ONLINE MENTORING AND PRE-SERVICE ELEMENTARY TEACHERS' CONFIDENCE TO TEACH MATHEMATICS AND SCIENCE

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ABSTRACT

The purpose of this study was to determine if online mentoring increases pre-service teachers' confidence in teaching mathematics and science. Previous research has shown that traditional face-to-face mentoring increased self-confidence in new teachers (Fresko, 1999; Yost, 2002). The present study measured confidence to teach mathematics using a subscale of three items that assess confidence levels from the Mathematics Teaching Efficacy Belief Instrument (Enochs, Smith, and Huinker, 2000). Confidence to teach science was measured using a subscale of three items that assess confidence levels from the Science Teaching Efficacy Belief Instrument (Riggs and Enochs, 1990). Results showed that pre-service teachers who received online mentoring had statistically higher teaching confidence in both mathematics and science than pre-service teachers who did not receive online mentoring. These results are encouraging for institutions considering online mentoring to improve attitudes toward teaching among pre-service teachers.

INTRODUCTION

Many factors go into the development of a successful teacher. Confidence in ability to teach is often lacking in beginning teachers, particularly when dealing with subject matter in which they perceive their preparation to be weak. Traditionally, individual personal mentoring has been used to bolster the confidence and competence of teachers in training, but the logistical difficulties of arranging face-to-face training often limit the application of this strategy. The question addressed in this study is whether computer-based online mentoring can be effective in strengthening confidence.

Recently, there has been a great deal of research on online or e-mentoring (Kasprisin, Single, Single, and Muller, 2003; Eisenman and Thorton, 1999; Price and Chen, 2003). Single and Muller (2001) define e-mentoring as "a relationship … established … primarily using electronic communications and that is intended to develop and grow the skills, knowledge, confidence, and cultural understanding of the protégé to help him or her succeed while also assisting the development of the mentor" (p. 108). Even though e-mentoring is still relatively new, its popularity has expanded rapidly (Kasprisin, Single, Single, and Muller, 2003).

Formal online mentoring programs have several advantages over traditional face-to-face mentoring. E-mentoring provides scheduling and location flexibility, and thus more contact opportunities than traditional face-to-face mentoring (Kasprisin, Single, Single, and Muller, 2003; Price and Chen, 2003). Traditional mentoring programs are often unsuccessful because of scheduling conflicts (Eisenman and Thorton, 1999). E-mentoring can ameliorate that problem. Online mentoring can also lessen the protégé's initial feelings of intimidation associated with meeting one-on-one with the higher-status mentor (Kasprisin, Single, Single, and Muller, 2003). Additionally, e-mentoring encourages accessing online resources and support services (Price and Chen, 2003). Finally, online mentoring increases shared opportunities for pre-service teachers, cooperating teachers, and college professors to exchange ideas, ask questions, and receive feedback on lesson planning and other teaching situations (Price and Chen, 2003).

The current study seeks to address the effect of online mentoring on the confidence level of pre-service teachers in teaching mathematics and science. Confidence related to teaching can be defined as belief in the efficacy of one's teaching skills and techniques. Teachers with higher confidence in their teaching abilities are more likely to flourish in the classroom (Ross, McKeiver, and Hogaboam-Gray, 1994). Students in classes taught by teachers with more teaching confidence are more likely to achieve at higher levels thanks to higher standards set by the teacher (Ross, McKeiver, and Hogaboam-Gray, 1994). Also, teachers with higher levels of confidence are more likely to try new ideas, try more difficult but more powerful teaching strategies, and involve parents in school activities (Ross, McKeiver, and Hogaboam-Gray, 1994; Tschannen-Moran and Hoy, 2001).

This study examines the effect of online mentoring on the confidence level of pre-service teachers in mathematics and science teaching. Research from the past few decades on traditional mentoring and confidence levels of teachers has shown that traditional mentoring is a valuable resource for helping new teachers gain self-confidence (Fresko, 1999; Yost, 2002). Given the results of research on e-mentoring and confidence levels of pre-service teachers in mathematics and science teaching, we expected that online mentoring would increase pre-service teachers' confidence levels. Mathematics teaching confidence was measured using three items from the Mathematics Teaching Efficacy Belief Instrument (Enochs, Smith, and Huinker, 2000). Science teaching confidence was measured using three items from the Science Teaching Efficacy Belief Instrument (Riggs and Enochs, 1999). Higher scores on the surveys are associated with higher levels of confidence possessed by the pre-service teacher (Riggs and Enochs, 1990).

METHOD

Participants

A total of 108 students participated in this study—105 (~97%) females and 3 (~3%) males. Participants were junior-level undergraduate elementary or early childhood teacher candidates enrolled at The College of New Jersey, Ewing, New Jersey. The study took place during the fall 2005 and spring 2006 semesters.

Materials

Confidence was measured using the Science Teaching Efficacy Belief Instrument (Riggs and Enochs, 1990).[1] The Science Teaching Efficacy Belief Instrument contains 25 items that ask participants to indicate how strongly they agree with a statement, with responses ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*) on a five-point Likert scale. A subscale consisting of three items that assessed confidence levels of the participants was used in this study. These three items display good reliability; Cronbach's $\alpha = 0.72$.[2] The statements used to measure confidence levels of teaching science included: "I know the steps necessary to teach science concepts effectively," "I understand science concepts well enough to be effective in teaching elementary science," and "I am typically able to answer students' science questions."

Confidence in ability to teach mathematics was assessed using the Mathematics Teaching Efficacy Belief Instrument (Enochs, Smith, and Huinker, 2000).[3] The Mathematics Teaching Efficacy Belief Instrument contains 21 items that ask participants to indicate how strongly they agree with a statement, with responses ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*) on a five-point Likert scale. A subscale containing three items that assessed confidence levels of the participants was selected for use in this study. These three questions displayed good reliability; Cronbach's $\alpha = 0.76$. Items relating to confidence level of students included, "I know how to teach mathematics concepts effectively," "I understand mathematics concepts well enough to be effective in teaching elementary mathematics," and "I will typically be able to answer students' mathematics questions."

Procedure

The 108 teacher candidates enrolled in the junior practicum volunteered to participate in this study to measure their confidence levels regarding elementary mathematics and science teaching. Each participant was told that the purpose of the study was to look at the shifting needs of pre-service teachers and a variety of factors within the mentor-protégé relationship. The participants were also told that if

online mentoring proved beneficial to new teachers the program would encourage policymakers in the New Jersey Department of Education to make online mentoring available to novice teachers.

To be fair to students enrolled in courses in which they would receive grades, whole classes of students were randomly assigned to either the control group (traditionally mentored students) or the treatment group (online mentored students). The traditionally mentored classes consisted of 58 students and the online mentored group classes consisted of 50 students. The traditionally mentored group experienced the practicum class in the traditional manner, working face-to-face with their mentors. The online mentored groups' mentors were the college professors who taught the junior practicum classes and the cooperating teachers who worked with students in the field. The online mentored group experienced blended mentoring, receiving e-mentoring from content specialists in mathematics and science in addition to face-to-face mentoring from his or her college professor and cooperating teacher. Both the traditionally mentored and online mentored groups received TaskStream accounts (TaskStream is a commercial, Internet-based communication program designed to support collaboration in developing lesson plans and units) and training in how to use them (TaskStream, 2006). E-mentors communicated with their treatment group protégés using TaskStream to share ideas, written documents, feedback, and resources. Traditionally mentored group members were given TaskStream accounts, but they did not receive mentoring.

The Mathematics Teaching Efficacy Belief Instrument (Enochs, Smith, and Huinker, 2000) and the Science Teaching Efficacy Belief Instrument (Riggs and Enochs, 1990) were administered to each group twice, once at the beginning of the semester and again at the end of the semester.

RESULTS

Changes in confidence from face-to-face compared to online mentoring were assessed using a series of repeated measures *t* tests comparing pre- and post-mentoring scores. Outcomes of these tests are displayed in Table 1.

Table 1
Responses to Statements Assessing Pre- and Post-Mentoring Confidence Levels

Mathematics Face-to-Face Mentoring	**Pre-Test Mean**	**Pre-Test *SD***	**Post-Test Mean**	**Post-Test *SD***	***t*-statistic**	***p*-value**	***Effect Size (Cohen's d)***
I know how to teach mathematics concepts effectively.	3.58	0.68	3.60	0.74	0.099	0.92	0.03
I understand mathematics concepts well enough to be effective in teaching elementary mathematics.	3.79	0.62	4.00	0.54	1.152	0.26	0.36
I will typically be able to answer students' mathematics questions.	3.74	0.55	3.60	0.63	-0.778	0.44	0.24
Mathematics Online Mentoring							
I know how to teach mathematics concepts effectively.	3.25	0.93	3.72	0.61	2.942	0.004**	0.61
I understand mathematics	3.78	0.66	4.06	0.64	2.070	0.041*	0.43

concepts well enough to be effective in teaching elementary mathematics.							
I will typically be able to answer students' mathematics questions.	3.80	0.62	4.08	0.56	2.192	0.031*	0.47
Science Face-to-Face Mentoring							
I know the steps necessary to teach science concepts effectively.	3.58	0.51	3.33	0.62	-1.274	0.212	0.44
I understand science concepts well enough to be effective in teaching elementary science.	3.63	0.68	3.67	0.72	0.145	0.886	0.06
I am typically able to answer students' science questions.	3.63	0.68	3.27	0.88	-1.358	0.184	0.46
Science Online Mentoring							
I know the steps necessary to teach science concepts effectively.	3.20	0.80	3.58	0.62	2.483	0.015*	0.54
I understand science concepts well enough to be effective in teaching elementary science.	3.42	0.82	3.84	0.61	2.708	0.008**	0.57
I am typically able to answer students' science questions.	3.35	0.79	3.74	0.72	2.485	0.015*	0.52

Notes: $^{*}p \leq 0.05$, $^{**}p \leq 0.01$

Responses are based on a 5-point Likert scale in which "1" represents "strongly disagree" and "5" represents "strongly agree."

Pre-service teacher confidence increased from pre- to post-mentoring assessment for 9 of the 12 assessment responses; of the 3 decreases in confidence, none was statistically significant.

None of the pre-post changes in confidence for traditional face-to-face mentoring was significant. Effect sizes for face-to-face mentoring, as measured by Cohen's *d*, tended to be small, ranging from .03 to .46.[4] By contrast, all 6 of the confidence responses for the online mentoring groups increased significantly from pre- to post-mentoring measures. Effect sizes for these response changes ranged from .43 to .61. The significant effects are displayed in Figure 1.

DISCUSSION

Similar to previous research on traditional mentoring (Fresko, 1999; Yost, 2002), this study found a significant increase in confidence levels of pre-service teachers who received e-mentoring. This study supported the hypothesis that online mentoring increases the confidence level of pre-service teachers. It suggests that students who were mentored online had a significantly higher confidence level in teaching mathematics and science than their counterparts in the control group that did not receive online mentoring.

Teacher confidence needs to be addressed in college education programs throughout the country. As previous research has shown, teachers with higher confidence levels in their teaching are more likely to succeed in the classroom (Ross, McKeiver, and Hogaboam-Gray, 1994). Additionally, students of these

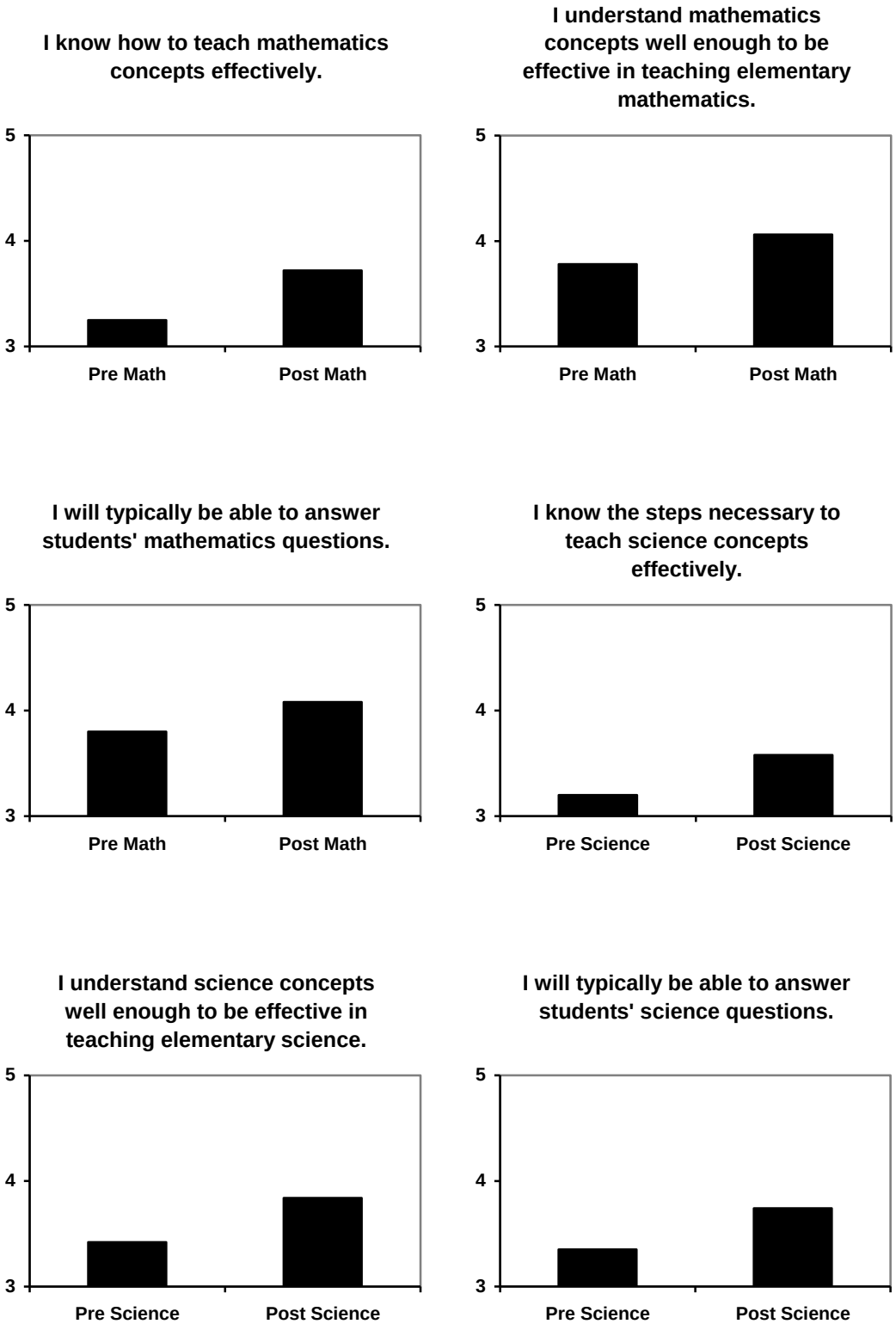

Figure 1. Mean confidence ratings of pre-service teachers who received online mentoring.

teachers have been shown to achieve at higher levels than students who are taught by teachers with lower confidence in their own teaching (Ross, McKeiver, and Hogaboam-Gray, 1994). This most results from teachers setting higher standards in their classrooms and trying new teaching techniques with their students (Ross, McKeiver, and Hogaboam-Gray, 1994).

This is important in teacher education programs because teachers with higher levels of self-confidence are more effective teachers. Lack of teaching confidence has been shown to relate to high levels of anxiety in teaching content-specific areas (Bursal and Paznokas, 2006). Moreover, research has shown that pre-service teachers with higher mathematics and science anxieties felt that they would be less effective in teaching mathematics and science (Bursal and Paznokas, 2006). Bursal and Paznokas (2006) also found that pre-service teacher confidence levels in teaching mathematics are directly related to confidence levels in teaching science.

A limitation of this study is that all but 3 of the 108 participants were females, precluding any assessment of possible gender interactions.

The finding that online mentoring of pre-service teachers is more effective in raising self-confidence of the learners than traditional face-to-face mentoring is important. It indicates that the logistical difficulties of arranging face-to-face mentoring can be bypassed without loss of efficacy. Indeed, online mentoring has been demonstrated to be more effective than traditional mentoring in raising self-confidence.

This study measured only the effects on confidence. Further research is needed to address the efficacy of online mentoring for other crucial aspects of effective teaching, including content knowledge, ability to create effective lesson plans, ability to assess students' prior knowledge, and use of creative instructional strategies. The current findings suggest that e-mentoring can be an effective tool in teacher education.

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ENDNOTES

[1] The authors granted permission to use their instrument.

[2] Cronbach's *a* is a measure of the average inter-item correlation among a set of items. It measures consistency among individual items in a scale. Cronbach's *a* can range from zero to one, with one being the highest consistency.

[3] The authors granted permission to use their instrument.

[4] Cohen's *d* is a measure of effect size. It measures the difference between two means, measured in standard deviation units. Cohen's *d* is zero if there is no difference between the means, or no effect. A higher value indicates less overlap between the two distributions. There is no mathematically defined upper limit to *d*. Cohen, the developer of the statistic, suggested these general rules: less than .2 means there is a minimal effect; .2 to .4 means there is a small effect; .4 to .6 means there is a medium effect; .6 to .8 means there is a medium to large effect; greater than .8 means there is a large effect.