

THE EFFECT OF EFFICACY ON TEACHERS' CONCERNS WITH REGARD TO THE IMPLEMENTATION OF A NEW MATHEMATICS CURRICULUM

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The present study aims to examine the concerns of primary school teachers in Cyprus in relation to the recent implementation of a new mathematics curriculum. An adaptation of the Stages of Concern Questionnaire (SoCQ) based on the Concerns-Based Adoption Model (CBAM) and a teachers' efficacy questionnaire were administered to a representative sample of teachers. The findings suggest that teachers' concerns are largely affected by their efficacy beliefs. Furthermore, there were significant differences in teachers' self-concerns across years of involvement with the implementation. However, no significant differences were found in task and impact concerns across teachers in the initiation, implementation and refinement stages.

INTRODUCTION

Research results suggest that the perception of those involved in innovations are of major importance for the successful implementation of an innovation (Richardson, 1990; Sztajn, 1997). The significance attributed to the innovation by those involved in it is often considered as one of the most crucial factors for its successful implementation. However, the literature examining the relationships among the factors that contribute to the successful implementation of reforms, such as the experiences, concerns, and skills of the teachers involved in the process, appears to be inconclusive. This study aims to provide the framework of a model that may explain the relationships between teachers' concerns and their teaching efficacy. Our work focused on the application of the CBAM model in Cyprus with teachers attempting to implement a new mathematics curriculum through the adoption of a new series of mathematics textbooks.

One of the main purposes of the new Cypriot mathematics textbooks is to engage students in thought-provoking, original problems that involve challenging themes. Students are expected to investigate a series of carefully sequenced activities aimed at hands-on discovery of mathematical concepts, with mathematics often integrated with other content areas. The textbooks also aim at supporting teachers' efforts in identifying and addressing students' prior knowledge and connecting it with new ideas at linking conceptual and procedural knowledge, and at relating mathematics to other fields of human endeavor. The adoption of the new textbooks and the subsequent changes in the teaching of mathematics is considered one of the most important innovations in primary education in the last ten years.

The new series of textbooks has been introduced gradually in all public primary schools in Cyprus since 1995: Grade 1 teachers were called to use the new series of textbooks in 1995, grade 2 teachers in 1996, and so on until 2000, at which point all teachers became involved in the adoption of the innovation. At present, there are teachers at different stages in the implementation of the reform. Given the importance of the innovation, it was considered necessary to investigate the degree to which Cypriot teachers had accepted the new curriculum suggested through the new mathematics textbooks and followed it in the classroom.

The proposed efficacy and concerns model (ECM) is an attempt to examine teachers' concerns about the implementation of the new mathematics textbooks and explain how teachers' efficacy influences their concerns.

THE PROPOSED MODEL AND THEORETICAL BACKGROUND

The ECM model integrates two basic ideas about the implementation of educational reforms - the concerns based stages and teachers' efficacy beliefs. Drawing upon relevant literature from each of the two domains, we have attempted to explain the proposed model, which is depicted on Figure 1.

Concerns-based Stages

Concerns refer to the feelings, thoughts, and reactions individuals have about an innovation that is relevant to their daily job (Hord, Rutherford, Huling-Austin & Hall, 1998). The adoption of an innovation requires a change that involves people, thus making it necessary to form an understanding of human concerns in order to help individuals move in the process of change. Concerns exert a powerful influence on the implementation of reforms and determine the assistance that teachers may need in the adoption process.

The CBAM helps educational leaders to this effect by showing them how the individuals most affected by change react to the implementation of innovations (Hord et al., 1998). The model can identify the special needs of individuals and enable administrators to provide the appropriate assistance. 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 of the three tools is the SoC questionnaire, which is used to measure teachers' concerns about an innovation they are expected to implement (Hall & Loucks, 1978). The SoC questionnaire is structured around three dimensions of concerns: self, task, and impact, as depicted in the right side of Figure 1. In the self-concern dimension teachers are trying to learn about the innovation and understand what the innovation means to them. In the task-concern dimension, teachers express their concerns about how to cover objectives, provide and organize instruction. The third dimension, impact, focuses on teachers' concerns about the effectiveness of the innovation on students' performance and abilities.

Earlier research by McKinney, Sexton, & Meyerson (1999) indicated that implementation of innovations occurs in a sequential manner – initiation, implementation and refinement (Figure 1). The initiation phase is closely related to the development of self-concepts, the implementation phase with the task-concerns and the refinement with the impact-concerns of teachers.

Teachers' Efficacy

The conceptualization of teacher efficacy is based on the theoretical framework of self-efficacy developed by Bandura (1997). Bandura (1997) defined perceived self-efficacy as “beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments” (p. 3). In the same sense, teaching efficacy, which is a form of self-efficacy beliefs, can be defined as teachers' beliefs in their abilities to organize effective teaching-learning environments and have positive effects on student learning.

Self-efficacy influences several aspects of behavior that are important to teaching and learning (Woolfolk & Hoy, 1990). Among these are the choices of activities that a teacher makes, the effort put forth and persistence in accomplishing a task (Bandura, 1997). Teachers' efficacy beliefs have also been related to student achievement, student motivation, teachers' adoption of innovations, and teachers' management strategies (Woolfolk & Hoy, 1990).

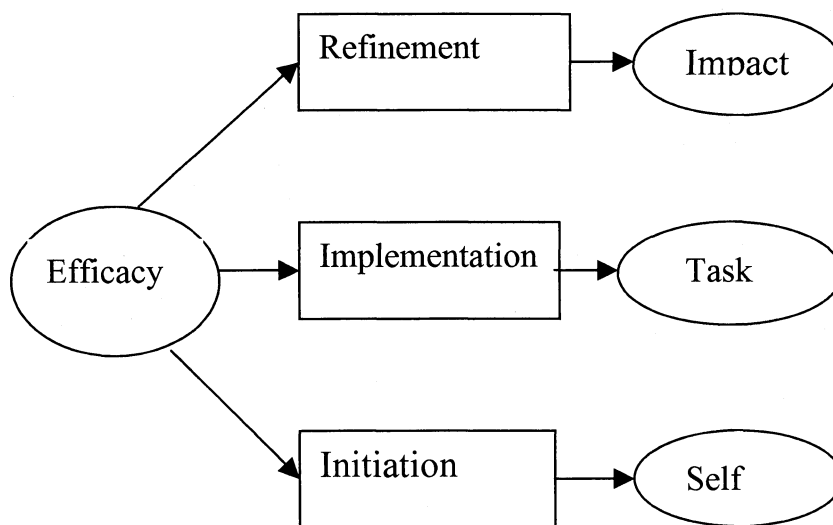


Figure 1: The proposed ECM model

Dempo and Gibson (1985) identified two dimensions of the construct. The “general teaching efficacy” which refers to the belief that teachers in general are able to influence students' learning, and the “personal teaching efficacy” that measures the individual's conviction in his/her own power to control students' motivation and achievement. More recently, Soodak and Podell (1996) supported a third dimension of teacher efficacy and proposed a different interpretation. They suggested that

teacher efficacy is comprised of three factors: Personal Efficacy (PE), Outcome Efficacy (OE), and Teaching Efficacy (TE). More specifically, PE refers to teachers' beliefs that they have the skills to bring changes in students' behavior and performance, while OE refers to the belief that, when teachers implement those skills, they can achieve desirable outcomes. The TE factor refers to teachers' beliefs that teaching in general can lead to students' successful performance overcoming influences outside the classroom which affect learning, including children's home environment.

In this study we adopt Soodak and Podell's interpretation of teacher efficacy since it incorporates previous research results (Woolfolk & Hoy, 1990) and it is consistent with Bandura's (1997) differentiation between efficacy expectation and outcome expectations. However, in the present study we only use the PE dimension of teaching efficacy due to space constraints.

AIMS OF THE STUDY

The first aim of the present study was the validation of the ECM as a theoretical model of explaining the effect of teaching efficacy on the development of teachers concerns towards the implementation of mathematics reforms. The second aim is closely related to the first and it refers to the examination of how efficacy beliefs influence the concerns of teachers as they move through stages of implementation. Specifically, the model suggests that as teachers are involved in the teaching with the new mathematics textbooks, they move through the initiation to implementation and refinement stages. In the present study, we assumed that teachers who were involved with the innovation for 0-1 years belong to the initiation stage and thus they merely express self-concerns. Teachers involved with the innovation for 2-3 years belong to the implementation stage, which is related to the task-concerns. Finally, teachers with 4-6 years of involvement belong to the refinement stage and thus they are expected to express impact-concerns.

During the process of innovation, teachers express different concerns, which are influenced by their efficacy beliefs. To date, no other model has incorporated efficacy and teachers' concerns in a comprehensive manner involving causal relationships. The following two hypotheses reflect what we would expect if efficacy affects teachers' concerns about the implementation of new mathematics textbooks :

- (a) The fitting of the ECM showing causal effect of efficacy on teachers' concerns to be acceptable, and
- (b) A decrease in self-concerns with increases in task and impact-concerns when teachers' scores at the initiation stage are compared with those at implementation and refinement stages. Similarly, we would expect a decrease in task-concerns with increases in impact-concerns when teachers' scores at the implementation stage are compared with those at the refinement stage.

METHOD

Participants and Instrumentation

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 sample included three groups of teachers covering the initiation, implementation and refinement stages.

Two instruments were used as data sources. Both instruments were administered at the same time to all participants. The first instrument was an adaptation of the SoCQ as described by van den Berg & Ros (1999). The SoCQ questionnaire, which included 36 items, was used to measure the self, task and impact concerns. For the purposes of the present study teachers' rating to 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 recoded so that higher numbers indicated greater agreement.

The measures of teaching efficacy were obtained through a questionnaire which was used in previous studies in Cyprus (see Christou, Philippou, & Dionysiou, 2001). Respondents used a six point agree/disagree scale to respond to 13 statements which measured TE, 11 which measured PE, and 10 which measured OE. The coding of the negatively stated items was inverted to ensure that high scores meant high efficacy on all items of the scale.

Data Analysis

The assessment of the proposed model was based on a multi-sample mean and covariance structures analysis, which is part of a more general class of approaches called structural equation modelling. One of the most widely used structural equation modelling computer programs, EQS 6.0, was used to test for model fitting in this study. In order to evaluate model fit, three fit indices were computed; the chi-square to its degree of freedom ratio (χ^2/df), the comparative fit index (CFI), and the root mean square error approximation (RMSEA). These three indices recognized that observed values for $\chi^2/df < 2$, values for CFI $> .9$, and RMSEA values close to 0 are needed to support model fit (Marcoulides & Hershberger, 1997).

RESULTS

To test the first hypothesis we posited a model with three factors (self, task and impact concerns), which are causally related to teaching efficacy (see Figure 1). Factor loadings, factor regressions and variable intercepts were constrained to equal across the three groups of teachers (teachers at the initiation, implementation and refinement stages). We tested the ability of a solution based on this structure to fit the data. As reflected by the iterative summary, the solution converged smoothly,

and the goodness-of-fit statistics showed that the model had a very good fit to the three-group data ($\chi^2 = 364.174$, $df=236$, $\chi^2/df=1.54$, $CFI=.96$, $RMSEA=.02$). All items loaded strongly and distinctly on each of the factors shown in Figure 1. The standardized loadings of all measures were above .5, and were statistically significant in all groups. The regressions of efficacy on the self (.297), task (.880) and impact concerns (.461) were significant and equal in all groups, indicating that efficacy exerts an important effect on teachers' concerns (see Table 1).

To examine the second hypothesis of the study of whether the latent construct means of self, task, and impact concerns are significantly different in the three groups of teachers, we turned to the construct equations, which are presented in Table 1. The parameters of interest in this case were the factor intercepts that represent the latent mean values. Because the initiation teachers had their parameters fixed to zero for comparison purposes, we concentrated on estimates for the teachers in the implementation and refinement stages. The lower part of Table 1 shows the comparison between teachers in the implementation and refinement stages. To compare these two groups of teachers we fixed the factor means of the implementation group to zero.

Comparison between teachers in initiation and implementation stage
Self = .172V999* + .297Efficacy*
Task = -.218V999 + .880Efficacy*
Impact = -.083V999 + .461Efficacy*
Comparison between teachers in initiation and refinement stage
Self = .254V999* + .297Efficacy*
Task = -.143V999 + .880Efficacy*
Impact = -.066V999 + .461Efficacy*
Comparison between teachers in implementation and refinement stage
Self = .297V999* + .297Efficacy*
Task = -.169V999 + .880Efficacy*
Impact = -.085V999 + .461Efficacy*

V999=Latent factor mean

*=statistically significant at .05 level

Table 1: Construct equations of teachers' concerns

Table 1 shows that self-concerns are increased significantly in teachers in the implementation (.172) and refinement stages (.254). This increment means that teachers have less self-concerns when their involvement in the innovation increases. On the contrary, teachers' task and impact concerns seem to increase as they proceed to higher stages of implementation. This is denoted by the negative sign of the latent

factor means (-.143, -.169 for task, and -.066 and -.085 for the impact concerns). However, the latter effects were not significant by z-tests. These results replicate partially the results reached by van den Berg and Ross (1989).

DISCUSSION

The purpose of this study was twofold. First, to explore the effect of teaching efficacy on teachers' concerns regarding the implementation of a new mathematics curriculum and the use of new mathematics textbooks; second, to address the extent to which teachers at different stages in the implementation process of the innovation had different concerns in relation to the innovation.

Earlier research indicated that teachers' efficacy beliefs were related to student achievement, student motivation, teachers' adoption of innovations, and teachers' management strategies (Woolfolk, Rossoff, & Hoy, 1990). The data of the present study reinforced previous studies by validating a model in which the relationship between efficacy and concerns is a causal one. The model also showed that teachers' efficacy beliefs affect more the task concerns of teachers than the self or impact concerns (see Table 1).

The differences in concerns across different groups of teachers was the main 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 & Shaaban, 1999). The study provided evidence that years of teachers' involvement with the new mathematics curricula and mathematics textbooks explained to an extent the developmental nature of teaching concerns. Teachers' concerns in the initiation stage appeared to be self-oriented, reaffirming van den Berg, & Ros (1999) conclusion that teachers during the early years of an innovation are absorbed with day-to-day difficulties and pay little attention to the newly encounter problems of the students. Teachers at the initiation stage in this study seemed to focus on the implications of the new mathematics curriculum and textbooks for themselves; 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, teachers at the implementation and refinement stages reported less interest in the consequences of the innovation for themselves but they did not report greatest interest in their students and did not have more ideas with regard to the adoption of the innovation in comparison to teachers in the innovation stage. Although this result seems to contradict the conclusions of other research studies (van den Berg & Ros, 1999), it can be explained by the fact that concerns in the present study were analysed in the light of the teaching efficacy effect.

The results highlight the importance of attending to the concerns and experiences of teachers with respect to the new mathematics curricula and textbooks. It is important for policy makers and school leaders 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 program.

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