

My Struggle with Maths May Not Have Been a Lonely One: Bibliotherapy in a Teacher Education Number Theory Unit

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Bibliotherapy provides a new approach to eliciting and understanding the affective responses of pre-service primary teachers. This paper further explores bibliotherapy as a reflective tool in teacher education by analysing affective responses of pre-service primary teachers studying an elective number theory unit. Pre-service teachers voluntarily wrote responses to readings about school students' learning, discussed their understanding of their own experiences in the light of the readings, and identified readings that impacted most on them. The paper describes the responses using the five stages of the bibliotherapy and identifies some factors which affect levels of engagement with the process.

We read to know
we are not alone

C S Lewis (in Attenborough, 1993)

Introduction

Bibliotherapy is a technique that was developed in psychology and library science. It aims to use guided reading and discussion to assist individuals to overcome negative emotions related to their real-life problems. Hendricks, Hendricks, and Cochran (1999) trace the development of the process and discusses its applications. Bibliotherapy has been used in preparing pre-service teachers to teach students with emotional and behavioural disorders (Marlowe & Maycock, 2000) and students with special needs (Morawski, 1997) by encouraging pre-service teachers to identify with the teachers in the readings. Bibliotherapy has also been used to help secondary students overcome mathematics anxiety (Furner & Duffy 2002; Hebert & Furner, 1997). Taken together, these studies suggest that bibliotherapy has potential as a technique to address mathematics anxiety in pre-service primary teachers.

Previous research of pre-service teachers in a unit focusing on mathematics and learning difficulties (Wilson & Thornton, 2005; 2006) suggested bibliotherapy as a promising new tool for eliciting and understanding pre-service teachers' affective responses and providing a framework and language for educators to understand and communicate about the reflective process. In that research, pre-service teachers reflected on their perception of themselves as learners of mathematics, identifying with students in case studies and re-evaluating their own experiences, developing a more positive self-image as learners of mathematics and gaining insight into how children's anxiety about mathematics can be minimised (Wilson & Thornton, 2005). These reflections had a dual nature, showing both affective and cognitive elements.

Not all pre-service teachers have the opportunity to participate in a unit focusing on students' learning difficulties in mathematics. This study extends the conversations about the use of bibliotherapy in mathematics teacher education by exploring its use in a unit that had a mathematics content focus, in this case an elective number theory unit. It describes a pilot study of the responses of students to the bibliotherapy process in the context of a unit

where the readings were not part of the unit content nor set as an assessment task. A smaller selection of the readings from the previous study (Wilson & Thornton, 2006) was used, and a modified process of writing about a critical incident, followed by weekly reflections, was followed. This study will be used to inform further research investigating how bibliotherapy might be used during mathematics units for pre-service teachers to examine their attitudes towards themselves as learners and teachers of mathematics.

Theoretical Framework

The theoretical framework is based on research on three components: bibliotherapy; pre-service teachers' beliefs, attitudes and emotions; and mathematics anxiety.

Bibliotherapy

Bibliotherapy can be defined as “the guided reading of written materials in gaining understanding or solving problems relevant to a person’s therapeutic needs” (Riordan & Wilson, 1989, p. 506, quoted in Miracle, 1995). It is a technique that aims to assist individuals to overcome negative emotions related to their real-life problem by guided reading about another person’s problem. The readers identify with the protagonist in the story, but feel safe because they are not the one experiencing the crisis. Readers interpret through the lens of their own experiences. Reading is followed by discussion in a non-threatening environment (Aiex, 1996).

Clinical bibliotherapy involves a therapist working with individuals with serious emotional or behavioural problems. Developmental bibliotherapy, as in this study, is used to refer to the use of guided reading with students (Hebert & Furner, 1997, p. 170).

The stages of bibliotherapy can be summarised as:

identification - the reader identifies with and relates to the protagonist.

catharsis - the reader becomes emotionally involved and releases pent-up emotions.

insight - the reader learns through the experiences of the character and becomes aware that their problems might also be addressed or solved.

universalization – the recognition that we are not alone in having these problems, we “are in this together” (Slavson, 1950, quoted in Hebert & Furner, 1997, p. 170).

projection – the reader can envisage having a different concept of their professional identity.

Wilson and Thornton (in press) identified this fifth stage in their study of pre-service teachers, and describe it in terms of the literature on projective identity (2007). The process of bibliotherapy “requires a meaningful follow-up discussion” (Hebert & Furner, 1997, p. 169). Participants become involved in discussions and follow-up activities such as journal writing (Flores & Brittain, 2003).

Pre-service Teachers' Beliefs, Attitudes and Emotions

Thompson’s (1992) review into affective elements of mathematics education concluded that teachers’ beliefs limit their openness to change. In addition, Pajares (1992) noted that pre-service teacher beliefs about mathematics and mathematics teaching are established as a result of their own school experiences, and resist change. He used the metaphor for pre-service teachers as “insiders in a strange land”. Unlike medical or law students, they enter a familiar environment and thus changing their conceptions of teaching can be particularly difficult. Buerk (1982, p.19), identified students who believed that “mathematics is only a collection of correct answers and proper methods”, and whose views about mathematics

knowledge conflicted with their general view of knowledge, and suggested that identifying and overcoming the disparity may address their negative feelings about mathematics. In a similar study, Seaman, Szydlik, Szydlik, and Beam (2005) identified contradictions in pre-service teachers' beliefs about the nature of mathematical behaviour that persisted throughout their program, and concluded that teacher education programs should encourage students to reflect on their existing beliefs. Borasi (1990, p. 179) emphasised the importance of students identifying their beliefs. Beliefs have both a cognitive and an affective aspect (Grootenboer, 2006). A significant number of primary school teachers identified their school experiences as a factor in their beliefs about mathematics (Carroll, 2005).

A number of studies have reported on the benefits of reflection in pre-service teacher education courses. Mathematical autobiographies have been used to encourage reflection by pre-service teachers (Ellsworth & Buss, 2000; Sliva & Roddick, 2001). Flores and Brittain (2003, p. 112) describe the use of writing “as a tool to help pre-service teachers reflect on their growth as they learn to teach mathematics”. Ambrose (2004) states that reflection alone may not change pre-service teachers' belief systems and describes mechanisms that have potential for changing beliefs: providing emotion-packed, vivid experiences; becoming immersed in a community; reflecting on beliefs; and developing attitudes that help connect beliefs. Taken together, these studies provide a compelling case for focusing on pre-service teachers' perceptions of their own mathematics learning as an important strategy in addressing their attitudes about teaching mathematics.

Mathematics Anxiety

Mathematics anxiety has been identified as a learning difficulty for many children (Dossel, 1993). In addition, Hembree (1990) found that the level of mathematics anxiety of pre-service elementary teachers was the highest of any major on university campuses. Trujillo and Hadfield (1999) discussed the roots of mathematics anxiety in American pre-service primary teachers. Similarly, Haylock (2001) presented further evidence that many pre-service primary or early childhood teachers have anxiety about mathematics.

Research into primary teachers' effectiveness has emphasised deep and connected knowledge and a positive view of themselves as learners of mathematics (Askew, Brown, Rhodes, Johnson, & Wiliam, 1997; Ma, 1999), suggesting that pre-service teachers' mathematics anxiety is detrimental to their ability to teach mathematics effectively. As Wolodko, Willson, and Johnson (2003, p. 224) state:

Our challenge is to help preservice teachers confront their past experiences and anxieties about teaching and learning of mathematics. If these are openly dealt with during their university education, fewer teachers may be content to teach just as they have been taught.

Recent studies of pre-service teachers with high levels of mathematics anxiety have shown low confidence levels to teach elementary mathematics (Bursal & Paznokas, 2006) and low mathematics teacher efficacy (Swars, Daane, & Giesen, 2006). The latter study concluded that “results of the interviews in this study seem to suggest that preservice teachers need experiences within mathematics methods courses which address their past experiences with mathematics” (p. 311).

Research investigating how university study might address this anxiety has focused on teaching mathematics to develop deeper knowledge (Chick, 2002) or on the impact of studying mathematics teaching strategies on pre-service teachers' beliefs and attitudes

(Frid, 2000). Wilson and Thornton (2005; 2006) concluded that enhancing pre-service self-image as learners and practitioners of mathematics using the bibliotherapy process may help them see mathematics as making connections and to encourage the view that all students can learn mathematics (Australian Association of Mathematics Teachers, 2002) as well as help them address their own mathematics anxiety.

Methodology

Research Context

The setting for this study was an elective number theory unit, at an Australian urban university in 2006. The unit explored aspects of number theory such as the historical development of the idea of number and number patterns. In addition, pre-service teachers wrote reflections on and discussed research papers that reported how school children feel about mathematics and about themselves as they learn mathematics and gave a broad overview of the difficulties that primary school students have in learning mathematics. The research papers included readings about mathematics anxiety (Dossel, 1993), understanding in mathematics (Skemp, 1976), how children learn mathematics, multiple approaches to learning mathematics, and children's beliefs about mathematics. The readings considered psychological and sociocultural aspects of learning mathematics, addressing both the affective and the cognitive domain. Readings were chosen for their potential to invoke an emotional response in the reader.

Data Sources and Collection Methods

In the first workshop, pre-service teachers were asked to describe a critical incident in their school mathematics education that impacted on their image of themselves as learners of mathematics. During the semester pre-service teachers wrote guided reflections on eight readings and wrote two in-class reflections, discussing these and their personal observations from schools. Suggested prompts such as: "What did you learn that was new?", "Something I disagreed with", "Something that surprised me", and "Something that confirmed what I thought", were used by some students while others wrote open-ended reflections. Pre-service teachers voluntarily agreed to participate in the study and chose which of the reflections they would complete. The students were aware that reflections submitted for the pilot study were not part of the content of the unit or its assessment, but had discussed the rationale for completing the readings as a valuable contribution to their professional learning.

Research Sample

The research sample for this study was a class of eleven (seven female and four male) pre-service primary teachers. The students were either in the second year of a four year education degree or the first year of a two year graduate entry education degree and hence differed in the amount of professional experience that they had completed. All had studied or were currently completing a unit focused on mathematical content. All 11 pre-service teachers agreed to participate in the study.

Data Analysis Methods

When the unit was completed, the critical incidents and journals were analysed for evidence of the stages of bibliotherapy. The quotations in this paper have been selected to provide an insight into the thinking of those who identified strongly with the readings, rather than as a representative sample from all pre-service teachers. This paper focuses on the extent that the bibliotherapy process was taken up by pre-service teachers in this context. Fictitious female names were assigned to all students to preserve anonymity.

Results and Discussion

Critical Incidents

The critical incidents indicated the pre-service teachers' initial feelings. As might be expected from a group of pre-service teachers who had chosen a mathematics elective, most (seven of the eleven) reported positive experiences of mathematics. Faith expressed it thus, "I am a huge maths lover". In the description of the critical incident several mentioned the positive and lasting influence that an individual teacher had on their attitude towards mathematics.

Hilary professed positive attitudes, "At a basic level, I love maths. I love that there is an absolute right or wrong answer" but then described her reactions to her year 11 experiences, "I didn't understand and everything began to move away too quickly. I questioned and questioned but still couldn't come to an understanding, so I quit." This avoidance exemplified the coping mechanisms that some pre-service teachers use in situations that they find stressful (Sliva & Roddick, 2001) and is similar to the pre-service teachers whose written critical incidents reflections highlighted a cycle of fear, failure and avoidance reported in previous research (Wilson & Thornton, 2005).

Four pre-service teachers who expressed disquiet about their mathematical experiences at school reported struggling with a lack of understanding. "We never understood what the formulas were or why they worked" (Joyce). "If I did finally work out how, as soon as the question changed slightly, I wouldn't be able to do them" (Christine).

Journal Reflections

All participants submitted the critical incident and at least one of the in-class reflections. All except one person submitted reflections on at least one of the eight articles, with almost half the class submitting reflections on four or more articles. The two pre-service teachers who identified themselves as having more issues with anxiety submitted the most reflections. In the first half of the semester more than half the class submitted reflections, with numbers diminishing towards the end of the semester. The researcher attempted to gauge which readings had the most impact by asking students to select three of the readings that had resonated most with them for the final in-class reflection. All participants except one chose the Dossel (1993) article about mathematics anxiety, even though it was some ten weeks since they had written the reflection on this article.

Using readings to clarify pre-service teachers' understanding of their own learning was central to the bibliotherapy technique. An important part of the pre-service teachers' reflections revolved around the view of mathematics that they had developed during their schooling. I "was able to retain the formula, and put the correct variable in it but I did not

really understand the concept” (Debbie). These views are consistent with those reported in the research literature. Taylor (2003, p. 333) investigated the common misconception among United States students “about the nature of mathematics as being built on remembered procedures”. The study presented an alternate conception of the nature of mathematics as making connections.

Although the commitment to doing the weekly writing seemed to vary inversely with the pre-service teachers’ perceptions of themselves as mathematics learners, most described the experience as useful, although one student expressed some disquiet about taking time from the unit to discuss the readings in the anonymous student evaluations. Two students responded to the readings by undertaking further research on mathematics anxiety for assessment tasks in other units that did not have a curriculum focus. One chose it as the topic for an assignment for another unit and the second convinced the two team members in her group to use mathematics anxiety as the focus of their group presentation. One of the members of the class for this presentation described the panic she felt when suddenly presented with questions about mathematics in a context where she was not expecting them.

The journal entries provided evidence that some students had shown an emotional response to the readings, had reflected on their own experiences and had engaged in the stages of bibliotherapy.

Identification. The pre-service teachers’ reflections showed that they identified with the character (in this case the students in the articles) and the situation in which they found themselves. “I have struggled with maths anxiety without being aware that I had it” (Debbie). The use of bibliotherapy encouraged pre-service teachers to reflect on themselves as learners of mathematics: “I have connected with the articles as a learner of maths too” (Bev).

Catharsis. Through their reading of the articles the pre-service teachers became emotionally involved and released pent-up emotion. “As soon as new maths concepts were presented I would get very panicky” (Debbie). Joyce felt the article (Dossel, 1993) confirmed a lot of her own experiences of high school, “Can anyone blame a girl for wanting to stick to what they feel they can cope with – rather than risking the humiliation of tackling the unknown connections between big ideas” and included a quotation attributed to Edward E. David Jr “mathematics courses are chiefly designed to winnow out the weak and grind down the ungifted”. These students responded emotionally and connected with the readings.

Insight. Through their readings and discussion the pre-service teachers gained a different perspective from the experiences of others and became aware that their problems might also be addressed. “I had never heard of maths anxiety prior to this. It pieced many pieces together in this puzzle of mine” (Faith). “I have taken in as a learner that it is ok to get an answer that is different from everyone else” (Bev). Difficulties from school were because “the teacher hadn’t explained in the class in a way that I understood, or was relevant to me” (Christine). Realising this was a valuable part of the process.

Universalisation. Reflecting on the readings and sharing of their experiences pre-service teachers were able to connect with each other and find that they were not alone in their feelings and experiences. Stories show that others have the same issues and one is not alone (Rizza, 1997). Joyce wrote: “I can see evidence of ‘maths anxiety’ every time I tell

someone I am doing a subject called number theory”. Debbie saw the process as incomplete, “I still feel that I have maths anxiety and it would take a while before I can overcome these feelings.”

Projection. Their reflection on their own circumstances was followed by a consideration of what it could mean for the future and the implications of their insights for their teaching. “Reading about maths anxiety made me reflect on my own experiences as a child. It also made me think towards the future” (Alison). These pre-service teachers questioned not only the views that they had developed of themselves as learners of mathematics, but also the image that they had previously held of themselves as teachers of mathematics.

Bibliotherapy addresses Ambrose’s (2004) criteria for mechanisms that have potential for changing beliefs, as it provides emotion-packed, vivid experiences, encourages pre-service teachers to become immersed in a reflective community, and connects beliefs and emotions. Pre-service teachers are thus able to modify their self-concept as “insiders” as identified by Pajares (1992) and re-image themselves as teachers who do not only teach “just as they have been taught” (Wolodko et al., 2003). This has important implications for developing pre-service teachers’ ability to write reflectively. Askew, Brown, Rhodes, Johnson, and Wiliam (1997) found evidence that teachers’ perceptions of mathematics and how it is learned were more important in promoting positive outcomes for students than different teaching methods or ways of organising classrooms.

Conclusion and Implications

The juxtaposition of bibliotherapy with mathematics teacher education units has proved to be a powerful strategy to address mathematics anxiety in pre-service teachers. Although teaching mathematics units well to pre-service primary teachers is important in their teacher education, a focus on learning (or learned) difficulties is necessary to address some of the anxiety felt. The strength of the bibliotherapy technique is that the identification, catharsis, insight, universalisation, and projection allow the pre-service teachers to reflect more coherently on their beliefs about mathematics learning and teaching. The special feature of the bibliotherapy approach of eliciting pre-service teacher reflections stems from its ability to call forth cognitive responses paralleled by emotional responses. In comparison to other reflective practices, the potential of bibliotherapy lies in opportunity to change the way pre-service teachers feel. The unique feature of using bibliotherapy to address mathematics anxiety is that, unlike other studies where pre-service teachers identify with teachers in the readings, the pre-service teachers in this study identify with the students.

This study investigated the extent to which the bibliotherapy process was taken up in a unit where readings were presented to the students as a valuable contribution to their professional learning rather than the content of the unit, and the reflections did not form part of an assessment item. These results and observations have implications for the way the bibliotherapy process could be incorporated into other teacher education courses. It might take more time to go through the final stages of the process in units such as these, although it is important to realise that everyone is unique and there is no schedule for recovery. From the responses of the pre-service teachers, it is apparent that the stages of bibliotherapy are not linear and do not only happen once. Each reading has the potential to

stimulate a new cycle of responses which can be described as identification, catharsis, and universalisation. With each cycle pre-service teachers develop greater insight eventually leading to a robust projection into their future as teachers.

It would be valuable in future research to identify useful articles or readings that impact on the majority of pre-service teachers and to investigate successful ways of integrating bibliotherapy into a range mathematics teacher education courses in ways that benefit all students, not only those who suffer from mathematics anxiety.

The pre-service teachers' comments give voice to the concern that negative learning experiences will not reinforce negative beliefs and feelings about mathematics in the students they will teach and echo the concerns of teacher educators who identify this as an issue. "It is definitely worth the effort to free our students" (Debbie).

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