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Engaging Preservice Teachers in Reflexive Practices: Developing Embodied Understanding of Technology-Enhanced Pedagogy

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Engaging preservice teachers in reflexive practices:
Developing embodied understanding of technology-enhanced pedagogy

Abstract

This paper reports the qualitative findings of a two-year study aimed at investigating the process and impact of video technology-aided and researcher-guided reflection on seven preservice teachers' learning to teach with information technology (IT). Video technology and guided reflection could afford the participants to develop their embodied understanding about technology-enhanced pedagogy and positively impact their future actions. However, dialogic understanding from guided reflection was found most crucial for preservice teachers to unsettle previously held assumptions, reconstruct new understandings, and consequently could prepare thems to be thoughtful for future actions. Implications for teacher education are discussed.

Key words: preservice teachers, reflexive practice, technology-enhanced pedagogy, video annotation tool

Introduction

Teacher education is standing at the crossroads of change. Traditional forms of direct instruction and training for teacher education have been criticized for being decontextualized (Kelchtermans, 2004). Besides, much of teacher preparation is limited to increasing teachers' knowledge rather than their decision-making and professional judgment capabilities (Munby, Russell, & Martin, 2001). Fairbanks and her colleagues (2010) proposed that beyond traditional forms of professional knowledge, teacher preparation program should support the development of thoughtful teachers who are responsive to students' needs and the changing contexts in education.

Information Technology (IT) is one of the changes as well as challenges teachers have to confront with. Furthermore, the innovative and thoughtful use of digital technologies has the potential to transform teaching and learning in the classroom. Accordingly, learning to teach with IT becomes a new scholarly and professional discipline for teacher learning (Willis, Thompson, & Sadera, 1999). After analyzing 68 studies that examined the use of technology in preservice teacher education, Kay (2006, p.383) concluded that "most research examined attitudes, ability or use of ICT, but rarely looked at all three." Repeated findings have suggested that although most novice teachers possess essential technology knowledge and skills as well as positive attitudes, they either do not appear to be ready to use IT in their teaching (Kay, 2006; Rakes, Fields, & Cox, 2006) or demonstrated limited pedagogical engagement of students in using information technology (Author et al., 2009; Judge & O'Bannon, 2007; Swain, 2006). Focusing on preservice teachers' use of IT during their field placements, the first author of this paper (2005) and Dawson (2006) both emphasized the importance of engaging preservice teachers in reflection as a means to understanding their technology field experiences.

To gain insights into preservice teachers' reflection on the use of IT for classroom teaching and learning, we designed this two-year holistic study aiming to link the preservice teachers' ability, attitudes and their use of IT in the classroom throughout their initial teacher preparation program and their engagement in reflection as a means to understanding their IT-related teaching practice.

In this study, the following questions were designed to guide the research:

1. What are the perservice teachers' capacities and dispositions for using IT after taking a ICT course?
2. How do they use IT during two field placements?
3. How do they develop their understanding of technology-enhanced pedagogy?

Literature Review

This literature review focuses on two relevant bodies of research: reflection and its applications in teacher learning, and the effective use of IT as a way of promoting preservice teacher's reflection. Video technology is employed as one of the means for promoting reflection in this intervention study.

Reflection for Teacher Learning

In teacher learning, understanding is a crucial topic. Rather than a static attribute of an individual's knowledge, understanding is emerging and developing, situated in contexts, and is defined as a mental activity that contributes to development (Britzman, 2003; National Center for Improving Student Learning and Achievement in Mathematics and Science, 2007). In alignment with this thinking, there has been a substantial amount of research focused on promoting teachers' understanding (Borko et al., 2000; O'Brien & Schillaci, 2002). Britzman (2003) asserts that preservice teachers' understanding is gained in and from one's dynamic, discursive practices, deepened from actively constructing personal meaning and reflecting on one's own discursive practice(s). Dall'Alba and Sandberg (2006) further argue that teacher learning should focus on the development of embodied understanding that is embedded in dynamic, intersubjective practice and integrate *knowing*, *acting* and the professional *being* in question (p.389).

Reflection has been acknowledged to play a pivotal role in constructing teacher understanding of teaching and learning (Wilson, Shulman, & Richert, 1987), since it could bridge the gap between theory and personal embodied practices. It is the reflection of our experiences that leads to learning - not merely the experience itself (Dewey, 1933; Posner, 2005). According to Dewey (1933), reflection involves "a state of doubt, hesitation, perplexity, or mental difficulty, in which thinking originates" (p. 12). This uncertainty is followed by the act of searching for materials that will resolve this doubt and settle the perplexity. Thereupon, experience with no reflection at best leads to superficial knowledge (Posner, 2005).

As a "kind of meta-reflection", reflexivity is a "turning back on itself", which emphasizes its critical nature of unsettling previously held assumptions to gain new awareness (Freshwater, 2001: p. 529). Etherington (2004) defines that reflexivity is the process of 'being aware in the moment of what is influencing our internal and external responses'. Lisle (2000) provided the two-fold meanings of reflexivity: reflecting, as in thinking analytically, critically and evaluatively and 'reflexing', receiving an image then projecting future actions like a response to a given stimuli. This study defines reflexive practice as a process of analytic, critical, evaluative monitoring of the actions of self and others in order to or not to modify one's ongoing actions for future actions.

Reflection models have been well documented in the literature. For example, some reflection models are best described and defined either as phases and transitions between phases (Schön, 1983; Atkins & Murphy, 1993) or hierarchical levels (Van Manen, 1977). Rolfe, Freshwater and Jasper proposed a Reflexive Practice framework (2001), which is a simplistic cycle by focusing on three kinds of questions: *What*, *So What* and *Now What.* The questions of *what* are related to descriptive reflection. The question of *So What* are related theory-and-knowledge building reflection to address overall meaning and application. The questions of *Now What* are action-oriented, focusing on the implication for action. Consistent with Lisle's (2000) definition of reflexivity, we adopted the reflexive model by Rolfe, et al (2001) in this study.

Using IT for Teacher Reflection

Jonassen (2003) called for the use of IT to support reflective education, as IT offers powerful opportunities for preservice teachers to reflect on one's practice and articulate one's epistemological and pedagogical beliefs (Barnett, Harwood, Keating, & Saam, 2002). However, simply providing a technology is unlikely to change the process of preservice teacher learning and reflexive practice substantially. Rather, a preservice teacher needs guidance and support to engage in reflecting on and for teaching practices and understanding of teaching and learning.

Among a variety of effective strategies and approaches for enhancing reflection, teachers analyzing video clips of their own teaching has the potential to promote reflection (Wang & Hartley, 2003; Yerrick, Ross, & Molebach, 2003). New on-line tools for selecting, annotating, and sharing videos (Rich & Hannafin, 2009) have the potential to improve (1) what teachers notice, including both specific teacher actions and student conceptions (Sherin, Linsenmeier, & van Es, 2009**;** van Es & Sherin, 2002), and (2) how teachers reason, from simply reporting of what they see to synthesizing, generalizing, and interpreting (Sherin, 2004). Video technology alone could afford preservice teachers to reflect their intersubjective practices, but might not be able to help them to integrate their knowing, acting and being in question, as they might fail in thinking analytically, critically and evaluatively about future actions – which is what entails the reflexive practice as defined in this study. Preservice teachers need some form of scaffolding or guidance to help them reflect more meaningfully, otherwise they tend to focus on the more technical aspects of teaching and themselves not their students (Calandra, Gurvitch, & Lund, 2008; Crawford & Patterson, 2004).

Informed by the literature, the intervention in this project was designed to provide the necessary reflexive practice to help preservice teachers develop an embodied and collaborative understanding of technology-enhanced pedagogy through guided self-reflection and peer critique, using an on-line video annotation tool as well as face-to-face group discussion.

Research Design and Methods

Context of Study and Participants

This qualitative study was based on a two-year Diploma in Education (Elementary) program at the National Institute of Education, Singapore. Prior to the enrolment in the program, most of the preservice teachers had acquired contract teaching experience where they were required to handle a full teaching load (average 40 hours per week) to assess their suitability for the job. In the first semester of the program in addition to taking other educational foundation courses and curriculum courses (methods courses), all the preservice teachers have to undertake a 12-week, 2-credit core course on the pedagogical ways of using IT for engaged learning. They learn about the conceptual framework for using IT for engaged learning and the pedagogical knowledge during the first four weeks; they then learn technological knowledge about at least two IT tools in the next six weeks. In the final assessment, they work in groups of 3-4 members to design lessons that should effectively integrate IT into content areas, which they can use in their future teaching. They are required to present their lessons to their course mates.

At NIE, preservice teachers have two field placements: five weeks for Teaching Assistantship (TA) after the first year of their coursework and ten weeks of Teaching Practice (TP) at the end of the second year of coursework. They are expected to use IT during TA and TP. In the first two weeks of TA, preservice teachers observe their cooperating teachers in action. They start to handle half a teaching load (average 20 hours per week) from the third week onwards. During the ten weeks of TP before the completion of the program, they handle half a teaching load.

From a cohort of 300 preservice teachers, we purposefully selected 21 preservice teachers with a wide range of technology skills and invited them in this study. The selection was based on their self-reported technical skills indicated in the pre-IT course survey. However, 14 of them opted out of the study before the start of TP because they were overwhelmed by the demand of their field placements. Thus, in this paper we report the qualitative findings of the remaining seven participants who completed the full circle of the data collection after TP.

The profile of these seven participants are as follows: Tom (high level of skills), Tasha (Medium), Taffy and Tamah, who majored in Chinese Language and Literature, will be teaching Chinese Lanugage upon graduation. Sam (High), Sean (Medium) and Saffy (Medium) who majored in General Education, will be teaching three out of the following four subjects: English Language, Social Studies, Mathematics or Science. Their ages ranges from early 20s to early 40s.

Research Intervention

In order to scaffold the participants' to develop their understanding of using IT for classroom teaching and learning, we provided a systematic structure to facilitate the preservice teachers' reflexive practices.

We conducted a workshop for the participants before TA. During the workshop, we demonstrated how to identify a critical incident using an online video annotation platform, how to reflect on critical incidents, and how to use guided questions for reflection. When introducing the concept of critical incidents, we made it clear that: "incidents happen, but critical incidents are produced by the way we look at a situation ... a critical incident is an interpretation of the significance of an event" (Tripp, 2006, p. 8). Therefore, an incident could be made up of many critical incidents as different perspectives are given to interpret the incident.

When introducing Rolfe, Freshwater and Jasper's Reflexive Practice framework (2001), we explained that the rationale for choosing this framework is that it is future-oriented, and can provide a holistic picture of reflexive practice by focusing on three kinds of questions: *What*, *So What* and *Now What.* Lastly, we provided additional sub questions to each type of question (see Table 1).

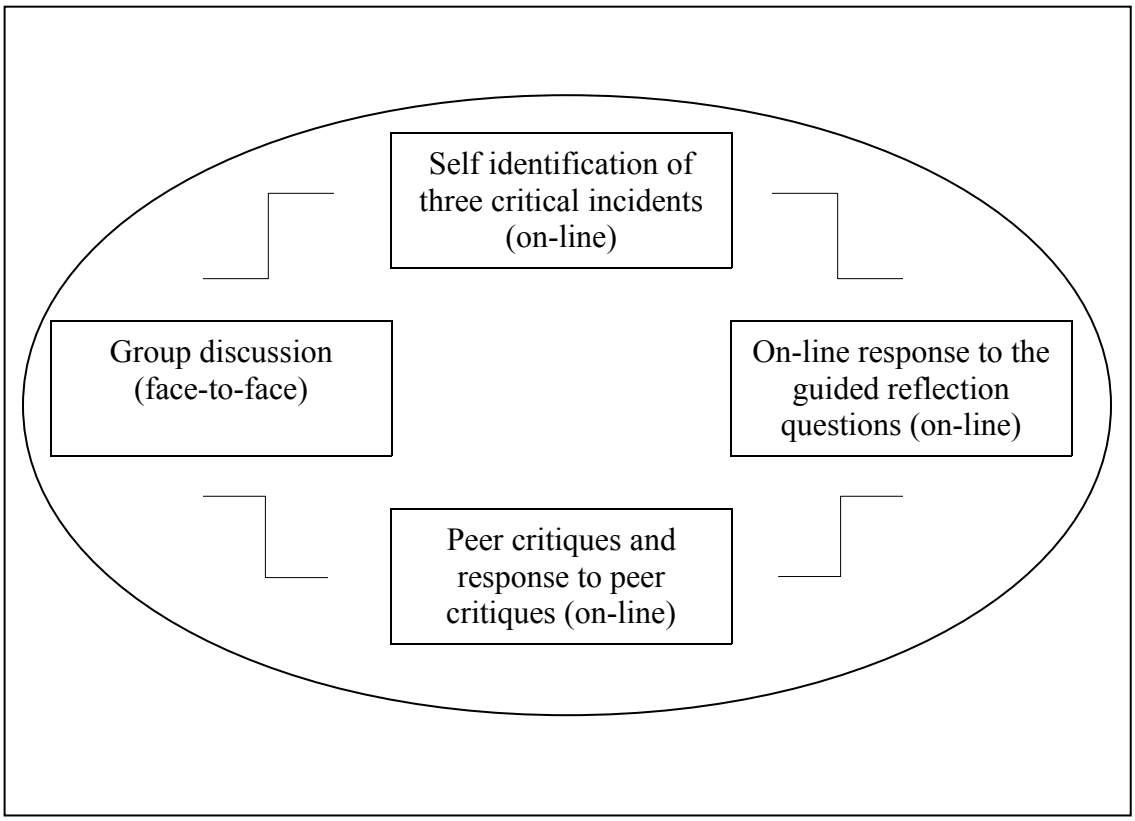
Table 1

Ten guided reflection questions

	Signature question: In this lesson, what did I learn about using IT?
What	1. *What* was this critical incident about?
	2. *What* were my concerns and reactions at the time of the incident? Did I stop teaching? Please explain why?
	3. *What* were the students' responses and feelings (positive/negative) to this incident?
	4. *What* did I learn about using IT in this incident?
So what	5. *So what* made this incident critical or significant for me?
	6. *So what* personal/theoretical knowledge can I bring to the situation?
	7. *So what* can the critical incident tell me about my beliefs and values as they related to teaching?
Now what	8. *Now what* impact did the selected incident have on my future teaching?
	9. *Now what* do I need to do in order to make things better/ improve my teaching/ resolve the situation/ feel better about my teaching in the future?
	10. *Now what* broader issues need to be considered in order to make my teaching more successful in the future? Will it lead to any consequences? Please explain.

After the workshop, the participants engaged in two guided reflection cycles in TA and TP. The components of each reflection cycle are illustrated in Figure 1.

Figure 1. A guided reflection cycle



After observing and video recording the lessons, we uploaded the video recorded lessons onto the Digital Interactive Video Exploration and Reflection (DIVER), an on-line video annotative platform developed by Standford University. We engaged the participants in self analysis by getting them to identify three critical incidents about their own teaching practice. During TA, we asked the participants to answer as many of the relevant questions provided as possible from a list of ten guiding questions for each critical incident. We also encouraged them to try to select incidents related to the use of IT in their lessons. During TP, we asked the participants to focus their reflection on the use of IT for their teaching practice. We asked them to answer three or more questions most meaningful to them. In this way, they had to make professional judgments by thinking deeply about what matters to them most in a more focused process.

We then engaged the participants in peer critique by getting each of them to provide comments to at least one other participant, and to respond to the peer critique from another, by using the DIVER platform. Finally, we conducted face-to-face group discussions. The detailed decription of the group discussion will be elaborated in the section of data collection.

Data Collection and Analysis

After getting the ethics approvals from the University and the written permission from each participant, we engaged in an iterative process of qualitative data collection and analysis. We conducted four rounds of one-to-one interviews for each participant in order to elicit the participants' self report on their pedagogical beliefs, their attitudes towards using IT for classroom teaching and learning, and past and present learning and teaching experiences of using IT. We observed and videorecorded one lesson during TA and two lessons during TP for each participant (except one lesson for one participant).We kept field notes for the lesson observations. The observation and video recording served two purposes — for the researchers' data analysis and the participants' self-reflections. We organized the seven participants into two groups: Chinese Language Group and General Education Group. After TA and TP respectively, we conducted one group discussion for each group. Thus, we have a total of 4 group dicussions. Table 2 provides a summary of the qualitative data sources.

Table 2

Summary of the qualiative data sources

Description of activities/ qualitive data sources	First Year of Study (August 2008—August 2009)	Second Year of Study (August 2009—August 2010)
4 rounds of one-to-one interviews for each participant	• First interview at the beginning of IT course (August 2008) • Second interview after the IT course (December 2008) • Third interview after 5-week TA (August 2009)	• Fourth interview after 10-week TP (October 2010)
Classroom observation and video-recording of the technology-based lessons	• One TA lesson (July 2009)	• Two TP lessons (March-May 2010)
Participants' self-reflection by using DIVER	• After TA (August 2009) + Peer critique & response to peer critique	After TP (August-October, 2010)
Group discussions	• One for Chinese Language Group and One for General Education Group After TA (August 2009)	One for Chinese Language Group and One for General Education Group After TP (August-November 2010)

In this study we adopted multiple data analysis approaches according to the nature of the data from various sources. Qualitative content analysis (Denzin & Lincoln, 2000) was used to analyze the interview data, because it produced descriptions along with the participants' expression of their views about their social worlds. After collecting the interview data, two members in the research team started a preliminary explorative content analysis (Bogdan & Biklin, 1992). There are three iterations of data analysis**.** The first iteration focused on identifying initial codes. The second iteration focused on identifying themes and arranging the themes into three major categories: Learning from the university coursework, Learning from

self reflection, Learning from peers. The third iteration was application to the data set to answer the three research questions. We triangulated the interview data with video data, lesson plans and samples of their students works.

The video data analysis involved multiple phases. Firstly, we entextualized all the video data by describing all the activities in a lesson to identify a teacher's pedagogical approaches. Secondly, we checked our descriptions with the video for accuracy. In addition, while reading through the entextualized descriptions, we identified the participants' pedagogical practices with reference to their teaching plans. Thirdly, we triangulated the video data with the interview data and the other artifacts, such as lesson plans and samples of students' work. Finally, we organized the participants' IT use in classroom into three categories: teacher-centered use, teacher-student-shared use and student-centered use based on the kind(s) of IT application(s), the ways and the number of teaching/learning activities in which IT was used.

Reflection data were analyzed using multiple methods too. Since the reflection data contained critical incidents, peer critiques and response to peer critiques and group discussions, we first did content analysis of critical incident aimed at identifying the focus of reflection.We then adopted the interactional sociolinguistic approach to discourse analysis, which was built upon theories in sociolinguistic ethnography (Gumperz, 1986; Hymes, 1974) to analyze the data of the peer critiques, response to peer critiques, and group discussions. We employed this approach because of the interactive nature of the data in this study. Also, interactional sociolinguistics is able to track how the participants act and react to each other, construct meanings and understandings of the incidents they identified, and develop social significance through their reflexive practices: self reflection, peer critique, and group discussion. In addition, the processes of the social construction of intertextuality and intercontexuality are able to be revealed. As a team, we also maintained analysis memos and conducted periodic reviews of all analyzed data and analytical memos.

Key Findings

In this section, we present the key findings in line with the three research questions. The seven participants: 1) registered positive changes in their capacity for using IT, and dispositions towards using IT for classroom teaching and learning after attending an IT course; 2) demonstrated efforts to explore various technologies, thus expanded their beginning repertoire of using IT for classroom teaching and learning as noticed during the two field placements; 3) showed the development of their embodied and dialogic understanding of technology-enhanced pedagogy through reflexive practices.

Registered Positive Changes

Evidence from the interview data shows some positive changes in the participants' technology ability and dispositions for using IT. After taking the IT course, the participants reported that they had acquired new technology knowledge and skills and they were able to use *WebQuest*, concept mapping, *Facebook,* and *Pbworks* as a tool for classroom teaching and learning. They also gained pedagogical knowledge such as collaborative learning, Understanding by Design, inquiry–based learning and project-based learning. Additionally, evidence also reveals a shift

in participants' pedagogical beliefs: from a one-way transmission of knowledge from teacher to students to a two-way interaction between teacher and students. Taffy commented "Classroom teaching is changing from teacher-centered to student-centered. In fact this poses greater challenges to teachers … Teachers should give more space to students for self exploration" (Second Interview). Sam echoed:

> Initially, I deemed teaching as simply conveying knowledge, facts and theories to the students. To do this, I believe[d] that a teacher had to be knowledgeable in the subject. After taking the IT course, I find that teaching does not only encompass the knowledge of the subject but it also involves communication strategies as well as teaching pedagogies … As I progress along my studies in the university X, I have deepened my understanding of teaching as a whole. (Second Interview)

Accompanying these changes, the participants demonstrated a shift in their perception of using IT for classroom teaching and learning. This is revealed in Sam's second interview:

> I have learnt that IT could be a friend or a foe. Based on various affordance studies that I have done, using IT is beneficial to the classroom but one can easily be fooled by the downsides … Therefore, teachers should always have a backup plan just in case IT fails. In addition to this, IT should be used hand in hand with engaged learning. There is of no use, if the teacher simply shows a video and animations as an aspect to concentrate students' attention … IT could really provide a platform for students to learn intentionally and get engaged on topics through discussions and collaboration.

It seemed the seven participants were ready for using IT to enhance their students' learning during their upcoming field placements.

Demonstrating Continuous Efforts to Explore Various IT Uses

Indeed, video data analysis indicates some changes in the participants' ways of using IT for classroom teaching and learning during TA and TP. Among the 19 videorecorded IT-based lessons, there were two major patterns of IT use: teacher-centered use and student-centered use. See Table 3 below. There seemed to be a close connection between the ways of using IT and the subjects taught. The four Chinese Language majors shared a similar approach in teacher-centered use of IT for delivery of the content; the other three General Education majors adopted a student-centered approach of using technology for exploration and production.

Table 3

The use of IT during TA and TP

Pseudonym (Technology skills)	TA		TP	
	Use of IT	Pedagogy	Use of IT	Pedagogy
Tom (H)	Teacher used Flash to tune in the lesson	Teacher-centered	Teachers used a suite of tools to enhance their teaching *Except Tom who used Wikipedia to demonstrate how to use it as a resource in his second observed lesson	Teacher-Centered
Tamah (M)	Teacher used ppt to present teaching content.			
Taffy (L)	Teachers used a suite of tools to enhance their teaching			
Tasha (L)				
Stacy (M)	Teacher used IWB to present PPT Students used IWB to show their understanding	Teacher-centered with two student hands-on learning activities	Teacher used video as a starter for story writing Students used Word to compose stories, published them into Blogger, and did peer editing	Student-centered
Sam (H)	Teacher used on-line documentary to introduce the topic Students used *WebQuest* to conduct an inquiry-based activity	Student-centered	Students explored on-line resources and conducted the on-line self-assessment	
Sean (L)	Students used *WebQuest* to complete an authentic task		Students used the Flash Story to design their own comic stories based on readings from the textbook. Students published their self adapted comic stories on line	

The four participants, who majored in Chinese Language and Literature, used IT primarily for teacher-centered instruction both in TA and TP. Pedagogically, they followed a similar instruction flow: teacher led introduction, teaching vocabulary and phrases, and reading and explaining the text. Tasha and Taffy used a similar suite of IT tools: MS Powerpoint, Ministry's on-line resources, *Hanshen*—a software for teaching Chinese characters, Flash to present the content for the entire teaching process. However, they showed a "polished performance" by enhancing their usage from TA to TP.

Tom encountered some negative experiences when trying to translate his belief of IT use into practice by using different tools for each observed lesson in his two field placements. For example, he used a flash animation to tune in the lesson for the TA observed lesson. He was disappointed as he could not meet his expected outcomes because most of his students could not understand the content of the story although they were engaged in watching the animation. During the first TP observed lesson, the same as other three Chinese majors Tom used the PowerPoint slides and Ministry's on-line resources to present the content, and *Hanshen* with sound to demonstrate the stroke sequence of Chinese characters. He was delighted that his students were engaged in learning. Believing IT should not be used for presenting the content,

he decided to "adopt a teacher-centered approach by using *Google* and *Wikipedia* to demonstrate how to use these tools as open resources for finding answers to any interesting question … Unfortunately, my students don't know how to ask questions." (Fourth Interview). Recalling his tried-but-not-true experiences on using IT, Tom remarked: "I still believe my idea [i.e., technology should not be used only for presentation] is right. I am just more confused about using IT. I invested a lot of time and energy into the IT design. But when I use it in class, students are noisy and they don't appreciate my efforts" (Fourth Interview)."

Among the other three participants majoring in General Education, Stacy used the Interactive White Board (IWB) to present Powerpoint slides about the four seasons and engaged her second graders in using the IWB to group pictures and match them to a particular season in an English lesson during TA. In the first and second observed Grade 4 English lessons during TP, she used a video clip as a starter to appeal to students' senses of sight and hearing before students' embarked on creative writing. Then she arranged her students in groups to write an opening paragraph for the movie clip and published their paragraphs onto the blog. Lastly, she engaged her students in a peer editing activity.

In a social studies lesson during TA, Sam engaged his students in a group inquiry activity by using *WebQuest* so that his students could "use IT as a knowledge construction tool" (Third Interview). In the first observed lesson in TP, Sam engaged his students in using an on-line website for self-exploration and self-assessment for a science lesson. He did not use IT for the second observed lesson because the projector in the classroom was out-of-order.

During an English lesson in TA, Sean took additional effort to ask his school Technical Assistant to connect 39 netbooks to the Internet. But some of his students encountered a problem with getting Internet access. Faced with such an unexpected situation, Sean modified his lesson plan and allowed his students to complete the assignment after class. During TP, Sean only had one lesson videotaped for this study due to time constraint. He engaged his students in using an on-line Flash story tool to create their own comic scripts and publish them. Reporting his successful experiences, Sean shared his embodied understanding of IT use in the classroom: "I feel that the more responsibilities students have, the greater enjoyment of their learning … I will still stand firm that teaching and learning can be enhanced by IT but will not be replaced by IT" (Fourth Interview).

Developing Embodied and Dialogic Understanding from Reflexive Practice

Developing embodied understanding from self-reflection

The participants valued the opportunity of self reflection on their own teaching practice as a means of gaining "self awareness and self acknowledgement of my own strengths and weaknesses" (Sam, Third Interview). Being the first part of reflexive practice, viewing and annotating their teaching videos on DIVER afforded the participants to notice what mattered to them, and "be aware of all these incidents which cannot be noticed on the spot" (Tasha, Third

Interview). Tasha further commented: "I can improve my teaching better". The guided reflection pushed the participants to focus their reflection through the analytic, critical, evaluative lens, so that they began to engage in an on-going process of monitoring their own action, and searching for alternatives for future action. Sam commented:

> At the first glance on the video, you don't even see that there's a critical incident, until you really put it as a critical incident and you investigate into it, then you find out that there are so many alternatives, there're so many things you can do, and so many ways to avoid it. (Fourth Interview)

Among the 21 critical incidents (three critical incidents from each of the seven observed lessons) during TA, we identified and arranged the critical incidents into two broad categories: teaching effectiveness and the use of IT. Specifically, five out of the six incidents in the 'use of IT' category focused on the failure of using IT in the classroom. For example, Tom chose his unsuccessful experience of using the Flash animation as a tuning-in activity described in the previous section as one critical incident. His reflection revealed his earlier embodied understanding about IT resources for classroom use: "I should choose appropriate IT resources from the perspective of the second language learners" (TA on-line reflection). Sean shared his similar frustrating encounter and his embodied understanding about IT use in the classroom:

> I was really upset that most of my students could not access the wireless connection despite the fact that I told the TA to set the netbooks … Sometimes things just happen. Using IT is just one of the examples that things may go wrong when you least expect it … Always have a back-up plan if the lesson involved heavily on IT resources (TA on-line self-reflection).

During TP, the two broad categories of teaching effectiveness and the use of IT remained the same among the total 33 critical incidents (nine less than expected). Specifically, in the category of IT use, there were three substantial changes.

Firstly, all the seven participants chose to identify critical incidents related to the use of IT. They acknowledged that the researchers' expectation for focusing on the use of IT and their continual learning from other university courses contributed to this change.

Secondly, there was a certain substantial change in the participants' acting from "unconscious performance" to "conscious action". For example, after learning the lesson from his first unsuccessful experience in using a Flash animation, Tom became more flexible and overcame the constraints of limited available resources by selecting an English Flash animation related to the teaching content. In order to help his students to understand the video, he provided an explanation in simple Chinese before showing it and before the group activity. He was delighted that his students "enjoyed this flash animation very much" (TP on-line self-reflection).

Similarly, Sean learned a lesson from his TA experience of relying on the school's Technical Assistant to set up the Internet access. He made a "conscious action" of "going into the computer lab one hour earlier to set up and check all the desktops that the students will be

using. One desktop failed to operate …. One can never be well prepared for IT resources … Therefore, have a backup plan if you need to conduct an IT lesson" (TP on-line reflection). In brief, the technical problems added more frustrations to the participants.

Thirdly, there was an emerging and significant theme within the category of IT use in the classroom – drawing a link between the effectiveness of teaching and the effectiveness of IT use in classroom teaching and learning. For example, when Stacy engaged her students in creative writing, she had a concern that "there were not enough computers in the computer lab … I wonder if those students who were sharing computers are learning less …" (TP on-line self-reflection). She was delighted that her students began to take the initiative in helping one another. Stacy was convinced by her own practice of using IT for engaged learning: "Students will be engaged if they find purpose in doing the activity … (TP on-line self-reflection). Different from TA, in TP Stacy started to reflect on IT use with a lens of pedagogical effectiveness, rather than IT use *per se*.

Additionally, the ten guided questions based on Rolfe, Freshwater and Jasper's Reflexive Practice framework (2001) could potentially reinforce the integration of the participants' knowing and acting in terms of technology-enhanced pedagogy. Table 4 lists the frequency of the four most frequently answered questions in two field placements (See Table 4), and it shows the participants could potentially reflect upon their practices reflexively for future action.

Table 4

The four most frequently answered questions

	Signature question: In this lesson, what did I learn about using IT?	TA		TP			
		F	%	F	%	Total F	Ranking
What	*What* was this critical incident about?	14	17%	17	29%	46% 1	1
	What were the students' responses and feelings (positive/negative) to this incident?	12	14%	10	17%	31%	2
So what	*So what* made this incident critical or significant for me?	10	12%	7	12%	24%	3
Now what	*Now what* do I need to do in order to make things better/ improve my teaching/ resolve the situation/ feel better about my teaching in the future?	12	14%	6	10%	24%	3

These four questions cut across the three types of questions: *What, So what* and *Now what*. The frequency of "*What* was this critical incident about?" ranked the top, and it may imply that the participants started their first step towards understanding of the incident by describing the incident (Tripp, 2006). "*What* were the students' responses and feelings (positive/negative) to this incident?" ranked second. It may imply that the participants focus much of their attention

on students' responses and feelings. The question, "*So what* made this incident critical or significant for me?" indicated that the participants attempted to make personal meaning from the reflection on the incidents. "*Now what* do I need to do in order to make things better/ improve my teaching/ resolve the situation/ feel better about my teaching in the future?" indicated the participants tended to reflect on their future actions. Thus, the guiding reflection framework and the video annotation tool allowed the participants to gain a more holistic and all-encompassing view of their own teaching practices.

The above findings reported the positive changes in the participants' embodied understanding about technology-enhanced pedagogy, partially owing to their engagement in the guided self-reflection on their own practice. We were also interested in how the participants further developed their embodied understanding. Dialogic understanding was found to be one of the significant sources.

Dialogic understanding from group discussion

After the self-reflection on the selected critical incidents, the participants were also involved in peer critique and responding to peer critique on DIVER. The participants appreciated the practice of peer critiquing each other online. For example, Sam commented: "… the best thing is, when other people read it [self reflection], they'll give you alternatives as well, and you'll be surprised that you never even think about the alternatives" (Third Interview). Tasha echoed: "My peer (Taffy) critiqued my reflection. I agree with what she said. I think peer critique is helpful, because one mind is not enough" (Third Interview). Tasha and Taffy extended their collaboration beyond the on-line reflection: "In fact, we contacted each other when we were free and exchanged ideas. We shared what we had learned from the classroom teaching. I like this kind of collaboration, because the outsider could be clear of the whole picture" (Tasha, Third Interview).

Analysis of the online interaction shows a variety of patterns among these participants: simply providing positive appraisal as a way of encouragement and confirmation of the peer's performance, showing appreciation, consolidating their peers' decision or practices, and recasting their shared beliefs or actions, etc. Also, some discourse indicated a pattern of doubt – clarification - further justification. This type of interaction pattern might imply a certain disagreement in an indirect and mild manner. It could also imply that when others viewing a short critical incident mainly embedded in a video clip on DIVER and reading the reflection, they tended to be conservative in providing critical comments, because they were probably lost in a larger picture of the whole lesson and other background information, as Sean commented, "because I was not there I cannot understand fully what went on in the classroom" (Fourth Interview).

In order to overcome the limitation that the use of short video clips on critical incidents might result in decontextualized discussion, we designed group discussion not only to allow the participants to have an opportunity to explain the contextual information about the incidents but also view the critical incidents from more perspectives than what peer critique could achieve. We arranged the group discussions according to the subject majors so that the participants could have the common language and content knowledge for discussion. During each group discussion, each participant was asked to choose one critical incident from the

three, described the specific context, explained the rationale for choosing this incident, and expressed their thoughts and feelings about classroom practice.

In the group discussions, the researchers facilitated the turn taking among all the participants in order to elicit more perspectives, and problematize some of the participants' practices, understanding and beliefs, with the hope of producing some opportunities for participants to think analytically, evaluatively and critically for their future actions. Data analysis confirms that during the group discussion, participants were able to provide more contextual information about a single critical incident, the whole lesson where the incident was embedded, background about the learners, rationales, beliefs, and decision making process behind the partipant's practices. Also it revealed a type of dialogic understanding among the participants about technology-enhanced teaching, as the group discussion discourse was filled with tensions and multiple voices.

We used the first part of the Chinese group discussion—four Chinese major participants and two researchers —after TA as an illustration. Because of the space limit, we could only provide a few interaction units to exemplify how tensions and multiple voices could integrate the participants' embodied understanding and practice into question, and how they eventually seek new dialogic understanding. The group discussion started with Tom's self reflection on his frustration of his unsuccessful experience of using a Flash animation in TA. As an immigrant, Tom unconsciously kept referring his learning experience back in China to judge his Singaporean students. He shared his rationale for choosing the flash animation to "motivate their interest in the new text". However, from students' reaction, he realized he "made a wrong selection", as this material was beyond his Singaporean students' Chinese proficiency. One of the researchers invited Tasha, who is a local Singaporean Chinese Language teacher, to share her understanding.

Excerpt 1.

13 Tasha: I think it's probably because of the blur screen - students got lost in understanding the story. Because X school is associated with Hokkiens, most of the students' parents have Chinese education.
14 Tom: Not necessarily. In fact, many students are from English speaking families. Many Hokkien Association schools, including Y school, the students there are from English speaking families.
15 Tasha: I know this because I graduated from X.
16 Tom: Now it changed a lot.
17 Tasha: My children, a few years ago, was studying there as well. I remember when my children were in X, they learned the text.
18 Tom: Yes. The text is for P5 students. The class I was teaching is P4.
19 Tasha: Oh so they haven't learned that text yet. It might be appropriate if you could choose the text for P4.

In this interaction unit from turns 13 to 19, a tension between Tahah and Tom could be detected: Tasha uses her personal and her children's experience to indicate that students in that school have a strong Chinese language family background and they should be able to understand the animation. However, Tom keeps clarifying that the current situation has

changed a lot and believes his choice of the teaching material is just beyond the understanding of his students. Tasha's perspective didn't seem to problematize what Tom has believed.

One researcher then invited another participant, Taffy, who immigrated to Singapore from China, to voice her opinion.

Excerpt 2.

24 Taffy: I think Tom might have not known well the students' Chinese proficiency. It was out of your expectation that they could not understand the animation. Is that right?
25. Tom: Yes.
26 Taffy: I think in future when we encounter a similar situation, we probably need to explain the whole story in a more minute detail.
27 Tahah: A general introduction to this story.
28 Taffy: It is more or less like you are telling the story to let them understand the story better. Then if you play the animation, I think the result will turn out to be good. We don't know the students well.
29 Tom: It's suffering to us as well, as we don't know them well.

At turn 24 Taffy problematizes Tom's understanding about the reason for his unsuccessful experience and voiced out her embodied understanding that being a preservice Chinese teacher from China, she did not understand Singaporean students well. Tom immediately agreed and shared his frustration due to his lack of knowledge about his target students. At turns of 26-27, Taffy and Tasha attempted to offer alternatives for future actions. But Tom still believed "it is impossible to bridge the gap between Singaporean students and Chinese students when using the same materials".

Tamah, the other local Singaporean Chinese language teacher was invited to provide her perspective in the group discussion. She confessed that being a teacher without any teaching experience, she admired Tom's attempt to search for the materials beyond the provided resources. Tamah showed a reflexive practice by connecting Tom's practice to her own.

After all the participants had taken turns to express their perspectives, the whole group discussion became more open and turn taking became more dynamic. The researchers no longer needed to nominate any participant to take turns. Instead, the researchers participated in the group discussion by contributing their perspectives, problematizing Tom's understanding, and co-constructing with participants new understanding or possible alternatives for future action. In addition, overlapping of the turns between the participants became more frequent. All these indicated a type of heteroglossiaic and dialogic discourse, where dialogic understanding is achieved.

As a few more interaction units continued, more perspectives had been given, and more previously held assumptions has been problematized, but it was noted that Tom still didn't seem to be willing to regard his practice as a problematic act. Based on the tension mentioned earlier, Tahah continued to problematize Tom's questioning skills and wait time, particularly for the instance when he was checking whether students understood the animation with video evidence. Tom seemed to accept his "problematic" questioning practice. One of the researchers further problematized Tom' understanding at Turn 64 (Excerpt 3), which eventually led Tom to verbalizing what he had taken for granted.

Excerpt 3.

64 Researcher 2: When you were doing the lesson planning, did you focus on IT use or the teaching content, materials or your students?

65 Tom: Er... when preparing the lessons, I didn't really think about what the students were reading about in their spare time, what they really understand. Perhaps, I just make judgments based on my personal experience. For example, took it for granted that when I was in P2 I was able to understand this story.

As the interaction continued, new dialogic understandings emerged among the participants and researchers. Eventually, Taffy proposed another alternative for future action. In such group discussions, the four participants and two researchers used dialogue to open up a space to generate multiple alternatives and gained dialogic understanding, which impacted their teaching practices during TP.

For example, learning a lesson from Tom during the first group discussion, Tasha posed three questions before showing the animation and providing further explanation after showing it: Therefore, showing a Flash animation is not only as "an entertainment but as part of pedagogy" (Taffy, Fourth Interview). Taffy shared her learning experiences from the group discussion:

> I think the group discussion is a short-cut for me. My peers' concerns and problems are also mine. They might not be my current concerns but probably future ones. So I have learned from my own reflection or others' reflections. Their experiences prepare me well for the future. (Fourth Interview)

Discussion and Implications

The first key finding suggests that the preservice teachers improved technical skills and gained new knowledge about technology-enhanced pedagogy and possessed similar positive beliefs and a spirit of exploration after the IT course. Although they achieved a similar outcome of *knowing,* they demonstrated a variation in *acting*. For example, the three General Education majors showed a consistent pattern and exploring in the experiment of the student-centered use of IT among the two/ three lessons during the two field placements. However, the four Chinese majors did not translate their student-centered *knowing* into *acting*. They did not alter their teacher-centered pedagogy during the two field placements, although they showed "polished performance" by changing a certain aspect of using particular tools. We wondered why there is such a different pattern between the Chinese majors and General Education majors. There is the area for future research. As student teachers, the seven participants were still in the state of doubt, hesitation, perplexity or mental difficulty, there is no evidence that they did not draw a whole integration of knowing, action and being. The implication is that teacher education programs need to provide guidance for preservice teachers for reflexive practices to construct their identity.

The second key finding is that the video technology-aided reflection introduced in this study seems to have been beneficial to the preservice teachers. The self reflection helped the

participants to demonstrate two kinds of change: to show a "polished performance", and to take "conscious action" to replace the "unconscious performance." Additionally, rather than having potential, the study approved that the on-line tool for selecting, annotating, and sharing videos (Rich & Hannafin, 2009) afforded preservice teachers 1) to notice both specific teacher actions and student conceptions (Sherin, Linsenmeier, & van Es, 2009**;** van Es & Sherin, 2002), and 2) to synthesize, generalize and interpret their own practice (Sherin, 2004). One new finding from our study suggests the on-line annotative tool affords preservice teachers to search for alternatives for the future improvement. They became more thoughtful and flexible in using IT in the later field placement. Realistically, it cannot be expected that the preservice teachers could integrate *knowing*, *acting* and *being* the professional *in question* through involving in the guided reflection on three lessons. But one thing is certain that it is important to scaffold preservice teachers to change their initial understandings of their own practice. It is a good start for the preservice teachers to engage in reflection with a focus—what most matters to them—at the stage of developing their initial understanding of their own practice.

The third key finding shows little change in the reflective discourse between TA and TP. It is worthwhile to pointing it out the virtual space of peer critique and response to peer critique is not as beneficial to the participants as expected. The face-to-face group discussion is more meaningful for the participants, because they could produce more opportunities for heteroglossiaic and dialogic discourse, where new embodied and dialogic meanings about technology-enhanced pedagogy are negotiated. In the process of reflexive practice, where the participants made their thinking public, open to discussion or comment, they analytically, critically, evaluatively monitor the actions of self and others in order to modify ongoing actions for future actions. They could gain a new awareness from unsettling previously held assumptions and they seek different alternatives for future action. Additionally, the researchers play a crucial role in facilitating the group discussions. Rather than making a personal judgment or providing solutions, the researchers made deliberate attempts to problematize the situations, and prompt the participants to critically reflect on their own actions and the actions of their peers. In this process, the teacher educators/researchers and participants tend to consider themselves as learners and ultimately their students as learners. They show mutual respect, trust, and acceptance as a result that each member is encouraged to advance embodied and dialogic understanding through sustained, collaborative investigation that previously was unknown to them.

We recommend three implications for teacher education. First, teacher education programs should encourage preservice teachers to use various forms of IT to eliminate the problem of depending on a single particular technology application. They need to prepare preservice teachers to be flexible and thoughtful in using whatever available technologies to enhance their own learning and their students' learning from their technology field practices, so that preservice teachers can begin to build the repertoire for teaching with IT. Second, the teacher education programs should provide on-going support and guidance for reflection during the teacher preparation program. As discussed, the self-reflection by using the on-line annotation tool with the guided self reflection questions is beneficial. But teacher educators/researchers play a more crucial role to engage preservice teachers to reflect critically about their own performance and their peers' performance in the group discussion in order to reinforce the reflexive practice. Third, teacher education programs should extend the support and encourage

preservice teachers to continue to collaborate and share their experience and expertise in a supportive network after graduation from the start of their careers.

Conclusion

Our research has studied the process and effect of engaging seven preservice teaches in the guided reflection on constructing their initial understanding of technology-enhanced pedagogy during their initial teacher preparation program. In this laborious, time-consuming, and reflective process, the preservice teachers gained embodied understanding of technology-enhanced pedagogy from reflecting on their own teaching practices, and constructed dialogic understanding from reflection on their peers' practices and drew a connection with their own. Thus, learning to teach with IT thoughtfully is more than just technical and intellectual pursuits. We believe it is a personal, social process of draw a synergy of knowing, acting and being. It is our hope that the findings from our study provide new insight on examining how preservice teachers construct embodied and dialogic understanding of technology-enhanced pedagogy, and learn and act together to promote the thoughtful use of IT in the dynamic reflexive discourses. We invite other teacher educators and researchers to join our endeavor in searching for a better alternative for preparing preservice teachers to teach with IT thoughtfully.

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