

Mathematics Teachers' Perceptions Of Their Own Professional Development Needs

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Abstract

This paper addresses concerns that current professional development provisions might not be doing enough to help teachers to keep up with the implementation of teaching reforms. The purpose of this study was to gain insights about mathematics teachers' perceptions of their own professional development needs in order to make recommendations about how these needs can best be met. Thirty-five preservice and 84 inservice teachers were asked to rate their current knowledge and their need to know more about 60 specific aspects of teaching mathematics. The relationship of their perceptions to some independent variables, such as gender, level of schooling they taught at and length of teaching experience, was also examined. The results of this project have raised some potential implications for the development of preservice and inservice mathematics education programmes, with the need for more input in the areas of effective computer use and problem solving/promotion of student thinking being the clearest priorities.

Introduction

Recent reforms in mathematics education require teachers to engage in ongoing professional growth through their careers in ways that were unprecedented in the past. Nevertheless, there have been claims that many teachers are simply giving up attempts to grow and reverting to the traditional practices with which they feel the most comfortable (Gregg, 1995). Effective teaching is a difficult art and one that is never fully acquired as new research suggests new approaches that teachers are required to keep abreast with and implement in their practices. In order for them to be able to do this it is necessary to constantly update their knowledge and understanding of teaching and learning styles, knowledge of and success in using strategies themselves, knowledge about how children can learn mathematical concepts, and a belief in the value of what they are doing (Watson, 1986).

The fact that they experience difficulties with implementing reforms points to the need for "carefully designed, sustained professional development opportunities which involve teachers actively in the learning process" (Dass, 1998, p. 3). In fact, the United States National Foundation for Improvement of Education has gone so far as to recommend that teachers need to take charge of their own professional development opportunities if they want to go beyond merely keeping up with changes (Renyi, 1998).

It has been suggested that one of the current weaknesses of many professional development programmes is that they lack this essential ingredient of involving the teacher actively in the growth process or allowing for the developmental needs of the teacher (Butler, 1998). If teacher professional development programmes are to be improved to take into account the developmental needs of the teacher, then research is clearly needed to identify what these needs are. The purpose of this study was to fill in this gap in research about professional development needs, by asking teachers themselves what their needs are in relation to six knowledge domains. Specifically, it aimed to listen to groups of preservice and inservice teachers' expressions of what they believe they currently know and what they need to know more about. To do this, the study drew on previous research about essential teacher knowledge.

There are several kinds of knowledge with which teachers need to be competent. One of these is procedural knowledge, which refers to knowledge of the rules, procedures and symbols needed to complete a task (Eisenhart, Borko, Underhill, Brown, Jones and Agard, 1993; Simon, 1993). A second is conceptual, or content, knowledge which refers to the ability to understand the concept and connect or apply the pieces of knowledge (Leinhardt, 1988; Sullivan, Clarke, Spandel and Wallbridge, 1992 ; Eisenhart et al., 1993; Simon, 1993). For mathematics teachers, this includes ability to make generalisations, describe relationships and demonstrate higher order reasoning skills (Sullivan et al., 1992). In addition, teachers need to be competent with general pedagogical knowledge, that is general knowledge of how to teach, and specific content pedagogical knowledge, that is knowledge of how to teach specific content in their subject area.

Background To The Project

This is a part of a larger project reported by Jegede, Taplin and Chan (1999), which was concerned with mathematics and science teachers in two education institutions in Hong Kong. The results reported here focus just on the mathematics teachers from the original sample.

Jegede et al. (1999) asked preservice and inservice mathematics and science teachers to rate their knowledge about 60 specific aspects of teaching in their specific subject areas, within the categories of:

- Content Knowledge: knowledge and understanding of concepts,
- Procedural Knowledge: ability to follow rules and procedures,
- Pedagogical knowledge: general knowledge of how to teach,
- Pedagogical Content Knowledge: knowledge of how to teach specific content in the subject area,
- Knowledge About Teaching Theories and Their Use, and
- Personal Experiences with Aspects of Teaching.

Each item had two segments: respondents' current knowledge and their desire/need to know more. The two segments of responses to each item were on a 5-point Likert scale based on 5 = "Very Adequate" to 1 = "Very Inadequate" for current knowledge; and 5 = "Very High" to 1 = "Very Low" for need to know more.

The instrument showed a high reliability coefficient of 0.97 and high internal reliability coefficients of above 0.87 for each of the six sections, indicating very high internal consistency. Other characteristics of the instrument which supported its internal consistency include the following: item means ranged from 2.49 (minimum) to 4.13 (maximum), inter-item correlations ranged from -0.30 (minimum) to 0.83 (maximum), and the correlation among the sections of the instrument ranged from 0.37 to 0.81 ($p < 0.01$) for the segment on responses about "current knowledge" of the respondent, and between .35 to .78 ($p < 0.01$) for the segment on the respondent's desire/need to know more.

The main findings reported by Jegede et al. were:

- i) significant differences between what the teachers said they knew and what they needed to know more about, in all of the six sections, and
- ii) significant differences between preservice and inservice teachers in their perception of the adequacy of their current Pedagogical Knowledge; Pedagogical Content Knowledge, and Knowledge of Personal Experiences with Aspects of Teaching; and the need to know more about Procedural Knowledge, Theories of Teaching, and Personal Experiences with Aspects of Teaching section.

The purpose of the analysis reported in this paper was to take the Jegede et al. findings a step further and explore, specifically for the sub-group of mathematics teachers, what the major needs were that they identified.

Sample

A total of 119 preservice and inservice mathematics education students from two institutions of higher education in Hong Kong participated in the study. All the students in the mathematics education programmes at these two institutions formed the population of the study, however participation was voluntary. The sample was made up of 35 preservice and 84 inservice teachers. Thirty-four were male and 85 were female, 104 were specialising in primary school teaching and 15 in secondary. The questionnaire was administered through the tutors who regularly met the various classes during the second semester of 1998.

Results

Specific Items with High or Low Ratings

The mean item ranking was 3.21 on "current knowledge" and 3.89 on "need to know more". Some items have been singled out because they had mean ratings of less than 3 or more than 4. These items are shown in Table 1 ("current knowledge") and Table 2 ("need to know more").

Table 1. Current Knowledge: Items ranked above 4 or below 3

Section	Item	Mean	SD
Content Knowledge	ability to use Internet as a learning resource	2.44	1.09
	ability to use journals as learning resources*	2.88	0.88
Teaching Theories	new theories about teaching and teaching approaches	2.94	0.72
	what assistance is available from curriculum officers*	2.98	0.65

Table 1 (...cont'd)

Section	Item	Mean	SD
	membership of professional organisations*	2.75	0.90
	justifying teaching approaches to parents, fellow teachers, principal etc.*	2.99	0.80
Personal Experiences	use of micro-teaching as preparation for teaching practice*	2.84	0.80
	teaching practice under supervision of an experienced (mentor) teacher	2.93	0.79

*rated "current knowledge" low but did not see it as a priority in "need to know"

Table 2. Need to Know: Items ranked above 4 or below 3

Section	Item	Mean	SD
Content Knowledge	ability to use computers as learning resources	4.01	0.88
	ability to use Internet as a learning resource	4.02	0.84
Pedagogical Knowledge	guiding pupils to develop their own strategies to find answers	4.02	0.78

Table 2 (...cont'd)

Section	Item	Mean	SD
Pedagogical Knowledge	motivating uninterested or anxious pupils to want to learn	4.08	0.73
	asking questions which encourage the pupils to think	4.06	0.88
	skills of classroom management	4.11	0.90
	how to use tools (e.g. computers) to enhance teaching	4.00	0.85
	helping pupils to use their knowledge to solve unfamiliar problems	4.00	0.71
	relating topics to real-world situations	4.05	0.84
	provision of suitable extra challenges for the pupils who finish early	4.02	0.84
Teaching Theories	new theories about teaching and teaching approaches	4.00	0.71
	how to use "new" ideas/current theories in teaching	4.05	0.74

No item in the "current knowledge" section had a mean rating higher than 4, which suggests that none of the teachers in the study thought their current knowledge was more than "adequate". Similarly, no item in the "need to know more" section was rated below 3, suggesting that they had an above-average need to know more about all of the items listed. There was only one item, "use of the Internet", that appeared in the Content Knowledge section. This was the item rated the lowest on the "current knowledge" scale (2.44) and was rated relatively high on the "need to know more" section (4.01). There were no Procedural Knowledge items rated either low on "current knowledge" or high on "need to know more". Also, there were no Pedagogical Knowledge items rated low on "current knowledge", although there were five from this section rated high in the "need to know more" section. These were concerned with guiding pupils to develop their own strategies to find answers (4.02), motivating uninterested or unmotivated pupils to want to learn (4.06), asking questions to encourage pupils to think (4.06), and classroom management skills (4.11). Similarly, in the Pedagogical Content Knowledge section there were no items rated low in "current knowledge", but four in "need to know more". These were concerned with using computers and other tools to enhance teaching (4.00), helping pupils to apply knowledge to unfamiliar problems (4.00), relating topics to real-world situations (4.05), and provision of suitable challenges for pupils who finish early (4.02). In the Teaching Theories section, there were several items rated low: new theories about teaching and teaching approaches (2.94), assistance available from curriculum officers (2.98), membership of professional organisations (2.75), and justifying their teaching approaches to others (2.99). However, only one of these, new theories about teaching and teaching approaches, was rated highly in "need to know more" (4.00), along with how to use new ideas and current theories in teaching (4.05). The teachers indicated that they had less than average knowledge of two items in Personal Experiences, namely use of micro-teaching as a preparation for teaching (2.84) and teaching practice under the experience of an expert mentor teacher (2.93). However, neither of these items was rated as important in the "need to know more" section.

In order to identify more detailed information about whether different groups of teachers have different professional development needs, a series of independent samples t-tests was conducted using the independent variables of gender, teaching level (primary or secondary), teaching status (preservice or inservice), and years of experience. The following sections will discuss the differences between means that were found to be significant at the $p < 0.05$ level.

Comparison Between Genders

The only gender differences occurred in the "current knowledge" section (Table 3), with none in "need to know more".

Table 3. Comparison of the mean scores by gender using independent samples t-test (significant, $p < 0.05$)

Current Knowledge:

Section	Item	Group	N	Means	SDs	df	t
Content Knowledge	ability to use computers as learning resource	Male	29	3.45	1.15	108	2.8444
		Female	81	2.85	.0.90		
	ability to use Internet as learning resource	Male	30	2.90	1.40	111	2.928
		Female	83	2.24	0.91		
Pedagogical Knowledge	asking open-ended questions	Male	27	3.63	0.74	110	2.343
		Female	85	3.25	0.74		
	skills of classroom management	Male	28	3.64	0.68	110	2.001
		Female	84	3.29	0.86		
Pedagogical Content Knowledge	use of tools (e.g. computers) to enhance teaching	Male	28	3.29	0.76	110	2.115
		Female	84	2.90	0.84		
	encouraging pupils to make generalisations about rules	Male	27	3.52	0.64	109	1.988
		Female	84	3.20	0.74		
Personal Experiences	knowledge about school culture/routines/duties	Male	27	3.52	0.75	109	1.999
		Female	84	3.15	0.84		

There were some differences appearing in each of the categories of Content, Pedagogical, Pedagogical Content Knowledge and Personal Experiences, but none in either Procedural Knowledge or Teaching Theories. The male teachers believed that they had a higher level of knowledge than the female teachers on matters relating to the use of computers and the Internet as learning resources ($t=2.844$, 2.928 and 2.115 respectively on the three items concerned with this) - although even the highest male rating of 3.45 for ability to use computers did not reflect a particularly high degree of confidence with their current knowledge in this area. The males also indicated that they had a higher perception of their current knowledge about management issues such as classroom management ($t=2.001$) and knowledge of school routines ($t=1.99$), and of some aspects of higher level thinking, namely asking open-ended questions ($t=2.343$) and encouraging pupils to form generalisations from rules ($t=1.988$).

Comparison Between Primary And Secondary Teachers

There was only one area in which there was any significant difference between primary and secondary school teachers. This was in relating topics to the real world (Pedagogical Content Knowledge, $t=2.090$). On this item, the primary teachers rated their current knowledge higher than the secondary teachers did - not surprising given the emphasis in the primary school on this aspect of teaching, and the fact that the primary syllabus is more oriented towards real-world applications.

Comparison Between Preservice and Inservice Teachers

As can be seen from Table 4, the inservice teachers rated their current knowledge higher than the preservice teachers did on a number of aspects of Procedural, Pedagogical and Pedagogical Content Knowledge, and Personal Experiences. There were no statistically significant differences, however, in the two groups' ratings of their current content knowledge. The preservice teachers rated themselves higher on only one item, knowledge about interaction with pupils' parents ($t=2.476$).

Table 4. Comparison of the mean scores by teacher status using independent samples t-test (significant, $p < 0.05$)

Current Knowledge:							
Section	Item	Group	N	Means	SDs	df	t
Procedural Knowledge	ability to solve a problem in more than one way	pre-service	35	3.23	0.69	115	2.005
		in-service	82	3.54	0.79		
Pedagogical Knowledge	how different learning styles can affect pupils' learning	pre-service	35	2.94	0.68	113	3.443
		in-service	80	3.45	0.74		
	skills of classroom management	pre-service	35	3.00	0.80	113	3.647
		in-service	80	3.59	0.79		
Pedagogical Content Knowledge	how to explain specific topics to a learner	pre-service	35	2.94	0.87	113	2.833
		in-service	80	3.36	0.66		
	relating topics to real-world situations	Pre-service	35	3.20	0.63	112	2.414
		in-service	79	3.53	0.69		
	using concrete materials to model situations	pre-service	35	3.06	0.48	111	3.076
		in-service	78	3.47	0.73		
	encouraging pupils to find more than one method of solution to a given task	pre-service	35	3.29	0.71	112	2.134
		in-service	79	3.65	0.88		
Teaching Theories	interaction with pupils' parents	pre-service	35	3.14	0.69	112	2.476
		in-service	78	3.00	0.76		

Table 4 (...cont'd)

Section	Item	Group	N	Means	SDs	df	t
Personal Experiences	timing/scheduling teaching programmes	pre-service	35	2.97	0.79	112	2.598
		in-service	79	3.35	0.70		
	knowledge about school culture/routines/duties and what is expected of a teacher	pre-service	35	3.03	0.89	112	2.052
		in-service	79	3.38	0.82		
Need to Know:	knowledge about classroom routines for checking homework, supervising individuals or groups, etc.	pre-service	35	3.00	0.73	112	3.500
		in-service	79	3.52	0.73		
Procedural Knowledge	ability to recognise patterns and make rules from them	pre-service	35	4.06	0.68	110	2.555
		in-service	77	3.65	0.82		
	knowledge of rules for problem solving (heuristics)	pre-service	35	4.26	0.70	110	3.054
		in-service	77	3.79	0.77		

Table 4 (...cont'd)

Section	Item	Group	N	Means	SDs	df	t
Pedagogical Content Knowledge	ability to solve a problem in more than one way	pre-	35	4.29	0.67	110	2.553
		service	77	3.86	0.88		
	ability to apply knowledge to unfamiliar problems	pre-	35	4.23	0.60	109	2.630
		service	76	3.79	0.90		
	how to explain specific topics to a learner	Pre-	35	4.20	0.76	109	2.034
		service	76	3.86	0.86		
provision of suitable extra challenges for the pupils who finish early	pre-	35	4.26	0.78	108	2.054	
	service	75	3.91	0.86			
Teaching Theories	assistance	pre-	35	4.06	0.73	108	2.243
	available from	service	75	3.69	0.82		
	curriculum officers	in-					
	membership of professional organisations	pre-	34	3.91	0.79	107	2.749
service	75	3.40	0.94				
strategies to cope with pressures of the Hong Kong teaching environment	pre-	35	4.06	0.68	108	2.121	
	service	75	3.69	0.90			
		in-					
		service					

Table 4 (...cont'd)

Section	Item	Group	N	Means	SDs	df	t
Personal Experiences	teaching practice under supervision of an experienced (mentor) teacher	pre-service	34	3.97	0.83	107	2.621
		in-service	75	3.48	0.94		
	timing/scheduling teaching programmes	pre-service	34	4.18	0.63	107	2.665
		in-service	75	3.75	0.84		
	knowledge about school culture/routines/duties and what is expected of a teacher	pre-service	34	4.03	0.67	107	2.042
		in-service	75	3.68	0.89		

In the "need to know more" section, the preservice teachers gave high ratings (4 or above) on a number of aspects, especially those concerned with different aspects of problem solving, catering for individual differences, finding assistance and strategies to cope with the Hong Kong teaching environment and the management of daily routines. The inservice teachers gave significantly lower ratings to all of these items. There were no significant differences between the two groups' ratings on any of the Content or Pedagogical Content Knowledge items.

Comparison of Teachers by Years of Experience

To gain some further insights about the effects of experience, the inservice teachers were categorised into those with five years' teaching experience or more and those, including preservice, with less than five years (Table 5).

Table 5. Comparison of the mean scores by years of experience using independent samples t-test (significant, $p < 0.05$)

Current Knowledge:

Section	Item	Group	N	Means	SDs	df	t
Pedagogical Knowledge	catering for the needs of individuals	<5 years	51	3.12	0.59	76	2.089
		5 years	27	3.41	0.57		
	skills of classroom management	<5 years	50	3.42	0.76	76	2.016
		5 years	28	3.79	0.79		
Pedagogical Content Knowledge	encouraging pupils to make generalisations about rules	<5 years	49	3.16	0.69	75	2.109
		5 years	28	3.54	0.84		
Personal Experiences	knowledge about school culture/routines/duties/	<5 years	49	3.18	0.83	75	2.626
		5 years	28	3.68	0.72		

There were not many differences here. The teachers of five years or more said they knew more about aspects of classroom management including catering for individual differences ($t=2.089$), school culture and routines ($t=2.626$) and general management skills ($t=2.016$). The only other difference was in encouraging pupils to make generalisations about rules ($t=2.109$). There were no differences in their need to know more about any aspects.

Summary and Discussion

The purpose of this study was to investigate preservice and inservice mathematics teachers perceptions of their current knowledge about various aspects of mathematics teaching and to identify the areas in which they believe they need to know more. The relationship of their perception to some independent variables, such as gender, level of schooling they taught at and length of teaching experience, were also examined.

The results of the study included the following:

- (i) The teachers appeared to be reasonably confident with Procedural Knowledge and all aspects of Content Knowledge except for that relating to the use of computers and the Internet as learning resources,
- (ii) While they rated items relating to their current Pedagogical Knowledge and Pedagogical Content Knowledge as reasonably adequate, these were the areas in which they identified their highest priorities for knowing more.
- (iii) While they rated items about their current knowledge of Teaching Theories as inadequate, they did not indicate a very high need to know more about these, other than a high need to know more about new theories about teaching and learning approaches and how to use these.
- (iv) The male teachers had a higher perception than the females of their current knowledge about using computers and the Internet as teaching resources, as well as of classroom management skills and the ability to ask open-ended questions. However, there were no gender differences in the "need to know more" section.
- (v) The only significant difference between primary and secondary school teachers was in current knowledge about relating topics to the real world.
- (vi) There were no significant differences between preservice and inservice teachers on any items relating to Content Knowledge. The inservice teachers rated their current knowledge higher on a number of items from the Procedural, Pedagogical and Pedagogical Content Knowledge, and Personal Experiences categories. The preservice teachers had a higher perception of their knowledge about interaction with pupils' parents. The preservice teachers indicated a higher "Need to Know" in several areas including different aspects of problem solving, catering for individual differences, finding assistance and strategies to cope with the Hong Kong teaching environment and the management of daily routines.
- (vii) There were only four areas in which teachers with more than 5 years' teaching experience indicated a higher perception of their current knowledge than their less experienced counterparts. These were classroom management and school routines, catering for individual differences, and encouraging pupils to make generalisations about rules.

Several aspects of these results are worthy of further discussion, as they have potential implications for the planning of professional development programmes for both preservice and inservice teachers.

An interesting outcome was that the teachers did not give ratings of 4 ("adequate") or more for any aspect of their current knowledge. Further, there were no ratings that indicated a low need to know more about any items. This suggests that they were not over confident with what they knew and generally felt that they still had a lot to learn. In some areas, they presumably felt that their knowledge, even if not really adequate, was enough for them to get by. One clear exception to this was any item to do with the use of computers or the Internet as resources to enhance mathematics teaching, so this is clearly one area on which professional development programmes need to focus for both pre- and inservice teachers. Another area where they did not perceive their knowledge to be particularly high but were only moderately concerned to know more was in aspects of Teaching Theories, including sharing ideas with other teachers, teachers as researchers and assistance from curriculum officers, professional literature or professional organisations. They had a high interest in learning more about Pedagogical and Pedagogical Content Knowledge, particularly about teaching theories and how to use new ideas in their teaching. They did not show much interest in learning about issues such as micro-teaching, mentor teachers and timing and daily routines. Their lack of interest in the latter is not surprising, as it is likely that these would more easily be acquired by "on the job" training than through professional development programmes.

There was also some evidence to suggest that different professional development provisions might be necessary for different groups of teachers. For example, males were more confident than females on several aspects of "current knowledge". This is consistent with other research findings that suggest males have greater confidence than females about their content knowledge, particularly in relation to the use of computers that is traditionally regarded as a male domain (Kalaian and Freeman, 1994, Harlen, 1995). The implication is that female teachers may need more assistance than males on matters to do with computers, and it may in fact be worthwhile to consider offering some sessions designed exclusively to meet the needs of the female teachers in order to raise their confidence to the same level as their male counterparts.

It was interesting that there were no clear differences between primary and secondary school teachers. Based on claims that primary teachers often have inadequate mathematics content knowledge even for the levels at which they are teaching (Tirosh and Graeber, 1989; Tirosh, Tirosh, Graeber and Wilson, 1991; Simon, 1993; Taplin, 1995) it would have been expected that the secondary teachers would be more confident about their content and pedagogical content knowledge at least. One area in which the primary teachers were actually more confident of their current knowledge than were the secondary teachers was how to relate mathematics activities to real-world situations. With increasing expectations

for mathematics teaching in the secondary school to have real-world applications, this suggests that it might be appropriate to utilise some of the approaches from primary teacher education that are preparing primary teachers more adequately in this respect.

It is not surprising that the inservice teachers rated their current knowledge higher than the preservice teachers on a wide range of items that are related to experience, including classroom management, learning styles, explaining and modelling situations and relating them to the real world, timing, scheduling and routines. It is surprising, however, that the preservice teachers rated themselves higher on knowing how to interact with pupils' parents. Perhaps the inservice teachers' comparative lack of confidence in this area has stemmed from experiences that their less experienced counterparts do not anticipate, and which have made them feel less knowledgeable about how to deal with these. From the opposite point of view, it is also interesting to look at the areas in which the inservice teachers did not have any higher ratings of their current knowledge than the preservice, and which those with more than 5 years have similar ratings of their knowledge to those with less than 5 years. For example, there were no differences on any of the items related to Content Knowledge and Knowledge of Rules and Procedures is one such example. One possible implication is that, as a considerable amount of attention is given to content and procedural knowledge in the preservice courses, teachers are at their most confident with this at preservice level and do not perceive their content knowledge to grow during their years of service. Or perhaps they do not perceive a need for it to grow beyond what they have learned in their preservice years. Other examples of areas in which there is no indication of the inservice teachers having higher perceptions of their knowledge include guiding pupils to construct their own knowledge, use of discussion, encouraging pupils to think by asking appropriate questions and providing appropriate challenges, and understanding affective factors. As these are all criteria for implementing reforms, it is unlikely that even experienced teachers will have the confidence to change if their knowledge of these has not grown beyond that of their inexperienced counterparts.

Some potentially interesting implications have arisen from the comparison of preservice and inservice teachers on the "need to know more" section. Again, these differences are not surprising because the former lack experience, but it does point to the need to consider how preservice programmes can help to increase knowledge, especially as inservice teachers also expressed quite a high need to know. On aspects of procedural knowledge related to problem solving, the inservice teachers had less need to know more. This raises the question of whether inservice teachers have somehow acquired greater confidence or perception of their knowledge about problem solving - and if this is so, when and how this acquisition occurred - or whether they have instead just become less enthusiastic to learn more

about this type of approach than their counterparts who have probably heard a lot about it but have not really tried it. If this latter reason were the case, it would certainly be consistent with Gregg's (1995) claim that teachers lose enthusiasm about new ideas if they try them and find them to be too difficult to implement. These are questions that warrant further investigation.

In making any recommendations about professional development programmes based on the data presented here, it is important to bear in mind that the experienced teachers in this project were all engaged in part-time courses in mathematics education and yet, despite this, they were still not highly confident about their knowledge. If their reason for doing a course is that they are the ones who acknowledge that they do not have high knowledge and need to know more, then there may be some bias in the sample. Further research needs to be done amongst experienced teachers who are not currently, or have not since their initial training, engaged in any courses, as their perceptions could be quite different. What this study does give us, however, is some useful insight about the perceptions of those teachers who are interested in studying of what it is that they need to study more.

The results of this project have raised some potential implications for the development of preservice and inservice mathematics education programmes, with the need for more input in the areas of effective computer use and problem solving/promotion of student thinking being the clearest priorities. Further investigation of the questions raised here about the teachers' perceptions of what they need to know more about can potentially contribute some valuable insights about the nature of these professional development programmes, and particularly how they can be adapted to meet the different needs of different groups of teachers. This is just a first step towards Dass' (1998) and Renyi's (1998) vision of carefully designed professional development that involves teachers in the learning process. Further investigations are needed to explore such issues as the learning processes that they perceive to be the most beneficial, and the nature of ongoing support they need to be able to implement changes successfully. Another question is whether some aspects of these domains are in fact the responsibility of preservice or inservice education and, if the latter, whether the necessary knowledge or skills can be acquired better through inservice programmes or through "on-the-job" training and experience. Nevertheless, it is an important first step in encouraging teachers to take an active role in their professional development programmes so they will become more effective agents of change in their classrooms.

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