THE REFLECTIVE THINKING OF THREE PRE-SERVICE SECONDARY MATHEMATICS TEACHERS

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This paper reports on the reflective thinking of three pre-service teachers during a one-year teacher education program. We interviewed the participants three times during their practicum and once more in their first year of teaching to investigate the nature and depth of their self-reflections. We developed a three-stage, hierarchical model of reflective practice to interpret the interview responses. Results show slight improvement in the participants' practicum reflections and a greater capacity for reflection in their first year of teaching, but even then their responses were generally descriptive in nature. We suggest some reasons for this situation.

REFLECTIVE PRACTICE AND BEGINNING TEACHERS

The term 'reflective practice' is commonly used to describe a disposition to reflect critically on one's classroom practice and is regarded as an important part of teacher development (Jaworski, 2006). For pre-service teachers, the school-based fieldwork or practicum can become an important "site for learning" but only "if the learner possesses a disposition to be reflective" (Smith, 2003). However, research suggests that pre-service teachers find it difficult to develop a reflective stance on their classroom practice (Alger, 2006) and their reflections are cursory or superficial (Bean & Stephens, 2002). Yet, if pre-service teachers do not cast a critical eye on their practice they are likely to reinforce their existing beliefs and attitudes about teaching (Grootenboer, 2005). They may focus too much on the practical concerns of teaching, such as lesson planning and classroom management (Moore, 2003), rather than becoming more aware of student learning (Jaworski & Gellert, 2003).

Practicum classrooms may not reflect the reformist vision of university courses (Goos, 1999) and many pre-service teachers have practicum experiences that simply reinforce outmoded pedagogies from their own school days (Grootenboer, 2005). Pre-service teachers seek approbation and acceptance from supervising teachers (Roberts & Graham, 2008) but have often not developed a personal philosophy of teaching so simply copy the teaching techniques they observe, leading to a simplistic and technically-based view of teaching (Putnam & Borko, 2000). Passive imitation of supervising teachers does little to encourage a stance of critical reflection or promote the beginning teachers' capacity to learn from their field experiences in any meaningful way (Zeichner, 1992).

as a useful means of identifying and developing reflective practice. This paper focuses on three members of a teacher education program as they recount significant classroom incidents from their practicum experiences. We examine what their reports indicate about the development of their reflective practice.

THEORETICAL PERSPECTIVES ON REFLECTIVE PRACTICE

We developed a three-stage, hierarchical model for analyzing the reflective practice of our participants based on the work of Lee (2005) and Muir and Beswick (2007). Lee investigated pre-service teachers’ reflective thinking and described Recall (descriptions of experiences without looking for alternative explanations), Rationalisation (searching for causes to help explain experiences), and Reflectivity (analyzing experiences from various perspectives with the intention of future changes in action). Muir and Beswick examined experienced teachers and identified Technical Description (general accounts of classroom experiences often focusing on the technical aspects of teaching), Deliberate Reflection (identifying and explaining critical incidents), and Critical Reflection (considering the perspectives of others and contemplating alternative actions). To highlight the particular concerns of beginning teachers, we developed the following three levels of reflective practice, with examples for each one taken from our interview data:

- **Descriptive Recall.** General descriptions of classroom practice; evaluating the success or failure of actions; focusing on the technical aspects of teaching (e.g., “I ran out of material at the end of the lesson”).
- **Practical Rationalization.** Accounts of critical incidents; explaining the actions; searching for causes (e.g., “I want to do more group work but my supervising teacher says I’m not giving the class enough practice exercises. I want her to write me a good report”).
- **Critical Reflection.** Analysis of experiences; considering various perspectives; offering alternatives (e.g., “I tried to teach them multiplication of fractions but they didn’t know their tables. A lot of students got confused and I had class management problems. I should have revised some tables questions and kept the numbers smaller”).

CONTEXT AND METHOD

This study is part of a larger study (see Prescott & Cavanagh, 2008) and took place at a university in Sydney, Australia, during a one-year professional program for secondary teaching. The 50-day practicum was completed in a single school under the direction of one supervising teacher, predominantly in one teaching day per week over the course of an entire school year. The mathematics methodology units at university allow students opportunities for reflection and analysis of their practicum experiences through, for example, reflective tasks completed in conjunction with the supervising teacher, action research projects on student learning, and regular ‘school experience discussions’ similar to the ‘Episodes and Issues’ framework suggested by Jaworski and Watson (2001, cited in Jaworski & Gellert, 2003). In these discussions, pre-service teachers “bring significant episodes (or anecdotes) from their teaching to share … [and] are encouraged by tutors to take a positively critical stance towards such issues, relating the questions that arise to teaching situations they have personally experienced” (p. 847).

This study occurred during the final implementation of a new Mathematics Syllabus for Years 7 to 10 (Board of Studies New South Wales [BOS NSW], 2002) that emphasized Working Mathematically, an approach to teaching mathematics providing “opportunities for students to engage in genuine mathematical activity and to develop the skills to become flexible and creative users of mathematics” (BOS NSW, 2002, p. 45). Working Mathematically is a focus of our research.

Three semi-structured interviews of 20 minutes’ duration occurred with each participant during the practicum year. In the first interview, participants recalled their own school days, discussed their motivation for choosing a mathematics teaching career, and shared their concerns about the impending practicum. In the second and third interviews, they described their own and their supervisors’ mathematics lessons, and gave an impromptu lesson outline for a specified topic. In a fourth interview in June of the following year, the participants reviewed their practicum experiences from the stance of a first-year teacher. In all interviews, the participants discussed their teaching practices and the roles played by their supervising teachers so we might gain insights into the quality and depth of their reflective processes. All of the interviews were transcribed and read carefully so that emergent themes could be identified and coded. Our reflective practice model guided the coding of the data as we looked for patterns in the participants’ responses. After the initial analysis, we revisited the data to look for illustrative examples for the themes we had identified and formed the three narrative case studies (Miles & Huberman, 1994).

THE CASE STUDIES

Sam’s reflective thinking

Sam (pseudonyms used for all participants) described his best teacher as “very caring” and his own motivation for teaching as “a great need to help people and I guess I’m caring, so teaching and helping students is something I enjoy. I care a lot about students”. Sam expressed a desire during practicum to “engage students in practical activities; to try to link the concepts to the real world”, rather than the way he had been taught with teachers who “came in, wrote on the board, we wrote notes and we did exercises in class and we did exercises for homework”. However, in outlining how he might teach a lesson on decimals he said, “I’d write up a heading and I’d write the theory behind it. ... And then run through some examples”.

Sam completed his practicum in a difficult school in a low socio-economic area and he quickly became preoccupied with classroom management issues. His supervising teacher spent much of the time “screaming to keep the kids under control. The
amount of learning wasn’t that great, but she kept them under control”. Early in his practicum Sam worried that he was becoming “too focussed on trying to implement the lesson as I planned. Hopefully as I progress I’ll be able to focus less on what I’m trying to teach and more on the discipline.” He later described one of his best lessons as one where “I didn’t get much discipline issues”.

Sam continued to report difficulties in the classroom, so his supervising teacher suggested that he try hands-on activities in lessons as a means of improving student behaviour. She provided him with many resources he could use, but as he did not model this approach in his own lessons, Sam was unsure about how to implement them effectively. As a result he found lesson preparation time consuming and saw problems continued nor could he offer any alternative strategies for dealing with them other than persisting with activities as suggested by his supervising teacher.

It was only after the practicum, when Sam had been working as a teacher in a school with similar management issues to his practicum school, that he began to recognize other sources of the difficulties he experienced in trying to manage his classes. In the final interview, he commented on students’ poor behaviour saying, “I think it could stem from students not understanding or having learning difficulties”. He also spoke about some of the unruly classes he was currently teaching, “I don’t like teaching something that’s simply just got to be taught for the sake of it; and that confuses them so then I have class management problems. It’s sort of a vicious circle”. Sam realized the futility of teaching some topics, like fractions, when students “don’t know their tables and can’t work with whole numbers”. Instead, Sam said he would prefer to devote more time to basic numeracy but felt he was under “pressure to cover the program”. He commented, “As a first-year teacher you’re afraid to tread on toes, you don’t want to do anything that’s too ‘out there’ because you’re on probation so you don’t want to be taking too many risks”.

John’s reflective thinking

John saw mathematics teaching principally as “clarity in explanations where everyone understands” since this was what he remembered most from his own schooling. John commented that he expected his practicum classes to be “well behaved, motivated, like I was when I was in secondary school”.

John’s practicum occurred in a school which he described as “good, with minor class management issues”. He characterized a successful lesson from his supervisor as “chalk and talk” with “content delivered quickly and clearly” and “key principles well explained”. However, as John heard more about alternate pedagogies at university he began both to question some of the practices of his supervising teacher and to recognize the limitations of his own schooling. He described constructivism and the working mathematically approach to teaching as “a breath of fresh air that changed my attitude to teaching dramatically” but he was disillusioned that “the methods we discuss at uni [are] not practised at school”. For John, the disconnect became more apparent when he tried unsuccessfully to implement this more student-centred approach in his lessons. He recognized that his difficulties arose because students were not used to Working Mathematically and the “school culture doesn’t promote this”. Even though John was “allowed to do lessons my way”, he resolved to follow his supervisor’s more traditional style and continue to “actively discuss [with the supervisor] what we learn at uni”. John described how his supervisor was “lending a sympathetic ear” and had challenged John with “if you can prove to me that [Working Mathematically] can work, I will try to adopt it more”. However, the challenge proved too great for John and, as his subsequent attempts at Working Mathematically did not succeed as he hoped, he began to question the efficacy of the approach because he did not think he could sustain it and complete all of the syllabus content. He concluded that it was better to “proceed with caution”, adopt a transmissive style of teaching, and build his confidence.

Later, as a first-year teacher, John repeated his claim that students were not prepared to engage in higher-order thinking required by the working mathematically approach because they want “memory work, a lot of drill”. Hence “it’s easier to develop your teaching skills in an instrumental teaching scenario and once you’ve got the basic skills, then you can start to try new things”. John reconfirms his ideas about clear explanations in teaching, noting, “your ability to explain things must be flawless”. He stated, “I’ll be focussing on my ability to explain things, try and keep at the right level, use the right words”.

Peter’s reflective thinking

Peter spoke about his passion for teaching noting that in high school and all through university he had “spent a lot of time teaching other students” and felt he was “good at it”. His best mathematics teacher was one whose lessons were “quite unstructured and we could explore things we wanted to explore. So lessons were a lot more discovery-oriented and we did the exercises for homework”. Peter wanted “to inspire students’ interest in math” and show students who may not like maths how it can be “applicable and important in their lives”. He said he wanted to “stretch” the students.

Peter’s practicum took place in a comprehensive high school where achievement levels in mathematics had historically not been high. Peter described his supervisor as a “traditional” teacher whose lessons were always “very structured with a quick quiz, review of homework, examples, and well graded practice exercises”. He concluded that “students need structure so lessons are predictable” and described one of his own lessons on angles as successful because “they [students] remembered the rules next lesson”. Peter also reported that the lessons he designed to engage students more in their learning had little success as the “class wasn’t used to doing group work”. He also commented that his supervising teacher had very strong views about how mathematics should be taught and expected Peter to follow a transmissive style. Peter said he became frustrated when his supervisor did not support a working
mathematically approach and when he criticized Peter for the lack of practice exercises he provided for students. Peter eventually decided that a "good [practicum] report necessitated following his way", but he looked for opportunities to try out new ideas when his supervisor was absent from the class.

In the fourth interview, Peter described being a full-time teacher as "a real high" because he was "finally able to do what I wanted to do" and had "more freedom to try things, to experiment" rather than having to "please my supervising teacher". He now tried "to begin [lessons] with concrete examples and generalize them to formulate the rules" because that was his own preferred learning style. However, Peter noted that he could not take an investigative approach in every topic due to textbook "more difficult" compared to "more confident". Sometimes because "students are not interested in taking up the challenge of Working Mathematically". Peter commented that he was "still learning the content" since he had not taught most topics before, so he was relying on a textbook more than he would like but would adopt his preferred Working Mathematically style as he felt "more confident".

DISCUSSION AND CONCLUSION

The participants' initial reflections were at the level of Descriptive Recall (e.g., Sam's concern about student behavior, John's desire to provide clear explanations, and Peter's comments that students prefer more structured lessons). The strong focus on technical aspects of teaching is consistent with previous studies, highlighting the dominance of such matters in the practicum (Moore, 2003) as an essential first step in developing one's reflective practice (Shoffner, 2008). Some development in the participants' accounts of their reflective thinking did occur, albeit in varying degrees, to the level of Practical Rationalization (e.g., Sam's acknowledgement of student learning difficulties as the likely source of their poor behaviour, and John's growing realization that adopting a working mathematically approach was more difficult due to the pedagogical style of his supervisor). Peter made progress towards Critical Reflection (by realizing that waiting until the practicum ended would allow him to adopt student-centred activities more freely in his own classes). All participants showed greater capacity for critical reflection on their practicum experiences in the final interview, perhaps confirming Schön's (1987) view that significant reflection may occur "only when a student moves out of the practicum into another setting" (p. 299).

The practicum classrooms of our participants were perhaps not ideal settings for them to experience Working Mathematically in practice, but we do not believe they have to be so in order for critical reflection to occur. However, practicum classrooms do need to "provide enough room for students to envisage alternatives, interact with children, and try out new approaches" (Ebby, 2000, p. 95). The reports of all three participants in our study indicate that there was little space made available for such considerations during the practicum so it is perhaps not surprising that there was little evidence of critical reflection. All three case studies demonstrate the crucial role of the supervising teacher and confirm the supervisors' tendency to give advice rather than help student teachers "problematize what they observe, and to reflect on what might be done to improve things" (Jaworski & Gellert, 2003, p. 836).

Our results indicate that reflective thinking can be risky and daunting, particularly for beginning teachers who lack the insights that can come with greater classroom experience. Despite opportunities for reflection in the university program, the participants made disappointingly little progress in developing their reflective practice. Perhaps the often stressful nature of the practicum makes self-reflection too difficult for novice teachers, particularly if they attach little importance to reflective practice or perceive it to be of little benefit. Instead, it appears that the work of reflection is more likely to be done when beginning teachers make the transition to their own classrooms where they can shape their professional identities more freely.

REFERENCES


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INTERACTIVE PATTERNS IN A TAIWAN PRIMARY FOUR MATHEMATICS CLASSROOM

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Class interactive patterns in a Taiwan primary four mathematics classroom are explored in this study. Lessons conducted in a mathematics classroom, and interviews after each lesson, are video recorded for two weeks to collect data. The pattern, students write and teacher interprets, is one of the primary class interactive patterns found in this study. In this pattern, each student plays as a problem solver and a recorder, while teacher plays as an interpreter. It can be divided further into three sub-types, which are students write and teacher selects one record, students write and teacher supplements, and students write and teacher summarizes, based on the process how teacher elaborates after students solve a problem.

INTRODUCTION

After long-term interaction, some interactive patterns always appear in a classroom (Bauersfeld, 1988; Richards, 1991). These interactive patterns not only guide students in class, but also have a great impact on their behavior outside the class. When students are imbued thoroughly with what they frequently hear and see in a classroom, the way they behave and think in the classroom may eventually become their own habit. The longer the period of interaction is, the deeper students are influenced. In the end, the patterns are more likely to influence their ideas about what mathematics is (Bauersfeld, 1995). On the other hand, these class interactive patterns, to a teacher, are of great help in their teaching. Therefore, the objective of this study is to explore class interactive patterns in a mathematics classroom.

There are two types of study regarding characteristics of class interaction. The first type of study distinguishes class interactive patterns in the features of behavior that teachers and students express during class interactive sequences. For example, researchers using an emergent perspective have identified “funnel pattern”, “focusing pattern”, “elicitation pattern”, and “discussion pattern” (Bauersfeld, 1988; Voigt, 1994; 1995; Woodward, 1994). In funnel patterns, the teacher sets up a series of questions to narrow down possibilities until students figure out the teacher’s presupposed solving procedure. The characteristics of a focusing pattern is that the teacher asks the students a question to indicate a key point and then leaves them to solve the problem (Wood, 1994). In this type of study, the nature of teachers’ and students’ interaction is not depicted specifically enough. Class interactive patterns are formed by a series of interactions amongst students and a teacher. Therefore, different participants develop different class interactive patterns. Even two classes, which are both categorized as...
PREFACE

It is a great pleasure to welcome you to the 33rd Annual Conference of the International Group for the Psychology of Mathematics Education, which is held in Thessaloniki, at the Aristotle University and the University of Macedonia.

Thessaloniki is the second largest city in the country, in the district of central Macedonia with a continuous 3000-year history. With almost one million inhabitants, Thessaloniki is an important economic, commercial, intellectual and cultural centre for Greece and South-East Europe.

Its long multiethnic and multicultural history is documented in a wealth of monuments, from ancient ruins dating 23 centuries back to important churches dating from the 5th century and still in use. Conference attendees will have the opportunity to visit all monuments and museums in guided tours, organized by the conference secretariat during the conference.

The Aristotle University of Thessaloniki was founded in 1925. The structure of the University today, its range of activities and its size makes it the largest and most complex institution of higher education in the country. About 101,000 students are registered in the 42 Schools that cover a very broad scientific spectrum. The University of Macedonia is a newer and smaller institution, well organised and very potential one in human personnel and infrastructures.

Organizing a PME conference in Greece has been an endeavour long pursued by the regular Greek PME members, who have made efforts to turn the 2009 annual meeting of our society to a social and scientific success. The theme of the conference, “In search for theories in Mathematics Education”, has been chosen in the hope that, as Ancient Greece provided the context within which Mathematics advanced theoretically, Modern Greece can become the threshold for enhancing the ongoing debate on this crucial issue.

After more than 30 years of high level research activity and the development of a variety of perspectives to analyze the complicated phenomena of learning and teaching mathematics, the community appears mature enough to invest on building up coherent and compound theoretical approaches, a task that will hopefully be promoted substantially by this conference’s scientific activities.

The 33rd PME Annual Meeting seems to be one of the most highly attended in the history of International Group of PME. This fulfils us with the expectation that the many researchers from all over the world who will participate will contribute to the scientific programme of the conference in many interesting and scientific challenging ways. At the same time, we hope that the city and the country will provide an opportunity to everybody to experience some of the Greek culture and history.