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SUPPORTING REFLECTION ON LEARNING WITH A WEB ENVIRONMENT IN AUSTRALIAN PRESERVICE TEACHER EDUCATION CLASSES

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Current efforts for teacher education reform in several Asia-Pacific countries suggest that preservice teachers need to develop a better understanding of learning. One way to do this is to have preservice teachers reflect upon themselves as learners in their teacher education classes. In this study, students in a course in an Australian university teacher education program used a World Wide Web site that was designed to incorporate a three-phase reflective framework — analysis, synthesis, and theorizing — to assist them to reflect on their experiences as learners in university classes. The web environment included a database to help the students structure their reflections to collect data and theorize about their experiences. In the third phase of the framework — theorizing — the students developed a metaphor to represent the complexity of their own learning and labelled it with key learning factors. Most students believed that the design of the website guided them in their reflections and the metaphor enabled them to represent the complexity of their own classroom learning. Students in other Asia-Pacific countries would also be able to use the reflective framework in their teacher education classes and it could be adapted to include other influences such as culture on learning.

Keywords: Reflection; teacher education; world wide web; metaphors.

1. Introduction

Over the last few years, several Asia-Pacific countries have been developing new standards to guide and prepare teachers. This is evident in reform efforts in Asian countries such as in Singapore, as promoted in *Thinking Schools, Learning Nation and the Desired Outcomes of Education Policy* (Deng & Gopinathan, 2003), and in Thailand in the *National Reform Act* of 1999. Similarly, other nations such as New Zealand are developing Professional Standards for Graduates of Initial Teacher Education programs and Australia is currently undergoing a national inquiry into the training of teachers and developing national standards to guide "the way in which universities prepare the next generation of teachers" (Nelson, 2005).

One of the common recommendations in these new standards for teacher preparation is for preservice teachers to develop a deeper understanding of teaching and learning. Such an understanding implies that teaching and learning is a complex relationship which varies with the type of students, curriculum, context and resources in a classroom setting (Hoban, 2000). To learn to be a teacher, therefore, means that "developing desirable character, beliefs, and understanding, learning to think and think critically and creatively should become the hallmark of teacher preparation programmes in Singapore in the new era" (Deng & Gopinathan, 2003, p. 64). Similarly, New Zealand's evolving standards state that "Graduating teachers will show an understanding of learning and teaching within the contexts of rapidly changing environments" (Teacher Education Forum of Aotearoa New Zealand, 2005).

One way for preservice teachers to develop an understanding of learning is to reflect upon their own experiences as learners in their teacher education classes. Most preservice teachers spend over 300 hours each year in formal classes and are exposed to a wide range of teaching strategies and content as well as interacting with a variety of students. These classes, therefore, provide an authentic context for students to learn how to reflect upon their experiences. Although reflection has become a popular process over the last 20 years in teacher education, it is not a new concept. It originated in the writings of John Dewey (1933) as a way of thinking about a problematic situation that needs to be resolved, "The function of reflective thought is, therefore, to transform a situation in which there is experienced obscurity, doubt, conflict, disturbance of some sort, into a situation that is clear, coherent, settled, harmonious" (pp. 100–101). Dewey argued that this process commenced with pre-reflection in which an individual became perplexed about a situation followed by five phases to resolve the problem: (i) suggestion; (ii) intellectualization; (iii) hypothesis; (iv) reasoning; and (v) testing. Building on the work of Dewey, Schön (1983, 1987) noted two types of reflection — reflection-in-action and reflection-on-action — stating that reflection is not only a way of thinking, but is a hallmark of being a professional. He contended that professionals need to recognize the "complexity, uncertainty, instability, uniqueness, and value-conflict" (1983, p. 39) of a work setting and frame and reframe their practice. These notions about reflection have been used widely in teacher education over the last 20 years (Barnes, 1992; Brookfield, 1995; Clarke, 1995; Grimmett & Erickson, 1988; Hatton & Smith, 1995; Jay & Johnson, 2002; Korthagen, 1985; Korthagen & Kessels, 1999; LaBoskey, 1994; Loughran, 1996, 2002; Valli, 1992; Zeichner, 1983).

But reflecting upon how one learns in a teacher education class is not an easy task. Although it is common practice in preservice teachers education programs to encourage students to document their experiences in journals (Bain, Ballantyne, Packer & Mills, 1999; Loughran, 1995; McRobbie, 1994; Wilson, Hine, Dobbins, Bransgrove & Elterman, 1995) the content often focuses on what students understand or do not understand, not about how they learn, how they are being taught and may not be reflective at all. Moreover, if students study their own experiences

as learners, it may give them a context for studying theoretical perspectives on learning such as radical constructivism (von Glasersfeld, 1984, 1989) situated learning (Lave & Wenger, 1991) and social constructivism (Vygotsky, 1986). Although these perspectives offer different insights about learning, they are based on different assumptions and sometimes do not adequately portray the complexity of classroom learning. When university students reflect upon their own experiences in university classes, however, they can gain an understanding of many interrelated factors that influence learning.

1.1. *The reflective framework*

The reflective framework that is the focus of this paper was developed during three years of research whilst teaching in university courses to guide preservice teachers in studying how they learn in university classes (Hoban, 1997, 1999, 2000). The framework encourages each preservice teacher to be "a researcher in the practice context" (Schön, 1983, p. 68) with the context being their experiences as learners in their university classes. The theory that underpins the framework is a social constructivist perspective which assumes that there are personal, socio-cultural and physical influences on learning (Duffy & Cunningham, 1993).

There are three phases in the reflective framework which encourage preservice students to collect data and theorize about their own classroom experiences: (i) *analysis* of their experiences according to four categories including personal (the individual), social (peer and teacher), and physical factors (the setting); (ii) *synthesis* of the key factors for each category which involves a process of comparing and contrasting factors; and (iii) *theorizing* from the data to develop a metaphor to represent the complexity of a classroom learning environment that incorporates the main factors. Metaphors are a useful way to represent embodied experiences and are a valuable tool for relating and theorizing about ideas (Bullough & Gitlin, 2001; Carroll & Eifler, 2002; Lakoff & Johnson, 1980). In developing their metaphors, the students think about the relationship between the most important factors and the metaphor is a representation of the relationships between the factors.

The reflective framework, which is the focus of this study, directs preservice teachers to reflect upon the personal, social and physical influences on their learning and it has been implemented with several cohorts of preservice teachers using conventional paper-based journals. However, evaluations with these students (Hoban, 2000) showed that the reflective framework was a difficult process for them to use, as they were unsure about what to document and how to theorize about their reflections. In an attempt to make the reflective framework easier for preservice teacher education students to use, a learning tool or technology was needed to guide the preservice teachers in how to use the framework. In particular, a technology was needed to give structure to their reflections by helping them to document, synthesize and theorize about their experiences as learners.

1.2. *Use of a web environment*

The World Wide Web (web) has been used for many purposes including information delivery with pre-defined resources, information delivery with online interaction, pre-designed instructional delivery, information synthesis, creation of resources and immersive collaborative environments (Bannan-Ritland, Harvey & Milheim, 1998; Flake, 2001; Herrington & Oliver, 1999). The tools and components used for such a variety of purposes include the presentation of information using static visual displays (Mitchell, 2000), animations with audio (Hartley, 2000), multimedia modules, e-mail, listserves and chat rooms. In particular, a variety of platforms have been especially developed for online discussions such as LiveText, Blackboard, WebCT, FirstClass and Polycom's WebOffice (Carter, 2002). Some of these platforms, such as Blackboard and WebCT, have customized templates for building online courses and have a suite of work tools for online quizzes, threaded discussions, real time communication and bulletin boards. Others such as FirstClass are designed so that everyone has their own virtual office and are more suitable for district-wide initiatives. Polycom's WebOffice is more expensive than the others but the user owns the product rather than buying a temporary licence. A particular feature of these web platforms is that their discussion spaces promote open communication with little focus on direction unless provided by a moderator.

Although these web environments provide a suite of tools such as synchronous and asynchronous forums for discussions, they usually allow free flowing communication and do not necessarily promote reflection (Hammond, 2000; Seale & Cann, 2000; Whipp, 2003). Studies have showed that online discussions are more likely to be reflective if there is some structure such as particular questions or interactions provided by a facilitator or moderator (Bennett, 1998; Baker & Lund, 1997; Hawkes & Romiszowski, 2001). In order to make the reflective framework in this study easier to use, a web environment was designed that incorporated a database to help students structure their thinking and to enable them to share their insights about learning (Hartley, 2000; Sweller, Van Merrienboer & Pass, 1998). The site was designed with the intention of minimizing the cognitive load on students when reflecting by using a screen design which "promotes understanding by allowing the reader to focus on new information rather than devoting time and energy to variations for format" (El-Tigi & Maribe Branch, 1997, p. 25). The purpose of this study, therefore, was to ascertain whether a World Wide Web (WWW) site assisted preservice teachers to use a reflective framework for analyzing and theorizing about their experiences as learners in university classes.

2. Method

In spring semester 2003, 25 preservice teachers used the web environment in a 13-week science methods course, EDUS224, as part of their elementary teacher education program at a university in Australia. The students had a three-hour class each week — a one-hour lecture immediately followed by a two-hour hands-on

science workshop. After the class the students spent time online documenting their reflections. Documentation of the students' weekly learning experiences and development of a metaphor to represent their experiences constituted 40% of their final assessment mark.

The web environment was designed to guide the students in using the three-phase reflective framework and so had particular headings for each phase as well as explanations of what to do. When students logged onto the Web site, the first page of the site explained the framework and a hyperlink took them to the first page for data collection. When students opened it up, a dialogue box appeared for each of the four categories to support the analysis of their learning — personal, social (teaching and peer) and physical factors which influenced his/her learning. The Web site, therefore, assisted students to focus their reflections because the dialogue box prompted them to think about each category:

(1) *personal* factors attributed to each student, such as prior knowledge, feelings, self esteem, motivation and personal learning strategies;
(2) *teaching* factors attributed to the instructor/tutor, such as class organization, teaching strategies, class goals, and rapport;
(3) *peer* factors attributed to other students such as how they encourage each other, share ideas and cooperate in tasks; and
(4) *physical* factors attributed to the surroundings of the classroom.

The students filled in data for each field based on their experiences in their class and also provided a weekly summary which could be accessed by other students across the class. A screenshot of the first two dialog boxes, one for *personal factors* and one for *teaching factors* is shown in Fig. 1.

Towards the end of the subject in phase 2, the students could click on the "synthesis" hyperlink and the database would collate all the documentation for each category across all of the weeks. They could then use an iterative process of "constant comparative analysis" (Glasser & Strauss, 1967, p. vii) to compare, combine and synthesize factors resulting in the identification of several key factors for each of the four categories. For example, the web-based design that incorporated a database that linked the dialog boxes from week to week enabling each student to see the personal factors across all the 10 weeks on one screen. This aggregation of data assisted the students to identify the key factors within each category and these were summarized in a table called a "Learning Profile". Collectively, the key factors highlighted in their Learning Profile represent a student's identification of factors which would establish an optimal learning environment for them in a university class. It should be noted that an optimal learning environment would only be possible if all of the enhancing factors (or nearly all) were present.

In the third and final phase, "theorizing", each preservice student considered the key enhancing factors identified in phase 2 and theorized about the relationships between them to devise a metaphor (Lakoff & Johnson, 1980) that represented the complexity of a learning environment for a university class. Although the students

Fig. 1. Two of the four fields of the database to support phase 1-analysis.

did not use the web site for sketching their metaphor, it was anticipated that the database on the website would help the students to document, aggregate, analyze and theorize data from their class experiences. Importantly, the process of theorising was assisted by having the reflective data for each category presented systematically and collectively in the templates. This thinking is consistent with Strauss and Corbin's (1994) interpretation of a theory as "*plausible* relationships proposed among *concepts* and *sets of concepts*" (p. 278, italics in original). Alternatively, students may conceptualise the metaphor earlier from their reflections in the subject and then use the factors from their profile to label the diagram.

In addition to the weekly documentation on the web, the students filled out a two-page survey at the beginning and end of the course asking them to describe their beliefs about how they learn in university classes and to identify a metaphor that represented their learning. These beliefs were analyzed to ascertain if there had been any change during the course as a result of the weekly reflections. An indicator of reflection was that students were thinking differently about their learning and in particular, if they could describe a metaphor to represent it. Deducing a metaphor showing a relationship between the factors that influenced their learning and demonstrates higher order thinking that is typical of reflection (Biggs & Moore, 1993). In short, it was anticipated that using the web environment assisted

the students to document their reflections and provided a quick access for them to check the patterns in their reflections to help them theorize and develop metaphors. The next section presents the results of the study and starts with an example of data collected in the three phases of the reflective framework by one student. As well, a table summarizing the students' change in beliefs is shown. Pseudonyms were used for each of the students in the study.

3. Results

3.1. *Phase 1. Analysis*

Table 1 shows one of the student's (Elizabeth's) web documentation as written in the four fields of the website in week 2 of the subject. It should be noted that

Table 1. Elizabeth's reflections for the four categories in week 2.

Category	Data
Personal Factors	− I am not confident with teaching science in front of an audience. Therefore I feel this elective will be very rewarding as I will gain KNOWLEDGE, CONFIDENCE and UNDERSTANDING of how to teach science to a young audience. + I work better in an environment where I am comfortable and feel free to exchange ideas and questions without the worry/fear that others will criticize me. + It was amazing how pre-knowledge that I have gained over time was used in this lesson. I did not realize simple experiments can make things clear. + As this was the first real science lesson, I had no idea of what to expect from this elective and so I was INTERESTED and WILLING to get involved.
Teaching Factors	+ I enjoy a RELAXED environment where I feel free to contribute to the class discussions. − Initially, I did not feel it was necessary to write a reflection of the lesson on the internet. I prefer to share and discuss how I feel in some cases. I feel it easier to talk about problems or ideas rather than writing it down. − I'd prefer writing on the white board to be set out more clearly. + The instructor seemed to deliver the information clearly and effectively, providing relevant FEEDBACK for us (the students) to improve.
Peer Factors	− Initially, everyone in the class was a little daunted as what to expect from this lesson. + From this lesson, I feel confident about raising issues and asking questions. Everyone in the class was willing to accept everyone's ideas openly and ask for any queries. + The class members continually gave positive ENCOURAGEMENT to those students who did not understand the work covered. Everyone tried to help everyone understand what the lesson was about (TEAMWORK). + I enjoyed working in small groups to achieve each activity where everyone had their own idea on what they thought was right. + Everyone in the class seemed to get on well with everyone (COOPERATION).
Physical Factors	+ This class is not large, therefore whether the instructor was teaching or standing, he was always close by. There were no heads in the way, there was enough material to go round, and the labs are well lit. + It was great providing food and coffee for us during breaks. + As the materials were well set out, it was easy to get straight into the hands-on-activities.

students noted a positive factor with a "+" and a negative factor with a "−" and highlighted keywords using upper case to help-synthesized the data. This type of data documentation occurred each week for 10 weeks after each science methods class.

3.2. *Phase 2. Synthesis*

Table 2 represents Elizabeth's Learning Profile which is the synthesis of key factors for each of the four categories for the duration of the subject:

3.3. *Phase 3. Theorizing*

The student (Elizabeth), whose reflections are shown in Tables 1 and 2, theorized to develop a metaphor of "learning to snow ski" to represent the complexity of how she learned in a university class. This metaphor was sketched and labelled with factors from her Learning Profile shown in Table 2. These included personal factors such as "prior knowledge, confidence, preparation and motivation", teaching factors such as "guidance, feedback, clear and concise instruction" and peer factors such as "encouragement, teamwork and group motivation" as shown in Fig. 2.

She explained how her metaphor of a learning to ski represented a complex learning environment and drew implications for her classroom teaching:

Table 2. Elizabeth's learning profile synthesising key enhancing factors.

Category	Key factors from the synthesis of weekly data
Personal Factors	– prior knowledge, confidence and understanding – interested and willing to get involved – preparation is necessary in order to benefit from the lesson – motivation and reflection – sense of achievement – prior knowledge — you need to do the readings – "what you put in is what your get out!", creating a relaxed environment
Teaching Factors	– positive feedback/reinforcement for us (the students) to improve – information given to the students is clear and concise – providing relevant examples to explain concepts – classroom management – teacher involvement
Peer Factors	– positive encouragement – working as a team (teamwork) – group dynamics – group motivation when needed, e.g. 'We can do anything, come on girls!!!'
Physical Factors	– all class members working together (cooperation) – the relaxed atmosphere created by the teacher and students – materials safe and accessible (all materials are available when needed) – the preparation of each activity e.g. layout and materials needed – timing of the lesson e.g. activities

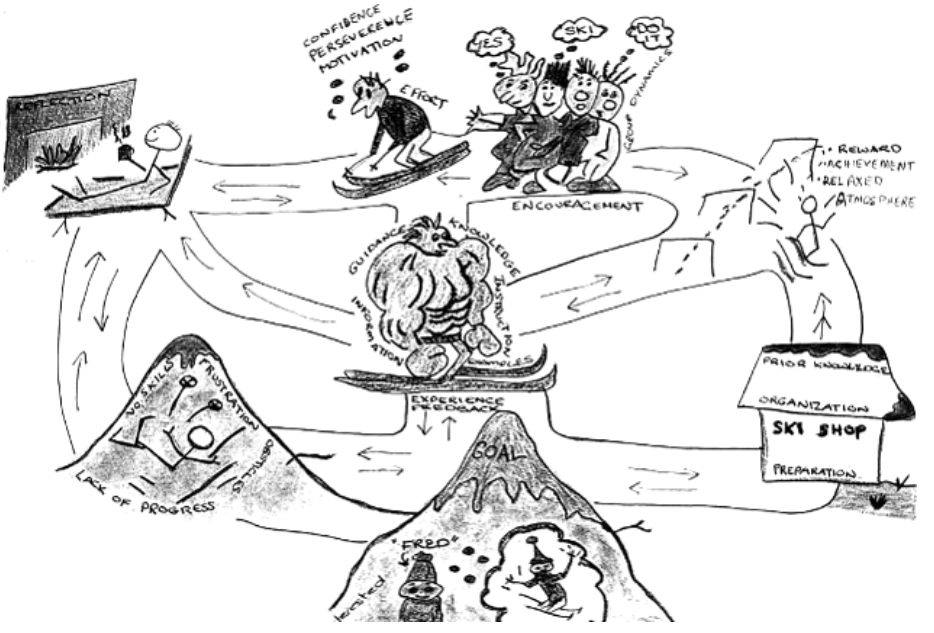

Fig. 2. Elizabeth's metaphor for learning in university classes as "learning to ski".

There are many steps involved before turning into a proficient skier similar to the fact that it takes time and practice before you are a capable student in any area of learning. It is important that the student sets a goal on what they want to achieve, however, there are decisions to be made on the plan of attack. The ski shop is an integral part in the learning process as preparation, organization and understanding are necessary to commence learning. Comparing this to a classroom situation in being prepared with homework, equipment and prior knowledge so that you are not disadvantaged to the rest of the class. The most important factor is the instructor/teacher who provides correct information, positive reinforcement/feedback, guidance and instruction. In most classroom settings the teacher is the main focus for students in preparing, organizing and implementing various lessons.

Importantly, Elizabeth's metaphor to represent her classroom learning not only shows a multiplicity of factors and arrows, but some of the arrows are two ways which indicates the dynamic nature of learning.

4. Summary of Other Students' Data in the Subject

In addition to completing their weekly documentations on the website, 25 students completed a two-page survey at the beginning and end of the course to ascertain any

Table 3. Students' beliefs about learning and metaphors before and after the course.

	Students who perceived learning as a personal influence	Students who perceived learning as a personal and social/cultural influence	Students who could provide a metaphor to represent learning
Beginning of course	13/25 or 52%	12/25 or 48%	5/25 or 20%
End of course	4/25 or 16%	21/25 or 84%	25/25 or 100%

change in their beliefs about learning and noted if they could identify a metaphor to represent their learning. As well, the end of course survey asked students about the use of the website to assist their reflections. Table 3 summarizes these data showing each preservice teacher's beliefs about learning before and after the course as well as whether they could represent their beliefs as a metaphor.

Table 3 shows that at the beginning of the course 13/25 (52%) or about half of the students believed that learning only had an personal influence such as rote learning, looking at lecture notes, recording, relating to what I have learned, reflecting on information, trying out ideas, remembering and writing things out. This represents a simplistic understanding of learning processes because it does not take into account other social or cultural influences. The other 12 students, however, did include social influences on learning as well such as listening to others, thoughtful discussion and background reading. In addition, only 5/25 (20%) of students were able to conceptualize a metaphor to describe their learning in a class situation such as making a costume, fertilizer, balance beam, symbiotic relationship and roller-skating.

At the end of the subject, most of the students' beliefs about learning had become more comprehensive as only 4/25 (16%) referred only to personal ways of learning with 21/25 (84%) referring to social or cultural influences as well. In addition, all 25 students deduced a metaphor to describe their classroom learning using a wide variety of examples. These included a soloist in an orchestra, learning to be an acrobat in a circus, playing in a one-day cricket match, going on a mountain hike, being in a rocket blasting off into space, playing in a fun park and playing a game of baseball. These were labelled with their key learning factors deduced from using phase 2 of the reflective framework. Importantly, in nearly all of their metaphors, there were multiple influences on learning connected by two-way arrows indicating dynamic interactions in their learning.

Figure 3 shows one of these metaphors which is a playground. From studying her own experiences of learning during the subject, she believed that the fundamental influences on her learning were her own prior knowledge, guidance from the teachers, her class experiences and the structure of lessons (as shown by the small house in the middle). Her learning was further enhanced if there was time for reflection (represented by the swings), sometimes she got stuck and went round in circles (represented by the roundabout), tasks were difficult but some were mastered

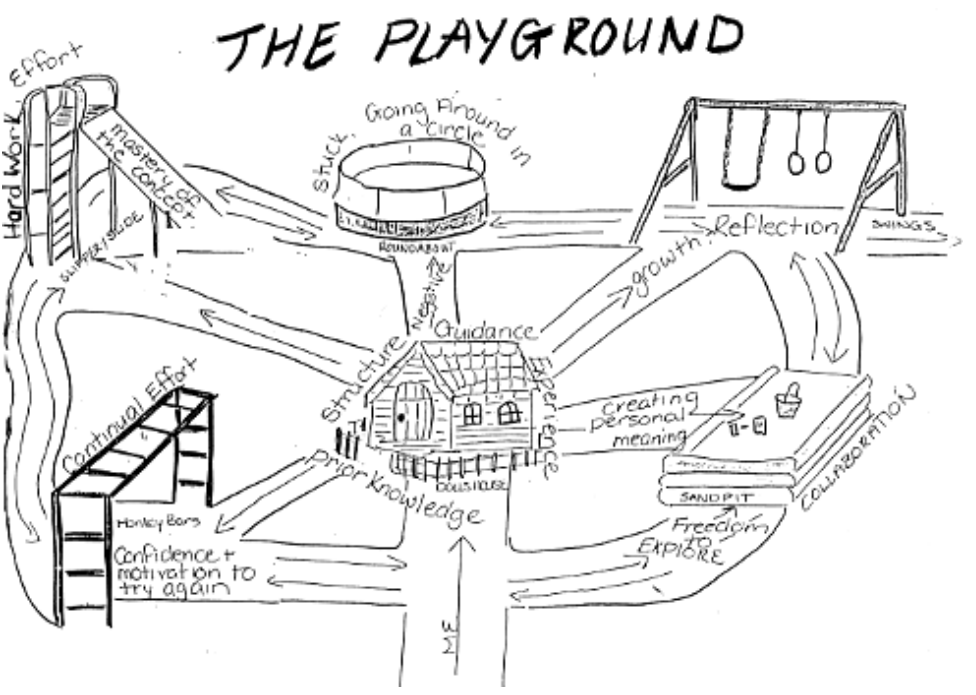

Fig. 3. A student's metaphor for learning in university classes as "a playground".

(represented by the slippery dip), and it was important to be creative and collaborative (represented by the sand pit).

Because most of the students had changed their beliefs about learning and all deduced a metaphor to represent a model of learning, it was concluded that the reflective framework had supported students to reflect upon how they learn in their university classes. In addition to being asked about whether they changed their beliefs about learning in the survey, the students were also asked about the affordances of the website for documenting their reflections.

Overall, 22/25 written statements indicated that it was positive using the web for reflection as "there was very little stress", and "it was easier and well structured". Interestingly, three of the students noted that using the web actually helped them to reflect on their reflections because "it is easier to look back to", "bits of paper might get lost", "it was accessible" and "I would rather use the web because it was well structured". Several of the students stated that the web helped them to compare and collate their data:

> The idea of using the web was good, it was convenient for everyone and everything was in front of you in one place which made it easier to collate etc. I would prefer to use the web but have the option of doing it in my own time.

> It was better using the web. It was a great way to group the information into the different factors and it was easier to see a clear pattern of learning.

One student, however, found it to be inconvenient when the university website was not working properly:

> I preferred to use the web because at the end it was easier to bring everything together. I also found that the reflections were more to the point and there was not as much rambling on. The only negativity was the inconvenience of getting onto the net whenever we needed to reflect and also when the web page was down.

One student preferred to use pen and paper:

> It would be much easier to write by hand or word process on a word program. The good side, however, of the web journal was that we were able to read each other's reflections.

Interestingly, one student used both pencil and paper as well as the web in a complementary approach as she initially used pen and paper and then the web:

> I found it difficult to reflect on the lesson straight away after the two hours. I usually only took a few notes on the computer and went home and wrote it on paper. When I had free time, I would type it up at home or at the university. This way, I found that I was not wasting my time for an hour staring at the computer screen and nothing coming out of my head. Hence, I need more time to reflect; I am a thinker; I take time to process information.

To summarize, all the 25 students were able to use the website to document their reflections and all produced a metaphor to represent the complexity of their learning. All the students except for one found the website to useful in guiding them in their reflections and helping them to collate and theorize the data collected to deduce their metaphor.

5. Discussion

If standards for teacher education programs recommend that preservice students should develop an understanding of learning, then reflecting upon their own experiences as learners in university classes is one way to do this. Moreover, if reflection is a way of analyzing and making sense of experiences in practice settings (Dewey, 1933; Schön, 1983, 1987), then a preservice education class is an authentic context for promoting this type of reflection. Too often, preservice teachers are encouraged to reflect on their experiences as teachers in school settings, yet do not take advantage of using their own experiences as learners in teacher education classes. Hence, teacher education courses should promote reflection as a process to understand the complex nature of teaching and learning and encourage their students to analyze

their authentic experiences in their teacher education courses. Although studying learning experiences can be complex, this study shows one way of doing this using the three phase reflective framework.

Research has shown, however, that preservice students' writing in online discussions does not necessarily mean that they reflect on their experiences (Hammond, 2000; Seale & Cann, 2000; Whipp, 2003). Searle and Cann (2000) note that there are four key factors which influence the success of using online technologies for reflection: (i) the way the technology is used; (ii) the nature of the student groups; (iii) the role of the tutor; and (iv) the students' preferences for reflection. In this study, the web environment explained the phases of the reflective framework to the students and provided a database to help them structure their thinking about how they learn in university classes. As such, the technology was specifically designed to guide students in using the three-phase reflective framework to encourage reflection.

Although several authors (Davis *et al.*, 2000; Hacker & Niederhauser, 1990; Hoban, 2005; Jay & Johnson, 2002) have argued for the importance of preservice teachers developing insights into the complexity of learning, none have proposed a way for this to occur beyond reading theoretical articles. Moreover, if preservice students are engaged in reflecting about how they actually learn, they may develop insights about how they should teach based on the analysis of their own experiences as learners. Although reflection is a difficult process for preservice teachers to develop, this study has showed that an online environment supported preservice students in the documentation, analysis and theorizing about their experiences.

Although students in previous courses used the reflective framework with pen and paper journals (Hoban, 1997, 1998), this is the first time that students have documented their reflections in a web environment. This was because the web gave the students a structure with headings to guide them in using the framework as well as examples of diagrams that are not possible to give students in paper-based journals. As such the web environment gave the students cues to help them in their reflections and theorizing about their experiences. Previously, students had to write their reflections each week in a journal and then manually scan across many pages to synthesize the key factors for each category. Also, the students had to seek patterns within the data and deduce their metaphor to represent an optimal learning environment. Doing this manually was time consuming and conceptually difficult for some students. It was apparent from the course survey that the website reduced the cognitive load involved in reflection and assisted students in documenting and organizing data for analyzing and theorizing.

Another consideration for preservice students using the reflective framework is that it may give preservice students a context for studying formal educational theory about learning. A close analysis of Figs. 2 and 3 show that the students' personal theories about learning involved individual and social influences on their learning and noted the importance of context. As such, students were theorizing about their own experiences which can then be compared and contrasted with formal educational theories about learning. Furthermore, it is important that trainee teachers

are not simply passive recipients of formal theory at university, but engage in theorizing about their own experiences. This means systematically using a framework to reflect upon their experiences by documenting, analyzing and seeking patterns within the data for generating personal theories.

Two issues, however, need to be made apparent for any other instructors who may want to use the reflective framework. First, initial use of the framework was conceptually difficult for preservice students as they had not reflected upon different learning influences before and were unsure about how to do it. For this reason, several metaphors produced by students in previous courses were shown at the beginning of the course as models of how to represent their learning experiences. Furthermore, this needed to be revisited several times in the first few weeks with discussions about how to document their learning on a weekly basis. Also, towards the end of the course several students commented that this was the first course in their teacher education program which gave them a specific framework to guide their reflections. Previously they had written reflective journals in other subjects, but were not provided with a framework and students stated that in many cases they just wrote about "what the instructor wanted to hear". It appears from the students' data that the website facilitated students' use of the reflective framework because it guided them in their reflections and helped them to manage the data for phases 2 and 3 of the framework.

A second issue is that although the students could access each other's summary of their weekly learning, I was the only person who saw all of the students' reflections for the course as I assessed their web data. Certainly, the WWW site made it easier to assess the students' entries as all the data were more accessible on the website rather than screening large hand written journals. Also, it was a valuable insight for me to understand how different students responded in different ways to the same lesson. In some weeks, the same science activities were praised by some students and criticized by others. This highlights the problematic nature of teaching and it would be valuable for the preservice students to become more aware that people interpret similar experiences in different ways. Although students could access a summary of each student's weekly reflections on the web, they could not access the Learning Profiles or metaphors produced by other students. In the future, the website will be modified to enable the sharing of the metaphors, however, there are ethical issues that need to be considered as the students are documenting personal experiences that are assessible by others. Nonetheless, it is a valuable lesson for any teacher to realize that students do not perceive the same class experience in the same way.

There are several implications for the preservice students who used the website. First, not only is it important that preservice students develop an understanding of how they learn, but it is also important that they make connections to help them consider the implications for how they teach. One of the students developed a metaphor of "going fishing" to describe learning and noted that you need to use different hooks and different types of bait to engage a range of children in a class in learning. Also, many of the students wrote in their end of course survey that

they would need to teach in different ways because of the multiple ways that they learned. Many students also highlighted the importance of interacting with children because of the dynamic nature of their own learning. Moreover, it is worthwhile for students to compare their insights about their own learning with existing educational literature. In this respect, students could compare and contrast their personal insights about learning with formal learning theories such as constructivism, social constructivism and situated learning. Importantly, if preservice students developed an understanding of the complexity of learning, it may well inform their thinking about the complexity of teaching.

6. Conclusion

Several Asia-Pacific countries such as Singapore, Thailand, New Zealand and Australia are concerned about the quality of their teacher preparation programs and have recently reviewed or are devising national standards. A common feature to the new standards is the notion that preservice students need to develop an understanding of teaching and learning. Although this can be addressed by reading educational literature, this article has described one teaching strategy in which teacher education students reflected upon their own experiences as learners which may be more meaningful for students than reading educational literature. In addition, the Web environment helped the students to focus their reflections and guided them in analyzing and theorizing about their experiences to deduce metaphors to represent their learning experiences. Moreover, the national standards in many countries promote "reflective practice" by teachers so it is worthwhile for preservice students to develop skills for reflection in their teacher education programs.

An implication from this study is that the strategy was used in an Australian context and it needs to be considered whether it could be successfully used in other Asia-Pacific teacher education programs? As students in any country participate in some teacher education classes, they all have an authentic context for studying their experiences. However, it would be helpful for these students to have some examples of the type of documentation as well as viewing some metaphors as models for their reflection. The use of a web environment that incorporates a database is useful for this purpose as the particular fields give students a structure for their reflection as well as some examples of data and metaphors could be included on the website as guidance. Also, the fields in the database could be adapted to suit particular Asian contexts. For example, other fields could be added such as "cultural influences" on learning or "specific content knowledge" to give students further guidance to structure their reflections. It would need to be considered by the instructor, however, if the student data and metaphors should be shared amongst the students in the course or only be viewed by the instructor. If the reflections on class experiences are shared, it creates the possibility of promoting an online discussion about different interpretations of class experiences. However, there are ethical considerations regarding privacy issues that would need to be addressed.

Finally, this paper described one teaching strategy to help preservice students develop an understanding of the complex nature of teaching and learning through reflection. To be further understood and embedded as a conception of teaching would require teacher educators in other subjects at university and teachers in schools, who guide preservice students on practicum, to also promote this way of thinking. Developing such a conception can be very helpful. It promotes an understanding of teaching as an "adventure" that is problematic and challenging and why teaching is a profession of lifelong learning. Teachers in classrooms are expected to be "reflective practitioners" (Schön, 1983, 1987). Encouraging preservice students to reflect upon their own experiences as learners at university is one step towards promoting this way of thinking.

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