reflection papers, the 36 students who initially had a positive outlook to ICT integration stated that after the course their beliefs were more positive and that they also felt adequately informed about integrating ICT into teaching and learning. Specifically, they stated that before the course (a) they lacked technical skills to appropriately integrate ICT into the curriculum (3), (b) they were not adequately informed about the potential of ICT in teaching and learning (25) and (c) they were not cognizant of how ICT should be integrated into the classroom environment (28). The following excerpts are indicative examples of students' positions:

> I was always interested in ICT-enhanced instruction, but the truth is that I was not informed about the role of ICT in teaching and learning. I thought that ICT was only good for games and nothing else. I never thought that it had an instructional value. Gradually, I changed my mind about how it can be effectively integrated in a pre-primary classroom. (S_{65})

> I was always interested in using ICT, but in reality, I didn't know how to integrate it in the curriculum. I thought that it was enough to have children play with it. I never thought of ICT as a tool to enhance teaching and learning. Now, I feel better prepared to use it in my classroom. (S_{89})

The students who expressed scepticism about teaching with ICT (64) stated that their beliefs changed after taking the course and attributed their scepticism at the beginning of the course to several reasons. Some of them (10) stated that they lacked

necessary technical skills, 58 of them stated that they were not informed about the pedagogical uses of ICT, 62 of them stated that they did not know how to integrate ICT into their classroom and 55 of them attributed their initial scepticism to fear. All students stated that they learned a lot from the course and felt well informed about the pedagogical uses of ICT and how ICT can be integrated into the curriculum and their classroom. The following excerpts are taken from students' reflection papers and are indicative of their thinking:

> My beliefs have changed. At the beginning, I thought that the computer was just a box that had complete control over us. Gradually, I changed my mind, and I came to appreciate the fact that ICT is just another tool that can help a teacher become a better teacher. (S_6)

> Initially, my attitude was negative, because of ignorance. After dealing with the stories of other teachers, I learned about the process they went through, their successes, and failures. This helped me re-evaluate my beliefs. I still believe that the teacher must have face to face interactions with the children, but there are cases that ICT can help. (S_{97})

> At the beginning, I was very skeptical about using ICT in K-3 education. I was afraid that ICT would replace the teacher or her role would be marginalised. Gradually, I came to realise how wrong I was, because ICT can be a powerful tool in a teacher's hands when she knows how to use it properly. (S_{78})

Course evaluations

Students' course evaluations at the end of each semester were particularly informative. Students, regardless of having positive or negative beliefs at the beginning of the course, almost unanimously stated that the course was really beneficial and that they felt well informed about the value of integrating ICT to enhance teaching and learning in early childhood education. Specifically, of the 100 students who participated in the study, 77 stated that the course was different from other courses they took and that the course content was challenging (66). Moreover, students stated that the materials were directly related to the teaching profession (88), that the discussions were interesting (78) and that they could express and clarify their own ideas (86). The following excerpts represent indicative examples of students' evaluations.

> The course was different from any other course I have taken. It made me think in ways I've never dreamed of. (S_1)

> The content of the course was challenging, but very interesting, and reading about the efforts of other teachers helped us remember the content better. (S_{12})

> The method was successful, because of the complexity of the subject matter. (S_{30})

> The way the course was taught contributed to our understanding, because it allowed us to express our thoughts freely without worrying that someone might make fun of us. (S_4, S_6 and S_9)

> The discussions during class meetings were interesting and the readings relevant and useful in integrating ICT in a real classroom. (S_{15})

Focus interviews

During the focus interviews students further explained that the course was an eye-opener to them and that they no longer felt ignorant or misinformed about the value and pedagogical uses of ICT in the classroom. Most importantly, students vividly explained that they realized that the real issue was to think critically about the pedagogical uses of ICT and how to best utilize ICT in certain instructional situations. Finally, all students commented on how the case-based instructional approach helped them develop critical thinking skills. The excerpts that follow explain students' views:

> I learned to critically communicate with others. In reality this skill will help me throughout my career and personal life. (S_{78})

> I learned to be patient and listen to others' points of view. I also learned not to be judgmental, but to analyze, examine, and argue with reason and evidence. (S_{27})

> The instructor's questions made the students think and helped them develop a critical spirit about ICT and its value in teaching and learning. (S_{19})

Discussion of results

The present study provides evidence that case-based learning can effect pre-service teachers' beliefs about the pedagogical uses of ICT and correct certain misconceptions they may have regarding the value of ICT in K-3 education. The data from the study clearly indicate that pre-service teachers are not free of personal beliefs about the role of ICT in K-3 education and that they may also have false beliefs about the potential of ICT tools in teaching and learning. Specifically, of the 100 students who participated in the study, 64 were sceptical and reluctant about teaching with ICT and expressed certain false beliefs and misconceptions about the pedagogical uses of ICT in early childhood education. Thus, the study also presents evidence for the need to provide adequate ICT training in teacher education programmes in order to correct possible false beliefs that pre-service teachers may have about the pedagogical uses of ICT.

Research evidence from the reflection papers, course evaluations and focus interviews illustrates the effects of case-based learning on pre-service teachers' initial beliefs and how a case-based approach helped them re-evaluate their beliefs and become adequately informed of the pedagogical uses of ICT. Specifically, of the 100 pre-service teachers who participated in the study, 83 stated that prior to taking the ICT course they were not properly informed about the value of ICT in teaching and learning and 90 said that they did not have the skills or knowledge to integrate ICT into the curriculum and classroom. The evidence clearly suggests that case-based learning, and the associated activities and discussions, were the vehicle that helped pre-service teachers re-evaluate their beliefs. According to the results, all participants, especially those who initially expressed scepticism and negative beliefs (64), were willing to think again or had been convinced about the value of ICT in teaching

and learning. The model of case-based learning seems to be an effective approach for helping students to understand the value of ICT as an educational pedagogy.

Interestingly, the case-based approach also proved to be good for the 36 students who held positive beliefs about ICT integration from the beginning of the study. Specifically, these students wrote in their reflection papers that even though they were interested in teaching with ICT, they had not been informed about the potential of ICT in teaching and learning (25) and they did not have the knowledge or skills to integrate ICT into the classroom (28). All 36 students said that after completing the course they felt well informed about the pedagogical uses of ICT. In addition, these findings show that pre-service teachers' positive beliefs about ICT integration alone cannot ensure success, because pre-service teachers may be lacking other skills and knowledge equally important for the successful integration of ICT into a real classroom.

Finally, I would like to comment on the types of cases that were used in the present study. It was previously mentioned that there were four types of case: (a) cases of teachers who initially held negative beliefs and successfully integrated ICT into their classrooms; (b) cases of teachers who initially held negative beliefs and failed to successfully integrate ICT into their classrooms; (c) cases of teachers who initially held positive beliefs and successfully integrated ICT into their classrooms; (d) cases of teachers who initially held positive beliefs and failed to successfully integrate ICT into their classrooms. This methodological decision was very important, because students were able to identify with a teacher who shared the same point of view and through him or her vicariously live the same experience. This instructional tactic triggered reflective thinking and provided students with a learning activity that was perceived as relevant to them. Thus, it is imperative that teacher educators carefully select appropriate cases for discussion in order to achieve an enduring effect on learners' beliefs and better facilitate the transfer of pre-service teachers' conceptual growth and change to a real classroom.

Conclusion

In conclusion, the findings of the study showed that case-based learning effected the beliefs of pre-service teachers regarding ICT integration and corrected certain misconceptions or false beliefs they had prior to participating in the study. Despite the fact that it is clear from the results of the study that case–based instruction effected pre-service teachers' beliefs, the nature of the data does not guarantee that pre-service teachers' self-reported statements about experiencing changes in their beliefs will actually carry into the classroom. This is due to the fact that many other factors, such as reluctance to change, general fear of innovation, and other external factors (Rogers, 1995), may inhibit the integration of ICT in the classroom. Nonetheless, a case-based model seems to effect pre-service teachers' beliefs, and positive beliefs are good predictors of behavior intentions and actual classroom practice (Fishbein & Ajzen, 1975). Thus, future research is needed to examine the extent to which a case-based approach for the teaching of ICT in pre-service teacher

training can have an effect on appropriately integrating ICT in real classroom practices.

Note

1   In this study the term ICT is used broadly and includes the Internet, the World Wide Web and all types of educational software.

Notes on contributor

Charoula Angeli undertook undergraduate and graduate studies at Indiana University–Bloomington, USA (B.S. Computer Science 1991, M.S. Computer Science 1993, Ph.D. Instructional Systems Technology 1999). She has worked as a post-doctoral fellow at the Learning Research and Development Center at the University of Pittsburgh, USA (1998–1999). She is now at the University of Cyprus as a lecturer in instructional technology in the Department of Education (2001–present). Her research interests include the utilization of educational technologies in K-12, the design of computer-enhanced curricula, educational software design, teacher training, teaching methodology, online learning and the design of learning environments for the development of critical and scientific thinking skills.

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