

Reflection in Self-Assessed Online Discussion

Jenni Way

The University of Sydney

<j.way@edfac.usyd.edu.au>

This paper reports on the use of a combination of prompted written reflection, online discussion and self-assessment as a vehicle for enhancing learning in an undergraduate primary mathematics subject. At the end of semester, 71 students completed a survey of their perceptions about the influence of the components of the experience on their learning, and their online reflections were analyzed for themes and levels of reflection. The students clearly valued the online discussions with their peers and engaged in quality reflection on a range of substantial issues, however the full role of self-assessment was unclear.

Introduction

Although just beginning their journey within the teaching profession, the learning of pre-service teachers is still encompassed by definitions of professional development, such as a “process of growth in which a teacher gradually acquires confidence, gains new perspectives, increases knowledge, discovers new methods, and takes on new roles”(Jaworski, 1993, pp. 10-11). As adults, pre-service teachers can be described as self-directed learners, motivated by the challenges they encounter in their own lives (Knowles, 1980), in particular, the experiences within their mathematics education courses. Accordingly, pre-service teachers must confront their values and beliefs as well as specific mathematical knowledge, in order to grow both personally and professionally (Frid & Sparrow, 2004). Reflection is commonly considered to be a key mechanism for facilitating adult learning processes and is often featured in the aims of teacher education courses, including mathematics education units of study. However reflection is often poorly defined and so is perhaps under utilized as an effective teaching and learning strategy. It is also argued that learning – the construction of knowledge – occurs within a social and cultural context, not in isolation, making discourse a crucial component of effective learning environments (Sfard, 1998; Wood, Cobb & Yackel, 1992). Researchers have reported the benefits of using online discussion environments to challenge pre-service teachers’ beliefs (Schuck & Foley, 1999) and to promote reflective dialogue and critical thinking (Hough, Smithey & Evertson, 2004). Considering all these well-established notions collectively, leads to the proposition that combining reflection, online peer discussion and self-assessment in a cohesive experience for pre-service teachers has the potential to promote effective learning about mathematics education. The central question of this research is therefore: *In what ways does self-assessed online reflective discussion of readings impact student learning?*

This question is broken down into three contributing questions:

1. What are the students’ perceptions of their learning through self-assessed online reflective discussions?
2. What aspects of mathematics education do the students perceive as problematic and/or choose to reflect upon?
3. What qualities or levels of reflection do the students achieve?

Theoretical Background

This review of literature provides a theoretic background for each of the main components in question; self-assessment, reflection and online discussion, and demonstrates how these factors are distinct yet interwoven in the complexities of learning.

Self-Assessment in Education

McMillan and Hearn (2008) present a theoretical rationale for the value of self-assessment in promoting motivation and learning in students. They describe self-assessment a three phase cyclic process: “Essentially, students identify their learning and performance strategies, provide feedback to themselves based on well-understood standards and criteria, and determine the next steps or plans to enhance their performance (McMillan & Hearn, 2008:41). Three theoretical fields; cognitive and constructivist theories of learning and motivation, meta-cognition theory, and self-efficacy theory provide the basis for the effective function of self-assessment. To construct new knowledge students organize, evaluate and connect new information with existing understandings. This constructivist view of the internalization process is associated with motivation for learning, in particular, argue McMillan and Hearn (2008), with the goal-theory perspective. Two main types of goals are reported in research: performance goals where the monitoring and evaluation of learning are external; and mastery goals where the monitoring and evaluation are to some extent internal (Dweck, 1996). Self-assessment skills support the mastery perspective, which is perceived to have positive outcomes such as autonomy, confidence self-regulation and often, greater engagement. The second theoretic field, *meta-cognition*, relates to the student’s ability to consciously control particular cognitive skills such as selecting, predicting, self-monitoring and self-evaluation. The research suggests that such meta-cognitive skills can be taught and developed to enhance learning and achievement (Schunk, 2004). The third theoretical field of *self-efficacy* theory explains how a student’s self-perception (beliefs) of their own knowledge and abilities in a particular area of endeavour influence their learning behaviours and achievements (Schunk, 2004). Effective and positive self-assessment encourage students to persist with their study and to set higher goals for achievement (Brophy, 2004).

The Nature of Reflection

The foundation of the notion of reflection as an active and deliberate cognitive process lies with Dewey (1933) who explained it as “involving sequences of interconnected ideas which take account of underlying beliefs and knowledge. Reflective thinking generally addresses practical problems, allowing for doubt and perplexity before possible solutions are reached” (Hatton & Smith, 1995:2). Building on the three-level hierarchy of reflection proposed by Van Manen (1977), of technical, practical and critical reflection, researchers have developed variations to suit their particular research contexts (for example, Day, 1999; Muir & Beswick, 2007). When actual classroom practice is involved the notions of *reflection in action* (Schon, 1983) are generally also included. However, when studying the reflection of pre-service teachers, unless they are engaged in a practicum, the teaching actions tend to be hypothetical and presented through their writings. Hatton and Smith (1995) developed four levels of reflection to assess student writing: descriptive writing, descriptive reflection, dialogic reflection and critical reflection. In all of these hierarchies the general pattern is to build from the identification of factors, through analytical consideration, to a rationale integrating multiple perspectives. However, the characteristics

of the reflection levels presented in previous research did not meet all the requirements of the self-assessed, collaboratively composed reflective conversations involved in this study. Therefore, a new version of descriptors needed to be prepared.

Online Peer Discussion

The use of online discussions in teacher education programs has become increasingly common, with some research suggesting the potential of such discussion forums to challenge pre-service teachers' beliefs (Schuck & Foley, 1999); to promote reflective dialogue and critical thinking (Hough, Smithey & Evertson, 2004) and develop their mathematical knowledge (Groth, 2005/2006), particularly when combined with some face-to-face experiences that support a sense of professional community (Goos & Bennison, 2005). Several researchers highlight the value of asynchronous online learning environments as this allows the discussion to develop over a period of time, with time to reflect, give and receive feedback and perhaps experiment with some practical ideas (Groth, 2005/2006, Ng & Cheung, 2007). Using a survey of student perceptions as well as a test of recall of concepts, Ng and Cheung (2007) found that a combination of face-to-face interaction and online reflection and discussion was potentially an effective pedagogy with undergraduates. The importance of thoughtfully structured tasks for promoting critical thinking and positive perceptions of online discussion, is often highlighted by researchers (Cheong & Cheung, 2008; Ng & Cheung, 2007).

Context and Research Design

With the theories of self-assessment, reflection and online discussion in mind, an existing 'reading reflection' assignment was redesigned to specify levels of reflection, engage students in online peer discussions and have them self-assess their own interaction and learning. The next section describes the particular context for the research and the methods used to gather and process the data.

The cohort for this study was pre-service teachers (hereafter referred to as 'students') in their second year of a Bachelor of Education (Primary) degree in NSW, taking their first mandatory mathematics education subject. Each week, students were assigned a mandatory reading, an additional recommended reading, and encouraged to find for themselves a third piece of related reading to pursue their own questions. Five of the ten weeks were selected for assessment, accounting for 30% of the subject's marks. Students were required to post their 200 word reflection to a their tutorial group's Discussion section on the university's e-Learning facility (WebCT). Each student was also required to read the reflections of their colleagues and post one or more responses, then encouraged to enter into a scholarly discussion. To conclude the week's task each student completed a self-assessment pro forma requiring them to specify the quantity of reading and to rate the quality of their own reflection and discussion against fixed criteria (See Table 1). The self-assessment criteria provided for the students included three levels of descriptors for the individual reflection on readings, as well as three levels of criteria for responses to other students and reflective dialogue. The lecturer then moderated the assessment each week by selecting about one-third of the students from each tutorial group for scrutiny and individual feedback.

At the end of semester the students were asked to complete an anonymous evaluative survey, consisting of 13 items in the form of statements with a 5-point Likert scale for rating agreement, and three open-ended questions encouraging both positive and negative feedback. The 13 items can be grouped into three categories; the assessment aspect (4

items), the type of readings (4 items), and the online experiences (5 items) (See Tables 2 & 3). Of the 107 students enrolled, 71 completed and returned the survey in the final lecture, representing about a 66% return. The second source of data in this study is the collection on online postings. (83 students gave signed permission for their work to be quoted).

Table 1.
Self-Assessment criteria

<i>Level</i>	<i>Individual Reflection</i>	<i>Responses to other students</i>
1	Key points that caught my attention and I think are important in developing understanding of this topic	A respectful comment that highlights a key point, identifies a similarity or difference with my perspective, or gives a reaction to someone's point or question.
2	Connections between readings, lecture/tutorial experiences, and previous personal experiences – that demonstrate new learning	Several respectful comments that add a new perspective, make a new connection, or raise a question – and so demonstrate further reflection on the topic.
3	Deep and critical reflection regarding significant issues and the beginnings of a personal philosophy of teaching – that demonstrate growth in knowledge and professional understanding	Contributions to a scholarly debate about a significant issue – that demonstrates respect for other viewpoints and high-order thinking (critical reflection, original ideas, synthesis of knowledge, evaluation).

Analysis

As each of three research questions is quite different in nature, three different analysis methods were used. Analysis of the survey involved a basic frequency approach to provide data for the first research question regarding the students' perception of the tasks.

To address the second research question regarding the issues students chose to reflect upon, a Grounded Theory method of content analysis (Babbie, 2007) was applied to a random sample of about 30% of the discussion threads (200 discussions). Open coding was used as first level analysis of the *manifest content* (immediately obvious surface content) to reveal categories of issues discussed by the students.

The third research question, regarding levels of reflection, was addressed by applying the self-assessment descriptors to judge levels of reflection in a sub-sample of discussion threads. Due to space limitations the results from this analysis are not reported in this paper, though mention is made of levels of reflection in the discussion of categories.

Results and Discussion

The Survey Results

Only the results for the Assessment and the Online Experiences groups of items have been presented; these being the most pertinent for this paper. For clarity, during the discussion of results the ratings of Agree and Strongly Agree have been combined (similarly for the Disagree ratings) but have been displayed separately in the data tables.

As a form of assessment, the procedure was well received by the students (See Table 2). Although not all in agreement, 69% responded positively to the notion that the self-

assessment component supported the critical consideration of their own contributions, with another 23% taking a neutral view. The majority (80%) admitted they would not have completed as much reading without the assessment requirement. The implication here is that the self-assessment process may have stimulated further reflection and learning, but the motivation aspect highlighted in the literature is obscured by the fact that each student's self-assessment was converted into marks and recorded.

Table 2.
Assessment items: Percentage of participants (n = 71)

Survey item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1 I would have done the same amount of reading if there were no assessments involved.	24	56	14	3	3
11 The self-assessment criteria helped me to critically consider my own contributions.	0	8	23	61	8
12 The overall assessment process was fair.	0	0	10	77	13
13 The allocation of 30% of the unit's marks was appropriate for the amount of work.	0	11	10	73	6

As seen in Table 3, the majority (85%) of students agreed that the online discussions encouraged them to think and reflect more deeply than they otherwise have done (Item 2). Most students found their colleagues reflections and comments both interesting (85%) and useful in terms of personal learning (85%) (Items 3 & 4). Participation in the online discussion was considered to assist learning by 76% of the students, with 23% taking a neutral stance (Item 5). A small number of students (12%) would have liked to privately hand in a paper-based reflection, but 69% preferred the online procedures (Item 10).

Table 3.
Online Experience Items: Percentage of participants (n = 71)

Survey item	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2 The online reading reflection and discussion process encouraged me think and reflect more deeply than I may have otherwise done.	0	3	13	61	24
3 I found other peoples' reflections and comments interesting.	0	0	15	58	27
4 Reading the reflections of my colleagues increased my learning on the topic.	0	0	15	65	20
5 Participating in discussions increased my learning on the topic.	0	1	23	62	14
10 I would rather hand in a written reflection on paper than contribute to an online process.	23	46	18	8	4

This final result raises the question of 'Why do some students prefer one form to the other?' Some indication is given through the open response questions at the end of the survey. Of the 53 surveys that contained responses to the open questions, 34 included a comment about the value of online reflections. Most of these responses indicated that the students found "engaging in conversations and debates" to be most worthwhile because "It allows comparison between how you are thinking with that of your contemporaries" and that "reading other people's perspectives increased my knowledge, broadened my view".

Student Reflections

Even though each week's topic and readings were different, a number of strong recurring themes emerged in the students' postings: attitudes, general principles, specific strategies, relevance and the profession. These are briefly elaborated and discussed below.

Attitudes

This theme actually encompasses a broader spectrum of psychological aspects than just 'attitude'. In their reflections, students raised questions about beliefs, expressed past and current self-perceptions, and explored their attitudes towards mathematics and the teaching of mathematics. As their transition from pupils to teachers begins, the students are beginning to construct a personal philosophy of mathematics education and in doing so confront their beliefs and attitudes about the learning and teaching of mathematics, as well as the nature of mathematics itself. The importance of awareness of one's beliefs and attitudes has been emphasised in self-efficacy research (Schunk 2004) and in explorations of pre-service teacher development (Frid & Sparrow, 2004). The following quotation from a student illustrates reflection on the role of such awareness.

My third reading dealt with pedagogical preconceptions of mathematics, and whether teachers could challenge their beliefs about mathematical learning, or whether they would always be influenced by the way they were taught in school. I think that all teachers need to be aware of their past learning experiences and be able to effectively critique them so that they can effectively challenge their beliefs and engage their students in meaningful and constructive mathematical learning. (Ivy)

General Principles

As the students build their mathematical content knowledge and pedagogical content knowledge they begin to perceive the relationships between Mathematics and other areas of education. Some general teaching principles are identified; such as the importance of engaging students, developing language, valuing deep understanding and the role of assessment in guiding planning for teaching. The students project themselves into teaching situations, explaining what they intend to do and why, and so demonstrate a form of *reflection in action* (Schon, 1983).

I think for me, the big difference is that initially I saw maths as so separated from the other KLAs - and so the idea of teaching it seemed very foreign before this course. But I now realise that the same teaching principles apply across the board - things like knowing the learner, making learning relevant, creative, enjoyable, being critically reflective, using appropriate assessment etc. (Amy)

Specific Strategies

Each week the students encountered the key concepts and relationships in a particular mathematical topic, such as counting, fractions, multiplication, pattern or problem solving. Through lectures, tutorials and readings they explored particular resources, representations of concepts and processes and teaching techniques designed to promote conceptual development, which often challenged existing conceptions. This category captures the students' thinking about specific concepts, strategies or issues associated with particular topics. The following quotation also illustrates the value of the students sharing some face-to-face experiences in classes.

Colouring sections of a shape is definitely the most common exercise on fractions... and to make matters worse, some worksheets have shapes that have already been divided into the right number of parts (I mean if colouring in is all that children required to do to show their understanding of fractions, at least have them cut up the shapes by themselves to show their understanding of equal parts). I don't know about you, but I actually thought early fractions was just about 2D representations before this weeks learning (cos that's all I've ever seen the kids doing). (Chen)

Relevance

Every week at least one discussion incorporated reflection on the relationships between mathematical content within school, and 'real life contexts' outside school. The students discussed why it might be important to make connections between classroom mathematics and the use of mathematics in everyday life, and how this might be accomplished. These reflections often extended beyond basic practical suggestions to consider the broader social and cultural contexts of mathematics education and so demonstrated *critical reflection* as defined by Hatton & Smith (1995).

I totally agree that in order to engage a student, it is important to link the learning to his/her everyday life. With younger children, as teachers, I believe that it is important to involve parents and to give them suggestions/guidance as to how to assist in this. Something as simple as pointing out to parents the importance of picture books and how to link this with mathematical concepts. A lot of parents may not be aware of how they can assist their child and it is up to us to guide them. (Sharne)

The Profession of Teaching

Students regularly expressed their concern about the daunting responsibilities and challenges of becoming a teacher. Also evident was their growing awareness of both the demands and support provided by the professional community they were entering. Sometimes these discussions involved consideration of multiple perspectives and historical, political and socio-cultural contexts for the issues, thereby, individually or collectively achieving high-level reflection.

We are constantly reminded by the literature and by our tutors of the importance of teachers holding high standards for our students. However it really hit home to me this week in reading the various policies of the AAMT that it is just as important that teachers hold themselves to equally high standards. To be honest, whilst I recognise the validity of the policies, I was feeling a little intimidated by the burden of expectation that the AAMT has of teachers. And since these policies were written by teachers themselves, it makes the expectations seem more real, as it means it was not written by a bureaucrat with political motivations. We've definitely got big shoes to fill! Whilst I have acknowledged the immense task we have ahead of living up to the professional standards of teaching, it is important to note that we do have support along the way. One of sub-domains of the Standards of Excellence is personal professional development. The same institutions that develop these standards run courses to help teachers achieve these standards. This was quite reassuring. (Daniel)

Conclusion

This study sought to address the question: 'In what ways does self-assessed online reflective discussion of readings impact student learning?' and explored students' perceptions of their learning, the issues they chose to reflect upon, and the nature of their reflections. The necessity for teachers in all phases of their development, to challenge existing perceptions and beliefs is emphasised in the literature and there is strong evidence from this study that the pre-service teachers not only confronted existing ideas and beliefs about mathematics education, but they were well aware of the need to do so. As forecast by previous research, the online discussion proved to be a powerful learning environment for these students as they grappled with significant issues; and again, they were aware of the learning benefits of interacting with each other's views. Clearly the imperative to complete the assigned readings and compose concise reflections as a recorded assessment provided strong external motivation, but the results also suggested that the learning of many students was stimulated in some way by the self-assessment process. While it is apparent that the self-assessment criteria provided some guidance on levels of reflection, the role this

process played in promoting learning remains unclear. This aspect warrants further investigation. More complex analysis of specific conversations and the development of themes over the semester, as well as the tracking of some students, may lead to a better understanding of how individuals and groups interact and collaborate to build higher levels of reflection.

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