

**Does a Co-Learner Delivery Model in a Mathematics Methods Course Affect  
Pre-service Teacher Candidates' Self-Efficacy in Teaching Mathematics?**

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## **Purpose**

This study is related to a previous study (Ribeiro, 2009) that examined teachers' perceptions of teaching self-efficacy. In the first study the sample consisted of two groups of teachers that took the same professional development course in mathematics. The comparison group took the course in their school district with other teachers and the experimental group took the course with pre-service teachers in a university classroom. After completing the course, both groups were measured in three dimensions of teaching self-efficacy: student engagement, instructional strategies, and classroom climate. Findings indicated that although both groups had significant gains in self-efficacy toward teaching mathematics in the three dimensions, there was not a significant difference between the adjusted post-test group means.

The study presented in this paper also examines perceptions of self-efficacy in the dimensions of student engagement, instructional strategies, and classroom climate, however, the focus is on the pre-service teachers who were part of the original study.

## **Theoretical Framework**

In order for teachers to acquire new beliefs and learn new strategies, they need to develop self-efficacy or confidence that new learning is relevant and supported by long-term support and organizational accommodations (AFT, 2002). Bandura (1977) defined self-efficacy as one's beliefs about one's ability to organize and execute tasks to achieve specific goals. In order to develop self-efficacy, teachers need to rely on the judgment of their capabilities to bring about

desired outcomes of student engagement and learning (Neitfield & Cao, 2003). Teachers with high teacher efficacy beliefs are more open to new ideas and more willing to adopt innovations; they exhibit lower drop out tendency and are less likely to experience an “emotional burnout” phenomenon; they set high goals and harbor high expectations for their pupils (2003). Currently, most research regarding self-efficacy has been conducted with teachers and has not included preservice teachers (Charalambours & Kyriakides, 2007). One recent study (Cheong, 2010), however, did focus on pre-service teachers. The study compared the sense of self-efficacy of pre-service teachers who taught individually with pre-service teachers who engaged in collaborative teaching practices. Results suggested that collaborative practice teaching is more effective than individual approaches to practicing teaching.

In order to examine pre-service teachers’ perceptions of self-efficacy, researchers rely on fieldwork experiences, which, at the master’s level, usually occur throughout the entire program (National Council for Accreditation of Teacher Education, 2008). Field experiences are “integral to teacher preparation programs as they provide the opportunity for pre-service teachers to develop the knowledge, skills, and the professional dispositions expected of highly effective teachers” (p.32). Typically, pre-service teachers gain such experience in a variety of settings appropriate to the content and level of their program. When field experiences are thoughtfully and purposefully constructed within a program sequence, the experiences can facilitate students’ development of competencies necessary to begin careers as teachers (2008).

Although few studies address the effects that alignment of these pre-service field experiences with course content have on pre-service teachers' sense of efficacy, some studies suggest a correlation. (Phillippe et al., 2007) conducted an experimental study looking at the effects of early field experiences on pre-service teachers' Math content knowledge and beliefs. The researchers found that those pre-service teachers, who studied children's mathematical thinking in the field at the same time they, themselves, were taking courses in mathematics, developed a deeper understanding of teaching, learning and content knowledge than did pre-service teachers whose fieldwork was not aligned to coursework. In another study it was found that when teachers have more time to interact with their subject matter collaboratively with their peers, they are more likely to engage in practices such as effective instructional strategies or student engagement strategies in their classrooms (Lieberman & Wood, 2003). Modeling, experiencing, and reflecting on new practices bring about changes in attitudes and beliefs when participants discuss, experiment, and reflect in a safe atmosphere (AFT, 2002).

### **Methodology**

This mixed methods study gathered data using a non-equivalent comparison group design supported with qualitative data using focus groups notes.

### **Description of the Treatment**

The treatment consisted of pre-service teacher candidates conducting field service hours with teachers who took the same mathematics methods course.

The course entitled, *Thinking Mathematics* is a professional development course that has been used as an in-service training for teachers throughout the United States and is also a course in a Masters of Arts in Teaching (MAT) program located in a midsize university in southern New England. All the cooperating fieldwork teachers (k-6) in the study taught in the same urban ring school district located in southeastern New England and participated in the same mathematics methods course from the same instructor as their pre-service teachers. The difference between the groups was that some teachers ( $n = 17$ ) took the course at their school site with their peers during the winter term of 2008-2009, while the other cooperating fieldwork teachers ( $n = 14$ ) took the math methods course with their pre-service teacher candidates at the university, during the following 2009 spring term. Each fieldwork treatment lasted for 11 weeks with 2-hour sessions each week.

### **Sample**

Flyers promoting the study were distributed to each of the MAT students in the same cohort ( $N = 56$ ). Out of the target group,  $n = 31$  signed up to volunteer in this study. The two groups of pre-service teachers, Student Comparison Group A ( $n=17$ ) and Student Experimental Group B ( $n=14$ ) represented a cohort of pre-service teachers enrolled in a MAT program at the local university. Group A received the treatment in a university classroom setting and conducted their fieldwork in classrooms with the teachers who took the treatment three months earlier at their school site. Group B received the treatment with their cooperating fieldwork teacher in a university classroom setting. The pre-service teacher and

the cooperating fieldwork teacher conducted fieldwork from the course in the cooperating fieldwork teacher's classroom.

### **Instrumentation/Data Collection**

Data were collected using a mixed methods approach. A quantitative self-efficacy survey was followed by qualitative focus groups. Both groups were administered the survey as a pre and post-test. The quantitative instrument used was a translated version of the "The Sense of Efficacy Scale (TSES), Long Form (Tschannen-Moran, Hoy & Hoy, 1998), which was adapted in a previous study (Charalamnous, Philippou & Kyriakides, 2007) to measure pre-service teachers' efficacy beliefs in teaching mathematics.

In this study 22 of the 24 items were used in three dimensions; 6 items in student engagement, 8 items in instructional strategies, and 8 items in classroom climate. Each dimension was scored on a 9-point Likert-type scale. The responses were anchored with the descriptors *1 –nothing, 3-very little, 5-some influence, 7-quite a bit, and 9-a great deal* (Tschannen-Moran & Woolfolk Hoy, 2001; Heneman III, Kimball, & Milanoski, 2006).

Two focus groups (Morgan, 1997) were conducted, one included participants from the Student Comparison Group A, and the second included participants from Student Experimental Group B. Both sessions were facilitated and audio taped by the same facilitator. The researcher was not present at the sessions. Focus groups help to understand the perceptions that the participants had in the study based on their responses thus providing a deeper exploration, context and interpretation for this study (Morgan, 1997). The questions were crafted based on

the literature and were the same for each group. The Focus Group Kit (Morgan & Kruger, 1997) was used to guide the design and implementation of the interviews.

### **Data Analysis**

Descriptive statistics were conducted at the dimension levels for Student Engagement, Instructional Strategies and Classroom Management. Pre-tests and post-tests in each of the three dimensions for the separate groups were analyzed using related *t*-tests. Analysis of Covariance (ANCOVA) was used to compare the adjusted post-test means for each group after controlling for any initial pre-test differences.

After each focus group session, the facilitator debriefed with the researcher. The audio transcripts were transcribed by the researcher. The Classic Approach strategy of the transcript and focus group notes allowed for the development of themes and placement of results into categories (Krueger & Casey, 2009).

### **Results**

Participants in the study assigned a code name to identify their pre-test and post-test assignments.

#### **Quantitative Findings**

The quantitative instrument used was a translated version of the The Sense of Efficacy Scale (TSES), Long Form (Tschannen-Moran, Hoy & Hoy, 1998), which was adapted in a previous study (Charalamnous, Philippou & Kyriakides, 2007) to reflect efficacy beliefs of pre-service teacher candidates in teaching

mathematics in three dimensions; student engagement, instructional strategies, and classroom management.

### Reliability

Cronbach's alpha for the data from student engagement, instructional strategies, and classroom management were .94, .96, and .91 respectively.

### Group Differences on the Adjusted Post-test/ Means

ANCOVA was used to analyze the adjusted post-test means of the two groups.

Table 1 contains the data from Group A ( $n = 10$ ) and Group B ( $n = 12$ ) with respect to pre-service teachers' self efficacy in each of the three dimensions being measured: student engagement, instructional strategies and classroom management. Results revealed that no significant differences were found between the two groups after equating groups on the pre-test.

**Table 1**

**ANCOVA Summary Comparing Group A ( $n = 10$ ) and Group B ( $n = 12$ ) with respect to Pre-Service Teachers' Self-Efficacy**

Dimension	Group A <i>M</i>	Group B <i>M</i>	<i>F</i>	<i>p</i>
<b>Student Engagement</b>	7.41	7.20	0.252	0.622
<b>Instructional Strategies</b>	7.45	7.41	0.011	0.918
<b>Classroom Management</b>	7.04	7.42	0.839	0.371

## Student Engagement

Two paired-sample *t*-tests were conducted to calculate growth within the two groups (A & B). Table 2 contains the data for the pre-test and post-test within Group A ( $n = 10$ ) and Group B ( $n = 12$ ) for pre-service teachers' self efficacy in student engagement.

**Table 2**  
***t*-test Comparing the pre-test and post-test within Group A ( $n = 10$ ) and Group B ( $n = 12$ ) Growth of Pre-service Teacher s' Self-Efficacy in Student Engagement**

	Test	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
<b>Group A</b>	Pre	5.75	1.88	3.34	.009
	Post	7.48	.85		
<b>Group B</b>	Pre	4.75	.98	5.66	.000
	Post	7.14	.93		

The results illustrate that both groups showed statistically significant growth with student engagement.

## Instructional Strategies

A paired-sample *t*-test was also conducted to calculate the growth of pre-service teachers' self- efficacy in instructional strategies using each group's pre- and post-test results. Table 3 compares the pre-test and post-test data within Group A ( $n = 10$ ) and Group B ( $n = 12$ ).

**Table 3**  
***t*-test Comparing the Pre-test and Post-test within Group A ( $n = 10$ ) and Group B ( $n = 12$ ) for Growth of pre-service Teachers' Self- Efficacy in Instructional Strategies**

	Test	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>
<b>Group A</b>	Pre-	5.73	2.06	3.60	.006
	Post-	7.56	.93		

<b>Group B</b>	Pre- Post-	4.76 7.32	1.16 .91	5.91	.000
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The results illustrate that both groups showed statistically significant growth with instructional strategies. Again, Group A started with a higher mean pre-test score ( $M = 5.73$ ) and resulted in a higher mean post-test score ( $M = 7.56$ ). However, Group B showed a greater growth difference between their pre-test and post-test mean scores ( $M = 4.76$ ,  $M = 7.32$ ).

### **Classroom Management**

A paired-sample *t*-test was also conducted to calculate the growth of the two groups for classroom management. Table 4 contains the data that compares the pre-test and post-test within Group A ( $n = 10$ ) and Group B ( $n = 12$ ).

**Table 4**  
***t*-test Comparing the Pre-test and Post-test within Group A ( $n = 10$ ) and Group B ( $n = 12$ ) Growth of Pre-service Teachers' Self-Efficacy in Classroom Management**

	<b>Test</b>	<b><i>M</i></b>	<b><i>SD</i></b>	<b><i>t</i></b>	<b><i>p</i></b>
<b>Group A</b>	Pre-	6.31	1.70	2.46	.036
	Post-	7.29	1.15		
<b>Group B</b>	Pre-	5.25	.96	6.29	.000
	Post-	7.21	.97		

The data in Table 4 indicates that significant growth was present for both groups. Again, Group B showed a greater growth difference between their pre-test and post-test mean scores.

## **Summary of Quantitative Findings**

The ANCOVA indicated that after controlling for initial differences between the groups on the pre-test, no significant differences were found in the adjusted post-test means. Examination of the pre-post change within each group did indicate that significant growth did occur for both groups on the three self-efficacy dimensions.

## **Qualitative Findings for Groups A and B**

The following themes emerged based on focus group notes from the Group A and Group B meetings: synchronous learning & experiential time, roles in fieldwork experiences, collaboration opportunities and teachers as learners. Each of these themes will be addressed separately.

### **Synchronous Learning & Experiential time**

Participants from both groups stated that working with a teacher who was aware of the content and pedagogies being introduced to pre-service teachers was beneficial. Comments from Group B participants (experimental group) stated that conducting fieldwork with teachers who were taking the class with them allowed them to see in-class modeling of the content taught in class. One participant said, "In several fieldwork experiences I had with prior classes, I didn't really observe what I was learning in coursework, but in this math class I saw the strategies you learned together in class being taught the next day being modeled with students". Another pre-service teacher said, "It makes so much sense now

and the children are getting it and their faces (are) lighting up. I saw what my instructors taught me through the students' eyes on the next day.”

Group A participants (comparison group) also observed strategies that were presented in the coursework, but did not necessarily observe the strategies at the same times the theories were taught in the course. Although group A participants were assigned to teachers who were trained in the same methods, there were no assurances that these teachers were going to demonstrate the same theories in their classroom that the pre-service teacher candidates were learning in their coursework during the same week.

### **Roles in Fieldwork Experiences**

Participants from both groups commented that their roles in fieldwork varied and were dependent on the wishes of the classroom teacher. Most teachers who took the course with pre-service teacher candidates immediately tried many of the strategies learned in the course allowing their co-learner pre-service teachers to observe, and in some cases, to co-teach the lesson. One respondent from Group B said “We were in the same classroom learning at the same time, hearing what the instructors had to say. So we both knew we had the common experience that we had been exposed to already, so we didn't have to catch up with each other before we moved on to whatever (the) activity was.”

Many Group B participants said the fieldwork they experienced in this course provided them with more opportunity to work with children than they had experienced with prior fieldwork, and they felt it was because of the immediacy of the collaboration with the classroom teachers. Many respondents from Group A

had similar statements about their fieldwork experience during the math methods course. Many participants stated that it allowed them to be more participatory in the k-12 classroom as compared to their experiences with prior fieldwork.

### **Collaboration Opportunities**

A third theme that emerged from focus group notes was an increased level of collaboration between the Group B pre-service teachers and their classroom teachers. Pre-service teachers' comments revealed that a collaborative relationship developed sooner than it had in prior field experiences. In addition, the pre-service teachers stated that they were more willing to take risks in front of the cooperating teacher, and they had a deeper involvement with the students (i.e. more opportunities to teach lessons). One respondent said, "I just wanted to say...that if you compare this to any other courses we have taken (the) main difference is we had that teacher in the classroom, so we were on the same page and they were learning (what) we were learning and when you went into the class, I even had the teacher say 'isn't that how they did it?' You never felt intimidated. It was the most comfortable I have ever felt with a teacher in a classroom."

Some candidates stated that the field work felt like a co-teaching experience. "...I was in the classroom observing. It felt so comfortable. It felt almost like you were a co-teacher because they would ask you, 'Is this how they did it in class? Oh, do you want to show this?' .... It was such a neat relationship between the teacher and the student that it just created a lasting impression. I think more so than any other observations we've had."

One participant indicated that on many occasions after the scheduled fieldwork time was over, she would stay in the class and, when the students were out of the classroom, the teacher would spend most of her free period discussing how the lesson went.

### **Teachers as Learners**

The "teachers as learners" theme emerged from pre-service teachers' responses that most teachers who took part in the study were very interested in their input. One powerful statement by a Group B participant was, "I got the impression when I first got into the class they were smarter than us, because they were teachers. And I realized they were just like us, and they were learning like we were learning, and that's part of that teacher learning piece for both of us."

### **Additional Findings**

On several occasions the pre-service teachers noted that their co-learner teachers felt apprehensive because they thought they were going to be critiqued when the pre-service teachers wrote the required reflections of their fieldwork. One student noted, "...they were nervous, some teachers may be nervous from the point of view that you were writing a reflection of their performance." Another pre-service teacher commented that she felt that the teachers were nervous about getting involved with MAT students because they would not have anything in common with the pre-service teachers. Group B participants also noted that on several occasions the topics discussed in the methods course were

altered in order to address the varied needs/interests of the teachers, which differed from the needs of the pre-service teachers.

None of these experiences were mentioned by the Group A focus group participants.

### **Conclusion**

Both treatments enhanced teacher efficacy in math instruction based on the participants' responses to both the quantitative and qualitative portions of the study. Clearly, the fieldwork associated with this study provided pre-service teachers, particularly those who sat in class with their fieldwork cooperating teachers, with more opportunities for practice and reflection of classroom strategies than with any fieldwork they had previously experienced. Several pre-service teachers noted that they had never had the opportunity to experience content or strategies learned in coursework being modeled in the classroom.

Regardless of the fieldwork delivery model, however, the findings suggest that, it is imperative that a fieldwork teacher must provide an experience that is thoughtfully and purposefully constructed within a program sequence. These experiences can only be made possible through strong communication ties and collaborative professional development between the university's teacher education program and pk-12 schools.

### **Recommendations**

This study was an evaluation of a co-learner fieldwork delivery model. The focus of the study was on how this delivery model could influence pre-

service teachers' self-efficacy in teaching mathematics. The following are recommendations based on the findings and conclusions of the study:

- 1) A redesign of the methods course used by Group B experimental participants.
- 2) Further development of professional development delivery models that provide fieldwork teachers with the content, skills, and pedagogy that align with the curricula of pre-service teachers.

### **Redesign of the Methods Course**

While most participants enjoyed the experience of co-learning with a partner, the course design had some flaws. To improve its effectiveness, a new design should address three areas. First, the course should be designed to meet common outcomes for both teachers and pre-service teachers. Second, the design should address the individual needs of each group. For example, each group's assignments should be created to be relevant to each participant's role in the co-learner partnership and ensure that the knowledge, skills and professional dispositions expected of highly effective teachers are developed (NCATE, 2008). Third, this new design should include additional contact time to allow for content delivery and discourse among the instructors, the pre-service teachers and the teachers.

### **Alternate Delivery Fieldwork Models**

Participants from both groups stated that working with a teacher who was aware of the content and pedagogies being introduced to pre-service teachers in coursework was beneficial. The MAT program should begin to investigate

alternate pre-service teacher fieldwork models, which allow fieldwork teachers to become more involved in the teacher education program. An example might be a hybrid pre-service teacher residency model.

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