



## Nurturing preservice teachers' understanding of technology-enhanced pedagogy through reflection

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This paper reports the preliminary qualitative findings of the first-year phase from a two-year study, in which we aimed to investigate: 1) the preservice teachers' knowledge, attitudes and use of Information Technology (ICT) for classroom teaching and learning, and 2) their learning from reflection upon their use of ICT throughout their two-year initial preparation program. The major first-year findings showed that all the 14 participants demonstrated a gain in ICT knowledge and skills and register positive changes in their beliefs in and attitudes toward using ICT for classroom teaching and learning. Their use of ICT, however, varied greatly from using ICT as a presentation tool to support their instruction to engaging their students in using ICT to work on the authentic tasks. The participants' reflection reinforced their perceptions of using ICT for classroom teaching and learning. The recommendations for engaging preservice teachers in reflection are discussed.

Keywords: preservice teachers, technology integration, reflection, pedagogical use ICT

### Introduction

Teacher preparation programs have emphasized the importance of preparing a new generation of teachers to effectively use Information and Communication Technology (ICT) to promote meaningful student learning (Singapore Ministry of Education, 2002; US Department of Education, 2006). Research findings, however, have repeatedly suggested that preservice teachers do not appear to be ready in using ICT in their teaching, although most of them possess essential ICT knowledge and skills as well as positive attitudes (Kay, 2006; Moursund & Bielefeldt, 1999; Swain, 2006). For the small number of preservice teachers who do use ICT for teaching in their school placements, few can use ICT as frequently and effectively as expected to promote higher order thinking or cooperative learning among students (Bird & Rosaen, 2005; Brown & Warschauer, 2006; Wright & Wilson, 2005). The primary reason is that preservice teachers are not cognizant of the complexities of teaching, which are aggravated with integration of technology (Brown & Warschauer, 2006; Dawson & Fichtman, 2007; Gao, 2005; Gao, Choy, Wong, Wu, 2009; Judge & O'Bannon, 2007; Swain, 2006). The following are several recommendations to address such an issue: (1) carefully examine preservice teachers' perceptions of their success in using ICT in teaching and ascertain whether there were changes in their views and daily practice (Swain, 2006); (2) provide on-going guidance and scaffolding for the preservice teachers beyond their university coursework (Gao, Choy, Wong, & Wu, 2009); and (3) engage preservice teachers in reflection on their field practice (Dawson, 2006). In this study,

we are interested in nurturing preservice teachers to develop technology-enhanced pedagogy through providing on-going scaffolding and engaging them in reflection.

## **Literature review**

Preservice teacher preparation provides fundamental experiences for the use of technology (Thompson, Schmidt, & Davis, 2003). In a review of 68 studies on preservice teachers' learning to teach with IT, Kay (2006, p.383) concluded that "most research examined attitudes, ability or use of IT, but rarely looked at all three". For example, a large body of studies has examined preservice teachers' technology knowledge and/or attitudes toward ICT after they have taken on-campus technology courses (See Kay, 2006, for a literature review on this topic). There are a growing number of case studies that have explored preservice teachers' technology field experiences. Some of them have focused on the factors influencing preservice teachers' decision-making in using ICT in their field placements (Bullock, 2004; Stuhlmann, 1998). Emerging evidence has suggested that there is limited constructivist use of technology among preservice and beginning teachers (Brown & Warschauer, 2006; Judge & O'Bannon, 2007; Swain, 2006).

In some of our previous qualitative studies on preservice teachers' attitudes, ability, the influencing factors and use of ICT (Gao, 2005; Gao, Choy, Wong, & Wu, 2009; Gao, Wong, Choy, & Wu, 2010), a similar finding suggests a variation in the preservice teachers' technology knowledge, attitudes, influencing factors, and the use of ICT for classroom teaching and learning in the process of learning to teach with IT. It was recommended that to engage preservice teachers in reflection on their technology field experiences (Gao, 2005), we should provide on-going guidance and scaffolds (Gao, Choy, Wong, & Wu, 2009).

Teacher reflection is seen as an essential factor for constructing teacher knowledge bases and the understanding of professional practice (Dewey, 1933; Schön, 1987). Posner (2005) argued that experience with no reflection at best leads to superficial knowledge; it is the experience combined with reflection that results in professional growth. Teacher educators and researchers have explored ways of providing on-going guidance and scaffolding for preservice teachers' reflection. Among a range of recommended strategies and approaches for reflection, analyzing the video clips of preservice teacher's teaching has the potential to promote reflection. However, without some sort of reflective or pedagogical framework as scaffolding and external guidance, preservice teachers generally tend to focus on themselves rather than their students and on the more technical aspects of their teaching, when engaging in video reflection (Calandra, Gurvitch, & Lund, 2008). Crawford and Patterson (2004) found that guided video reflection has the impact of promoting robust reflection rather than superficial reflection.

## **Research design and methods**

Bearing the literature in mind, we designed this research project to fill the research gap by engaging a small number of the preservice teachers in reflection on their technology use during their school placements. We aimed to nurture the participants, through reflection, to develop a better understanding of technology-enhanced pedagogies.

### **Research questions**

The dual purposes of the two-year mixed methods study were to investigate 1) preservice teachers' perceptions and practice in using ICT for classroom teaching and learning, and 2) their learning from reflection on their use of ICT throughout their initial teacher preparation program. This paper presents the qualitative findings of the first-year phase to answer the following research questions:

1. What are the participants' changes in beliefs on teaching and learning as well as their perceptions of using ICT for classroom teaching and learning, if any?
2. What ICT applications do the participants use for classroom teaching and learning during their five-week Teaching Assistantship?
3. What have the participants learned from their engagement in the reflection?

## Context of study

The study is situated in a two-year Diploma in Education (Elementary) program at the National Institute of Education, Singapore. Prior to the enrollment in the program, most of the preservice teachers had had contract teaching experience ranging from a month to a year at assigned local schools to assess their suitability for the job. The structure of the Diploma program comprises four-semester of coursework with two field placements: five weeks for Teaching Assistantship (TA) after one year of coursework and ten weeks of Teaching Practice (TP) at the end of the second year of coursework. All the preservice teachers at NIE take a core course titled “ICT for Engaged Learning” during the first semester of their program. They learn about different pedagogical ways of using ICT to engage students in meaningful learning as proposed by Jonassen, Howland, Marra and Chrismond (1999). They are expected to use ICT in pedagogical ways during TA and TP. This is in line with Singapore’s ICT MasterPlan III (2009-2014), which aims to “enrich and transform the learning environments of our students and equip them with the critical competencies and dispositions to succeed in a knowledge economy” (Singapore Ministry of Education, 2008).

## Data collection

The sample of our study comprises a cohort of 300 preservice teachers in the Diploma in Education (Elementary) program (June 2008 intake). We collected the survey data from the cohort at four points (before and after the ICT course, after TA and after TP) to gain a big picture of the changes in perceptions and self-reported use of ICT of this cohort of preservice teachers.

We purposefully selected 22 preservice teachers with a wide range of ICT skills to voluntarily participate in the qualitative portion of the study. Our selection was based on their self-reported ICT knowledge and skills and their willingness to participate indicated in the first survey. Two participants in their 20s rated themselves high technology competency as the result of having obtained the diploma in ICT. The other 17 participants in their 20s rated themselves either high or medium technology competency as a result of having grown up with ICT. The remaining three participants in their 30s and 40s rated themselves low technology competency. We also took gender, and their major subjects into consideration. There were 8 females and 14 males. Fifteen majored in general education, teaching English, Math, Social Studies and Science and seven of them majored in Chinese Language and Literature.

For the intervention, we conducted a scaffolding reflection workshop on the introduction of Rolfe, Freshwater and Jasper’s Reflexive Practice framework (2001) before TA to the 22 participants and engaged them in video analysis to promote reflection. The participants were expected to conduct a self-analysis of their own teaching (once during TA and twice during TP) as well as provide peer critiques to at least one other participant.

We completed the first and second interviews (one at the beginning of the course and the other the end of the course) for the 22 participants. During these interviews, we asked them to describe their beliefs on teaching and learning, their attitudes toward using ICT, and their past and present learning experiences, or teaching experience if they had any. Eight participants dropped out of the study before TA for various reasons. During our observation and video recording of one lesson of the remaining 14 participants during TA, we focused our attention on “who is using what for what purposes and when.” We also conducted the third interview and group discussion after TA. We kept field notes for the lesson observations and group discussion (See Table 1).

**Table 1: Summary of the qualitative data sources**

Description of Activities/ Qualitative data sources	First Year (July 2008—June 2009)	Second Year (July 2009—July 2010)
Conducting 4 interviews	<ul style="list-style-type: none"><li>• First interview at the beginning of ICT course (August 2008)</li><li>• Second interview completed after the ICT course (December 2008)</li><li>• Third interview after five-week</li></ul>	Fourth interview after the ten-week TP (May-July, 2010)

	TA (August 2009)	
Observation and video-recording the technology-based lessons	One TA lesson observation between July 20-30 2008	Two TP observations between January-March 2010
Analyzing one's own teaching, providing peer critique & responding to peer critique	The same period as above	The same period as above
Group discussions	After TA (August 2009)	After TP (July 2010)

Here, we report the findings of these 14 participants in the first year phase of the study.

### Data analysis

To make sense of the data, the qualitative content analysis (Denzin & Lincoln, 2000; Patton, 1990) and across stage methods analysis (Onwuegbuzie & Teddlie, 2003) were adopted. The authors believe the qualitative content analysis is most relevant for this study, because it produces descriptions along with expressions from subjects reflecting how they view their social worlds. It also enables the authors to examine meanings, themes and patterns that may be manifested or latent in a particular text. After the first round of interviews, two members in the research team started a preliminary explorative content analysis (Bogdan & Biklin, 1992) to independently analyze each participant and then compared and contracted the coding, and arranged the emerging themes into four major categories: Knowledge, Perceptions, Practice and Reflection. Some subthemes were added while re-analyzing the data (See Table 2). The observation data was triangulated with the interview data. As a team, we also maintained analysis memos and conducted periodic reviews of all analyzed data and analytical memos. In order to ensure the validity of the data analysis, we invited a field expert as an external audit after the first-year phase.

**Table 2: Themes and subthemes of data analysis**

Themes	Subthemes
Knowledge	Pedagogical knowledge Content knowledge Pedagogical content knoweldge Technology knowledge Pedagogical Technology content knoweldge Knowledge about reflection
Perception	Beliefs about teaching and learning Attitudes toward using ICT Rationales for using ICT Reception to reflection
Practice	Who What ICT application(s) When Why
Reflection	Learning from attending the scaffold workshop Learning from self-reflection

## Major qualitative findings of the first-year phase

The focus of this paper is to present the qualitative findings of the first-year phase (June 2008-June 2009). We identified and summarized the three preliminary major findings: 1) changes in the participants' knowledge, beliefs and perceptions about using ICT for classroom teaching and learning; 2) the use of ICT during the five-week TA; and 3) the learning from the engagement of reflection. We elaborate these findings in the following sections.

### Changes in knowledge and perceptions

First of all, the participants acquired different and new ICT knowledge from their ICT course, such as how to use *Blog* and *WebQuest* and *Pbworks*, *Hot Potatoes*. They also gained pedagogical knowledge, such as collaborative learning, Understanding by Design, Inquiry-based learning. Meanwhile, they registered changes in their beliefs in teaching and learning, in their attitudes toward using ICT in classroom teaching and learning. For example, there was a shift in their change of beliefs: from a one-way transmission of knowledge from a teacher to students to a two-way interaction between teacher and students. Thus, their perception of the roles of teachers changed from that of a knowledgeable authority to a facilitator for student learning, and even to a fellow learner alongside their students. For example, one participant with a high technology competency commented:

In the past, [learning] from my own experience as a student and as a contract teacher, I expected that the teacher did all the teaching, and the students would have to do all the learning. But now I have a different concept whereby learning sometimes actually comes through contribution [from the student] and discussion [among/with students], and we actually also learn certain things from the students. (Participant A)

Accompanying the change in beliefs about teaching and learning, the participants also demonstrated a shift in their perception of using ICT. For example, one participant with a medium level of ICT knowledge and skills revealed:

Before coming to NIE, I thought that ICT was basically more convenient for teachers to make use of various technologies to teach their lessons than for student learning... Now, after the course, my focus is more on letting students make use of various available technologies to enhance their learning - to help them learn better and to make learning more fun and interactive. (Participant B, Second interview)

Another participant with low technology skills reflected:

Before coming to NIE, I never knew what ICT was all about, because during my study days, there wasn't any ICT. We had no computers, and nothing but all chalk and blackboard ... At the beginning of taking the ICT course, I was scared ... Now, I think that ICT is not only [for] visual [attraction]. ICT can get the students involved in active learning, to easily relate ICT to them ...” (Participant C, Second Interview).

In sum, all the participants benefited from taking the ICT coursework by showing positive changes in their knowledge and skills of using ICT, beliefs about teaching and learning as well as their perceptions on using ICT for classroom teaching and learning from the university coursework, but could they translate their increased skills and comfort level into student-centred practices, while being caught in the midst of conflicting demands and multiple challenges during their teaching practicum?

### The use of ICT during TA

All the 14 participants used ICT for the one observed lesson during the five-week TA. They used ICT across some subject areas: Chinese (6 lessons), English (3 lessons), Science (5 lessons), Social Studies (1) and the grade levels 2 to 5. The 14 lessons were conducted in the different settings: 10 in the classrooms and two in a science laboratory with a standard ICT facility of a desktop and an LCD projector, and 2 in the computer laboratory with more than 30 desktop computers. The participants chose either to use or allow their students to use one ICT application or a combination of ICT applications during the teaching and learning process. We organized the 14 observed lessons from simplicity (using a particular tool for one teaching activity) to complex (a combination of ICT tools for the entire learning process). We arranged the

observation data according to the kind(s) of ICT application(s), the means, the ways and the duration of use in Table 3.

**Table 3: Multiple dimensions of the observed lessons with ICT use**

Number of participants (Who)	What applications	Means	The ways of using	When
6	<ul style="list-style-type: none"> <li>• <i>PowerPoint</i> slides</li> <li>• Flash</li> <li>• Interactive Whiteboard</li> <li>• Excel</li> </ul>	As a presentation tool to support teaching	Teacher used ICT to <ul style="list-style-type: none"> <li>• tune in the lesson</li> <li>• present               <ul style="list-style-type: none"> <li>○ Content</li> <li>○ questions</li> <li>○ summary</li> <li>○ math graphics</li> </ul> </li> </ul>	Part(s) in the teaching process
3	<ul style="list-style-type: none"> <li>• Flash/streamed video</li> <li>• MOE on-line resources</li> <li>• <i>Hansheng</i> (Chinese software)</li> </ul>	As a presentation tool to enhance teaching	<i>All of the above plus</i> <ul style="list-style-type: none"> <li>• present               <ul style="list-style-type: none"> <li>○ worksheets</li> <li>○ quiz</li> <li>○ stroke sequence of a Chinese character</li> </ul> </li> </ul>	The entire teaching process
2	<ul style="list-style-type: none"> <li>• Flash</li> <li>• On-line resources</li> <li>• Data logger</li> <li>• Interactive Whiteboard</li> </ul>	Primarily as a presentation tool to enhance teaching, occasionally as a cognitive tool to involve their students in using ICT	Revision Assessment Science simulation	A combination of teaching and learning process
3	<ul style="list-style-type: none"> <li>• Self-created <i>WebQuest</i></li> <li>• Blogger</li> <li>• On-line resources</li> </ul>	As a cognitive tools to allow students to use ICT	Allow students to <ul style="list-style-type: none"> <li>• work on an authentic task</li> <li>• solve a real life problem</li> </ul>	The entire teaching-and-learning process

Among the six participants in the first category who had a varying range of technology competency, three of them used one ICT application, primarily a *PowerPoint* presentation or a flash presentation as a presentation tool to support one of their teaching activities. The other three participants used a combination of ICT applications, such as Interactive Whiteboard, Flash, or Excel to enhance some of their teaching activities. Their decision making was primarily to “meet the needs of my students who are digital natives and for whom technology is part of their lives” (Participant D, Second Interview). They still used ICT in the traditional mode of transmission of the knowledge from teacher to students.

The three participants in the second category, also with a varying range of ICT competency, tended to use a combination of similar ICT applications to enhance their own instruction in the entire teaching process. For example, one participant (Participant B) in her earlier 20s and possessing high technology competency used the *PowerPoint* slides with “a lot of picture and animations to attract my students’ attention and interest” (Participant B, Third Interview) for a Chinese lesson. The second participant with high technology competency in her 20s used the *PowerPoint* presentation to present the content and show the still pictures, and used flash as a simulation for a science lesson. The third participant with low ICT competency (in her 40s) designed and implemented an ICT-based Chinese lesson. She was flexible in using various ICT applications. For example, when teaching new Chinese characters, she used *PowerPoint* slides to present still pictures to help her students understand the meanings of the characters. Next she used Han Shen, a Chinese Language software, to demonstrate the stroke sequence of the Chinese characters. She used MOE online resources for listening and reading activities. She used the highlighter function of the *PowerPoint*

application to highlight the key learning points and also corrected some frequently made mistakes. She ended the lesson by using a visualizer to present group activity artifacts. To a certain extent, the two participants still used ICT for enhancing their teaching without a significant change from transmission of knowledge to the students in the entire teaching process.

The two participants in the third category showed a certain degree of a change from the traditional mode of teaching by involving their students in using a combination of ICT applications as a part of learning process. For example, one participant asked her students to present their understanding to their peers by using Interactive Whiteboard. The other participants engaged her students in using data-loggers in a science experiment in addition to using a *PowerPoint* presentation, an on-line quiz and a simulation.

The remaining three participants in the fourth category engaged their students in using ICT to conduct an authentic task or solve a real-life problem during the whole learning process. For example, one participant involved her students in using *WebQuest* to design a healthy diet. The second participant (Participant A) involved their students in using netbook and the *WebQuest* for an English email writing activity in his classroom. The third participant used the *WebQuest*, streamed video, and Blogger for a Social Studies lesson in a computer laboratory. Although making special arrangements with the technology assistant before the lessons, the second and third participants encountered technical problems during the lessons, for example, problems getting access to the Internet. However, they were flexible in adjusting their lesson plans and allowed their students to complete the assignment after class.

### **Learning from reflection**

All the participants expanded their knowledge about reflection by attending the workshop on reflection that was offered before their five-week TA. They indicated that their initial knowledge about reflection was more or less on improving their own teaching. For example, two participants wrote their statements about reflection at the beginning of the workshop as such:

To me, reflection means reviewing past events in terms of strengths and weaknesses, and how ICT can benefit us now and in the future. We have reflection, usually after we have experienced or observed something. (Participant D's note)

Reflection is the self examination and feedback of positive and negative actions after we have taken them. The negative feedback will act as a guide for our future actions, to avoid the same mistakes. The positive feedback will also act as a guide to enhance our behavior/action, to further improve on action needed. (Participant F's note)

After the workshop, all participants could add another dimension -- reflection in action-- to their knowledge about reflection. They also showed a shift in focus on reflection: from teacher to learner. This shift was illustrated in the following excerpt during the first group discussion after the workshop: "Now, I begin to see that we can do reflection during the lesson so that we can improve ourselves and student learning" (Participant A). Participant A began to think about linking personal and theoretical knowledge with current action, commenting that:

Reflection is value-added. We should include student performance and responses to our beliefs/actions/teaching pedagogy throughout the whole process of reflection in action, reflection on action.

Six participants expressed the concerns and challenges of engaging in critical/reflexive reflection in the Singapore context. As student teachers, they would encounter a conflict of interests with their cooperating teachers and school administrators. The pressure to cover the curriculum would leave them neither space nor time to change the current practice in most schools. One participant commented: "ICT will be too difficult for me as a student teacher to change the situation that most teachers do not effectively use ICT for engaged learning. But I will try my best to set engaging learning as my goal of teaching with IT" (Participant C, First Group Discussion).

After TA, all participants reinforced their beliefs, and their perceptions of using ICT for classroom teaching and learning from their engagement in reflection. They valued the learning from self reflection by identifying critical incidents and answering the guiding questions after viewing their own video-taped lessons as a means of gaining "self awareness and self acknowledgement of my own strengths and weaknesses" (Participant F, Third Interview). There is some connection between the beliefs about the

teaching and learning and the focus on reflection. For example, Participant B who used ICT to enhance her own teaching in the whole teaching process reinforced her beliefs by saying that: “I used to simply think that whatever we teach, we just hope that the students can learn and understand ... Now, I begin to think how to present the materials to let them learn” (Participant B, Second Interview). Although she moved a small step in thinking about student learning, the focus of her reflection was still on her authoritative role to prepare and present the materials to her students.

Participant A, who showed a change from the traditional teaching mode by involving his students in the *WebQuest* English e-mail activity, focused his reflection on student learning:

My personal opinion is that true learning is obtained when the particular learner learns about a concept and applies the concept, and that is where true learning takes place... (Third Interview)

He continued to talk about his learning from reflecting on his own teaching practice:

My own practice of TA is more of a self-research ... I attempted to take away the paper and pen from what we usually describe as “drill and practice”... so instead of letting students just sit there and answering questions, I gave them the opportunities to find out “Why has the question been asked this way? “How can I use the different information to answer the question? ... (Participant A, Third Interview)

Similarly, the other participant, who used the *WebQuest* for the social studies lesson, showed that he began to develop a better understanding about technology-enhanced pedagogy—being able to draw a synthesis of technology use and pedagogy with a focus on student learning—technology-enhance pedagogy. This is reflected in the following words:

Before TA, it was a bit confusing, because I had so many theories that I had learnt from various modules, so I was trying to put the pieces together... I tried to form a mental picture... At that point, my idea of teaching and learning was quite simple: I teach, pupils learn. But now it's not as simple as that because teaching involves a lot of skills, and a lot of ways that I can manipulate a student's way of thinking and a student's way of learning... After TA, I have figured out what pedagogies I'm comfortable with... I'm able to map what strategies to use, what tools to use on which type of students. So, what I've learnt, about the theories and all that, I have come to practise them, and these theories have in turn become skills showing how effective my teaching is to the students... (Third Interview)

In brief, the participants reinforced their beliefs on teaching and learning from reflecting on their own ICT use.

## Discussion and implications

One of the major findings showed that all the participants registered positive changes in their beliefs about teaching and learning as well as their attitudes toward using IT. They gained new ICT knowledge and skills for classroom teaching and learning. They appeared to be ready and able to use ICT in their teaching in their early field placements. Our finding is quite different from the earlier studies in other countries which reflected that preservice teachers were not ready to use ICT in their teaching (Kay, 2006; Russell et al., 2003; Swain, 2006). Our latest finding in this paper is consistent with the findings in our earlier studies that the preservice teachers in Singapore are ready to use ICT in their teaching (Gao, Choy, Wong, & Wu, 2009; Gao, Wong, Choy, & Wu, 2010).

In fact, the 14 preservice teachers were not only ready to use ICT for classroom teaching and learning, but also did use ICT for all the 14 lessons that we observed. It seems that the participants' technology skills, their beliefs in teaching and learning, and their perceptions about using IT, are not primary, crucial factors that influences their use of ICT in their field placements. For example, the two participants with a similarly high level of ICT knowledge and skills used different ICT applications for different purposes. In addition, they shared the similar positive attitudes towards using different ICT applications but performed quite differently. One made an attempt to translate his espoused beliefs into practice by involving his students in using his self-designed *WebQuest* in the whole inquiry learning process. The other participant could talk about his constructivist beliefs and using ICT for student-centered learning during the first and second



interviews. But he could hardly translate his espoused beliefs into effective ICT use to promote the student learning that he talked about. He simply used a flash presentation to tune into the lesson. This finding is consistent with Fairbanks and her colleagues' argument that "knowledge alone does not lead to the kinds of thoughtful teaching we strive for" (Fairbanks et al., 2010 p. 161). It is also consistent with the findings from our previous studies that most preservice teachers could not "walk the talk" as they used ICT only to enhance teacher-centred instruction (Gao, Choy, Wong, & Wu, 2009, p. 723). It is easier for preservice teachers to make certain positive perception changes in the effective use of ICT for promoting student learning from the coursework. However, it is not easy for them to sustain such changes during teaching practicum (Gao, Choy, Wong, & Wu, 2009). It is important for teacher educators to help preservice teachers to draw connections to link their espoused constructivist orientations, the pedagogies and the use of ICT from reflection.

To a large extent, our interventions for engaging the preservice teachers in reflection had an impact in helping them gain knowledge about reflection and reinforced their beliefs about teaching and learning, and their positive attitudes towards using ICT. It seems that simply providing a scaffolding workshop on reflection and a structure for self-reflection and peer critique are not sufficient to influence preservice teachers to develop a better understanding of technology-enhanced pedagogy. There is a connection between the ICT use and the focus of the reflection. In other words, only those preservice teachers, who see learner-centered classrooms and student authentic learning tasks as central to the use of ICT for classroom teaching and learning, benefit most from engaging in reflection. They were able to synthesize their constructivist orientations, student-centered teaching approaches, and the effective use of IT.

There are many constraints to this study. For example, the volunteer participants of the study cannot present a general picture of preservice teachers learning to teach with ICT in the sense that the participants are self-motivated. In addition, we allowed the participants to decide which lessons they wished to be observed in. Thus there is a high likelihood that the participant might have made special preparations for the observed lesson. Therefore, such observations may not present authentic ICT use in a school placement. Furthermore, we as researchers did not intend to provide feedback for the observed lessons and the participants' self-reflections because we did not want to impose our judgment on the participants and thus create additional pressure on them on top of their overwhelming agendas in the TA. However, the participants do expect to receive feedback from the researchers about their technology field practice. This is the area for our further studies.

## Conclusion

Our study draws new insights not only on the changes of the preservice teachers' knowledge, skills and attitudes, but also on their ICT use (IT) for classroom teaching and learning in their early school placement. Furthermore, we engage preservice teachers in reflection as a way to develop a better understanding of technology-enhanced pedagogies. We hope that our exploration will stimulate our teacher education colleagues to engage in similar investigations on how to prepare new generations of preservice teachers to be adaptive teachers for technology integration. We see the need to investigate how to provide scaffolding and feedback for preservice teachers as a form of guidance for engaging them in higher levels of reflection.

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