



Learning new technology tools in pre-service teacher education: A model for instructional approach

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The purpose of this qualitative study is to propose a model of instructional approach for pre-service teacher education in the area of learning a new technology tool. Through the instructional approach, it is hoped that pre-service teachers will become confident in integrating the technology tool which they have learnt, to enhance teaching and learning in the classroom. The study involved 30 Post-Graduate Diploma in Education (Physical Education) pre-service teachers and 59 Post-Graduate Diploma in Education (Secondary) pre-service teachers who were attending a core Information and Communication Technology (ICT) course in the year 2010. An instructional approach was designed for the implementation of video sports games for the 30 Physical Education (PE) pre-service teachers and for the implementation of Interactive White Board (IWB) for the 59 Post-Graduate Diploma in Education (Secondary) (PGDE Sec) pre-service teachers. During the course, the pre-service teachers were introduced to Video Sports Games and Interactive White Boards through an instructional approach that comprised of self-paced team exploration of the tools, peer sharing and critique, team exploration of various lesson plans culminating in lesson ideas/plans designed as a team. Based on data collected through observations, reflections and artifacts submitted by the teams, this study proposes a refined instructional approach to be adopted at the pre-service teacher education level for effective learning of the technology tool. The findings revealed that immersion time with the tool, team learning, peer sharing and critique were significant components which enhanced the pre-service teachers' learning experience. The study explores the significant role of the tutor and pre-service teachers and proposes an enhancement of the current instructional approach.

Keywords: Teacher Education, learning technology tool, instructional approach

Background

A number of studies have reported that the large amount of investment in technology integration in education did not reap the desired results. Concerns were raised that the potential for ICT to change how teachers teach and how students learn had not been fully realized (Bate, 2010; Meredyth, Russell, Blackwood, Thomas, & Wise, 1999). Other studies reported that although technology integration has taken place, teachers were not making effective use of ICT for teaching purposes (OECD, 2001; Venezky & Davis, 2002; Voogt, 2008; Wray, 2009; Zhao & Cziko, 2001).

The intention of this qualitative study is to propose a model of instructional approach for pre-service teacher education in the area of learning a new technology tool. Through the instructional approach, it is hoped that pre-service teachers will become confident in integrating the technology tool which they have learnt, to enhance teaching and learning in the classroom.

Research on teacher learning of technology tools

One of the key factors that had a considerable influence on the teachers' decision to integrate technology was availability of time. Dias (1999) identified lack of time as a barrier to integration. Time in the study encompassed the opportunity to learn, to plan and to collaborate with other teachers. Lack of time was also cited by Wang and Chan (1995) who conducted a study among 130 Singapore secondary school teachers. The findings revealed that teachers' perception of lack of time hindered technology integration. Ertmer (1999) and Manternach-Wigans (1999) also claimed that teachers' perception of lack of time for them to learn and integrate technology into the classroom is a contributing factor that inhibited technology integration.

Dawson and Heinecke (2004) reiterated that teachers' lack of time to explore technology use and fragmented schedules in school contribute to technology being integrated as an add-on tool. The data collected for this study spanned over a seven month period with over eighty hours of classroom observations and interviews with key personnel and teachers in the school as well as document analysis. The explanation given by teachers in the study was that they did not have time to plan for effective technology-based lessons and that they needed time to fit technology in their lessons. In addition, the teachers felt that they did not have time to immerse in the use of the technology to enable them to have the knowledge and technology skills to plan.

Jaber and Moore (1999) and Martin (2000) indicated in their findings that teachers need to be given time to plan and to integrate technology into the curriculum in order to achieve substantial effective integration. Further, teachers should be given time to plan and implement within the school year and to share their successes and obstacles with their peers so as to learn from each other (Wetzel, 2001).

From the findings presented by the different studies, it can be inferred that the teachers wanted time to immerse themselves in technology use so that they would be competent and comfortable users of technology. In addition, teachers wanted time set aside for them to plan and reflect on technology integrated lessons. The teachers also wanted time set aside for sharing of technology resources and strategies. They wanted time to collaborate with each other and to attend relevant professional development that would provide them with knowledge of appropriate technology integration strategies.

Professional Development

Teachers were seen rooted in the traditional instructional form and hence they were not making the necessary effort to integrate technology to create innovative learning experiences for their students (Demetriadis et al., 2003). It is difficult to integrate technology into the traditional classroom practices and hence technology integration has been relatively ineffective (Jules Van Belle & Soetaert, 2001). Results of some studies showed that teachers were not making effective use of technology in their lessons (OECD, 2001; Pedretti, Mayer-Smith, & Woodrow, 1999; Zhao & Cziko, 2001). Some reasons for the dissatisfying results of technology integration could be attributed to teachers' attitude towards computer use (Demetriadis et al., 2003) as well as improper instructional reforms based on improper pedagogical beliefs (Selwyn, Dawes, & Mercer, 2001). Teachers needed knowledge of appropriate technology integration strategies and ICT skills to effectively integrate

technology into their lessons to optimize the benefits for their students' learning (Pierson, 2001; Shuldman, 2004). Teachers' professional development needs to focus on both technology skills training as well as appropriate technology integration strategies in the curriculum. Braak (2001) suggested that to overcome the lack of translation of technology competency and comfort level into strategies for applying technology effectively, there was a need to expose teachers to good practices during in-service training. The focus of these training should be to get teachers familiarized with technology, on the use of technology as well as the value of technology as a pedagogical tool.

Some studies reported that effective use of computers is dependent on the teachers' technology skills as well as their intention of technology use (Albalat & Tarrago, 1995; Hodgson, 1995; Venezky, 2004). Relevant professional development can take the form of observing colleagues, learning from each other, observation of each others' technology integrated lessons, as well as to provide opportunities for teachers to share and collaborate with each other (Blase & Blase, 1999; Flanagan & Jacobsen, 2003; Jacobsen, 2001, 2002; Prain & Hand, 2003). Divaharan and Lim (2010) suggest that teachers' technology integration practices can be improved through exchanges among colleagues, attending conferences as well as observing each others classroom practices. Teachers need knowledge of appropriate technology integration strategies and technology skills to integrate technology in ways that optimize the benefits for their students' learning (Pierson, 2001; Shuldman, 2004; Divaharan & Lim, 2010). Teachers' professional development needs to focus on both technology skills training as well as appropriate technology integration strategies in the curriculum.

In précis, it can be deduced from the findings presented from the literature review that there are some key factors that influence teachers learning of a new technology tool and to translate that learning into planning for effective lessons. These factors identified are availability of time, access and relevant professional development.

Most of these studies have focused on the professional development of in-service teachers. There is a need to examine how pre-service teachers' learning should be designed so that they know how to effectively design technology integrated lessons for their students. Pre-service teachers are relatively unfamiliar with teaching practices. The methods for teaching them about pedagogical uses of the technology tools could differ from that for in-service teachers. There is substantial evidence that faculty modelling of technology use is a particularly successful strategy for pre-service teachers' technology integration training (Divaharan & Koh, 2010; Strudler & Wetzel, 1999; Beyersbach, Walsh & Vannatta, 2001; Pope, Hare and Howard, 2002; Brush, Glazewiski, Rutowski, Berg, Stromfors, Stock and Stutton, 2003). Handler (1993) found that those who frequently saw computers being used in their pre-service methods course felt better-prepared to use the computer as an instructional tool. When tutor modelling is followed by opportunities for them to practice and apply technology tools in the design of lessons, it increased their self-reported confidence level for utilizing these technologies in the classroom (Pope et al., 2002).

A comparison of both in-service and pre-service professional development methods reveals that the technical skills need to be addressed. During in-service teacher professional development, exposing teachers to possible pedagogical approaches seems to enable them to plan and conduct effective technology integrated lessons. In pre-service training, however, there seems to be a need to adopt tutor modelling of the tool so as to allow for pre-service teachers to experience the tool before they are comfortable with designing technology integrated lessons.

The research questions that governed the study are:

1. What are the factors that facilitate pre-service teachers to learn a new technology tool?
2. How pre-service teachers learn a new technology tool introduced in the course?
3. What instructional approach should be adopted to facilitate the learning of a new technology tool for pre-service teachers?

Method

Course context

The study was conducted with 30 PGDE (PE) pre-service teachers and 59 PGDE (Sec) pre-service teachers who were attending a 12-week core ICT course. This ICT course is a core module that trains them in pedagogical skills associated with technology integration in their subject area. Pre-service teachers were taught the theories and principles of technology integration during the first four weeks. The next eight weeks were devoted to the learning of specific technology tools which focused on the pedagogical use of these tools. As tutorial groups were formed by subject specialization, tutors and pre-service teachers in each tutorial group jointly selected two to three specific technology tools that were pertinent to the group. Examples of specific technology tools available for selection were the Interactive White Board (IWB), concept mapping, video sports games, webquests, and Web 2.0 tools such as wikis and blogs. This study was conducted across a four week period where pre-service teachers were learning how to use Video Sports Games and IWB. The learning of each specific technology tool spanned across four two-hour lessons, once a week.

This study was conducted during the July 2010 semester where video sports games and IWB tools were formally introduced after they were piloted in the previous semester. Data was collected from three tutorial groups. One tutorial group consisted of pre-service teachers from PGDE (PE) who opted to learn how to integrate video sports games in their physical education lessons. The other two tutorial groups consisted of 59 PGDE (Sec) pre-service teachers who were from the Humanities and English Language programme. The pre-service teachers are all graduates in the age range of 21-25. They have at least a minimum of two months to a maximum of one year of school experience. This experience helps them to understand the demands of teaching in the classroom with an ICT tool.

The structure of learning specific technology tools

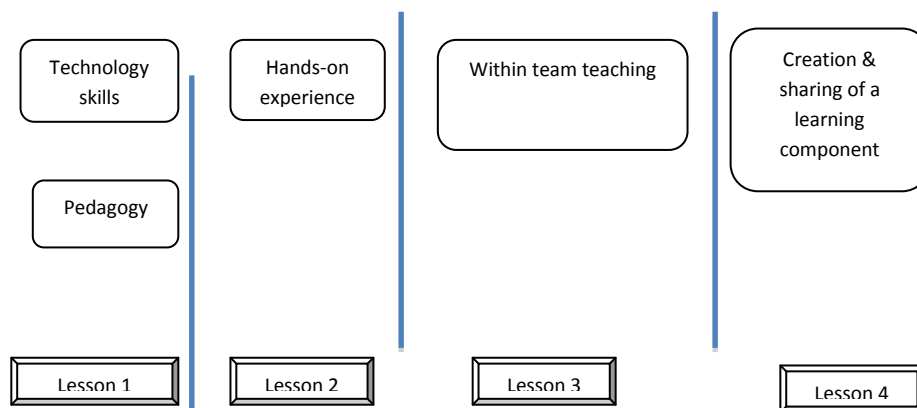


Figure 1: Instructional approach to the specific technology tool component

The approach to the learning of the specific technology tool component was designed based on review of literature (see Figure 1).

Lesson 1 – Self-paced learning from technological resources and pedagogical examples

During Lesson 1, the tutor introduced the various tools to the pre-service teachers. For IWB, the pre-service teachers accessed an on-line self-paced tutorial which helped them to understand how to operate the hardware as well as to learn the key features of the software that accompanied the board. For video sports games, the pre-service teachers explored the various game titles. To learn the technical skills, the pre-service teachers activated the help feature within the software and the game tutorials to assist them in the technical skills.

For pedagogical examples related to IWB, the pre-service teachers were asked to explore a database of lesson templates and materials prepared by teachers from Canada, United Kingdom and America, due to a lack of Singapore based resources. It was hoped that the exploration would create pedagogical awareness of the use of the tool. However, there was a lack of readily available pedagogical resources for Video Sports Games. The tutor created lesson ideas to ground the pre-service teachers' pedagogical awareness.

Lessons 2 & 3 – Hands-on exploration and peer sharing

The focus of lessons 2 and 3 were to provide pre-service teachers opportunities to learn the tool as a team. The pre-service teachers formed teams based on their subject areas. They explored the features of the tools, recalling the self-paced video tutorials as well as online resources. They learnt as a team and taught each other within their teams.

Lesson 4 – Integration of the technology tool in the subject area

After learning the technical skills and acquiring pedagogical awareness of how the tools can be used, pre-service teachers were required to integrate the technology tool in their subject specialization. Each team was required to select an area from their subject specialization and to integrate the technology tool which they have learnt. They were required to showcase how the tool can be used to enhance learning. The focus of this session was to provide opportunities for the pre-service teachers to apply their pedagogical knowledge and to design a lesson segment with the integration of the technology tool.

Data collection

The objective of this pre-service ICT course is to ensure that the pre-service teachers learn a technology tool and acquire pedagogical skills related to integrating the technology tool. Hence, the data collection focused on how the pre-service teachers perceived the learning opportunities provided for them and to refine the instructional approach based on their feedback. To comprehend the learning process, pre-service teachers were given 20 minutes at the end of each lesson to reflect as a team. The PGDE (PE) group had six teams consisting of five members in each team. The PGDE (Sec) group had a total of 12 teams from the two groups. Hence, data was collected from a total of 18 teams with a total of 89 pre-service teachers. Each team posted their reflections on their Wiki page that was set-up for them before the beginning of the module. A total of three cycles of reflection/feedback were collected from each team.

During the Cycle 1 reflection, the pre-service teachers were asked the following questions:

1. How did you and your team members learn the technology tool? Describe your individual experiences.
2. What difficulties did you face when learning the technology tool?
3. How did you overcome the difficulties?

During Cycle 2 reflection, the questions focused on the following areas:

1. What were the strengths and weaknesses of learning as a team?
2. Suggest ways in which the learning process could be improved.

During the Cycle 3, the questions sought to collect information about whether the pre-service teachers felt that

they have had sufficient exposure to pedagogical approaches and were able to integrate the technology tool.

1. How did you explore the integration ideas prior to designing the integration of the technology tool?
2. Suggest ways in which improvements could be made in the area of pedagogical awareness.

In the duration of the three lessons for each technology tool, the author who was also the tutor took observation notes on how the groups interacted and their learning preferences. The observation notes and the pre-service teachers' reflections provided useful data as the reflections allowed the researchers to ascertain whether the current instructional approach adopted (as reflected in Figure 1) was effective.

Data analysis

The pre-service teachers' reflections were analysed through the use of content analysis. The reflections were coded in the following manner to answer the research questions of this study:

1. What are the factors that facilitated pre-service teachers learning a new technology tool?

Responses coded were from Cycle 1 reflection questions 1, 2 & 3 and Cycle 2 Question 2 and Cycle 3 Question 2.

2. How pre-service teachers learn a new technology tool introduced in the course?

Responses coded were from Cycle 2 & 3 reflection questions.

The pre-service teachers' responses were triangulated with the observation notes by the author.

Results and discussion

Through content analysis, the following factors were elicited from the pre-service teachers' reflections.

Research Question 1: What are the factors that facilitated pre-service teachers' learning of a new technology tool?

Description	No. of teams	% of teams
Time to explore	17	94%
Access to resources	16	88%
Team learning	18	100%
Online tutorials	8	44%
Individual exploration	5	27%
Hands-on exploration	18	100%

Table 1: Factors pre-service teachers felt assisted them in the learning of a new technology tool

Pre-service teachers' reflections showed that they preferred exploring in teams rather than as individuals. They appreciated the time given to them to explore the technology tools in teams. In their suggestions for improvements, they highlighted that they wanted to be comfortable with the technical skills, before they could

comfortably explore the possible pedagogical approaches when planning for the integration of the technology tool. Besides, they wanted more time to discuss with their team members and even more time for hands-on exploration.

Research Question 2: How pre-service teachers learn a new technology tool introduced in the course?

83% of the teams (n=15) responded that they wanted to be comfortable with the technical skills first before they could begin exploring the pedagogical approaches to integrating the technology tool. All the teams (100%, n=18) also strongly felt that the culture of sharing among the team members contributed to their confidence in attempting to explore the tool. The fact that they had a common goal – that is to implement the technology tool in their subject area provided the impetus for the pre-service teachers to help each other to learn the tool and to discuss the possibilities for integration in their subject areas. In their comments for improvements, the some teams highlighted that the learning of the technical skills and exposure to pedagogical skills should be available to them at all times (as reference materials). This will allow them to refer back to the resources, should they have any difficulties. In addition, most of the teams (88%, n=16) also suggested that there should be sharing of technical skills, pedagogical skills and lesson integration ideas among the teams so as to enrich their learning from through the sharing by their peers.

Analysis of the tutor's observation notes concur with the pre-service teachers' suggestion. The teams did not attempt to stretch themselves beyond their group capacity. A possible reason could be that they are unaware that there is more potential to the technology tool than what has been explored by the team. One of the best possible ways to scale up their skill levels and knowledge levels may be to make provisions for sharing. This will enable them to be exposed to much more ideas than they have explored within their team. The tutor observation also revealed that there was less apprehension to learning the tool and the culture of sharing and team exploration seem to have provided the impetus to examine an entirely new technology tool which might not have been the situation should the pre-service teachers be required to explore individually. Only about 27% (n=5) of the teams indicated individual exploration as factor that contributed to the learning of a new technology tool.

Research Question 3: What instructional approach should be adopted to facilitate the learning of a new technology tool for pre-service teachers?

Based on the content analysis of the pre-service teachers' reflections and tutor observation notes, the author is proposing a new instructional approach.

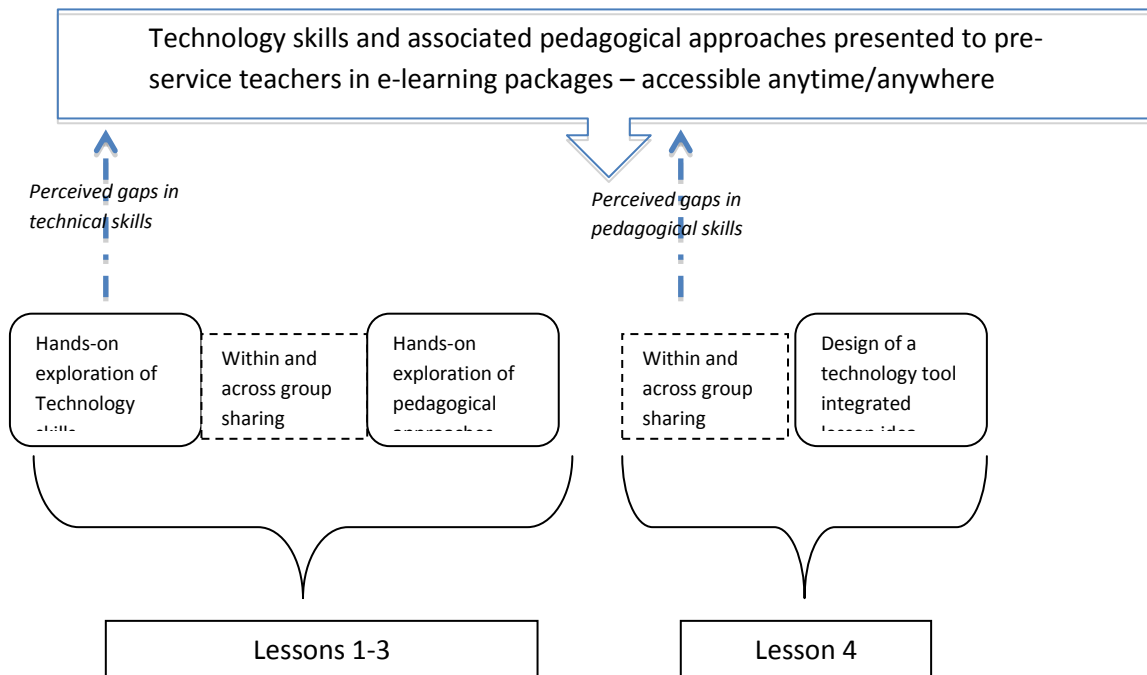


Figure 2: Proposed new instructional approach to the learning of a new technology tool

Proposed new instructional approach to learning a new technology tool

E-learning packages

The proposed design and creation of e-learning packages consisting of technology skills and pedagogical approaches is to provide opportunities for pre-service teachers to learn at their own pace. Based on the pre-service teachers' suggestions, these materials will be made available to them at the beginning of the technology tool learning sessions. The availability of the packages at the beginning of the module makes provision for the pre-service teachers to go through the packages as many times as they need to build up their technology and pedagogical skills. This creates time during face-to-face tutorial interaction. This allows them to make use of the time to discuss, share and learn from each other instead of using tutorial time to learn the technology and pedagogical skills. Hence, when pre-service teachers meet during lessons 1-3, they would have learnt the technology skills and pedagogical skills on their own time. They will come together as a team to share what they have learnt on their own. During the sharing, they can assist each other and to learn from each other. The availability of the reference materials at their disposal, allows for independent and self-directed learning. The anytime/anywhere accessibility to the e-learning packages again makes provision for the pre-service teachers to go back to segments of the package which they feel they need to in order to improve their technology as well as pedagogical skills.

During Lesson 4, the teams will share across, thus making provisions for across team sharing to optimise their learning capacity of the tool. Having learnt the various possibilities of the technology tool and various integration ideas, teams are now ready to design a lesson idea integrating the technology tool. The creation of the e-learning packages provides more hands-on team exploration time, team learning and across team sharing

during face-to-face tutorial time.

Focus on learning of technology skills

Feedback from pre-service teachers reiterated the findings from literature that teachers need to be comfortable with the technology skills before they can consider designing and integrating the tool into a lesson. Hence, the technology learning component begins with provisions for mastering the technology skills first in Lesson 1. Time has been given for them to share with each other as well as to share across teams. Once they are comfortable with the technology skills, they proceed to the next stage of exploration, pedagogical approaches. Again, time has been given for pre-service teachers to share their pedagogical knowledge with each other as well as across teams before they are required to design a lesson segment integrating the technology tool that they had explored. By the design stage, this new approach would have given pre-service teachers ample opportunities to gain technology and pedagogical knowledge so that they can comfortably design a lesson segment. Since the pre-service teachers found sharing with peers and learning from other teams extremely useful, the researchers will create more opportunities for them to share, thereby creating a culture of sharing.

Conclusion

The focus of this study was to explore the effectiveness of an instructional approach introduced to pre-service teachers in an ICT core module. The design of the initial approach was refined based on feedback and observation data collected from the pre-service teachers. The crucial modifications made to the instructional approach was to make provisions for more hands-on exploration time, face-to-face team learning and team teaching which was complemented by e-learning packages which can be accessed anytime and anywhere by the pre-service teachers. In addition, as requested by the pre-service teachers in their suggestions for improvement, opportunities have been provided for them to share across teams so that their learning experience is far more enriched. It is not the technology that matters in the classroom; it is the teachers who conceptualise and design lessons to enhance the students' learning experience (Davis, 2008; Taber, 2003; Wood & Ashfield, 2008). Hence, how the teachers learn should be the focus of subsequent research. This new approach will be implemented in the coming semester and the author hopes to collect data to validate the new approach or to refine it further.

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Please cite as: Divaharan, S.. (2011). Learning new technology tools in pre-service teacher education: A model for instructional approach. In G. Williams, P. Statham, N. Brown & B. Cleland (Eds.), *Changing Demands, Changing Directions. Proceedings ascilite Hobart 2011*. (pp.352-363).

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