

## Onsite Peer Tutoring in Mathematics Content Courses for Pre-Service Teachers

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### **Abstract**

*Pre-service elementary teachers often need help in mathematics courses. Tutoring is an effective practice (Boylan, 2002) and peer tutoring is one of the most successful forms of tutoring, due to the personal connections that are made (Tinto, 1993). A peer is defined as one at the same level, at the same institution, and having equal status (Falchikov, 2001). An onsite peer tutor is someone enrolled in the same course, with similar demographics, offering tutoring in the classroom before or after class. This research project created an onsite peer tutoring program<sup>1</sup> for college students enrolled in three mathematics content courses designed specifically for future PK-8 teachers. The purpose of this research study was to measure the impact of the onsite tutoring program and explore reasons for non-attendance.*

### **Literature Review**

Tutoring ranks as the most frequently indicated effective practice in developmental education (Boylan, 2002). Tutored students achieved significantly higher GPAs and showed greater course passing rates, course completion rates, and short-term retention rates (Hendriksen, Yang, Love & Hall, 2005; Topping, 1996). They also earned more credit hours than non-participating students (House & Wohit, 1990). Xu and colleagues (2001) found tutoring was more helpful for students at the lower performance level than for average or above average students. Motivational gains from tutoring included greater commitment, higher self-esteem, and increased self-confidence (Topping, 1996).

Damon (1984) observed that students gain more from learning with their peer group, through more direct communication and at a more easily understood level. Peer tutoring appears to be successful in helping students, and the personal connections influence retention (Tinto, 1993). House (1988) found that students worked better with a same-gender tutor, which was offered as a possible strategy for improving female students' achievement in college mathematics courses. In addition, female students were much more likely to attend tutoring than male students (Wright, 2003).

Students involved in course-embedded tutoring programs regularly outperformed non-tutored peers (Hendriksen, et al., 2005). Peer tutoring also encouraged informal study groups to be established (Evans & Flower, 2001). However, more research is needed on the success and effectiveness of onsite peer tutoring for specific mathematics courses (Halcrow, 2004).

### **Pilot Survey**

In the spring of 2006, a survey was given to 39 preservice teachers enrolled in two sections of a mathematics content course for future teachers, both taught by the researcher. The survey asked where they went for help for their mathematics courses. Results showed that 23% of the

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students had attended the instructor's office hours and 15% had attended the campus Tutoring and Learning Center (TLC). However, many reported that TLC tutors were not much help with these courses. At the time, eight mathematics tutors (four male, four female) offered tutoring for College Algebra through Calculus III. As mathematics majors, they did not have the experience or perspective for mathematical reasoning involving complex learning scenarios with mathematical manipulatives.

On the other hand, 46% of the preservice teachers reported informally tutoring peers during class, 54% had informally tutored peers outside of class, and 24% had formally tutored a peer during the semester. Survey results indicated a need for tutors who were able to help preservice teachers in these courses. When asked if they would attend onsite peer tutoring if available, 62% respondents said "yes" and 21% said "maybe".

### **Research Methodology**

A mixed methods research design collected quantitative and qualitative data over six semesters of the onsite peer tutoring program. Quantitative data included course number, section, semester, number of tutees, and time spent in tutoring sessions. Qualitative data resulted from online surveys from tutors, tutees, and non-tutees, asking them to evaluate the peer tutors and the effectiveness of the peer tutoring program.

Participants included students from three mathematics content courses for future teachers. Students were seeking teacher certification for elementary education, bilingual education, special education or middle school mathematics. Three sections of each course were offered during the long semesters and one section each during the summer sessions. The three courses addressed number concepts, probability and statistics, and geometry. These reformed courses were based on national standards as well as state standards for beginning teachers. As there are no mathematics methods courses offered for these degree programs, the content courses also model mathematical pedagogy, including collaborative activities, manipulatives and technology. A dedicated classroom offers manipulatives and a full multimedia teacher station.

Data were analyzed to address three research questions:

1. Are preservice teachers more apt to seek and sustain tutoring assistance provided by onsite peer tutors than the campus tutoring center?
2. Is onsite peer tutoring perceived as effective and successful by tutors and tutees?
3. Why did non-tutees not attend onsite peer tutoring sessions?

### **Results**

In the fall of 2006, the peer tutoring program was designed, funding secured for one year, the classroom reserved, and two peer tutors were hired and trained. Peer tutors were selected from the researcher's classes, and chosen to match the demographics of the students in the course: 93% female; 50% White, 46% Hispanic; with an average age of 26 years (OPIE, 2009). Tutors were also selected for their understanding of course content and their ability to communicate mathematically from multiple perspectives. Onsite peer tutoring sessions began in October 2006; serving two sections taught by the researcher.

Due to the late start, only 2 of 57 students (3.5%) participated with a total of 3.3 tutoring hours. In spring 2007, the tutoring program was expanded to all nine course sections (N=244). Eighteen students (7.4%) made 64 visits for a total of 55.8 tutoring hours over fifteen weeks. The number of visits ranged from one to fifteen per student; on average tutees attended 3.1 hours

over the semester. In addition, groups of students used the tutoring sessions eleven different times for group study (see Figure 1).

Summer 2007 yielded a sharp increase in tutoring activity, with 38 of 85 students (44.7%) attending a total of 265.6 tutoring hours over the five-week session. There were a total of 215 visits, ranging from one to fifteen visits per student. On average, tutees attended a total of 7 hours of tutoring over the summer session. At this point, program funding was extended to a second year. In fall 2007, the program accommodated 30 of 249 students (12%) for a total of 69 tutoring hours over the semester. In spring 2008, tutors served 31 of 253 students (12.3%) for a total of 78.9 hours over the semester.

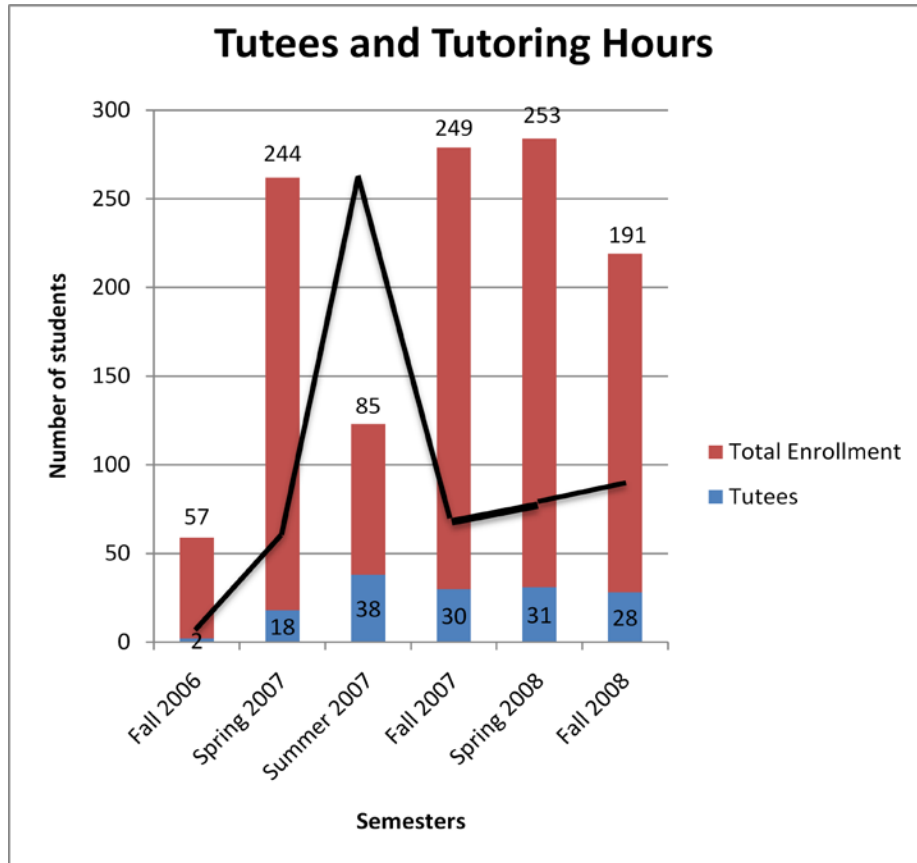


Figure 1: Number of tutees and total tutoring hours per semester.

The tutoring program was not offered in summer 2008, due to the end of funding. Negotiations with the TLC resulted in new funding of two tutors for fall 2008, with the program still being offered in the classroom. Twenty-eight of 191 students (14.7%) attended a total of 91.2 tutoring hours over the semester. Total tutoring time per student ranged from 7 minutes to 16.1 hours over the semester. In spring 2009, under new budget constraints, the TLC decided to pull the peer tutor program back into the existing campus program, hiring one peer tutor but moving the program to the TLC building. As a result, only a few students attended tutoring and so funding for the peer tutor program was discontinued in June 2009.

### Survey Results

In fall 2007, online student surveys were sent to the 386 students enrolled during the first three semesters of the program. Tutors, tutees and non-tutees were asked about their previous tutoring experiences, participation in the onsite peer tutoring program, and reasons for attendance or non-attendance. Sixty-six responses (14.1%) were received with respondents crossing gender, ethnicity, age and degree programs (see Figure 2).

Almost half of the respondents indicated that they had previously attended the TLC, with 29% specifically seeking help with a mathematics content class for teachers. Twenty-seven percent had used an outside tutor for help. Most felt positive about attending tutoring, with 59% indicating a positive or very positive experience. Only 9% reported negative or very negative feelings.

**Figure 2: Demographics of online survey respondents.**

Respondents	White	Hispanic	Black	Other	Totals
Female over 25	16 (24%)	19 (29%)	1 (2%)	1 (2%)	37 (56%)
Female under 25	9 (14%)	10 (15%)	1 (2%)	1 (2%)	21 (32%)
Male over 25	2 (3%)	3 (5%)	0 (0%)	0 (0%)	5 (8%)
Male under 25	2 (3%)	0 (0%)	1 (2%)	0 (0%)	3 (5%)
Total	29 (44%)	32 (48%)	3 (5%)	2 (3%)	66

#### *Tutee survey responses*

Twenty tutees responded (18 F, 2 M); 75% were non-traditional students. All tutee respondents attended at least two tutoring sessions, with five reporting attending more than ten sessions during a semester. When asked to rank the reasons why they sought tutoring, respondents chose “preparing for a quiz or exam” as the top reason (see Figure 3).

**Figure 3: Average rankings of reasons for attending tutoring (1 most important, 8 least important).**

Preparing for a quiz or exam	3.1
Help with completing assignments	4.1
Help understanding completed homework	4.4
Help using manipulatives	4.4
Help with a new math concept	4.6
Help with vocabulary	5.1
Help with computations	5.1
Help with word problems	5.1

Asked how they felt about attending tutoring sessions, using a scale from *very negative* to *very positive*, the twenty tutee respondents reported neutral (3), positive (9), or very positive (8)

feelings. No negative responses were given. Reported reasons for attending tutoring sessions included tutoring, practice using manipulatives, group work, or using the computer.

Tutees were also asked to indicate their agreement or disagreement with several statements made about the peer tutors. More than half of the responses were positive (Agree, Strongly Agree), agreeing that the peer tutors had positive attitudes, answered questions adequately, and gave answers which helped to improve student understanding. One tutee commented: “The tutors that I have encountered have always been extremely helpful. My understanding of the information increased because of their help. They have been enthusiastic about their work and patient when they had to re-tutor a concept.” Another wrote, “I really felt that going to tutoring really helped me pass the class. I was really nervous about taking math classes but the tutoring really helped me feel more confident about my math abilities.”

About one third of the responses were negative. One tutee commented: “The tutor was a math major [actually she was in the 4-8 mathematics program] and she didn’t really explain in a way that assisted a math learning impaired person could follow. At least not me. I felt she talked or explained above me. I was not comfortable with that.” Another student explained that there were too many students attending tutoring the time she went and she finally gave up waiting in line and left. A majority of respondents reported that their onsite peer tutoring experiences encouraged them to return for more tutoring.

#### *Non-tutee survey responses*

Forty-six non-tutees responded (40 female, 6 male); 57% were non-traditional students. A majority of non-tutees described how they felt about attending tutoring in general by choosing neutral (19) or positive (16) or very positive (4). Five non-tutees chose negative and one chose very negative. The very negative response was paired with the explanation that there was a scheduling conflict. Negative responses about attending peer tutoring also listed reasons as tutoring not needed, childcare issues, tutor not able to address questions, and “other” reasons. In the comments, several non-tutees mentioned that they did not know that onsite peer tutoring was available (even though instructors announced it, flyers were passed out in class and posted on the bulletin board). One student indicated that they were not comfortable talking to people they did not know.

#### *Tutor survey responses*

Four tutors responded to the survey. Tutors reported previously attending the TLC for help with their mathematics content courses, and three had used an outside tutor. All felt positive or very positive about attending tutoring. Tutors commented on how much the tutoring serves was needed by the students who attended, and were able to help students understand their homework. One tutor wrote: “Taking the time to diagram, explain and breakdown some of the math problems was rewarding, especially when the students were able to say, ‘Oh, I get it now!’ Additionally, it reinforced my learning and knowledge because I had to teach what I knew, and find some new ways to explain what I already knew. It was overall, a positive experience.”

Tutors also commented on negative aspects of the onsite peer tutoring program, and made recommendations for improvement. One concern was students who tried to get the answers to the homework, or came to tutoring instead of reading and trying the work themselves. Tutors also felt that different instructors wanted concepts explained a certain way, and that meeting with instructors to determine their preferences would be helpful, such as whether a lesson involved

manipulatives or not. Tutors recommended that instructors provide syllabi and a calendar of the topics covered each week.

### **Discussion**

Data were analyzed to address the first research question: Are preservice teachers more apt to seek and sustain tutoring assistance provided by onsite peer tutors than the campus tutoring center? Results showed that students were more likely to attend tutoring when offered by onsite peer tutors. Overall, more students (19.8%) were involved in peer tutoring than the 15% who sought assistance from the TLC for these courses during previous semesters. Many tutees participated in tutoring sessions multiple times, some more than ten times per semester. The number of students attending tutoring generally increased over the years of the program, as well as the number of students with repeat visits.

The second research question, “Is onsite peer tutoring perceived as effective and successful by tutors and tutees?” was addressed by data from online student surveys given in fall 2007. Survey comments by tutors and tutees indicated that the onsite peer tutoring program was successful. Tutors specifically stated that tutoring their peers helped them to reaffirm their choice of profession. Tutees commented that having something explained by a peer is often more helpful than the instructor or the textbook. Spending extra time on a concept or assignment was helpful to many, as well as extra practice with manipulatives. Students who missed class could attend tutoring to learn the concepts taught that day, as well as get help with their homework.

Overall, the onsite peer tutoring program appeared to be successful. This conclusion is especially strong for the condensed summer session courses. Many non-tutees commented that if they had known about the program they would have attended. Some tutees were able to take advantage of the program for multiple semesters. The tutoring program employed eleven different tutors over six semesters, all of which reported a very positive experience that helped them prepare for their career in teaching.

The third research question, “Why did non-tutees not attend?” was also addressed by survey responses. Almost half of the non-tutee respondents reported not needing tutoring services, or having schedule conflicts or child care issues. Almost a quarter of the respondents did not feel comfortable asking questions of a tutor, or questioned the tutors’ ability to answer their questions. Some “heard” that the tutors were not helpful with certain parts of a course. Others suggested that tutors introduce themselves in each course section, that instructors make more announcements about the tutoring program, and that tutoring should be offered on more days and at more times.

Tutees were more apt to be Hispanic and non-traditional students than were non-tutees. More tutees than non-tutees had gone to the TLC for help with a mathematics content course for teachers. Tutees were also more likely to have an outside tutor than non-tutees (see Figure 4).

**Figure 4: Comparison of tutees and non-tutees.**

Respondents	N	Gender	Over age 25	Attended TLC before	TLC for math class	Outside tutor
Tutees	20	90% F	75%	75%	70%	45%
		10% M				
Non-tutees	46	87% F	57%	33%	11%	20%
		13% M				

### Conclusions

The onsite peer tutoring program was more successful in attracting tutees to participate than the TLC on campus. Tutees generally felt positive about the program and felt it helped them in their mathematics course as well as with their confidence in doing and understanding the work. Tutors felt strongly about the service they rendered to their fellow students, and reported positive effects on their own learning and teaching. Non-tutees had various reasons for not attending tutoring. Many felt that they did not need tutoring. For those needing help, time and child care were problems. A few felt that the program was not going to be helpful to them.

Although the onsite peer tutoring program was funded by a college grant and the TLC for over two years, the program is not currently running. The researcher is pursuing permission for the release of course fees to begin the onsite peer tutoring program again. It is hoped that the results of this study will improve the program and that it will be more effective in helping preservice teachers learn the mathematics concepts and to prepare for success in their future mathematics teaching endeavors.

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