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TEACHERS' CONCERNS REGARDING THE ADOPTION OF A NEW MATHEMATICS CURRICULUM: AN APPLICATION OF CBAM

ABSTRACT. The main purpose of the present study was to identify and examine the concerns of primary school teachers in Cyprus in relation to the recent implementation of a new mathematics curriculum and the use of new mathematics textbooks. An adaptation of the Stages of Concern Questionnaire (SoCQ) based on the Concerns-Based Adoption Model (CBAM) was administered to a representative sample of teachers. According to the findings, the concerns of teachers largely focused on the task stage of the CBAM model. Furthermore, there were significant differences in the concerns of teachers across years of teaching experience but not across years of implementation.

KEY WORDS: CBAM, mathematics textbooks, reform, teachers' concerns

1. INTRODUCTION

The concept of concerns and the associated theoretical framework date back to the pioneer work of Fuller in the late 1960s. Fuller (1969) put forward a classification of teachers' concerns consisting of three developmental stages; namely, impact, self, and task concerns. Impact concerns refer to the teachers' apprehension concerning student outcomes, while self-concerns relate to the teachers' own worries about their ability to perform in the school environment. Finally, the task stage is linked to concerns regarding the daily teaching duties, especially in relation to constraints such as the large number of students in the class and the lack of resources. Fuller's framework has provided the basis for subsequent studies of the nature of teacher concerns, some of which have focused on concerns regarding the adoption of educational innovations and reforms.

In the present study, we examine the concerns that teachers in Cyprus may exhibit in response to new situations or demands emerging from the adoption of a new mathematics curriculum and new textbooks. Depending on the types of concerns and the associated feelings of certainty or uncertainty, teachers may consider themselves as qualified or not to implement the desired innovations. There is evidence to suggest that educational innovations and reforms are not implemented in the time frame envisaged by planners and policy makers (Friel and Gann, 1993; Hall and Hord,

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2001). Teachers are likely to resist change, unless they are convinced that it will significantly benefit themselves and their students (Thompson, 1992). Crawford et al. (1998) partly attribute this reaction to the teachers' reluctance to view themselves as change agents. Given the importance of the role of the teacher in the effective implementation of innovations, it becomes important to investigate the nature of teacher concerns in the innovation adoption process.

The present paper is organized as follows. First, we discuss the theoretical perspectives that relate to teacher concerns and describe in brief the Concerns-Based Adoption Model (CBAM). We then present the methodology and results of a relevant study conducted in Cyprus. The concerns of teachers are examined in relation to the implementation of a specific reform in school mathematics, which consists in the adoption of a new mathematics curriculum through the use of new mathematics textbooks. The extent, if any, to which teachers differ with regard to their concerns and support for the implemented mathematics reform is also considered. Finally, the conclusions of the study and their implications for educational planning in the area of innovations are discussed.

2. Theoretical background

2.1. *Mathematics reform and teachers' concerns*

The current reform effort in mathematics education has its roots in the 1980s and the reports in different countries that focused attention on an impending crisis in education, particularly in mathematics and science (e.g., "An Agenda for Action" (NCTM, 1980), "A Nation at Risk" (National Commission on Excellence in Education, 1983), "Cockcroft Report" (Cockcroft, 1982), "A Report on the Crisis in Mathematics and Science Education" (American Association for the Advancement of Science, 1984). It received further impetus with the publication by the National Council of Teachers of Mathematics (NCTM) of "Curriculum and Evaluation Standards for School Mathematics" (1989, 2000) and "Professional Standards for Teaching Mathematics" (1991) and by the implementation of the National Curriculum in England. Within this context, dozens of local and national reform efforts have recently been initiated in many countries, with the purpose to redesign curriculum in the light of new research findings in didactical approaches and reasoning. Some have focused on the development of new curricula, while others on teacher enhancement and mathematics textbooks.

New standards-based textbooks that support the visions of the reform for school mathematics have been developed. These textbooks are designed so

as to foster a specific conceptual approach to teaching and learning mathematics. Examining the factors that influence teachers' reaction to standards-based mathematics textbooks, Manouchehri and Goodman (2000), asserted that changes in teachers' practices do not occur by merely placing innovative materials at their disposal but by initiating and guiding the development of their pedagogical understandings. The findings of Manouchehri and Goodman's (2000) study support the belief that teachers need concrete images that depict what it is like to teach in ways that are consistent with the reformed visions of teaching. In the absence of these images, efforts towards implementing reform might be futile (Senger, 1999).

In the last two decades, studies on teacher change (Kagan, 1990) have presented the teacher as a decision-maker, problem solver, and person of values and beliefs that strongly influence practice. Recent documents in mathematics education have placed a great responsibility for the success of reform on the teacher (NCTM, 2000; Romberg and Carpenter, 1986). These responsibilities include an emphasis on mathematics processes such as problem solving and reasoning, communication and discourse around mathematical topics, connections within and across content areas. Teachers are urged to see themselves as guides, listeners, and observers rather than authorities and answer-givers. Many of these conceptions are new to the typical classroom teacher and require change at some level to make them a reality (Senger, 1999).

An extensive general literature deals with the processes and barriers involved in the implementation of curricular change (e.g. Fullan, 1991, 1993, 1999; Macnab, 2003). The classroom realization of curriculum reform comes about through the actions of individual teachers. It is teachers' beliefs, practices, and working environment that shape and direct implementation. To describe this phenomenon, Spillane (1999) has introduced the term 'zone of enactment' to refer to 'the space in which [teachers] make sense of, and operationalize for their own practice, the ideas advanced by reformers. . . . Differences in teachers' enactment zones are key in understanding their efforts to change the core of mathematics instruction' (p. 159). He argues that 'the new ideas about practice that teachers encounter through the policy and professional sectors can only work in and through teachers' existing knowledge and beliefs' (p. 169). Mathematics education research has recently focused attention on teachers' conceptions of mathematics and on their beliefs about the teaching and learning of the subject (Nelson, 1997). Many teachers' images and beliefs about mathematics and what learning mathematics entails may be incompatible with current research and reform efforts in the field (Nelson, 1997). Romberg (1997) showed that the use of a new curriculum in the classroom could create disjunctions between the teacher's former knowledge and practice,

which require resolution. This kind of disjunctions challenge teachers' concerns about the implementation of the innovation and lead some teachers to the point of anxiety and frustration.

The study of concerns has attracted a great deal of interest in recent decades as a result of the presumed link between the successful implementation of educational change and reform, and the level and type of individual concerns. Concerns can be described as the feelings, thoughts, and reactions individuals develop in regard to a new program or innovation that is relevant to their daily job (Hord et al., 1998). In this framework, innovation concerns refer to a state of mental arousal resulting from the need to cope with new conditions in one's work environment.

Concerns exert a powerful influence on the implementation of reforms and determine the type of assistance that teachers may need in the adoption process. The results of previous studies show that the perceptions of those involved in innovations are of major importance for the success of the innovation process (Senger, 1999). The significance or meaning that teachers attach to an innovation form the reactions to the innovation and the possible problems associated with these reactions. Thus, it is useful for administrators and educators to have a picture of teachers' concerns, both before and during the implementation phase of an innovation (Fullan, 1999).

3. THE CONCERNS-BASED ADOPTION MODEL (CBAM)

The Concerns-Based Adoption Model is an instrument that educational leaders use to evaluate innovations; it shows them how the individuals most affected by change react to the implementation of these innovations (Hord et al., 1998). The CBAM includes three key tools used to collect relevant data: Stages of Concerns (SoC), Levels of Use (LoU), and Innovation Configurations (IC). The most important tool in the model is the SoC questionnaire, which is used to measure teachers' concerns about an innovation they are expected to implement (Hall and Hord, 2001).

The SoC questionnaire provides the means for assessing the following seven stages of concern: Awareness, Informational, Personal, Management, Consequences, Collaboration, and Refocusing. A brief description of each stage is given as follows.

Awareness (stage 0): Teachers have little knowledge of the innovation and have no interest in taking any action.

Informational (stage 1): Teachers express concerns regarding the nature of the innovation and the requirements for its implementation. At this stage, teachers usually show their willingness to learn more about the specific innovation or reform.

Personal (stage 2): Teachers focus on the impact the innovation will have on them. At this point, they exhibit concerns about how the use of the innovation will affect them on a personal level. They may be concerned about their own time limitations and the changes they will be expected to make.

Management (stage 3): Concerns begin to concentrate on methods for managing the innovation within the classroom. Teachers now express concern over the organization and details of implementation, and the overcoming of difficulties. Time requirements are among the prime management factors, which create skepticism on the part of teachers in relation to the adoption of innovations.

Consequences (stage 4): Teacher concerns now center upon effects on student learning. If positive effects are observed, teachers are likely to continue to work for the implementation.

Collaboration (stage 5): Teachers are interested in relating what they are doing to what their colleagues are doing.

Refocusing (stage 6): Teachers evaluate the innovation and make suggestions for continued improvements, or consider alternate ideas that would work even better.

The LoU tool assesses how teachers are actually using the innovations. The following eight LoUs, which are almost congruent to the SoCs, have been proposed: non-use, orientation, preparation, mechanical, routine, refinement, integration, and renewal. Information on these levels is usually obtained through observations or conversations and interviews with teachers. Finally, the IC tool is used to identify the patterns of innovations that result when different teachers implement the innovations in their classrooms (Hord et al., 1998).

The CBAM model has a lot of similarities with the *phases* of change process as proposed by Fullan and Stiegelbauer (1991). Fullan and Stiegelbauer's (1991) phase I refers to the adoption process (or the phase of initiation), which leads up to and includes a decision to adopt or proceed with a change. This phase corresponds to the awareness and information levels of the CBAM model. Phase II, the implementation phase, involves the first experience of attempting to put reform into practice, and corresponds to the personal and management levels of CBAM. Phase III, which corresponds to the consequences and refocusing levels of CBAM, refers to whether the change is established as an ongoing part of the system.

3.1. *Research and applications of the CBAM*

The CBAM model has been applied extensively in educational contexts. The SoCQ has been used to measure concerns relating to a wide range of innovations in different countries. In the Netherlands, van den Berg

et al. (2000) examined teacher concerns in relation to the adoption of a specific innovation (adaptive teaching) using the CBAM framework. They found that teachers tended to focus on self-concerns at the beginning of the implementation process. By the end of the process, self-concerns were replaced by strong task concerns. The authors concluded that the reduction of task concerns was necessary for the successful implementation of adaptive teaching. van den Berg et al. (2000) reported that, in several European innovation projects, the level of self-concern was very high after 3 years of innovation implementation in 40% of the schools involved.

Numerous studies have employed the SoCQ tool in order to measure stages of teacher concerns. One broad area of investigation is that of curricular reform, with attempts made to evaluate reforms in mathematics (Crawford, 1997). More recently, Crawford et al. (1998) used the SoC questionnaire to evaluate the strengths and weaknesses of a project applied in North Carolina, in an attempt to implement a new algebra curriculum for all students. The project consisted in a series of 7-day workshops aimed at introducing teachers to the new curriculum. Teacher concerns were measured during the training sessions and after a year of implementation. The authors found significant differences between initial concerns and concerns after a year of implementation for the awareness, information, and refocusing stages. Concerns decreased for the first two stages and increased for the third stage. This indicated the success of the project in increasing the awareness of teachers concerning the new curriculum.

In another study, Giancola (2000) used the CBAM framework in an attempt to evaluate the implementation of the Delaware Challenge Grant project, which was aimed at the improvement of student performance through the introduction of specific educational software. The author examined the extent to which the software was used in the classroom and the student's home and identified several factors associated with successful program implementation, such as teacher interest and capacity. More recently, Chamblee and Slough (2002) synthesized the findings from two studies, a qualitative study on the implementation concerns of secondary science teachers resulting from the use of telecommunications and a quantitative study on technology implementation concerns of middle and secondary mathematics teachers of first-year algebra in North Carolina. This was done to determine whether teachers in both disciplines, i.e., science and mathematics, have similar concerns when implementing technology in the classroom. Both studies used the Concerns-Based Adoption Model to assess teacher concerns and levels of technology implementation. Teachers of both disciplines were found to have common technology concerns and implementation worries.

4. THE PRESENT STUDY

The current reform effort in mathematics education in Cyprus was initiated in the early 1990s. The Committee of Primary Mathematics Education in Cyprus urged that school mathematics programs be revised and updated to reflect the NCTM standards, develop students' mathematical power, feature relevant applications, and foster active student involvement.

Consequently, the development of new curricula and mathematics textbooks in Cyprus has been largely based on the fundamental principles of NCTM standards. One of the main purposes of the new Cypriot mathematics curriculum is to present thought-provoking situations that involve challenging themes through emphasis on the following: problem solving and reasoning, communication and discourse around mathematical topics, manipulatives and group work, and finally a new elementary school content (e.g., number sense, algebra, discrete mathematics, probability, and spatial sense). Teachers are urged to see themselves as guides, listeners, and observers rather than authorities and answer-givers. Students are encouraged to tackle diverse problems, which reflect real-life situations and involve their creative interest, while less emphasis is placed on rote memorization and procedure-driven computation (NCTM, 1989). Meaning and understanding are major goals to be achieved with the use of pictures, objects, graphs, and language in an attempt to help the student visualize abstract ideas. The new curriculum also aims at supporting teachers' efforts to connect students' previous knowledge with new ideas, link conceptual and procedural knowledge, and relate mathematics to other fields of human endeavor. The new mathematics curriculum and the subsequent change in the teaching of mathematics is considered as one of the most important innovations in primary education in the country in the last 10 years. Most of these developments represent a major departure from previous practices for the typical classroom teacher.

In the process of this innovation, the new curriculum was gradually introduced from 1995, first in Grade 1, the next year in Grade 2, and continued to the next grade in each successive year until 2000, when it covered all primary grades. As a result, there are presently teachers with variable involvement in the implementation of the reform. Unfortunately, the reform was put in operation without substantial professional preparation of teachers. The policy makers did not realize the importance of wide range teacher preparation as they conceived of change as an "event" rather than a process (Hall and Hord, 2001); this is clearly reflected in the way they chose to inform and train teachers regarding the innovation.

Specifically, teachers had two-day training workshops, after which they were left to accomplish the reform in the way they judged most appropriate. This "event mentality" had serious consequences for participants in the change process. For example, the pressure to bring about change quickly meant that there was no time to learn about, and come to understand, the new developments, or even to deal with the abandonment of previous practice.

The main purpose of the present study was to identify and examine the concerns that teachers express about the recent innovation in mathematics. Given the importance of the innovation, it was considered necessary to investigate the degree to which Cypriot teachers had accepted the new curriculum and followed it in the classroom. The investigation of teacher concerns is expected to provide information on the degree to which Cypriot teachers are capable of effectively implementing the approaches suggested by the new textbooks. The study of concerns can also facilitate the planning of in-service programs aimed at sustaining the innovation and meeting relevant teacher needs. It would be unwise, for example, for policy makers to concentrate on teachers' judgments about the appropriateness of tasks if the dominant concern in specific groups of teachers is information about the different kinds of tasks being used in the new textbooks. Thus, the present study aimed first at identifying the concerns of teachers and, second, at examining whether teachers with different numbers of years of involvement in the implementation of the innovation actually express different concerns in relation to it.

It was expected that teachers in the beginning stages of the innovation would show primarily concerns at the lower stages of the SoC (self-concerns) and that teachers in the more advanced stages would show primarily other concerns. It was also expected that teachers who had longer experience with the new textbooks would be found to support the innovation more than teachers who were novices in the implementation of the innovation. The former were also expected to express different types of concerns with regard to the innovation in comparison to the latter. Thus, the following specific research questions guided the study:

- What type of concerns do teachers have regarding the innovation in mathematics education associated with the new mathematics textbooks and curricula?
- Are there any significant differences in teachers' concerns across years of involvement with the innovation and the length of their teaching experience?

5. METHOD

5.1. *Participants*

The participants in this study were 655 teachers (155 male and 500 female teachers) from 100 elementary schools in Cyprus. Schools were selected on the basis of size, location and demographic characteristics. The independent variables of the study were the teachers' total teaching experience and the years of their involvement in the implementation of the new mathematics curriculum and the use of the new mathematics textbooks. Specifically, the sample included four groups of teachers dispersed across the whole range of teaching experience and three groups covering the years of involvement with the innovation. Table I presents the numbers of teachers in each group.

5.2. *Instrumentation: Concern scales*

According to Hall and Hord (2001), there are three ways of assessing concerns: one-legged interviews, open-ended statements and stages of concern questionnaires. Each of these methods is associated with a number of strengths and weaknesses. In this study, we present the results of the stages of concern questionnaires (SoCQ). The stages of concerns used in the study do not correspond exactly to the original American and European stages; adaptations were deemed necessary due to the conditions and context of Cyprus education, and the specific subject domain (mathematics). The first obvious difference between the questionnaires developed in the United States and Europe and the questionnaire used in the present study was the elimination of stage one. Specifically, in the present questionnaire, we excluded the stage of awareness because all teachers in Cyprus were acquainted with the new mathematics curricula and the new textbooks by the time the study was conducted. Moreover, the present questionnaire included 36 items, while

TABLE I

Teachers involved in the study by years of teaching experience and years of involvement in the innovation

Years of involvement in innovation	Years of teaching experience				
	1–5	6–10	11–20	>20	Total
0–1	62	19	15	66	162
3–4	88	76	47	66	277
4–6	34	99	51	32	216
Total	184	194	113	164	655

the American and the Dutch-Belgian questionnaires involved 35 and 52 items, respectively. Third, the number and the sequence of items within each stage as well as their wording were different to suit the needs of the mathematics domain in which the questionnaire was applied. Teachers' ratings on the 36 items of the questionnaire were made on a 9-point scale ranging from 1 (strongly disagree) to 9 (strongly agree); all responses were recorded so that higher numbers indicated greater agreement.

In an attempt to retain the structure of the original instrument, we piloted the questionnaire. During the pilot phases, factor analysis was conducted to validate the stages of concern. A minimum loading of .30 was consistently required for inclusion of a statement within a particular factor. The six-factor solution produced the most satisfactory description of the underlying factor structure. Factor 1 closely corresponded to the "consequences" phase of the innovation in the original questionnaire. Factor 2 was described as "refocusing" and factor 3 was interpreted as "management". Factor 4 closely resembled the "information" stage, while factors 5 and 6 were interpreted as the "personal" and "collaboration" dimensions, respectively. The loadings of the items on each factor and the variance explained by each of the factors of the final questionnaire are presented in the appendix.

6. Results

Before addressing the questions of the study, we examine the Cronbach alphas for the six scales, which represent the different stages of concern. The Cronbach alphas for all stages were sufficiently high for the total sample of teachers involved in the study. The values of the alphas indicate that the instrument has acceptable reliabilities for the sample of the study. The Cronbach alphas for the last stages are relatively low ($\alpha_{\text{collaboration}} = 0.70$, $\alpha_{\text{refocuss}} = 0.65$, and $\alpha_{\text{consequence}} = 0.73$), while the alphas for the management stage and the first two stages are considerably higher ($\alpha_{\text{management}} = 0.78$, $\alpha_{\text{information}} = 0.80$, and $\alpha_{\text{personal}} = 0.82$). This level of reliability is comparable with the reliability estimates of the original test (Hall and Hord, 2001) and it thus provides the basis for a first insight into the teachers' general concerns.

6.1. *Research question 1: Teachers' concerns*

Table II summarizes the mean responses to each sub-scale in relation to teachers' total experience and involvement in the innovation. The total highest means occurred in the information and personal stages ($\bar{x}_{\text{information}} = 6.78$, and $\bar{x}_{\text{personal}} = 6.43$), indicating that teachers at this implementation stage were well acquainted with the philosophy and the objectives of the new mathematics textbooks. More importantly, they reported that they had

TABLE II

Means of concern stages by teachers' experience and by teachers' years of involvement in the innovation

			Self		Task	Impact		
Inv[a]	Exp[b]		Information	Personal	Management	Consequence	Collaboration	Refocusing
1	1	Mean	6.42	6.27	4.99	6.22	5.26	5.89
		S.D.	1.29	1.19	1.21	1.14	1.49	0.81
	2	Mean	6.59	6.34	4.81	5.79	5.43	5.53
		S.D.	1.55	0.95	1.50	1.15	1.74	1.06
	3	Mean	7.03	7.16	4.89	6.53	6.02	6.13
		S.D.	0.91	0.64	1.10	1.13	1.24	0.46
	4	Mean	6.97	6.55	4.70	6.18	5.78	6.05
		S.D.	1.42	1.18	1.22	1.18	1.35	0.66
	Total	Mean	6.72	6.49	4.84	6.18	5.55	5.93
		S.D.	1.36	1.14	1.24	1.16	1.46	0.77
2	1	Mean	6.64	6.25	5.22	6.27	5.27	5.97
		S.D.	1.12	1.10	1.42	1.16	1.28	0.75
	2	Mean	6.65	6.43	4.62	5.94	5.56	5.81
		S.D.	1.35	1.39	1.31	1.40	1.32	0.77
	3	Mean	6.65	6.36	4.50	5.60	5.64	5.98
		S.D.	1.37	1.26	1.22	1.28	1.14	0.82
	4	Mean	7.34	6.46	4.50	5.75	5.74	6.00
		S.D.	1.05	1.11	1.12	1.41	1.39	0.76
	Total	Mean	6.82	6.37	4.76	5.95	5.52	5.94
		S.D.	1.25	1.22	1.32	1.33	1.30	0.77
3	1	Mean	6.60	6.29	5.13	6.26	5.68	6.13
		S.D.	0.75	1.20	1.37	1.42	1.28	0.83
	2	Mean	6.67	6.46	4.81	5.81	5.55	6.01
		S.D.	1.20	1.19	1.30	1.13	1.44	0.90
	3	Mean	6.97	6.59	4.85	5.80	5.88	6.13
		S.D.	1.14	1.25	1.35	1.10	1.25	0.73
	4	Mean	6.91	6.48	4.97	5.89	6.05	5.91
		S.D.	1.25	1.45	1.37	1.42	1.36	0.93
	Total	Mean	6.76	6.47	4.90	5.89	5.72	6.04
		S.D.	1.14	1.24	1.33	1.22	1.37	0.85
Total	1	Mean	6.56	6.27	5.13	6.25	5.34	5.98
		S.D.	1.12	1.14	1.34	1.20	1.36	0.78
	2	Mean	6.65	6.44	4.74	5.86	5.54	5.89
		S.D.	1.29	1.25	1.32	1.24	1.42	0.88
	3	Mean	6.85	6.57	4.71	5.82	5.79	6.07
		S.D.	1.21	1.21	1.26	1.21	1.20	0.74
	4	Mean	7.11	6.50	4.67	5.96	5.82	6.00
		S.D.	1.25	1.20	1.21	1.33	1.37	0.75
	Total	Mean	6.78	6.43	4.82	5.99	5.59	5.97
		S.D.	1.24	1.20	1.30	1.26	1.36	0.80

[a] Inv: 1, up to 2 years of involvement; 2, 3–4 years of involvement; 3, 5–6 years of involvement.

[b] Exp: 1, up to 5 years of teaching experience (TE); 2, 6–10 years of TE; 3, 11–20 years of TE; 4, more than 20 years of TE.

the abilities required for the implementation of the innovation. Both the information and the personal stages describe the self-worries of teachers, and thus comprise the self-stage of the innovation. In the present study, the values of the relevant means show that teachers did not focus on the self-stage of the innovation, which was expected, since most of them had some experience with the innovation. This finding is in agreement with the results of previous studies (Fullan, 1993; van den Berg et al., 2000). The low value of the management mean ($\bar{x}_{management} = 4.80$, see Table II) indicates that teachers were more concerned about ways of accomplishing objectives, following the progress of each student, getting materials together, and covering the content of mathematics in the set time limits. The management dimension encompasses only one factor; namely, the task stage of the innovation.

The consequence, collaboration, and refocusing factors relate to the impact of the innovation on colleagues and students. The means of these factors ($\bar{x}_{consequence} = 5.99$, $\bar{x}_{collaboration} = 5.59$, and $\bar{x}_{refocusing} = 5.97$) are higher than the means of the task stage ($\bar{x} = 4.82$), and lower than means of the factors of the self-stage ($\bar{x}_{information} = 6.78$, and $\bar{x}_{personal} = 6.43$). This result suggests that teachers, at this point of the innovation, had less concerns regarding the impact of the innovation on students' performance in mathematics, and more on ways of dealing with their daily instructional practices. Thus, it can be hypothesized that teachers tend to worry less about the impact of the innovation when they feel that they have overcome task-stage problems. According to McKinney et al. (1999), individuals move through stages of implementation in a developmental pattern. They first focus on self-stage concerns, then move to task-stage concerns and finally reach the impact stage. The results so far appear to support the developmental nature of concerns in the implementation of the new mathematics curricula. In addition, the results show that teachers' concerns are largely focused on the task stage, which is in close proximity to the self-stage. It can be expected that impact concerns will grow at a later stage of the implementation.

We now turn to the second question of the study, which deals with the concerns of teachers across years of experience and years of involvement with the innovation.

6.2. *Research question 2: Differences in teachers' concerns in terms of experience and involvement*

It was hypothesized that years of teaching experience and years of implementing the new mathematics curricula influence the movement of teachers from one stage of concerns to the others. To examine this hypothesis,

multivariate analysis of variance was applied with the six stages of concerns used as dependent variables. Years of teaching experience and years of implementing the innovation served as independent variables.

On the basis of the Concerns-Based Adoption Model, a shift from self-concerns towards task concerns, and from task concerns to impact concerns was expected to apply to teachers as a result of their experience with the implementation of the new mathematics curriculum and textbooks. However, the results from the multivariate analysis do not support this hypothesis. As can be seen from Table III, there were no significant differences in teachers' concerns across years of implementation (Multivariate $F_{(2,595)} =$ 0.03, 1.53, 1.5, 1.94, 1.65, 1.8, and $p = .97, .22, .22, .14, .19, .177$ for the information, personal, management, consequence, collaboration and refocusing factors, respectively).

TABLE III

Multivariate analysis of variance Summary of stages of concern by total years of experience and years of teachers' involvement with the innovation

Source	Dependent variable	Sum of squares	df	Mean square	F	p
Teaching experience (A)	Information	21.078	3	7.026	4.764	.003
	Personal	6.480	3	2.160	1.472	.221
	Management	14.707	3	4.902	2.894	.035
	Consequence	15.232	3	5.077	3.261	.021
	Collaboration	14.502	3	4.834	2.542	.055
	Refocusing	4.015	3	1.338	2.095	.100
Involvement with innovation (B)	Information	0.008	2	0.004	0.027	.973
	Personal	4.484	2	2.242	1.527	.218
	Management	5.091	2	2.545	1.502	.223
	Consequence	6.039	2	3.020	1.940	.145
	Collaboration	6.268	2	3.134	1.648	.193
	Refocusing	2.293	2	1.147	1.795	.167
A × B	Information	11.698	6	1.950	1.322	.245
	Personal	6.492	6	1.082	0.737	.620
	Management	8.209	6	1.368	0.808	.564
	Consequence	11.596	6	1.933	1.241	.283
	Collaboration	3.838	6	0.640	0.336	.918
	Refocusing	4.126	6	0.688	1.077	.375

The results of the multivariate analysis for beginning teachers (1–5 years of experience), for teachers with some experience (6–10 years), for the experienced (11–20 years), and highly experienced teachers (more than 20 years of experience) revealed some significant differences in the information, management, and consequence factors ($F_{(3,595)} = 4.76$, 2.90, 3.26, and $p = .00$, .03, and .02, respectively; see Table III). The significance of the observed differences was evaluated on the basis of univariate analyses of variance, which showed that highly experienced teachers scored higher than beginning teachers on the two scales measuring self-concern (personal concern/need for information) ($F_{(3,613)} = 3.93$, $p < .009$). This result suggests that experienced teachers exhibited less interest in the self-concern stage ($\bar{x}_{\text{information}} = 7.11$) than beginning teachers ($\bar{x}_{\text{information}} = 6.56$), indicating that highly experienced teachers had less information needs and more confidence in their abilities to deal with the innovation than beginning teachers. However, the difference between teachers with a few years of experience and experienced teachers was not found to be significant.

With regard to the task-concern scale relating to management, beginning teachers scored higher than the remaining teachers (univariate $F_{(3,637)} = 4.59$, $p < .003$). This suggests that beginning teachers ($\bar{x}_{\text{management}} = 5.13$) saw less practical problems in the implementation of the new mathematics curriculum and the use of new textbooks than other teachers.

The last three scales relate to impact concerns. The scores of teachers relating to refocusing were not found to differ significantly (univariate $F_{(3,606)} = 1.06$, $p = .389$), indicating that the teachers under study appeared to have similar concerns about alternative ways of implementing the innovation. However, concerns among teachers about the consequences and collaboration aspects of the innovation differed significantly with different levels of experience. Beginning teachers scored higher on the consequence ($\bar{x} = 6.25$) and lower on the collaboration scales ($\bar{x} = 5.30$) than the three other groups of teachers (univariate $F_{\text{consequence}(3,637)} = 3.99$, $p < .008$; $F_{\text{collaboration}\,(3,637)} = 3.43$, $p < .017$). It appears that beginning teachers worried less than other groups of teachers about the consequences, for their students, of using the new textbooks and curriculum; however, they were more concerned about their collaboration with other colleagues and the coordination of their work.

7. Conclusions

The purpose of this study was twofold. First, to explore teachers' concerns regarding the implementation of a new mathematics curriculum and the

adopted new mathematics textbooks; second, to examine the extent to which teachers' concerns vary according to their involvement in the innovation and their overall teaching experiences.

The CBAM questionnaire was used to provide a description of teachers' concerns about the innovation, which shows that teachers accepted the decision to proceed with the change in mathematics curricula and they do not seem to have high self-concerns about the innovation. The means indicated that teachers were not concerned about their abilities in relation to the new mathematics textbooks and on the contrary, felt capable of meeting the demands of the innovation.

The data of the present study showed that in general teachers focused mainly on the task stage. Of the three concern stages, the management stage exhibited the lowest mean scores, indicating that teachers at this phase of implementation mainly had concerns about planning instruction and teaching too many students. It seems that teachers' attention is focused on the processes and tasks involved in using the mathematics textbooks and on issues related to organizing, managing, and time demands. The task stage of concerns of teachers depicts the "zone of enactment", as defined by Spillane (1999), which emphasizes the efforts of teachers to operationalize the ideas implied by the innovation. Based on previous research (Hall and Hord, 2001), we could hypothesize that teachers' self-concerns at the early stages of implementation moved gradually to task concerns. It is possible that they will develop impact concerns in the future as they get more involved with the innovation, especially if the adoption of the innovation is systematically supported through professional development.

The differences in concerns across different groups of teachers formed the topic of investigation under the second research question of the present study. In general, research evidence on the development of teaching concerns has yielded mixed results (Ghaith and Shaaban, 1999). The present study provided evidence that the years of teachers' involvement with the innovation was not a critical factor in explaining the developmental structure of concerns. The relevant data showed that teachers' concerns did not change across the three groups of teachers with different time periods of involvement with the innovation. Moreover, the data did not show differences in the types of concerns as teachers progressed in the adoption of the innovation.

On the other hand, the findings of the study suggest that teaching experience is the most crucial factor in explaining the developmental nature of teaching concerns. The concerns of beginning teachers appeared to be self and task-oriented, reaffirming Huberman and Miles' (1984)

conclusion that teachers during the early years of their careers are absorbed with the difficulties of day-to-day coping and have little attention available for the problems of students. Beginning teachers in this study seemed to focus on the implications of the curriculum changes; they were largely interested in the changes that could occur in their personal work situations, and in the manner in which they could be required to prepare their daily work. In contrast, experienced teachers reported greater interest in the consequences of the innovation for their students and had more ideas with regard to the adoption of the innovation in comparison to beginning teachers.

The results of the study point to the importance of attending to the concerns and experiences of teachers with respect to new mathematics curricula and textbooks. It is the responsibility of educational leaders and policy makers to acknowledge and identify the concerns of teachers in order to increase the prospects of success for educational innovations. The differences found in this study between experienced and beginning teachers can be used to inform the planning and implementation of intervention programs. In-service education and training should be provided for beginning teachers with a high level of task concerns. Meeting the task concerns of teachers is necessary for the recognition of the teacher's professional self and the restoration of working conditions conducive to good teaching performance. Bearing in mind that "curricular reforms may be fragile and transient" (Senger, 1999, p. 201), educational planners should develop in-service programs supporting the teachers to get through the innovation. Otherwise, in the absence of professional development and effective support, especially for new teachers, there is the possibility that concerns will not progress from task to impact in the prescribed stages. Instead, progression may be halted as task concerns continue to intensify, encouraging teachers to return to self-concerns. Thus, the determination of the task orientation of beginning teachers, as highlighted in the present study, allows for the design and implementation of intervention strategies appropriate for the relevant stage of concerns.

Finally, it is important to note the authors of this study have adopted a specific approach to the study of concerns, which places emphasis on mental concerns associated with change in the educational system. It is hoped that future research on the implementation of innovations will provide evidence on additional aspects of change and their role in the educational system such as the importance of contextual and personal factors in the formation of concerns and the concerns of other stakeholders in the educational system such as parents, students, principals, government planners and administrators.

APPENDIX: THE ITEMS OF THE QUESTIONNAIRE AND THEIR LOADINGS ON EACH FACTOR

Factors	Loadings
Refocusing	
1. The new books place sufficient emphasis on the development of the pupil's way of thinking.	.78
2. The new mathematics books develop the pupils' mathematical thinking.	.75
3. The new books place a lot of emphasis on investigation.	.68
4. I submit my proposals regarding the improvement of the new books to the appropriate officials.	.59
5. Pupils acquire the knowledge and skills expected of them.	.53
6. The organization of mathematics in the new books contributes to the improvement of results.	.47
7. The knowledge acquired by the pupils through the new books is superficial.	−.44
8. The various activities included in the book finally function at the expense of practice in the four operations.	−.33
9. The new books place too much emphasis on problem solving.	−.31
Information	
1. I have very good knowledge of the targeted mathematics outcomes for the class I teach.	.61
2. I know the content of the new books for the classes that I have taught.	.59
3. I am familiar with the material covered in the new books for the classes I have not yet taught.	.48
4. I am aware of the changes associated with the new books in the mathematics curriculum.	.47
5. I was well informed about the philosophy of the new books at inspector conferences.	.35
6. The training seminars held covered the needs of teachers regarding teaching with the new textbooks.	.33
Personal	
1. The new books require the use of methods that I am not sufficiently familiar with.	.58
2. I feel insecure about some topics in the new books.	.53
3. I do not face difficulties in teaching mathematics with the new books.	.50
4. I have no difficulty with the knowledge required by the new mathematics books.	.49
5. I personally make use of all the activities in the book.	.49
6. My role in the class has changed with the introduction of the new books.	.45
Management	
1. The new books help reduce the stress of the teacher regarding the organization of teaching.	.61
2. The new books have reduced pupils' homework.	.57

(Continued on next page)

(Continued)

3. The material included in the books can be covered in the available time.	.51
4. The structure of the new books allows me to follow the progress of each pupil.	.45
5. For the teaching of some subjects. it is necessary to use equipment and resources that are not available at my school.	.44
6. I can organize my teaching with the new books so as to achieve the set aims.	.25
Collaboration	
1. There is cooperation between teachers and parents for the utilization of the new books.	.62
2. I often discuss questions relating to the new books with my colleagues.	−.43
3. The frequent communication with the headmaster concerning the new books is useful.	.38
4. The visits of the inspector help improve my teaching of mathematics.	.23
Consequences	
1. I believe that the new books will improve results.	.57
2. The activities in the new books relieve the teacher from a great deal of preparation.	.55
3. I believe that the new books introduce major changes in the teaching of mathematics.	.54
4. The introduction of the new textbooks is a useless innovation in primary education mathematics.	−.51
5. The new books meet the needs of all pupils.	.45

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