

# DISENTANGLING MENTORS' ROLE IN THE DEVELOPMENT OF PROSPECTIVE TEACHERS' EFFICACY BELIEFS IN TEACHING MATHEMATICS

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*The study reported in this paper builds on a broader work aiming to identify factors that affect the development of prospective primary teachers' efficacy beliefs (TEB) with respect to teaching mathematics. Eight student teachers were interviewed in the beginning, in the middle and in the end of a fieldwork course; they were encouraged to reflect on their experiences throughout the course. The analysis of the data revealed that mentors could influence student teachers' beliefs through their own teaching style, the feedback they provide to students, and the latent messages they implicitly convey to students. Yet, mentors' influence on prospective teachers' TEB should be regarded as a function of variable factors including the student-mentor personality matching. Implications for developing practicum courses and for further research are drawn.*

## INTRODUCTION

Understanding prospective teachers' mathematical beliefs and the circumstances under which these beliefs might develop is considered crucial to educating teachers. Kagan (1992) observed that pre-service teachers tend to leave the university programs holding primarily the same beliefs with which they join it. She thereby recommended that teaching programs afford novice teachers extended opportunities to examine and integrate new information into their existing belief systems. Fieldwork courses have the potential to provide student teachers (hereafter referred as students) with such experiences.

Fieldwork is the most relevant part of teacher education: it aims to help students integrate theory and practice, and learn to view their future role as learning facilitators (Pajares, 1993). On the one hand, fieldwork provides students with hands on experiences, leading them to "practice theory", while, on the other hand, it encourages students to "theorize practice", especially through critical observation and analysis of lessons taught by experienced teachers (Zanting, Verloop, & Vermunt, 2003). Commenting on the catalytic role of fieldwork in changing students' beliefs, Tilemma (2000) pointed out that, though some students hold quite stable beliefs that are well articulated and embedded in their personal belief systems, these beliefs might severely be challenged and become overruled by the conditions set by teaching practice. In fact, fieldwork may evoke negative feelings and attitudes, especially when it turns to be a "sink or swim experience", viz. when students are left alone to fight against the obstacles emerging of school realities (Fullan, 1991; Tschannen-

Moran, Woolfolk Hoy & Hoy, 1998). Hence, it goes without saying that examining the development of students' beliefs during fieldwork, particularly in demanding domains such as mathematics, could inform our understanding of student teachers' professional development.

During the last decades much emphasis was placed on a subset of teachers' beliefs, namely to teachers' efficacy beliefs (TEB). It has been well documented that this construct influences predominantly teachers' professional behavior and pupils' conceptions and performance (Bandura, 1997). In particular, teachers with high TEB were found to exhibit stronger commitment and lower drop out tendency, have higher expectations for their pupils, set high goals and strive to realize them, show enthusiasm, have the view that even non motivated pupils can learn, accept pupils' ideas and be less critical to wrong answers (Gordon, Lim, McKinnon & Nkala, 1998). Though beliefs in general are considered relatively stable, it is supported that fieldwork comprises a critical period, which provides fertile soil for the development of TEB (Pajares, 1993; Tschannen-Moran et al., 1998). It is, therefore, worth examining the effect of factors embedded in training programs on the development of student teachers' TEB.

The present study elaborates on the potential role of mentors in the development of students' TEB. Research has so far indicated that mentoring constitutes a central element in teacher training (Jones, 2001; Templeton, 2003). Zanting et al. (2003) regarded mentors as potential conveyors of their practical knowledge to student teachers, whereas Athanases and Achinstein (2003) found that mentors could help novices focus on pupils' learning, rather than worrying about their own competencies or about issues related to managing the class. Additionally, in Hobson's (2002) study students perceived school-based mentoring as one of the key elements of their initial teacher education experiences. Indeed, students regarded mentors as more effective individuals than other persons involved in their teacher preparation program, in facilitating the development of their class management abilities and their skills in maintaining discipline and for helping them apply different teaching methods, as well.

However, there is growing consensus that the quality of mentoring varies. Examining mentoring in England and Germany, Jones (2001) reported that mentors' role captures a wide spectrum, from mentors being considered as teaching models and critical friends who assist newcomers with planning, teaching and evaluating students to simply being there to provide assistance to student teachers only when requested. Some of the students who participated in Hobson's (2002) study also reported several communication problems with at least one of their mentors. Finally, drawing on the results of their study, Edwards and Protheroe (2003) concluded that, though mentors are in a position to guide student teachers' participation in the practices of teaching and in flexible pedagogic responses to local classroom events, they rarely do so.

Pointing to the necessity for further research in this domain, Feiman-Namser (2001) asserted that, “we still know very little about what thoughtful mentor teachers do, how they think about their work, and what novices learn from their interactions with them” (p. 17). To the best of our knowledge, no previous study has elaborated so far on the role of mentors in the development of student teachers’ TEB. Therefore, the present study geared towards unraveling mentors’ role in the development of perspective student teachers’ efficacy beliefs in teaching mathematics. Specifically, the purpose of the study was twofold. First, to cast some light on the ways through which mentors can influence the development of student teachers’ TEB, and second, to investigate factors that affect the magnitude of their impact on students’ efficacy.

## **METHODS**

The study took place at the University of Cyprus during the spring semester of 2002. The subjects were 89 four-year prospective teachers, 6 males and 83 females (mean age=22.14 years, SD=1.90) registered in the final teaching practice course. The course was structured in two parts of six weeks each with a week break in the middle for group reflection on practice. In each part, students were assigned interchangeably to a class in either a low primary cycle (1<sup>st</sup> to 3<sup>rd</sup> grade) or a high primary cycle (4<sup>th</sup> to 6<sup>th</sup> grade), where they attended the daily program, participate in all in-class or in-school events and taught nearly 120 lessons, 30 of which are mathematics lessons. Classroom teachers operated as students’ mentors: they were supposed to assign students what to teach, and discuss with students possible ways to present the content; they were also expected to be critical friends, providing students with feedback. Students also had the opportunity to observe their mentors while teaching mathematics and exchange ideas with them on issues related to teaching and managing the class.

The eight interviewees that participated in the present study were selected on the basis of gender, performance in mathematics and level of TEB in mathematics. Specifically, two students (S<sub>5</sub> and S<sub>7</sub>) were males; two students (S<sub>1</sub> and S<sub>5</sub>) scored below the average in the mathematics courses they had attended at the university, four (S<sub>3</sub>, S<sub>4</sub>, S<sub>6</sub> and S<sub>8</sub>) about the average, and two (S<sub>2</sub> and S<sub>7</sub>) scored above the average. The students’ teaching efficacy beliefs were measured three times using an existing scale translated in Greek and reworded to reflect efficacy in teaching mathematics (more information is provided in Philippou et al., 2003). The interviewees represented the four different patterns of the development of students’ TEB that emerged from the analysis. Namely, S<sub>1</sub> represented those students who entered the program with somewhat higher than the overall mean TEB; these beliefs were improved mainly during the first part of program. S<sub>2</sub> and S<sub>3</sub> started with slightly lower TEB than the average beliefs and got the most out of the program compared to other students. S<sub>4</sub> to S<sub>7</sub> were representative of students who entered the program with the highest TEB and continued to be above the level of the average students’ efficacy. Finally, S<sub>8</sub> had extremely low TEB throughout the program.

Students were interviewed three times, one at the commencement of the course, one in the middle and one in the end. The interviews were quasi-structured and were conducted with the aid of a specially prepared interview plan; each interview lasted about 45'. Subjects were asked open-ended questions aiming to clarify their experiences as mathematics students and mathematics teachers, and their interaction with pupils, other preservice teachers, their mentors and the university mathematics tutors during fieldwork. The constant comparative method (Denzin & Lincoln, 1998) was used to analyze the data that emerged from the interviews. Specifically, transcripts were read intending to identify frequently used concepts and integrating themes. In this study we elaborate on the themes that were pertinent to the role of mentors in the development of students' efficacy beliefs.

## FINDINGS

The analysis of transcripts indicated that mentors influenced the development of the student' TEB in diverse ways. However, nearly all transcripts suggested three overarching paths of this effect. In particular, mentors were found to affect students' teaching-image by their **teaching style**, the **feedback** they provided to students and the **latent messages** that their behavior conveyed to students, as analyzed below.

**Teaching style.** The mentors were more influential if they appealed to students as models in organizing and executing teaching tasks. The pattern of this influence, however, was not consistent across all students. A good mentor could be a positive model for a student, as appears in the reflections of S<sub>5</sub>:

Her [the mentors'] teaching was a challenge to me. She was using various teaching approaches and manipulatives, and I was trying to imitate her... I believe that the mentor affects the way the student works and thinks. A good mentor motivates the student to try harder... My mentor, no doubt, exerted a positive effect both on my beliefs and my performance: she made me work harder and believe that I can do well.

Nevertheless, good mentor teaching could also scare some students. S<sub>4</sub>'s commented, "I would never be able to teach as well as my mentor did. I tried to keep up with her as if there was a competition. I certainly could not override her; she had 12 years of experience". Likewise, referring to the efficiency of her mentor's teaching approach, S<sub>8</sub> pointed out that "She was leading the process as a master. I used to compare my lessons to hers and I was often disillusioned". For the same student, a less competent teacher seemed to be more influential for the development of her efficacy beliefs, as seen from her comments on the problems that her second mentor had in managing the class: "I was relieved to realize that I was not the only one who had problems in managing the class; even more experienced teachers had the same problems. That reinforced my confidence".

The difference between mentors' teaching style and students' beliefs about teaching and learning mathematics constituted another factor influencing students' beliefs. For instance, S<sub>1</sub>, S<sub>5</sub>, and S<sub>7</sub> described their mentors teaching as traditional. In most cases, that produced a rather "avoidance model", as evident in the following excerpts:

S<sub>5</sub>: My mentor used to keep pupils at a distance; his teaching was cool, and showed no interest in learning. I felt sorry for the children and tried to offer them something new and innovative. Being an old teacher, my mentor belonged to a different school of teaching and learning. And that incited me to perform even better in teaching mathematics.

Along the same lines, S<sub>1</sub> noted:

S<sub>1</sub>: My mentor was a counterexample for me. She was obsessed with covering the content; I highly disagreed with her teaching approach. I objected to rushing to present the content, since pupils seemed to fail to develop understanding. I was, thereby, incited to try to come closer to pupils and teach mathematics in more pedagogically consonant ways.

**Feedback and latent messages:** Students' efficacy was also sustained and further developed by the feedback they received from their mentors. Being confronted by the complexities of the teaching practice for such a long period, all eight students seemed to seek for this kind of support, since it reinforced their beliefs that they were doing well. For example, S<sub>2</sub> noted, "On finishing my lessons, she [the mentor] was very supportive. She was telling me that I was doing very well and that pupils were learning", whereas S<sub>8</sub> was indebted to her mentor, for "she persuaded me that our mistakes should be considered as opportunities for learning rather than indications of inefficiencies. That really helped me a lot".

Beyond the verbal channel of communication and persuasion, mentors were additionally affecting students' self-conceptions by the latent messages that their behavior conveyed to students. S<sub>7</sub> confessed that:

Every time I was deviating from the conventional way she was teaching, I felt that she was ready to tell me "you are creating troubles for my pupils". Her behavior was often degrading; she would interfere in my teaching saying, "let's explain this better".

In accord, commenting on one of her mentors' behavior, S<sub>3</sub> pointed out:

His whole attitude instilled doubts about my teaching competence. On seeing him observing my lesson, I often had the impression that he was ready to tell me "My God. Your teaching approach is ineffective!" I felt that I was the worst teacher in the world.

Interaction with a second mentor provided students with two teaching models, sometimes extremely dissimilar. The interviews revealed that students compared the two mentors in terms of their teaching practices and style and the feedback they provided to them. The mentors' impact also depended on the degree of congruence between the students' and mentors' personality, age and sex. For instance, mentors' openness to students' ideas, their teaching style and their avoidance in imposing their own ideas to their neophyte colleagues offered predominantly in the former being considered as accountable advocates, as echoed in S<sub>2</sub>'s reflections:

My mentor used to assist me in planning the lessons. She was not trying to impose her ideas on me; on the contrary, she was first expecting to listen to my own ideas. Then she was making suggestions. With no exception, I was following her suggestions... I trusted

her. She was teaching mathematics in a superb way; thereby I considered her recommendations as contributing to improving my teaching approach.

The discrepancy between mentors' and students' age was another issue raised by most participants in the interviews. As S<sub>4</sub> put it:

My first mentor was the one who had the most determinant effect on the way I envisioned myself as a prospective teacher. She was two years older than me... She made me believe that I could be improved. The second mentor was good; but she was much older than me. She was very helpful; yet I could not communicate with her as openly and efficiently as I was doing with my first mentor.

Finally, S<sub>3</sub>'s comments surfaced the role that the difference in mentors' and students' gender may have in the development of students' efficacy beliefs. In her own words,

“My second mentor was a male teacher and I did not feel very comfortable with him. I felt that I could not interact with him the way I was communicating with my female mentor”.

## **DISCUSSION**

Though the findings of the present study do not allow for overgeneralizations, they point to some possible ways through which mentors can affect the development of students' TEB during fieldwork. In accord with previous studies (e.g., Bandura, 1997; Wolf, 2003), the present study reveals that mentors can inform students' beliefs and teaching practices by their own teaching and by providing feedback to students. Moving a bit further, the study suggests that mentors can also impact students' TEB by the latent messages that their behavior conveys to students. We elaborate on each aspect in turn.

The findings of the present study seem to provide support to Bandura's (1997) claim that vicarious experiences constitute a significant factor informing individuals' efficacy. Specifically, several participants commented on how influential observing their mentors teaching was, both for their practices and their own efficacy beliefs. Yet, various factors appear to have determined the magnitude of this effect. Mentors' competence was one of these factors, since students seemed to gain more from more proficient mentors. However, the findings of the study provide support to the curvilinear effect of mentors' quality of teaching, given that when their teaching was perceived as more than reachable could degrade students' efficacy. Bandura (1997) would explain this finding asserting that an excessive discrepancy between mentors' and students' competencies sets the bar too high for students and leads them to conclude that there is no meaning in trying to keep up with their mentors. The discrepancy between mentors' teaching style and students' beliefs about teaching and learning was also found to determine the influence that mentors had on neophyte teachers. In fact, students seemed to be less influenced by mentors whose teaching practices were discordant with what they believed about teaching mathematics. Though in most of these cases students were trying to employ teaching approaches

that were consonant with current reform ideas in teaching mathematics, mentors could act as stumbling blocks in this endeavor.

The feedback that mentors provided to students was also found to inform students' efficacy beliefs, verifying Templeton's (2003) claim that feedback is more influential if it is provided after students' teaching. Yet, findings also suggest that were a mentor accepted as more knowledgeable and expert, his or her suggestions and feedback would be taken more seriously into account. Verbal interaction was not, though, the sole channel of providing feedback to students, since students could also receive feedback about their performance by the latent messages that the mentors' behavior conveyed to them. Though this factor has not been reported in previous studies, the interviewees' comments are indicative of the predominant effect that this path of "interaction" may have on the way students envision themselves as potential teachers.

In general, the findings of the present study provide support to the argument that there is no single way of informing individuals' efficacy beliefs (Bandura, 1997; Tschannen-Moran et al., 1998). What seems to support the development of a student's TEB can have a neutral or even negative effect on the development of another student's efficacy. It, thereby, seems more legitimate to claim that the development of students' TEB comprises a complex construct. Hence, when examining the mentor-student interaction as a potential contributor to the development of student's efficacy, we should better elaborate on the confluence of several factors, including the mentor-student personality congruence, in terms of age, gender, teaching style, and pedagogical beliefs.

With all this said, it goes without saying that teaching training programs need to place more emphasis on the potential impact that mentors have on the professional development of neophyte teachers. Given that some mentors were found to have reserved or even eliminated students' opportunities to experiment with current teaching ideas and appeared to degrade students' TEB, their role should not be underestimated. On the contrary, mentors' professionalism, their pedagogical ideas, and their competence in establishing channels of communication with preservice teachers should be seriously taken into account when considering the factors contributing to the success of fieldwork. It could even be supported that interacting for so many hours with students during their first teaching steps, mentors are more in place to scaffold the development of students' TEB than any other personnel engaged in teaching training programs.

Though the present study seems to have shed some light on mentors' potential role in the development of student teachers' TEB, several questions remain unaddressed. For instance longitudinal studies could reveal how lasting mentors' influence on students' efficacy beliefs is. Of equal importance is to examine what mentors are thinking of students. Future research could also investigate whether the latent messages that mentors convey to students are a function of students' deficiencies and self-doubts. In sum, the present study seems to have raised more questions than those it answered,

verifying Wolf's (2003) assertion that we need to gain more insight into the roles that mentors play to support student teachers' professional development.

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