Seventies, eighties, nineties, noughties.... a sequence of concerns

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Abstract

This paper outlines small scale research regarding mathematics anxiety and potential links to confidence and mathematics subject knowledge for primary teacher education (QTS) students in a HE institution, where the author is a Senior Lecturer in Primary Mathematics Education.

The purpose is to establish the existence of such anxiety and related concerns, to determine implications for students' achievement of government standards for the award of QTS.

Investigation is carried out through review of theory and consideration of questions subsequently arising, linked to collection of qualitative data from an interview with a QTS student, and analysis via an interpretivist approach.

Introduction

Small scale qualitative research is used to investigate the author's concerns arising from practice with students training for qualified teacher status (QTS). These concerns are negative attitudes towards mathematics and a lack of confidence in their mathematics subject knowledge, which could potentially affect their achievement of QTS standards.

Review of literature

In response to concerns about mathematics, the British government set up a Committee of Enquiry in 1978, resulting in the *Cockcroft* Report (1982), which led to the formation of a National Curriculum (NC) for mathematics education in 1989. Standards in primary mathematics have been criticised (Askew, 1998 and Pound, 1999), with concerns continuing into secondary education and beyond (DfES, 2004). In response to a need to raise standards in mathematics education, the National Numeracy Strategy (NNS) and the Primary National Strategy (PNS) were introduced into schools in 1999 and 2003 respectively. Ofsted (2005) claim that these 'have had a significant positive effect' (Ofsted, 2005, p1) but government targets have not been met. They report that 'the subject knowledge of a significant minority of teachers is limited (Ofsted, 2005, p2), affecting the quality of provision for children in that 'weaknesses in teachers' subject knowledge…continue to detract from the quality of teaching' (Ofsted, 2005, p14).

This raises an issue for students since government standards for QTS require that by the end of their training they should have 'the subject knowledge…they need' (DfEE, 2002, page 1) and 'have a secure knowledge and understanding of the subjects they are trained to teach' (DfEE, 2002, p7). Mooney and Fletcher (2003) state that 'a secure subject knowledge and understanding of mathematics is now widely acknowledged as a critical factor at every point in the complex process of planning, teaching and assessing mathematics itself' (2003, p1).

Alongside subject knowledge and understanding is the affective consideration of attitude, including confidence, since QTS standards specify that students 'be confident …in the subjects they teach' (DfES, 2002, p2), and state that 'teachers can and do make huge differences to children's lives…indirectly through their…attitudes' (DfES, 2002, p2). It is suggested by Mooney and Fletcher (2003) that a positive attitude towards mathematics will help student teachers to teach it well; yet adults frequently talk of their dislike of mathematics, an observation shared by Buxton (1981). In his research, terms such as 'fog, bewilderment, panic, irritation, frustration,

terror and anxiety' arose frequently in people's descriptions of their mathematical experiences, which in turn affected their ability to engage in mathematical activity. Kennedy and Tipps (1990) identify an anxiety regarding mathematics, experienced by some, that involves a negative, emotional reaction so strong that it can be described as fear which can affect students learning mathematics (Alsup, 2005; Tobias, 1978).

Anxiety about mathematics is recognised in adult learners by Archambeault (1993). Indeed, Buxton (1981) found such feelings of anxiety and inadequacy were common amongst British adults, which appears to remain prevalent in recent years since Haylock's (2003) findings indicate that 'many adults, in relation to mathematical tasks, admit to feelings of anxiety, helplessness, fear, dislike and even guilt' (Haylock, 2003, p2). Within HE in Britain, MacKenzie (2002) reports 'a history of low confidence and negative attitudes to learning about numbers and 'maths anxiety' in undergraduates.' Research identifies that this attitude can be shared by teachers (Briggs, 1993). Winteridge (1989) claimed that 'many primary school teachers lack confidence in their mathematical abilities' (Winteridge, 1989, p5) and the Times Educational Supplement (2000) reported trainee teachers being 'terrified' of mathematics. Haylock (2003) identifies that many students begin their QTS course 'with a high degree of anxiety about having to teach mathematics' (Haylock, 2003, p2).

Methodology

Research stemmed from initial concerns regarding QTS students experiencing a lack of confidence in mathematics, and a review of literature was carried out in order to understand this context. It is recognised that results would be more accurate if a wider theory base was used, but the review fitted the purpose of identifying the research problem. The focus question arising from the literature review was

> *If HE students experience mathematics anxiety, what are the implications for achievement of QTS standards for primary teaching?*

The intention was to link existing theory to the current position within the institution. This is a timely study relevant to current concerns outlined by Ofsted (2005) regarding a lack of mathematics confidence and subject knowledge in some primary teachers.

Data collection

Data collection was limited to one interview in order to gain a picture of the QTS student perspective, and to form a pilot for future research. This was a semi-structured interview, using questions arising from the review of literature, but allowing development of answers and open-ended questioning. In terms of objectivity, the researcher endeavoured to remain open-minded, self-reflective and impartial, as suggested by Denscombe (2002). The focus and purpose of the interview was outlined only briefly prior to the interview, and in more detail afterwards, in an attempt to avoid influence of responses.

The focus of the study was open to subjectivity - mathematics being interpreted by different people in different ways and producing constructs of varying levels of confidence. As such, an interpretivist approach was used in analysis. The authority of this study is open to question since the interpretivist method is subject to the perceptions of the researcher, and as such could be criticised as lacking rigour. However, as far as possible, mathematics anxiety and associated confidence and subject knowledge are considered and questions raised regarding how they can be measured.

The interviewee was made aware of the purpose of the research and the assurance of full confidentiality given, with the right to decline to participate fully or in part via choosing not to answer particular questions. Agreement was given regarding use made of the data, as outlined by Bell (1999), and the transcription of the interview was verified by the interviewee prior to analysis.

Such small scale study is restricted in terms of reliability, and the limitations inherent on a single interview are recognised. However, in terms of a pilot study, its purpose is fulfilled. In an attempt at accountability, the data collection, research strategy, method, analysis, and results are reported clearly so that judgements and checks can be made on the procedure and the findings. Authenticity is assured in that the research took place and the data is verifiable.

To increase validity, quantitative as well as qualitative analysis might be carried out, perhaps through testing mathematics anxiety. However, testing itself could potentially be a source of mathematical anxiety in participants, and the data therefore likely to be affected. The qualitative, interpretivist approach was chosen because of the nature of the affective considerations within the study and with more detailed data and a more grounded approach to analysis, the validity could be increased. Validity is strengthened by the determination of the questions asked arising from existing theory.

Data analysis

To gain entry to the QTS course, the interviewee took mathematics GCSE as a mature student with an existing lack of confidence, as reflected in her memories of

I kept thinking, I can't do this

Her responses to learning mathematics as an adult give support to the feelings of anxiety identified by Buxton (1981), Archambeault (1993), Kennedy and Tipps (1990) and Haylock (2003). Her attitude stemmed from her own learning experiences, with feelings towards mathematics similar to those suggested by Buxton (1981). Vocabulary included 'upset, scares me, complicated, oh no, above me, too hard, awful, sick, hot, panic, dread, horrible, really really horrible, really upset' with an obvious distaste for the subject exemplified in her statement

I hated maths, really hated maths in school. I really didn't like it

As indicated by Tobias (1978) and Alsup (2005), the attitude towards mathematics appeared to affect the ability to do it, making it 'far worse.' Her responses suggest that mathematics was learnt in a way that did not lead to understanding. By the beginning of the QTS course, she purports to thinking

I've forgotten it all

Her feelings resonated with MacKenzie's (2002) notion of 'maths anxiety' in undergraduates. Whilst on the course, college requires students to pass an audit determining their level of mathematics subject knowledge. Upon passing that audit, her reaction was

Phew, relief. I don't need to do that anymore

This puts into question a confident level of understanding.

The student considered there to be links between attitudes toward mathematics, level of subject knowledge and confidence in teaching the subject. Haylock's (2003) suggestion of student anxiety about teaching mathematics from the outset of a course was not manifested in the student's responses. However, nearing the end of the course, although confidence in teaching Key Stage 1 was evident, a degree of caution was expressed regarding the teaching of Year 6 and especially gifted and talented children. With regard to Mooney and Fletcher's (2003) suggested link between a positive attitude and an ability to teach mathematics well, this student indicated she had gained in confidence regarding this aspect.

Her own experiences of school mathematics lessons appeared to have strong resonance with her attitude towards mathematics, giving strength to the DfES's (2002, p2) claim that 'teachers can and do make huge differences to children's lives.' Reflections on the way in which she had been taught mathematics herself had led her to make decisions about her own teaching, as indicated by her comment

the way I teach maths is the total opposite of how I was taught when I was young

Teaching styles from her own childhood appeared to involve a set routine to apply to mathematics, and in later life had been taught at too great a speed for her. She indicated a philosophy of determining children's learning styles and providing a range of mathematical strategies that link to those different learning styles. The institution, she claims, has provided her with support for this, having learnt

lots of different ways we can teach children and lots of different resources

The use of which strategies, she feels, has improved her own confidence. She also found the course supportive for her mathematics subject knowledge

especially with the audit

Despite a negative attitude towards mathematics borne of her earlier experiences, she recognises that this is dependent on understanding, suggesting that if one understands the mathematics then it does not prove a difficulty. This attitude supports Mooney and Fletcher's (2003) claim that understanding mathematics is critical for teaching mathematics.

This student's attitude towards mathematics had obviously improved during her QTS experience. Here was a student lacking in confidence at the outset of her course, and, although not entirely confident in teaching older children without prior revision and consolidation of subject matter, was certainly not displaying the fear of teaching mathematics as indicated by Times Educational Supplement (2000) and Briggs (1993).

Conclusion

There have been concerns regarding mathematics education over decades. Some teachers are found to be lacking confidence in mathematics, which can be connected to their levels of mathematics subject knowledge and affected by mathematics anxiety, which is shown to exist in adults, including HE students, and was confirmed by the interviewed student.

Mathematics anxiety is manifested through emotive words used to describe people's feelings towards mathematics, and was evident in the student studied. Reasons for such an attitude towards mathematics appear to originate in her own experience of learning. Attitudes towards mathematics in turn affect her own teaching.

The institution has provided the student with support for teaching mathematics and for subject knowledge, and confidence in mathematics has improved, with indications of some limitations. Government requirements for QTS are difficult to establish without testing and yet there is an indication that the institution's auditing of mathematics subject knowledge has its drawbacks in that once achieved, it is forgotten about, suggesting a lack of lasting mathematics understanding.

In response to the research question, for a student experiencing mathematics anxiety, three main implications for the achievement of QTS are apparent, with suggested recommendations shown in Figure 1.

Figure 1

IMPLICATION FOR QTS ACHIEVEMENT	RECOMMENDATION
Lack of confidence in mathematics can affect learning	HE tutors to be aware and plan to meet needs accordingly
Negative attitudes towards mathematics potentially affect learning	Mathematical learning to be supported in ways which lead to conceptual understanding
Evidence of this institution helping to improve confidence through course	Tutors to identify good practice and build on this e.g. exploration of teaching styles

The intention is to take this pilot study forward into wider research. Despite its current limitations, some implications for the institution in support of QTS students overcoming mathematics anxiety are established, with regard to improving confidence and mathematics subject knowledge through a deeper understanding. However, the government requirements themselves need further consideration in terms of evidence of QTS students meeting standards related to affective considerations such as confidence, the measurement of which is questionable.

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