Using Jamie's Experiences: An Investigation into Using Teachers' Stories in Pre-service Mathematics Teacher Education

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Ensuring student teachers are prepared for the realities and dilemmas of the secondary classroom is an essential goal of pre-service teacher education. This paper describes a pilot study into the effectiveness of using a case-method interview in helping address such issues. Informed by the experiences of a beginning teacher, the case included theoretical links and related tasks. Findings included that student teachers were positive about case method stating it had assisted their personal growth as mathematics teachers.

"It's nice to see that I am not the only one…"

The purpose of the pilot study reported in this paper was to examine the effect of using scenario-based learning, case method in particular, in pre-service secondary mathematics teacher education. This paper describes a classroom trial of such a learning tool with graduate diploma student teachers.

Case method teaching as a means for using people's stories as a basis for combining theory and application is well established in teaching disciplines such as business, law, and medicine. Case method and how best to apply it for teaching and learning are well described by a range of authors (Erskine, Leenders & Maufette-Leenders, 2003; Barnes, Christensen & Hansen 1994; McAninch, 1995; Wasserman, 1994).

A 'case' presents the story of a dilemma faced by a focal person, and the subsequent decision-making. Through reading the case and carrying out associated tasks learners are able to personally identify with the scenario and consider themselves in the focal person's place. The tutor facilitates small group and whole class discussion of the case and tasks.

Case method involves learners in a shared virtual experience, emphasising involvement and promoting an interactive teaching and learning community. Close analysis of aspects of the case allow key concepts to be analysed and related theory to be discussed in direct relation to practice. Learners are able to confront realistic classroom challenges such as incomplete information, alternative decisions, and related implications. Thus case method provides a formal example of situated learning described by McInerney and McInerney (2002) as learning based on the use of activities similar to those of real world practitioners. Situated learning allows learners to develop shared knowledge in social situations and is consistent with social constructivist theory.

Study of cases and preparation of case tasks encourage autonomy and feelings of competence, control and choice, aspects which intrinsically motivate the learner (McInerney & McInerney, 2002). Such learning experiences help facilitate shared responsibility for and management of learning between the learner and tutor.

As a nation founded on the Treaty of Waitangi it is important for our programmes to reflect Māori culture, traditions and values. Teaching through story telling is an ancient pedagogy used in a wide range of cultures across the world. In particular, learning through stories is consistent with traditional Māori pedagogies (Hemara, 2000) and therefore use of

story-telling as a teaching and learning tool can be described as being consistent with the 'Protection' principle of the Treaty of Waitangi (Wilson, 2002) thus modelling in a small way an understanding of the implications of the Treaty of Waitangi for classrooms.

The use of case method as a pedagogical tool in pre-service teacher education is being explored across a range of disciplines at our institution. To our knowledge use of case method teaching is not widespread in mathematics teacher education. Merseth (2003, 2003a) provides a valuable set of cases created by a team of mathematicians, teachers, and teacher educators. A comprehensive theoretical framework underpinned the development and content of these cases and associated support materials. Merseth's aim was to show how case method teaching can stimulate powerful learning of specific mathematics teaching ideas and useful pedagogical generalisations.

This paper describes the initial findings of a pilot study into the use of case method teaching. A junior secondary mathematics topic within the curriculum's Number strand was chosen for the case as it was a topic accessible to all students, it exposes the dilemma of teaching for understanding or by procedures, and it was a topic that student teachers may have already encountered on one of their three completed teaching practices.

The case in this study is based on real experiences as described by a beginning teacher. Being a recent graduate from the pre-service programme in which the case was to be used she was very familiar with the course content. This knowledge enabled her to readily identify dilemmas from her own experience that would complement other course material and therefore be useful for our student teachers to consider.

The case deals with decisions to be made about teaching understanding and manipulation of integers to a mixed ability Year 10 class. It deals with the tensions of providing constructive mathematics learning for all students in a class with a wide range of prior knowledge of and interest in mathematics and with the constraint of limited planning and topic delivery time.

The pedagogical issues intended to be addressed through use of this case included: content coverage and differentiation, teaching for procedural or relational understanding, and developing ways to motivate and engage Year 10 mathematics learners. The case required student teachers to engage with the realities and complexities of planning for teaching a junior mixed ability mathematics class in order that they could better plan how to overcome common classroom difficulties. Previous practice constructing lesson and unit plans had been included within the course and on three teaching practices. Addressing such realities within their pre-service education was intended to further develop student teachers' skills for resolving such issues in their own teaching.

The research question of the study were:

- How effective are teacher stories and related tasks in engaging student teachers in considering classroom dilemmas?
- How effective is case method as a tool for preparing student teachers for classroom realities?

Preparing and Using the Case

In order to write the case an interview was conducted with Jamie (pseudonym) at the end of her first year of teaching. Part of the interview transcript is given in Figure 1. The case was written collaboratively be the authors of this paper by augmenting key themes from the interview transcript with information from theory. Figure 2 shows a section taken

from the case. Readings that would assist student teachers to explore their approaches to teaching were selected.

> Interviewer: Can you describe the year 10 class?
>
> Jamie: This is an ordinary year 10 class, it's not an extension or a remedial, but within that year 10 class there is a huge range of abilities, for example, when we set the trigonometry test recently, we had students with zero percent, and we had students with a hundred percent. There are students in that class who have poor reading skills, poor basic maths skills, they have difficulty with multiplying two numbers together, they're totally reliant on their calculators, and there are a number of students, three or four, who were last year in extension classes and have only just missed the cut-off to be still in extension.
>
> Interviewer: And how motivated are they to want to learn mathematics?
>
> Jamie: There is a hard core in that class, of probably five to half a dozen students who are only in this class because it's compulsory, in fact probably more than that, probably half the class would only be here because they have to be here. For example I have one student who's point-blank told me that she has absolutely not interest in doing maths, she is very focussed, she wants to be a dancer and hairdresser, and if it has nothing to do with hair or dancing, she doesn't need it. She doesn't need maths, she doesn't want to be here, and she's not the only one. There are several students who have pretty much reached their limit, think that they will never go beyond basic maths skills, and they've hit the roof for themselves, they can't do it, it is too hard for them, they're not motivated. There is, in the school, quite a climate in the year 10s in particular of being lazy. They don't do their work, they do the barest minimum, they have to be sat on to do their homework, and in class, unless you are physically standing over them and saying:
>
> "Get your pencil out, get your book out, open your book, turn to page such-and-such, why haven't you got your book open yet?"
>
> They will sit there until you have stood over them and pretty much talked them into doing a problem, and I'll have students that are during my fifty minute period, they might write the notes down, or they might do one or two problems, and you've asked them to do five or ten.

Figure 1: Excerpt from the transcript of the interview with 'Jamie'.

Case method and the pilot study were explained to student teachers in their final weeks of pre-service mathematics education. Student teachers were asked to read the case and a related reading. The reading (Watson, 2002) was chosen because it discusses teaching for understanding in contrast to teaching through use of procedures. It was felt that this reading would help the class examine their own teaching of integers and similar topics.

The class was told that 'Jamie' was a pseudonym for a real teacher who had been a student in their course from a previous year and that the case had been developed from an interview with Jamie at the end of her first year of teaching. It was explained that changes had been made to protect the identity of the interviewed teacher and to focus the class discussion on specific issues rather than the entire breadth of material within the interview.

Student teachers were required to bring ideas for discussion on how they would approach solving Jamie's dilemma of how to teach the integer topic within the constraints of time and environment presented. During the following class session student teachers were required to share their approaches initially in small groups where they could be refined and then groups shared with the whole class. Two further readings were then

distributed (Linsell, 2002; Tanner, Jones & Davies, 2002). Facilitated by the lecturer, use of these readings provoked further reflection and refinement of teaching approaches and planning.

> Jamie is worrying that her teaching has become 'very chalk and talk' and would like to increase her repertoire of teaching strategies for the Year 10 classes in particular. She thought back to earlier in the term when she had taught the same topic. Jamie had worried that for the bulk of the class that one minute they seemed to get it and the next day they couldn't do it. She thought that this was exacerbated by their lack of organisation. Many of the junior students don't bring exercise and textbooks consistently and instead work on bits of paper. Jamie thought again how very frustrating this is and decides that one of her goals for this term is to have a higher proportion of students consistently bringing their books. Jamie looked back to the school scheme. There was little detail for integers for Year 10 as the students had been introduced to these ideas in Year 9. Year 10 was supposed to be only a quick review of these ideas. However, many of the previous class had found the topic difficult, which had taken Jamie by surprise. She put this down to her lack of experience in teaching the topic and was determined to use what she found with them to inform her planning for 10F. Jamie looked back to the Year 9 scheme to see if it held more detail on how to teach the topic.
>
> Jamie had found it difficult to make the topic interesting when teaching the previous class. The students seemed to prefer to race through set questions with blind rule following rather than using thinking to check the reasonableness of their strategies and answers. They had brought a range of prior understanding of the topic. Some had good retention from Year 9 and were ready to move on quickly while others had to start from basic ideas. She felt that she hadn't coped with this range of prior knowledge well and had been teaching to the middle losing the top and the bottom of the class in the process. Jamie felt pressured by the amount of content to cover in a limited time. How could she teach all this content with understanding to the less able in only three lessons especially as 10F has two of their four maths periods each week in the afternoon and Year 10 assembly usually cuts into their Friday class time.

Figure 2. Excerpt from Case: How to teach an integer topic at Year 10?

Method

The class involved in this study were undertaking the secondary diploma mathematics curriculum course, the pre-requisite for which is at least one second year university mathematics degree paper. All student teachers in the programme are required to study at least two teaching curriculum subjects, and mathematics was a support subject rather than their main teaching subject for some of the class. Approximately half of the class lacked confidence in aspects of their personal content knowledge of secondary school mathematics. Class ages ranged from early 20's to early 50's with about half of the class being new university graduates. The mature student teachers had a range of parenting and career experiences, with several having used mathematics in their professions. All student teachers intended to teach in 2005, with eight seeking positions in secondary mathematics. Four student teachers had already been appointed.

The usual classroom environment for the pre-service class was open and collaborative. A teaching agenda for each session was pre-determined but was generally sufficiently flexible for the student teachers to bring their own issues and experiences to be examined by the class, an encouraged practice. The lecturer's philosophy of mathematics teaching and learning was shared throughout the course but student teachers were encouraged to advocate for other approaches as they developed their own working philosophy of teaching.

Data regarding student teachers' perceptions of the effectiveness of the case and of case method were gathered by way of anonymous questionnaires immediately following the case discussion. Student teachers were asked to indicate on continuum lines from 0 to 7 the extent of their agreement with a range of statements. For each they were invited to elaborate. Thirteen questionnaires were collected.

The lecturer made a written reflective statements following the use of case and the analysis of the data.

Student teachers' out of class preparation time was dominated by final assessments in the weeks immediately prior to the use of the case. The completion of these assignments had informally signalled the end of the course resulting in student teachers giving less than their usual attention and effort to out of class tasks at the time the case was used. This was likely to limit the attention student teachers gave to the case method task and the depth of discussion. The effect of the timing of using the case therefore may limit the findings of this study.

Further limitations include that the data was largely from student teachers' stated beliefs about their learning. Use of questionnaires alone does not allow for checking the validity of these statements. For greater confidence in results a more formal study including a range of ways of measuring the effectiveness of case method would be necessary.

Results

There was general positive feedback from both the student teachers and the lecturer for the aspects of case method about which they were questioned.

All but one of the student teachers felt that the case helped them consider strategies for meeting the learning needs of the range of students in mixed ability junior classes. In general student teachers felt that the case helped them to understand and explore the issues and dilemmas occurring in junior secondary school mathematics programmes. They commented that case method facilitated this by drawing from and presenting a real situation. Their comments show that the case was successful in portraying the complexities of teaching.

> [The case] helped me get a better idea of reality in a maths class and develop ideas for when I will be in a similar situation. It is more useful to problem solve using cases as they are closer to reality so more would be great to look at in class.
>
> I think Jamie sounds like what I would expect from a typical 1st year teacher, therefore the information wasn't new to me but it did help me to think about some [teaching] strategies.
>
> Good because it was 'real life' but didn't seem to get to any conclusions. Maybe other cases would do this.
>
> It is excellent to see real life problems, especially from someone that is a recent graduate working in [our district] and facing a problem that we all can visualise happening to us!
>
> Too many issues in the case – it would be useful to have focus questions on one area only.
>
> The class/group discussion is a way to clarify your own thoughts on a particular issue.

Twelve of the thirteen student teachers felt that case method was useful in preparing them to become mathematics teachers. Their feedback included statements regarding:

planning, searching for resources, addressing the needs of individuals in mixed ability classes, and updating curriculum content knowledge.

> …it did make me think about how I would teach negative numbers and considering how negative numbers are used in particular jobs.
>
> It made me go and look for ways to introduce this topic to junior students at various levels.
>
> It applies the information we have been taught and gets you thinking about how you would approach your lesson. Very useful.
>
> I never saw the link across subjects until now. I don't teach to the middle in PE, same needs to be done by me in maths.
>
> It helps update the curriculum content knowledge appropriate to the students' level, that you could use in class.

Several student teachers commented that through reading and discussing the case they felt reassured that they are not alone in facing classroom dilemmas such as those presented in the case.

> I feel I'm not able to say whether I completely understand all the issues but I have certainly seen some of the things Jamie mentioned in the classroom. I believe the issues that Jamie faced are relevant at both junior and senior levels of the school. It is good to talk about these issues in class and get some ideas or feedback from others who have been in the same boat. This case helped me consider strategies for motivating students in junior mixed ability classes.
>
> It is good in that it enabled me to see different people's solutions to problems. I came across this issue and it is nice to see that I am not the only one.

All but one of the student teachers felt that it would have been useful to study more cases in the maths education course.

> Be nice to get a variation of cases from pretty 'smooth sailing' to extreme.
>
> Could be studies with actual teachers coming to college to discuss their problems. Investigating case studies via literature only is less effective.

Comments from the lecturer following use of the case included:

> The discussion between peers in class was successful in showing that there are multiple ways in which to approach Jamie's dilemmas, and that the proffered approaches are tentative pathways.

The lecturer of the class stated that the most powerful statements from the questionnaire responses from his perspective were the comments that emphasised that case method gave the student teachers opportunities to discuss teaching in demanding classroom environments, an aspect he had felt was well covered within the previous class programme. In written reflective comments following analysis of the questionnaire responses, the lecturer stated:

> This has caused me to start examining my practice. I wonder if our classroom discussions about such situations had been too shallow in the past. Perhaps, a culture of 'expert' had arisen in the classroom where the confident and capable student teachers had supplied strategies for dealing with some situations which had made some of the other student teachers reticent to bring such situations up for analysis, and had in fact left them feeling more powerless.

Analysis

There was strong support for more use of case method within the course. Student teachers' comments indicated a range of reactions to the use of Jamie's case. While many found that the scenario gave them enough detail to be meaningfully engaged in the complexity of planning, some responded that the detail of the case made it too hard to identify the salient aspects. In contrast one student wanted further detail of the case study teacher's actions and of how successful her strategies had been.

Most student teachers found the case useful for glimpsing the reality of the classroom in the initial years of teaching. The most common recommendation from student teachers was to work on cases earlier in the course, in particular before the final teaching practice. They suggested that such timing would have provided useful preparation for the complexities of the classrooms they would face on the final teaching practice.

Two student teachers suggested that the issues would be usefully supplemented by bringing mathematics teachers into the class sessions to discuss the dilemmas and difficulties in their own practice. While this possibility could be pursued, we believe that many teachers would not speak as openly as the interviewed teacher about such difficulties in a pre-service classroom situation, a view she supports. Our feeling is that case method allows the lecturer more control in guiding the issues to be presented. Further there are financial and logistical considerations involved in inviting teachers to tell their stories on site.

Discussion and Conclusion

The pilot study results indicate that case method can be successful in engaging student teachers in considering classroom dilemmas and that student teachers found it an effective tool in their development towards being mathematics teachers. The feedback and reflection about this case study has encouraged us to continue developing cases.

Responding to the findings of this paper we intend to develop cases which cover a range of issues and levels of complexity and to continue to explore their effectiveness in this and other pre and in-service mathematics education courses. This will enable us to introduce simpler cases early in the programme building towards cases of greater complexity. Anecdotal reports from colleagues indicate that case method also holds opportunities for learning about teaching in other curriculum areas.

Working with authentic, unresolved problems required the student teachers to face dilemmas that they may well encounter in their teaching careers. We feel that the lack of 'expert' or 'best solution' is an important aspect of case method as it helps develop the reality that teaching generates issues that may have no complete solution. This helps show that as teachers we have to move situations on by ensuring we are making informed decisions and taking what appears at the time to be the best approach.

The formality of case method in contrast to discussion of anecdotal stories provides greater opportunities for student teachers to return to the specifics of the case as they develop and refine their planning and discuss case themes.

Our findings are consistent with authors who support case method (Erskine, Leenders & Maufette-Leenders, 2003; Barnes, Christensen & Hansen 1994; McAninch, 1995; Wasserman, 1994). We have found that cases have the potential to enable student teachers to grapple with the tensions of real classroom issues in a comparatively safe environment. This allows student teachers to develop the skills for dealing with dilemmas, to recognise

that there are multiple pathways to moving situations forward, and to recognise that 'advice' given by others while often received as authoritative, may be both contestable and tentative. Scrutinising, evaluating, and choosing whether to implement such 'advice' remains the responsibility of the person managing the lesson (Hughes, personal communication, 2005).

Further study is required to investigate the extent to which skills learned through case method are transferred to the student teachers' own teaching. Other questions raised by this study include investigation into which aspects of pre and in-service education are best suited to exploration through case method, how cases can be written to maximise their effectiveness, and whether there is an optimal balance between the teacher story and theoretical perspectives within the case. We recommend the use of case method as worthy of investigation by other pre-service and in-service mathematics educators.

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