

'FILLING GAPS' OR 'JUMPING HOOPS': TRAINEE PRIMARY TEACHERS' VIEWS OF A SUBJECT KNOWLEDGE AUDIT IN MATHEMATICS

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Data from one cohort of PGCE trainee primary teachers is used to examine their perceived value of a subject knowledge auditing process in preparation to teach mathematics in primary schools. Questionnaires (n = 96) were used to collect quantitative and qualitative data. Analysis suggests that some trainee teachers see the auditing process as 'filling in gaps' in their subject knowledge, developing their confidence and supporting them in their teaching, whereas other more confident trainee teachers do not see any relevance and may even see the process as 'jumping hoops' to fulfil the requirements of the course.

INTRODUCTION

Subject knowledge has been considered relevant to teacher performance and central to the knowledge required to teach mathematics. Government requirements (DfEE, 1997, DfEE, 1998) stated that teacher-training providers ensure that trainee primary teachers have the knowledge and understanding necessary to teach mathematics effectively and where

gaps in trainee teachers' subject knowledge are identified, ITT providers must make arrangements to ensure that trainee teachers gain that knowledge during the course (DfEE, 1997, p.27).

The recent Qualifying to Teach Standards (TTA, 2003) requires that trainee teachers demonstrate a proficiency in subject knowledge in order to teach mathematics.

Although a wider base of content knowledge related to teaching is recognised, the 'gaps' referred to in government requirements relate to subject matter knowledge and in particular 'substantive knowledge', that is the key facts and concepts (Shulman, 1986). Brown and Smith (1997) examined the links between increased substantive or personal knowledge and the wider knowledge base in the teaching of mathematics. Personal subject knowledge is seen as a key part of the wider knowledge base and an influential aspect of developing teaching through planning and reflection. In this way teachers' personal knowledge of key facts and concepts in mathematics may influence their approach to teaching.

Although it would seem evident that there is a relationship between personal knowledge and the teaching of mathematics, it is not so clear which facts and concepts are relevant to the teaching of primary mathematics. Should these facts and concepts be based solely on the curriculum taught in primary schools or should they demonstrate knowledge from the curriculum beyond the primary phase? The relationship between level of knowledge in mathematics and effectiveness in teaching

primary mathematics does not seem straightforward (Askew et al, 1997). In this institution the subject knowledge audit is based on the list presented in the requirements of 1998 (DfEE, 1998). This list includes several facts and concepts beyond the primary curriculum. Although there are clear progressive links with the primary curriculum it may not be clear to trainee teachers how this knowledge relates to the teaching of primary mathematics.

Research has previously looked at what we as researchers or teacher educators consider as valuable. This study examines one cohort of trainee teacher's perceived value of an auditing process in one institution. In order to determine the 'gaps' the trainee teachers are first asked to carry out online practice audits. They later carry out a final online audit before they undertake their school experience in the summer term.

THE STUDY

Ninety-six primary PGCE trainee teachers returned questionnaires evaluating the use of the subject knowledge audit. Within the cohort there is a mixture of specialisms, including mathematics and early years, and a range of abilities and experiences in mathematics. Questions included in the questionnaire were set out under two areas: how the audit had influenced their confidence in mathematics and how they perceived the relevance of the audit in preparing them to teach primary mathematics. A five-point Likert scale was used to quantify the data. Trainee teachers were also asked to explain why they felt the audit had (or had not) made a difference to their ability to teach primary mathematics.

Data was analysed using SPSS data analysis software. Descriptive analysis of data was carried out to make preliminary investigations of frequencies. The data was found to be suitable for factor analysis and this has been used to investigate perceptions further.

RESULTS AND ANALYSIS

Table 1 shows that just less than half of the trainee teachers felt confident in their mathematical ability but the majority felt that the course had supported them in developing their confidence. A very large majority felt they had sufficient subject knowledge to teach primary mathematics. The audit process is intended to develop subject knowledge but only about half of the trainee teachers felt that their improved confidence had come from this and only about one third of the trainee teachers saw that it had made a difference to their ability to teach primary mathematics.

Table 1: Percentage frequencies showing confidence in mathematics and implications of the audit process for teaching.

	Confident	Neutral	Not confident
How would you rate your confidence in mathematics generally?	46%	42%	12%
	Agreed	Neutral	Disagreed
My confidence in mathematics has improved over the course	79%	15%	6%
The online audit has improved my confidence	49%	35%	16%
Subject knowledge needs to be at least GCSE standard to teach mathematics well in a primary school	66%	23%	11%
My subject knowledge will support my mathematics teaching	90%	9%	1%
The audit process has made a difference to my ability to teach mathematics	35%	40%	25%
The audit process will be of long-term benefit to my teaching	21%	50%	29%

Sixty-four trainee teachers made verbal comments related to the perceived difference the audit had made to their ability to teach. The responses were categorised and ranked by correlating them with the Likert scale response to the statement *The audit process has made a difference to my ability to teach mathematics*. By ranking the statements accordingly a significant relationship (Spearman's Rank Order Correlation Coefficient of .716) was determined.

Using this ranking, the first two categories (Table 2) suggest positive responses (57.8% of the respondents). The comments from these categories may be said to see the value of improved or revised subject knowledge and a perceived relevance of this to their teaching.

I am now much more confident in mathematics and the audits gave me the opportunity to revise some long forgotten and not often used areas of maths.

Made me identify areas to work on and see maths on a large scale.

Categories 3 to 4 (Table 2) may indicate a neutral view of the relevance of the audit. Responses from these categories of comments would suggest that the trainee teachers did not see the audit process as a valid means of assessment or that their existing subject knowledge was beyond that of the audit.

Table 2: Frequencies of ranked verbal responses to "The audit process has made a difference to my ability to teach mathematics".

	Category	Frequency (percent)
1	Larger view of mathematics, knowledge beyond that needed or greater depth recognised as relevant to teaching	6.3
2	Revising/refreshing knowledge and developing confidence in the subject	32.3
3	Audit process was not supportive or was not seen as a valid means of assessment	5.2
4	Existing knowledge of mathematics beyond that of the audit	5.2
5	Does not support/develop teaching skills/knowledge	8.3
6	Immediate revision/preparation more useful	5.2
7	Level of subject knowledge required in audit not seen as relevant to curriculum required to teach.	3.1
8	Meeting university requirements	1.0
No statement made		33.3

Categories 5 to 8 (Table 2) may indicate trainee teachers who did not view the audit as supporting them to teach. These categories suggest a range of reasons that include a lack of recognition of a link between the level of subject knowledge required in the audit and the ability to teach mathematics. Some trainee teachers stated a preference for revising an aspect of mathematics prior to teaching it. Examples of responses are:

I feel there is a difference between mathematical ability and the ability to teach mathematics.

Knowing about the subject does not necessarily mean that I will teach it well.

I felt confident in most areas of maths. Any that I didn't I would revise before teaching the lesson rather than trying to remember everything all the time.

Confidence that I have met the ability the University requires.

Early years maths hardly warrants the necessity for GCSE standards of knowledge!

Having to do linear and simultaneous equations is not helpful to my teaching.

Factor analysis was carried out to investigate the responses further. In carrying out Principle Component Analysis (PCA) two components were selected for further examination. These suggest two groupings. One group felt that the audit had made a

difference to their ability to teach and that the audit would have a long term influence on their teaching. Although this group seemed to support the audit process they did not feel confident and did not feel that their subject knowledge would support their teaching. A second group can be identified as trainee teachers who felt confident generally and felt that their subject knowledge would support their teaching. They did not however feel that the audit would make a difference to their ability to teach.

DISCUSSION

There would appear to be two groups of trainee teachers with differing perceptions of the value of the online subject knowledge audit in this institution. One group of less confident trainee teachers recognised the audit as 'filling gaps' in their subject knowledge. They acknowledged increased confidence and saw a relevance to their teaching. Goulding et al (2002) also found that some trainee teachers welcomed an opportunity to address areas of weakness. However it must be noted that, although the majority of the trainee teachers felt that their confidence had improved over the course, only half felt that the audit played a part in this (Table 1). Evaluations of the PGCE course indicate that many trainee teachers appreciate the practical aspect of workshops and support from tutors in making them feel more confident.

The second group appeared to be characterised by trainee teachers who generally felt confident about mathematics but did not acknowledge the value of the audit process. They may have seen the process as 'jumping hoops' in fulfilling the university requirements. In some instances this may have been due to learning styles as the process of testing was not seen as valid. Various other reasons were given for those who gave a more negative response to the value of the audit. In particular several trainee teachers felt that immediate revision prior to teaching an aspect of mathematics was more beneficial. Some of the trainee teachers who did see the relevance of the audit appreciated a wider view of mathematics. These two responses may suggest differing beliefs in mathematics as a discipline.

In examining trainee teachers' perceptions of an audit process we may also be exploring their attitudes to mathematics. Ernest (1989) proposed that attitude, including confidence and beliefs, might influence approaches to teaching mathematics. Trainee primary teachers' lack of confidence, or even anxiety, in mathematics has long been recognised (Cockcroft, 1982) and it would seem that an anxious teacher would not have a positive approach to teaching mathematics. This study found that slightly less than half of the trainee teachers felt generally confident but it also found that the vast majority felt that their subject knowledge would support them in teaching primary mathematics. Some trainee teachers who do not see that improved confidence and level of subject knowledge can support their ability to teach mathematics at primary level may be revealing a belief in the teaching of mathematics that is limited to the preparation and delivery of discrete topics at an elementary level.

The different responses to the relevance of the audit may not only indicate different learning styles but also different attitudes to mathematics, including confidence and beliefs. The trainee teachers' perceptions can also provide a measure of how well the audit, as part of the course, reflects attitudes to mathematics. Development of the content and process of the audit would hope to see a larger proportion of trainee teachers who see the relevance of subject knowledge to their teaching of primary mathematics.

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