‘I am really not alone in this anxiety’: Bibliotherapy and Pre-service Primary Teachers’ Self-image as Mathematicians

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In this study bibliotherapy encouraged pre-service teachers to reflect on their school experiences and their views of themselves as learners of mathematics while studying school students’ experiences. Pre-service teachers’ responses to readings on students’ learning problems allowed them to reconstruct their experiences, changing their self-image of themselves as students, and their assessment of their capacity to learn and teach mathematics. Their reflections emphasised the lasting influence of individual teachers, and showed awareness of alternatives to the teaching approaches they experienced.

Research investigating the effect that studying students’ difficulties in learning mathematics, including mathematics anxiety, had on pre-service teachers’ perception of themselves as learners of mathematics hypothesised that these reflections may enable pre-service teachers to re-evaluate their own experiences. This may enable them to develop a more positive self-image as learners of mathematics. In addition, their reflections may also produce a greater insight into how children’s anxiety about mathematics can be minimised by teachers (Wilson & Thornton, 2005). This paper has a different focus. It examines the use of bibliotherapy to assist pre-service teachers to examine their attitudes towards learning mathematics and its potential to enhance their confidence as future teachers of primary school mathematics.

Theoretical Framework

Bibliotherapy

The purpose of the technique of bibliotherapy is to assist individuals to overcome emotional turmoil related to a real-life problem by reading literature on that topic. People address their problems by reading about the situations of a third person, or an animal. It is based on the active, dynamic process of reading, enabling the person to identify with the protagonist in the story, followed by individual or group discussion in a non-threatening environment (Aiex, 1996). 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 Myracle, 1995). Underlying the application of bibliotherapy is the assumption that reading is a dynamic process. The reader is an active participant in the process. People read, bringing their own needs and problems to the reading experience and interpreting the words in the light of their own experiences. Because the situation involves a third person, the reader is able to experience the problem from an objective viewpoint.

The process of bibliotherapy involves three stages: identification, catharsis and insight. The characteristics of these stages are:

identification - the reader identifies with the protagonist

catharsis - the reader becomes emotionally involved and releases pent-up emotions. Tension is released and this is accompanied by an “emotional feeling that lets the

readers know they are not alone in facing their problems" (Herbert & Furner, 1997, p. 168).

insight - the reader becomes aware that their problems might also be addressed or solved.

The reading by itself does not comprise the full process of bibliotherapy. "Successful bibliotherapy requires a meaningful follow-up discussion" (Hebert & Furner, 1997, p. 169). They stress that it is important to become involved in discussions and follow-up activities such as journal writing. From this, the reader can develop self-awareness, an enhanced self-concept and improved personal and social judgement. The technique has been used to help high ability students to overcome mathematics anxiety. "Bibliotherapy is a therapeutic, discussion-generating technique which offers educators appropriate affective strategies for dealing with mathematics anxiety in *secondary* math classrooms so that students achieve success" (Hebert & Furner, 1997, p. 170).

A significant area of research in recent years has been the role of reflection in teacher professional development. Mathematical autobiographies have been used as a tool to encourage reflection by pre-service teachers (Ellsworth & Buss, 2000; Sliva & Roddick, 2001). Bibliotherapy has close links with these reflective practices.

Mathematics Anxiety

The research background to the study involves the factors contributing to anxiety about mathematics and the impact of teachers' images of themselves as mathematicians on teaching practices. Research into the effectiveness of primary teachers of mathematics has emphasised the need for teachers to have a deep and connected knowledge of mathematics and to have a positive view of themselves as learners of mathematics. Askew, Brown, Rhodes, Johnson and Wiliam (1997) found evidence that teachers' own perceptions of mathematics and how it is learned were more important in promoting positive outcomes for students than particular teaching methods or classroom organisational practices. Ma (1999) found that Chinese teachers possessed a deep knowledge which is a function of both mathematical content knowledge and of teachers' views of themselves as learners of mathematics. It seems reasonable to conclude that mathematical anxiety among pre-service teachers must be overcome in order for them to become effective teachers of mathematics.

Mathematics anxiety has been identified as a specific learning difficulty for many children (Dossel, 1993). It is characterised by a feeling that mathematics cannot make sense, a feeling of helplessness, and a lack of control of one's learning. This anxiety has been associated with inappropriate teaching practices, and a belief in the wider society that success in mathematics is determined by ability rather than effort (Stigler & Hiebert, 1992). There is strong evidence that many pre-service primary or early childhood teachers have a fear of mathematics, and see themselves as unable to learn effectively (Haylock, 2001). Hembree's (1990) meta-analysis of research studies found that the level of mathematics anxiety of pre-service elementary teachers was the highest of any major on university campuses. Previous research such as that conducted by Trujillo (1999) has attempted to trace the roots of mathematics anxiety in American pre-service primary teachers. Research investigating how studying subjects at university might impact upon this anxiety has focused on how teaching mathematics has assisted students to develop deeper knowledge (Chick, 2002), or on how studying mathematics teaching strategies impact on pre-service teachers' beliefs and attitudes (Frid, 2000).

Methodology

This study examined pre-service teachers' images of themselves as learners and practitioners of mathematics. It investigated the effect of studying mathematical anxiety and school students' mathematical difficulties on pre-service teachers' understanding of how their own school experiences contributed to their views of their capacity to learn and teach mathematics. The reasoning was that pre-service teachers could potentially identify themselves through the case studies of children. The setting for this study was the unit Mathematics and Learning Difficulties at an urban university involving a class of thirteen (twelve females and one male) pre-service primary teachers. The unit focused specifically on difficulties school-aged children experience in mathematics, as a result of specific learning difficulties and of cultural and attitudinal factors, and examined research papers reporting how school children feel about mathematics and about themselves as they learn mathematics. The unit was not about severe learning difficulties but inclusion and students who struggle in the mainstream classroom.

Readings were chosen to give a broad overview of the difficulties that primary school students have in learning mathematics. They included readings about mathematics anxiety, how children learn mathematics, multiple approaches to learning mathematics, children's beliefs about mathematics and conceptual mediation. They focused on psychological and sociocultural aspects of learning mathematics and included references about the affective and the cognitive domain.

In the first workshop, pre-service teachers were asked to describe a critical incident in their own school mathematics education that impacted on their image of themselves as learners of mathematics. During semester as part of the assessment for the unit, pre-service teachers kept a log for eight weeks of reflections on readings, personal observations in schools and voluntary further reflections from their own schooling. Although these were part of the unit assessment, pre-service teachers chose which reflections were sent for the research project and had the opportunity to send additional reflections for the research only, directly to a third party without the lecturer's knowledge. Reflections submitted for the research were sealed until the unit was finished.

The research design ensured that students could not submit particular reflections purely in order to pass the unit. The design of the study was examined by the university's ethics committee to ensure that results would not be skewed by pre-service teachers wanting to pass the course. Pre-service teachers who had agreed to participate in the research were not identified until the unit had been completed. Thus researchers did not know which pre-service teachers were part of the study until the unit was over. Journals submitted for assessment but not explicitly sent as part of the research were not used. On completion of the unit, the critical incidents and journals were summarised. During the process by which the journals were summarised, three people examined them independently – the lecturer in the unit, a mathematics education lecturer and an experienced researcher who had a background as a primary school teacher. They each identified common themes and highlighted key statements in the texts available, which were reported in Wilson & Thornton (2005).

Pre-service teachers' written critical incidents focused on descriptions of a teacher or a way in which they perceived mathematics was presented as a subject; and their image of themselves as learners of mathematics and the feelings that this invoked. In the descriptions of the critical incidents, several themes emerged. These were the role of the teacher, the cycle of fear, failure and avoidance, the pre-service teachers' perceptions of the nature of mathematics, and their self-image as a learner of mathematics. Pre-service

teachers' retained intense memories of their experiences. They understood the effect that an individual teacher could have on a student, and already at the start of the subject, in the description of the critical incident, some were reflecting on the type of teacher that they aimed to be. Pre-service teachers' were very explicit in describing the impact that they felt their learning experiences would have on their future teaching. The cycle of fear, failure and avoidance reflected the coping mechanisms that some pre-service teachers used in situations which they found stressful. The potential of individual teachers to have a lasting influence was emphasised. The critical incidents provided a snapshot of how pre-service teachers felt when they started the unit (Wilson & Thornton, 2005).

This paper focuses specifically on how the pre-service teachers' journals relate to bibliotherapy. The themes that emerged in the critical incidents were developed more fully in the journal reflections. The themes identified and the quotations are a sample of some of the themes that came out of the research. To validate the conclusions arising from the data, the data were triangulated by using three independent researchers who each identified common themes. The quotations in this paper have been selected to provide a vivid description of the pre-service teachers' comments rather than as a representative sample from all pre-service teachers. Fictitious female names were assigned to all students to preserve anonymity.

Results

Journal Reflections

Using readings to assist pre-service teachers' understanding of their own learning was central to the bibliotherapy technique. The journal entries were evidence that students experienced the three stages of the process.

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. "The article by Steve Dossel (1993) presented issues that I was able to relate to personally. . . I related deeply to the 'unconscious defends itself' statement by Walkerdine, 1985" (Barbara).

Catharsis. Using their reflections 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. Through their reading of the articles the pre-service teachers became emotionally involved and shared and released pent-up emotion. "I experienced the being 'stupid' and 'vague' discussed by Walkerdine through shutting myself off from the pain of a 'competitive classroom' and protecting myself from 'the effect of public failure' Dossel (p. 5)" (Barbara). "Instrumental and relational learning was a bit of a mind blower for me and funnily enough gave me a little more confidence within myself, that it was the way I was taught that has made me mathematically challenged not my actual intelligence"(Felicity). Catharsis also involved the pre-service teachers realising that they are not the only one who has the problem (Aiex, 1996). Stories show that others have the same issues and you are not alone (Rizza, 1997). Felicity wrote: "The biggest thing I think I have learned this week was that I am really not alone in this anxiety there are lots of my peers and children still there with me and I can only hope that at the end of this semester I can turn this around and actually make a difference to another child so that they don't experience what I have."

Insight. Through their readings and discussion the pre-service teachers became aware that their problems might also be addressed or solved. “I believe that this week’s articles have helped me to answer many questions I have had about my own experiences of learning mathematics” (Barbara). Some reflections showed progress in their perceptions of themselves as learner of maths: “The article helped answer many questions I had about my own experiences of learning maths.” (Barbara). In some cases, these included development of a deeper understanding of what it means to learn mathematics such as the pre-service teacher who now perceives her grades from school “as a reflection of my ability to observe and imitate”, not of her mathematics understanding (Odette), and their awareness that there are alternatives to the approaches that they experienced: “Basically I feel a bit cheated – like I got a second rate education” (Jenny).

Their added insight into their own circumstances was followed by a consideration of what this could mean for the future. The pre-service teachers discussed the implications of the readings for themselves as teachers and identified specific strategies that they might adopt in their teaching. Extensive sections of some of the journals were devoted to a consideration of the effects of the readings on their intended teaching practices. The comments about teaching fell into several categories - their views of mathematics itself, characteristics of good teachers of mathematics, and their aim for their own teaching to be substantially different from the way that they were taught. Some of the comments address specific issues such as the need to ensure that their students see purpose and make connections in their mathematics learning. Others show detailed analysis of applications taken from particular readings, and descriptions of learning tools that they intend to incorporate into their classrooms. In several cases during the eight weeks of the journal reflections the focus of the comments moved from discussions of the self as a learner to later comments which focused almost exclusively on aspects of teaching.

An important part of the pre-service teachers’ reflections revolved around the view of mathematics that had developed during their schooling. “This is how I viewed maths, as long as I knew the set of rules and applied them appropriately then I didn’t really need to know why (“relational understanding”, Skemp, 1976, p. 3). To me maths was all about getting the right answer” (Mandy). “The mathematics that I learnt during high school seemed to remain in my memory from Monday (when a new topic was introduced) until Friday (the day of the test). Thus I do not feel I was provided with the opportunity to construct knowledge of mathematics” (Odette). These views are consistent with those reported in the research literature. Taylor (2003, p. 333) investigated the common misperception among US students “about the nature of mathematics as being built on remembered procedures.” Buerk (1982, p. 19) associated the “dualistic perception of mathematical knowledge” and discomfort which comes with it with the development of the “math avoidant” student. The study presented alternate conceptions of the nature of mathematics which influenced the way the pre-service teachers regarded their potential as teachers of mathematics.

One group of comments talked about the reassurance that pre-service teachers felt when faced with research that concluded that the best teachers were not always those who had performed best in mathematics at school: “It gives me great comfort to know that although I may not graduate at the top of the mathematics class, this will have no lasting bearing on my ability to teach it” (Jenny). They felt that as a result of their experiences in this unit they would be able to teach students who were experiencing difficulties successfully. “This subject has given me awareness that while a lot of students may be experiencing difficulty in maths, there are many resources available to assist. The most

important thing is to take positive action and not just assume that the student is ‘not good’ at maths" (Cathy).

Discussion

The identification, catharsis and insight developed through bibliotherapy convinced the pre-service teachers of the need to achieve positive attitudes in their classrooms. The importance of attitudes in the classroom is emphasised in the literature. “*Positive attitudes* not only enhance the quality of learning, but also the degree to which learning and understanding become embedded in the real-life experiences of the individual” (Carnellor, 2004, p. 5). The pre-service teachers’ comments reflected a determination that negative learning experiences would not be transferred to their students and continue a cycle of negative attitudes, beliefs and feelings about mathematics:

> This also leads me to my second thought that, for those teachers, who like me, have never believed maths to be their “thing”, there is the distinct possibility that our desire not to let students suffer our fate and to improve on our own childhood experiences in classrooms could well be the factor that makes us the more effective teachers. We are more open to the need for reflective teaching and professional development, and more willing to look for alternate explanations and examples. (Jenny)

The pre-service teachers reflected on the way that mathematics was presented to them in the classroom.

> I recall that during my primary school years that rote learning was a major emphasis in mathematics teaching. I felt alienated by the process and understood it to be something we did to keep the teacher ‘happy’. The purpose of this learning was never made explicit, perhaps if it had been I would have understood the relevance of this to my mathematical education and life beyond school (Barbara).

Their strong feelings as a result of the teaching styles to which they had been subjected impact on their goals as teachers, and their determination not to repeat the process with their own students. “There is no place for the methods of my past in classrooms of today if I wish to stop the cyclical nature of instrumental mathematics teaching experienced to date” (Barbara).

Conclusion and Implications

An obvious direction for future studies is to research the teaching practices of these pre-service teachers in the future to ascertain whether there is a disparity between their stated beliefs and their practices in the classroom. Despite their goals, there is the possibility that once in the classroom they will teach as they were taught. “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” (Wolodko,Willson & Johnson, 2003, p. 224).

Bibliotherapy using articles which focused on the factors impacting on school students’ mathematical difficulties developed pre-service teachers’ understanding of their own school experiences and their views of themselves as learners of mathematics, and brought about changes in their self-image of themselves as students and assessment of their capacity to learn and teach mathematics. Their reflective writing illustrated elements of the three stages of the bibliotherapy process. The potential of individual teachers to have a lasting influence, and the students’ awareness that there are alternatives to the approaches that they experienced, were emphasised in their comments.

Clearly such a study, conducted over a short time in a university environment, cannot reliably predict how these pre-service teachers might convey their feelings about mathematics to students, nor can it predict how they will actually teach mathematics in the classroom. Thus, follow-up longitudinal workplace-based studies investigating the link between mathematical anxiety of pre-service teachers and their effectiveness as teachers of mathematics to young children will be an important element of further research in the area.

Teaching mathematics well, in an engaging way, to pre-service primary teachers is clearly a key aspect of their teacher education. However, an explicit focus on learning difficulties may well prove a powerful additional element in addressing some of the well-documented anxiety felt by many pre-service primary teachers. Future research could also investigate the application of the techniques used in the study, such as critical incident analysis and bibliotherapy through guided reading and journal writing, to investigate their potential to combat mathematics anxiety in primary and high school students.

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