



Learning to be a science teacher: Reflections and lessons from video-based instruction

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This paper examines pre-service teachers' reflection on teaching after participating in an online course using videos of micro-skills coupled with self reflection and group blogs. Data sources included 137 online blog entries collected from 26 participants as well as semi-structured interviews with the participants at the end of the course. Larrivee's (2008) four levels of reflection (pre, surface, pedagogical and critical) were used to code the online reflections and content analysis of the participants' views of teaching was carried out with the interview transcripts. Analysis of online reflections showed that 67% of the reflection by pre-service teachers' falls in the pedagogical category and 2% in the critical category. These findings show that these pre-service teachers are capable of engaging in reflection beyond a surface level even with limited classroom experience. The resources that these pre-service teachers used to make sense of teaching are (1) their knowledge of learning theories; (2) their ideas of teachers' roles and responsibilities; and (3) their existing ideas of what makes good teaching. The pre-service teachers' reflection upon their learning showed evidence of willingness to incorporate the learnt ideas of good teaching in their future classrooms teaching. The use of micro-skills videos and reflection allowed them to restructure their pedagogical knowledge through identification, comparison, modification and synthesising.

Introduction

This study sets out to establish the forms, depth and extent of pre-service teachers' reflection using micro-skills teaching videos that are coupled with online self-reflection and blogs. The trigger for this study stems from two key issues highlighted extensively in teacher education literature: firstly the need to prepare pre-service teachers as reflective professionals (Osterman & Kottkamp, 2004; Schon, 1987) prior to acquiring authentic classroom teaching experiences; and secondly the possible role of technology in enhancing reflection and peer discussions in teacher preparation programs (Bryan, Recesso & Seung, 2008). In the next few paragraphs, we present the intertwined complexities of time, design and objectives of teacher preparation programs and explain how they inform this study.

Designing teacher preparation programs is challenging due to the demands on knowledge, skills and values that a teacher is expected to possess. There has been no agreement on the ideal model of teacher preparation since demands of teaching are culturally and contextually dependent (Korthagen & Vasalos, 2005). Further, teacher preparation programs also have to deal with the challenge of helping new teachers translate what they have learned in their teacher preparation program into practice (Greddis & Roberts, 1998). Debate is still rife about whether academics or practitioners

should be the primary faculty for teacher education (Levine, 2006) or whether teacher education institutes or schools should be the sites for teacher education (Humphrey & Wechsler, 2007). Time, relevant contextual experience and developing professionalism in teacher preparation programs are challenging issues that need to be addressed. This study fits squarely into the three key constraints highlighted. The program of interest is a short, one year teacher preparation program that aims to develop pre-service teachers' reflective capacity with respect to teaching practices in classrooms prior to their teaching practice. The participants in this program are graduates fresh from college who lack authentic classroom teaching experience. Technology appears to hold some solutions to this problem by augmenting classroom experience with videos and engaging pre-service teachers in reflection using blogs. Consequently, in this study, we examine how technology can be used for learning of micro-skills and reflection on how these skills can be applied in future practices.

The teaching of micro-skills is a common feature in teacher education programs (Bell, 2007); while there are numerous studies indicating its effectiveness in helping pre-service teachers learn about and reflect upon their practices (I'Anson, Rodrigues & Wilson, 2003; Kpanja, 2001), it is also fraught with criticisms for being a skills-focused training that is often devoid of contextualised information (Bell, 2007). In our study, rather than using videos to "teach" about micro-skills, the video clips (developed by the research team featuring student teachers role playing the various aspects of teaching) are used as a source of inquiry, complemented with the use of blogs to engage the pre-service teachers in reflection. In addition, many research studies have been carried out using web tools to encourage reflection and change of beliefs (Hernandez-Ramos, 2004); they occur mainly in instructional technology courses aimed at equipping pre-service teachers with skills concerning how to integrate technology in their classrooms. As such, the contribution of this study is to provide evidence and argue for the benefits of using video technology in a Web 2.0 environment for a teacher preparation course in which the primary objective is not 'teaching IT skills' but rather 'teaching skills'.

Our research is guided by these questions:

1. What forms of reflection do pre-service teachers engage in after viewing videos about micro-skills?
2. What kinds of knowledge do pre-service teachers use to make meaning of teaching from watching videos of micro-skills?
3. What are pre-service teachers' perception on the use of media and technology to learn teaching skills?

Literature review

This research focuses on the core constructs of using micro-skills in teacher preparation programs, and reflection and learning in an online environment. In the following sections, we review the literature in these areas and show how these ideas shape this study.

It is a conventional practice in pre-service teacher education to develop novice teachers in their teaching skills before they encounter challenging and complex teaching situations in real classrooms, and the use of micro-skills (or microteaching) is one approach to achieving this. Microteaching refers to the scaled-down teaching of specific teaching skills to a small group of peers in a non-threatening environment

(Hargie & Maidment, 1979; McIntyre, MacLeod & Griffiths, 1977). Research into microteaching showed enhancement in teaching performance, improvement in pupils' learning, and positive student-teacher attitudes to their course of teaching (Akalin, 2005; Wilkinson, 1996). Innovative approaches aimed at improving the implementation of microteaching were also reported, which included modifications to the components in microteaching program, applications of video technology, collaborative learning with peer and reflection (Hoban, 2000; Kpanja, 2001; Lee & Wu, 2006; Wilkinson, 1996). Research has provided evidence to show the effectiveness of microteaching through video recording, self reflection and additional feedback (Fernandez, 2010; Kpanja, 2001; Wilkinson, 1996). Our study involved pre-service teachers. So, rather than video recording their teaching, we developed videos of classroom teaching that illustrate specific micro-teaching skills. In addition, we adopted a different mode of student self reflection by incorporating blogs in the online learning experience. The inclusion of self and group blog presents the pre-service teachers with different platform for reflection and critique.

There has been considerable emphasis on the role of reflection to improve teacher professional development (Korthagen & Vasalos, 2005; Larrivee, 2008), especially with the need to ensure that we do not treat reflection merely as an intellectual exercise (Boud & Walker, 1998). In teacher education, there is an even greater need to ensure that as pre-service teachers reflect upon the theoretical knowledge they learn in pre-service teacher courses, and are able to translate this knowledge into field experience effectively. As such, reflection as a learning tool and activity is useful in pre-service teacher education courses to enable pre-service teachers to link between theoretical knowledge and their actual practices in future. Despite the importance and ubiquitous usage of reflection in pre-service teacher education programs, Hatton and Smith (1994) found that pre-service teachers are still engaged in descriptive reflection rather than more critical or dialogic forms of reflection. The issues of difficulty in determining and achieving desired levels of reflection as highlighted by Hatton and Smith still persist today and hence there is a need to examine more explicitly the forms of reflection and the roles of reflection in pre-service teacher education.

Reflection, as described by Dewey (1910), is a process whereby an individual engages in "active, persistent and careful consideration" (p.6). Teachers are able to engage in meaningful reflection about their learning at different levels of thinking when guided by a reflective framework (Hoban, 2000). The reflective thinking involves the process of making meaning of teaching through connecting the learnt theories and past experiences with the practices. Subsequently, a new learning is generated and serves as practices for professional development (Postholm, 2008). There have been attempts to examine reflection so as to devise a generally agreeable language to discuss reflection and promote the reflective practice (Day, 1999; Farrell, 2004). The different ways to examine types and levels of reflection include: reflection on action (Schon, 1987); dialogic reflection and descriptive reflection (Smith & Hatton, 1993); and technical reflection (Shulman, 1987). Larrivee (2008) built on the work of earlier researchers and developed a tool to assess teachers' level of reflective practice that encompass four hierarchical levels: (1) pre-reflection (interpretation of classroom situations without consideration to other events or circumstances); (2) surface reflection (considerations of teaching confined to tactical issues concerning ways to achieve predefined objectives and standards); (3) pedagogical reflection (teacher considers how practices are affecting students' learning and how improvements can be incorporated); and (4) critical reflection (ongoing reflection and critical inquiry on

teaching taking into consideration of philosophy and ideology). In this study, we chose to adopt Larrivee's levels of reflection for analysis since it takes into account a pre-reflection level that we hypothesise would likely apply to pre-service teachers.

Two technologies were employed in this study: video and blogs. Videos could serve as a good mode of inquiry that allows respondents to review rich contents that include various aspects of teaching: pedagogy, climate, management, classroom characteristics and student characteristics (Colestock & Sherin, 2009). The amount of attention given by teachers to each domain was different with instructional strategies receiving more concerns than other aspects. Colestock and Sherin found that teachers applied different strategies in interpreting teaching videos and subsequently developed their professional view of teaching through their interpretation and discussion. Video technology has also been implemented in microteaching to show examples of teaching or case-based learning by illustrating the actual and complex teaching environment. Videos allow pre-service teachers to learn teaching skills and teacher-student interaction through modelling and developing problem solving skills through observing the case in video playback (Kpanja, 2001; Lee & Wu, 2006). Video recording and playback is a useful technology to improve reflection in teaching (Akalin, 2005; Albrecht & Carnes, 2006; Benton-Kupper, 2001). Video-enabled and video-oriented discussion followed by critical reflection helped pre-service teachers to identify areas for improvement in professional growth (Fernandez, 2010; Kpanja, 2001). As a result, they could develop an increased awareness of their instructional strengths and weaknesses by observing the videos. The use of videos allows student teachers to have evidence-informed discussion and this fostered reflective practices among teachers (Albrecht & Carnes, 2006; Fernandez, 2010).

Blogs are a well accepted learning technology in education. Similar to online discussion forums, which allow participants to post their thoughts and subsequently read and comment on what is posted, blogs foreground the individual's thoughts and cater to a much wider audience – anyone who happens to find the blog online can read and comment. As such, the fundamental difference between writing for an online discussion forum and a blog is that a blogger writes to a diverse and probably unknown audience. In education, the use of blogs is still being explored and developed (Jonassen, 2000) and this is also the case in teacher education. Duffy and Bruns (2006) proposed that technologies like blogs, wikis and RSS promote desirable practices such as collaborative content creation and reflection of learning experiences, and enable peer and formative evaluation to take place. Hernandez-Ramos (2004) carried out a comparative study between the use of blogs and online discussion to promote reflection in an instructional technology course in a teacher preparation program. His study reported that while teachers prefer blogs to online discussion forums in their reflection, the availability of information to a wider audience resulted in some apprehension in using blogs.

However, once the teachers become familiar with using blogs, they reflected on events ranging from their reactions to the time spent with their students, to their own professional learning and classroom management strategies. In this study, pre-service teachers worked on an individual blog to reflect on the videos presented to them. Peers reading these blogs will be able to gain diverse perspectives from watching the same videos and reading the blogs. Shih (2010) used a blended learning approach using video-based blogs and found that students in the English Public Speaking course were able to enhance their learning motivation and encouraged their cooperation with their peers. He also reported that the video-based blogs helped students overcome their fear

in public speaking. This is a relevant finding for this study since pre-service teachers have to overcome their fear of public speaking when they start teaching.

In summary, the literature review indicates the need to determine the kinds and levels of reflection that pre-service teachers are engaged in to facilitate their learning of teaching skills. Further, evidence indicates the increasing popularity of incorporating videos and Web 2.0 technology, due to its usefulness in helping pre-service teachers reflect and attain levels of professionalism that would otherwise take a longer period of time to achieve. This study builds on previous studies by integrating the learning of microskills through video technology and reflection using blogs; it aims to examine exactly what forms of reflection pre-service teachers engage in with regard to learning teaching skills.

Methods

An instrumental case study methodology was used to study pre-service teachers who learnt microteaching skills through self-directed analysis of videos followed by reflection using blogs. Data for this research were collected from 2008 to 2009 from three cohorts of students who have since graduated from the program. The data corpus consists of transcripts of individual blog entries and semi-structured interviews.

Participants

There were 26 participants from three cohorts of pre-service teachers enrolled in a one-year postgraduate diploma in education program. All the participants have a Bachelor of Science degree and the majority of them have minimal formal teaching experience in schools. The participants specialised in the teaching of general science and biology at high school level. They volunteered to participate in an online microteaching course.

Intervention

This research was conducted in a 13-week science methods course that aims to equip pre-service teachers with different strategies and methods of teaching general science and biology. Specifically, the participants would learn (1) methods of science teaching; (2) teaching skills; and (3) ways to align the methods and teaching skills to teach a lesson. In this course, we specifically focus on the learning of four teaching skills: opening a lesson, closing a lesson, explaining skills, and questioning skills. As part of the course, the participants were expected to select a specific topic from the science/biology curriculum, plan a lesson and practice teaching this lesson with their peers as students. Peer critique and self-reflection formed part of the evaluative framework for their learning. They learnt the concepts and knowledge of microteaching through the online materials and were requested to view some teaching videos, followed by writing their reflection in online blog at different phases in the online course.

In this course, the participants learnt in a self-directed inquiry, video-enabled and web-based discussion environment. Using videos as a source of inquiry, the pre-service teachers assumed the roles of a self-directed learner to observe the videos and discuss the necessary teaching skills to improve student learning. Using Dewey's idea of reflection (1910), the course was designed to engage pre-service teachers in "active"

consideration when they view videos of teaching segments and to encourage them in “persistent and careful consideration” (p. 6). The online course was thus designed and structured into six phases: (1) an online lecture on microteaching skills that include opening and closing skills, explaining and questioning techniques; (2) a connect phase where the students viewed few teaching videos to assist them in making connection between the lectures and teaching situation; (3) a reflection phase where the students worked on a personal blog after watching the video segments; (4) a problem based video segment where the students watched a video segment where problems and issues are embedded; (5) an application phase where the students commented on the problems found in the video; and finally (6) an extension phase where they consolidated their knowledge of good teaching skills in their group on the blog platform. The package was uploaded in the university’s learning management system, *Blackboard*. Pre-service teachers are able to access the materials at their own convenience within a week.

The pre-service teachers were requested to reflect individually as well as in group blogging. All written reflections were available for all the respondents. Their reflections were not rigidly structured but some respondents reflected by referring to the guided questions and instruction such as “What is good about the teaching and why?”, “Would you be able to incorporate these in your own practice?” or “Discuss two examples for improvement”. Overall, they reflected and commented on all videos according to their own perspectives and understanding. They also gave additional comments to other members in the groups. All the excerpts quoted in this paper are identified with pseudonyms.

After the course, the students participated in semi-structured interviews in groups of three during which they were asked their views on three areas: learning of teaching from the videos, ideas about the relevance of microskills, and learning in an online environment. The interview transcripts were read, coded and thematised to surface groups of views as reflected by the pre-service teachers.

Data analysis

The 137 online blog entries made by the pre-service teachers and transcripts of their interviews were analysed. The participants’ reflections were analysed to examine how they interpreted the purposes of teaching actions. We postulated that pre-service teachers would be able to identify the purposes and the examples of strategies used in teaching videos if they have learnt what makes good teaching skills. Their reflection and interpretation will indicate their concerns and understanding of teaching. While much of the evidence in the literature showed that video technology enhanced reflection by pre-service teachers, little is said about what forms and levels of reflection pre-service teachers are capable of. The levels and forms of reflection are the core of this study. Thus, data analysis was carried out inductively on the online entries to thematise the ideas reflected by the pre-service teachers. We went through all the online entries until all possible themes emerged and were categorised into the different aspects of teaching. Next, we examined the individual entries in each category and coded them using Larrivee’s (2008) four levels of reflection and calculated the frequency of reflection in each of the four categories of pre-reflection, surface, pedagogical and critical reflection. Through this interpretive process, we set out to find out the multiple ways through which the participants make sense of teaching through watching teaching videos. The interviews were transcribed and the transcripts were

analysed for elements that the participants perceived to be useful from the online video content and online mode of learning in helping them to learn the art of teaching.

Results and discussion

To answer the research questions, we present evidence to show (1) the levels and forms of reflection that pre-service teachers attained after watching the teaching videos, (2) the knowledge that they use to make the connection between teaching as they observed from the videos and teaching in a real life context, and (3) the perceptions of pre-service teachers on the use of media and technology to learn teaching skills.

Levels of reflection by pre-service teachers

Based on each entry in their personal blog, 67% of all blogs entries fall in the pedagogical level, with only 2% in the critical category. Table 1 below shows the distribution of the categories of each reflection by the student teachers.

1. Pre-reflection level

Contrary to the hypothesis we had at the start of the analysis, only 9% of the reflection falls in the pre-reflection category. At this level of reflection, a participant merely interprets events in the videos without thoughtful connections to other events or circumstance. An example of a reflection at pre-reflection level is "started lesson by asking the class to recall... He then links to the main lesson by telling them he is teaching them the function of various digestive organs. ... he ask various question to stimulate the interest of students on the topic."

Table 1: Frequency table of levels of reflection

| Group | Four levels of reflection | | | | Total |
|--|---------------------------|---------|-------------|----------|-------|
| | Pre-reflection | Surface | Pedagogical | Critical | |
| Feb 2008 (Cohort A) (N= 10; No. of Entries: 28) | 4.2% | 22.2% | 72.4% | 1.2% | 100% |
| Aug 2008 (Cohort B) (N=4; No. of Entries: 46) | 14.0% | 16.3% | 67.4% | 2.3% | 100% |
| Mar 2009 (Cohort C) (N= 12; No. of Entries: 63) | 10.3% | 24.7% | 62.7% | 2.3% | 100% |
| Percentage of entries at different levels | 8.8% | 22.2% | 67.1% | 1.9% | 100% |

2. Surface level reflection

This level of reflection is characterised by comments on tactical issues relating to achievements of set goals and objectives. Overall, there were 22% of the participants who dedicated considerable attention to presentation skills for both verbal and visual presentation. This group commented on the teaching aids such as pictures, flowcharts, diagrams, computer animation and teacher's demonstration in terms of their relevance to the topics, the appearances and the appropriateness of the usage of visual aids. Comments such as "The flowchart the teacher used is visually engaging as it is colourful and clear" (Margaret, Cohort C) are common.

This group of participants also made considerable reflective inputs on appropriate opening and closure of a lesson in teaching. They gave attention to the procedural aspects of lesson opening including (1) visual presentation or interaction activities; (2) capture attention, arouse interest and curiosity; (3) apply good questioning skills to lead students to think; (4) recap the previous lesson; and (5) provide clear organiser to introduce what is to be done in the lesson. Examples of statements made include "The teacher shows students two pictures, one of healthy baby and another showing a skinny undernourished baby." (Sagarika, Cohort C) and "He use model to let the student know how the lesson will flow... this acts as an advanced organiser for the students to know what to expect." (Zainah, Cohort A).

3. Pedagogical level reflection

The data indicated that 67% the reflections made were at the pedagogical level, indicating attention paid to how the various teaching skills and strategies highlighted would impact the learning of students and how these strategies can be applied to improving the teaching and learning experience. Furthermore, this group interpreted that the purposes of using visual aids were to engage students in learning and serve as an organiser of the lesson. Their justifications were quoted as follows:

Use of visual aids...makes a visual impact on the students and allows them to follow the lesson easily. (Sally, Cohort A)

Visual aids such as models could be used to aid in his content delivery...it gives a 3D image...helps to engage students and encourage learning. (Ling, Cohort C)

Although the use of visual aids was emphasised, this group of teachers were aware of excessive usage. In their explanation, they criticised the repeated illustration of the same pictures in two media (cut-out board and *PowerPoint* slide). Instead, they suggested the best use of video or animation is to improve explanation by showing the complexity and reality of the taught topics (for example the real structure of the enzyme). Their suggestions about the amount and mode of visual aids used demonstrated their extended understanding of visual presentation to meet specific teaching purposes.

In terms of verbal presentation, this group stated the importance of clear and concise explanations. They mentioned the importance of appropriate pacing of lesson explanation and suggested that pacing should be determined by students' comprehension of the lesson. In addition, a change of the intonation and intensity of voice can be used to emphasise learning points. Conversely, a wrong use of words and tones potentially creates negative impression for the students. As one participant highlighted "he (the teacher) sounded unsure and used vague terms like 'something like that'. It does not inspire confidence of the students and the teacher will quickly lose the respect of the students." (Jeffrey, Cohort C). Some participants suggested that teachers should use accurate terms in their lessons and avoid using "Singlish" (colloquial accented English used by Singaporeans).

In this group, it was also common for them to discuss the importance of questioning skills as a vital component in verbal presentation. They gave positive feedback on good questioning examples shown in the videos. They perceived that good questioning skills helped to engage students, enhance higher levels of cognitive development and served as an assessment tool to check students' understanding. Furthermore, they

were willing to endorse questioning skills in their future teaching as highlighted by their reflection entries.

Teacher gave an overview of what has been thought...moved on to a higher cognitive level of questioning.... I think this is good because the transition to the higher-order thinking is smooth and the questions are aptly challenging to the students. (Sharini, Cohort C)

Teacher uses questioning to elicit response from the students...which can be used as a formative assessment of what the students have learnt. (Sally, Cohort C)

I will definitely try to incorporate the questioning skills into my lessons as it reinforces learning and encourages student to think. (Sophie, Cohort C)

Other areas highlighted as important for good teaching were effective classroom management, lesson planning and content knowledge mastery. The following excerpts showed what some participants identified as poor classroom management.

Teacher tends not to have eye contacts with the class...thus it may be hard for him to see who is paying or not paying attention. (Chin, Cohort C)

When students are not attentive, she should stop the lessons but yet continue to carry on. There is no classroom management. (Nurul, Cohort A)

The appropriateness of the use of analogy and precision of the explanation featured were also areas of discussion.

I am not comfortable with the analogies she used. For example the 'kueh lapis' (a traditional layer cake) and how the layers represent the internal and external intercostals muscles, I feel that the analogy was not clear enough and the students may get a little confused. (Chin, Cohort C)

The concept was not well explained because her illustration with arms and overlapping fingers was too abstract and did not seem congruent with what she is trying to express. (Jessy, Cohort C)

The teacher did not relate how the process of catalysis of the enzyme and substrate is linked to the lock-and-key hypothesis... he should illustrate how the enzyme acts as the lock and substrate acts as the key. (Teh, Cohort C)

Lesson planning and preparation were also important elements for this group of teachers. They attributed poor teaching, inappropriate pacing and poor time management to insufficient preparation. They placed importance upon refinement of lesson plans to improve teaching and suggested further reflection on improvements that can be made.

The lesson ran into overtime, the pace of her teaching was fast. In future, she might have to revise her lesson plan to take into consideration of time limitation...practise her lesson and time herself. (Pei, Cohort B)

It's usually the closing that's rushing, because especially for us trainee teachers with our lesson plans, we tend to over-plan and be ambitious. Thus, our closing is usually not done properly, especially when we realise that the lesson is ending and we are only halfway through the lesson plan. (Faridah, Cohort B)

From their reflection, there was a preference for student-centred pedagogy and they were aware of the needs of different learners in a classroom. They placed importance

in catering to different learning styles and various intelligences. When a teaching technique could not serve all, they suggested alternatives and modifications to meet the needs of different groups. Following were some examples of two participants' explanation and analysis.

He was totally auditory and did not cater for students who were not auditory learners... Most of them are visual and kinaesthetic in nature. Therefore it would be better if he wrote something or drew something while speaking so that student could learn better. (Nurul, Cohort A)

The teacher repeated the key points quite a few times during the explaining, I think this is good because students may need to hear information presented several times before they can catch all the details and they may also need to hear it presented in alternative ways. I also try to do this by presenting the information from different angles, or with different materials, as I think this will help students with different needs to understand. (Janet, Cohort A)

4. Critical level reflection

Only 2% of the reflections fall into the critical domain. At this level, the development of learner autonomy was emphasised. They paid attention and gave credit to the pedagogies that related to students' life experience and encourages students to develop responsibility in their own learning. In contrast, teacher-centred pedagogies generally received negative feedback and criticism from the pre-service teachers. The consideration of students' background and needs outside the context of the classroom exhibit their critical and holistic understanding of teaching.

The teaching is good as it is student-centred and the teacher manages to focus the energy on the students, asking them to respond and discovery the facts on their own... The teacher has devised a lead in, which related to the students' experience. It gives them a better idea of the concept. (Suriyah, Cohort A)

Despite the low occurrences of reflection at the critical level in the reflection blogs, some of the participants expressed some views at the critical level during the post-course interview that reflected their biases towards a highly student-oriented stance of good lesson and teaching. They perceived a good lesson as one that meets the students' level of understanding and background knowledge. A good lesson would help students understand the concepts fully; make connections of their knowledge and daily life experiences and develop their abilities in applying knowledge to solve problems. Some of them also emphasised that the content of teaching should be relevant to student daily life experiences, to engage students in learning and to encourage them to apply their knowledge. "Interesting" and "curiosity" were keywords mentioned frequently by pre-service teachers. They perceived an interesting lesson would engage students and hence improve learning. They perceived creating curiosity among students as a way to motivate them to learn further.

During the interview, some participants expressed their views about conflicts and pressure from external parties shaping their potential practices as a good teacher. These participants mentioned that they needed to ensure good classroom management, to meet curriculum objectives and ensure students obtain good examination results in order to meet the requirements of their schools and the Ministry of Education (MOE). Some participants perceived that there was a conflict between the school's expectations and the teacher's expectations in teaching. For instance, while a teacher would like to plan an interesting outdoor science lesson to encourage students

to learn science through inquiry, observation and investigation, he or she is bounded by time constraints, a heavy syllabus and examination oriented school requirements. Thus teachers have to limit themselves to conventional classroom teaching. Another example cited was the challenges of the school culture where classroom management and discipline issues were highly emphasised in the school. Therefore, learning activities involving group discussions and student active participations were misjudged as poor classroom management due to the noise level and classroom arrangement. Even though the participants were pre-service teachers, they already revealed their concerns about the teaching challenges in future as a result of the conflict between the school's and ministry's expectations and constraints in the learning environment. Most of the participants were worried about how they would overcome these challenges in their teaching career.

Knowledge used to reflect

In this section, we examine the knowledge (education theories, teachers' roles and responsibilities, and current ideas of what teaching is) used by these pre-service teachers to help in their reflection.

1. Understanding of educational theories

The participants were able to relate the use of teaching techniques to educational theories by elaborating the theory using their personal metaphor. The narratives below illustrated three participants' justification of the application of teaching pedagogy grounded on cognitive theory.

...linking subtopics together encourages the lesson to be committed to long term memory rather than short term memory. Asking the students for learning points forces the students to think through what they have learnt today and organise it into words. This helps to commit the information to memory and checks for understanding. (Jeffrey, Cohort B)

He made use of the student's prior knowledge to integrate new knowledge. It would be easy to make quick associations by building new knowledge upon the learners' prior knowledge, pretty much like linking concepts together like a spider web. (Zheng, Cohort B)

Closing 1 is good because it gives a comprehensive and summative overview. This is good because by Ausubel theory, it helps to enhance learning and understanding. (Pei, Cohort C)

The participants applied their understanding of educational psychology to evaluate the appropriateness of using certain teaching technique. They suggested that a strategy that can arouse students' emotional affection was able to engage students in learning and create greater impact in their memory. The excerpts below expressed their thoughts.

The use of emotion is good for creating an impact on the students. They are able to reflect and link their daily life to the lesson. (Wong, Cohort A)

2. Teachers' roles and responsibilities in creating conducive learning environment

A participant wrote the following excerpt expressing her view about the learning environment:

The student teacher really took the students' view into account; he gave them time to think and then developed on their answers... she showed that the students' answers were valued and they were willing to share as the environment was non-threatening. The teachers also encouraged student to think by not saying that the first answer given was wrong/incomplete. (Janet, Cohort A)

Similar reflective entries were repeated among these pre-service teachers. They understood that it is the teacher's responsibility to create an interactive learning environment by asking the right questions, giving appropriate responses to students and taking care of student-teacher interaction. They also highlighted that the teachers' personality and confidence influence the learning environment.

3. Existing ideas of good teaching

Some participants engaged in self-reflection of their own abilities and conceptions about what they can potentially carry out in their own classrooms to judge if a teaching segment is good. For them, good teaching must be thoughtful, realistic and attainable.

The videos have certainly given me a lot to think about and ideas on how to focus the attention of the students...I think the 2nd video was the simplest activity yet the most effective at grabbing the attention of the students.(Jeffrey, Cohort B)

I think all 3 videos example are good. Probably I would make use of some components of each and have a hybrid of all 3 (e.g. start off with a picture..., followed by citing a real-life example and get them to share what are their personal reflections and finally, end the lesson off by using flow-chart.) (Pei, Cohort C)

These participants evaluated the quality of the teaching showed in teaching videos and they decided to incorporate the good parts of them. They provided suggestions and modifications on the techniques to improve the quality of teaching. They synthesised their learning from their current ideas and understanding of what constitutes good teaching.

I would most definitely include some of the opening and closing examples shown here. ...I would definitely think of more "hooks" such as picture and short clips or animation to arouse the students' curiosity. In term of the closing, I would incorporate the questioning sessions at the end. It would definitely be beneficial to the student to know what to expect for the next lesson. (Nurul, Cohort A)

I would definitely be able to incorporate these during my practice...the base line is to ensure that the students get interested, form links to prior and future knowledge (improved information processing skills) and at the end of it, know their position in the learning process of that topic, and consolidate the content and important points delivered during class. (Faridah, Cohort A)

I would want to incorporate this explanation style into my classes in future. The use of something very recent and very relevant to students makes the learning personal. Dissecting the topic into a logical sequence also helps make the topic more bite-size and hence more digestible because of there is a rational flow. (Jessy, Cohort A)

Learning how to teach through reflection blog

We have shown the levels of reflection that these pre-service teachers engaged in when they learn how to teach and also the kinds of knowledge that they tap into for their reflection. In complement, this last section uncovers these pre-service teachers'

perception on using e-learning to learn the skills of teaching. During the post course interview, the reflection blog component received 67% of comments made. They perceived that the reflection blog made them more thoughtful, assisted them in analysis, improved their learning and served as reminder for their revision later. Results presented in this section are from semi-structured interviews with the pre-service teachers.

I think the videos and the reflection part was quite useful... we really got to see a real life classroom situation and then think about the good parts as well as the bad parts and comment on it. (Nisha, Cohort B)

It (blogging) helps in reflecting...blogging is helpful in the sense that it helps you to reflect (after lectures) and you really can look in, more in depth... It's (reflection) important...but it's just extra work. (Xu, Cohort A)

I think most of all our thought and all our criticism, the good, the bad comments are all stated in the reflections.(Lily, Cohort C)

Despite the generally positive perception about learning to teach through reflection blogs, there is also some opposition to online reflections. This could be a plausible explanation for perhaps 2% of the reflection in the critical level.

...you are probably going to get a very low quality answer where the student just writes one or two things that come to the person's mind,... may have the job of getting the students to recall or do some re-evaluation, but without the stress of assessment, the person is not going to really think that much, unless... It's a natural blog where someone really wants to write about it.... So, you are not going to get a very high quality blog. On the other hand, if it's assessed, then you are going to get an even lower quality blog... because the person's not going to write what they feel. They are going to write what they think the person... who's assessing, is looking for... So both ways, I think a blog sucks. (Suhaimi, Cohort A)

... (they) have been too politically correct (in their answers)... if you want a reflection, then I guess ... there was a big argument (of the topic). (Colby, Cohort B)

So it (reflection) helps ... in the assimilation of the information. But it's a lot more time consuming... Probably more time than I would like spend in lectures, because I have to go back, then view the comments by others and then read the comments by others. (Dion, Cohort B)

Learning through blogging, it's really only when you have sufficient time and there is some kind of a motivation to go on and do it. But for some of us, because sometimes we get busy, at the end of it, it's just completion of a task. It is time-consuming to a certain extent. I mean if you were to compare it to attending a regular class, where you don't have to do all these things. (Wong, Cohort A)

Conclusion

This study set out to determine the levels of reflection that pre-service teachers engaged in after watching videos on micro-skills coupled with the resources that potentially they could employ to help make sense of the videos.

The evidence from the online reflection blog suggests that using an online lecture coupled with teaching videos, 9% of entries fell in the pre-reflection level, 22% were surface level reflection, 67% were pedagogical, and only 2% were in the critical level. This is an unexpected pattern as we had expected these pre-service teachers to be

engaged dominantly in pre-reflection and surface level reflection, similar to the descriptive forms of reflection highlighted by Hatton and Smith (1994). With 67% of reflection entries relating to how the strategies can impact students' learning, this group of pre-service teachers showed that they have learnt about teaching from a ritualistic level to that of principled knowledge (Russell, 1993). Hence, the criticism that learning teaching skills in a micro-context is limiting and artificial (Calderhead & Shorrock, 1997) is refutable in this instance.

It is evident here that this particular mode of learning teaching skills in a micro context provided the pre-service teachers with a platform to reflect on the greater context of teaching in a real classroom. The concern over the tension that exists between understanding teaching and performance of teaching is addressed through reflection of the teaching segment. Engagement in reflection of the videos offers an avenue for these pre-service teachers to move their learning from ritualistic doing and listening, to a higher level that challenges their existing beliefs (Clarke & Hollingsworth, 2002). While our analysis of the online reflection blog showed that only 2% presented reflection at a critical level, post course interview conducted two weeks after the course revealed more critical perspective and in-depth thoughts about teaching. We postulate that the extra time available for the pre-service teachers to think about the course and their experiences made it possible for more critical and in depth reflection upon what they have seen in the videos and their practices in future.

The knowledge that these pre-service teachers used to make meaning of effective teaching are (1) their knowledge of learning theories; (2) their ideas of teachers' roles and responsibilities; and (3) existing ideas of what makes good teaching. The kinds of knowledge that they rely on to make meaning are different from those that in-service teachers used in Ottesen's (2007) study. Ottesen found that when in-service teachers talk about their practices, they use knowledge such as (1) commonsense understanding; (2) practical wisdom; and (3) scientific explanations. The different experiences of pre-service and in-service teachers could have influenced the different perceptions of knowledge used to make sense of teaching. Prior experiences and personal beliefs impact their interpretation of the videos, and subsequently their reflection on teaching and teaching skills. We provided evidence that these pre-service teachers were able to extend their learning from knowledge of basic teaching skills to the larger context of teaching in a real classroom. We are also aware that there are some pre-service teachers who have negative perspectives about learning through reflection blogs and their views provide a basis for the development of improved and varied forms of learning to teach. Further, one of the key limitations of this study is that the participants volunteered to be part of the study and hence some personal biases may have shaped the results.

The findings from this study are encouraging for teacher educators who focus on developing the basic teaching competencies and reflection of pre-service teachers, since they offer evidence about how technology-enabled reflection can help pre-service teachers map their learning onto their beliefs and practices about real classroom life. We do recognise that beliefs are deep seated ideas and shaping or changing teachers' beliefs takes a long time, but it would be reasonable to initiate the change process by engaging pre-service teachers in active discussion and thought processes. We suggest that future studies could adopt a longitudinal approach that tracks the teacher's development from pre-service into the initial year of teaching. This would allow us to better assess the impact of our intervention on the practices of beginning teachers.

Acknowledgment

This project is funded by the National Institute of Education, Academic Research Fund RI 1/07 MW.

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Please cite as: Tan, A.-L., Tan, S.-C. & Wettasinghe, M. (2011). Learning to be a science teacher: Reflections and lessons from video-based instruction. *Australasian Journal of Educational Technology*, 27(3), 446-462.
<http://www.ascilite.org.au/ajet/ajet27/tan.html>