Does peer tutoring facilitate medical student learner self-efficacy?

Pamela A.H. DeVoe[1], Peter Couse[2], Michael Hess, PhD[3]

Abstract

Introduction: Near-peer (MS II) tutoring is one way to address academic deficits while adding a coaching and mentoring experience for first year medical students (MSI). Self-efficacy is defined as belief in one’s ability to perform well on a certain task. Low self-efficacy may lead to avoidance, reducing the possibility of skill improvement, high self-efficacy can focus effort and create persistence leading to task success.

Methods: MS II near-peer tutor training included a module on learning psychology and guidance on building self-efficacy in MSI tutees. We used a retrospective pre-post survey to measure change in self-efficacy belief. For each block of fall semester students rated their confidence in understanding the block material prior to tutoring sessions and after tutoring sessions, and rated their overall comfort level with medical school. We also compared student self-efficacy scores with block grades.

Results: For the first two blocks of fall semester a significant positive change between students’ pre and post tutoring efficacy for learning block material was noted, these changes also predicted a positive change in exam scores.

Conclusion: First year medical students who regularly attend weekly near-peer tutoring sessions show an increased strength in self-efficacy for studying in medical school, which positively impacts achievement outcomes.

Keywords: , , medical student self-efficacy, learning in medical school

Introduction

Some students enter medical training unprepared for the rigorous and fast moving curriculum. Near peer (MS II) tutoring programs are one way to address academic deficits while adding a coaching and mentoring experience for first year medical students (Glynn, MacFarlane, Kelly, Cantillon & Murphy, 2006; Schaffer, Wile & Griggs, 1990).
Near peer tutors can help students increase both content and process (how to study) skills. Near peer tutors naturally act in a mentoring capacity, offering guidance on study habits, orientation to new material, and reassurance that the material and pace of medical school can be mastered. We consider mentoring to be one of the most important factors in the tutoring process, as this affective support role is directly related to motivation and self-efficacy for learning.

Social Cognitive Theory describes related self-belief constructs: self-efficacy (belief in one’s ability to perform well), self-concept (general view of self), self-doubt (negative view of self), and anxiety (Morony, 2012). Low self-efficacy may lead to avoidance, thus reducing the possibility of skill improvement; alternatively, high self-efficacy can focus effort and create persistence leading to task success (Artino, 2012; Shoemaker, 2010). A hallmark of self-efficacy is the belief that not only can the specific task at hand be mastered, but that mastery can be achieved at a high level of proficiency (Zimmerman & Schunk, 2001). Unlike general confidence, efficacy beliefs are seen as task specific and success oriented. Therefore a student may be confident about medical training in general, but hold weak self-efficacy beliefs for calculus, biochemistry, or physical exam skills. Bandura described four ways to strengthen efficacy beliefs, all of which could be impacted by the peer tutor/tutee relationship: mastery experience (performance accomplishment) -- based on domain specific personal achievement; vicarious experience -- based on watching someone else perform a task which creates belief of success in performing the same task, especially if the performer is considered similar in ability; social interaction (verbal persuasion) -- relates to verbal, experiential and encouraging engagement with others; and emotional arousal (or psychological state) -- evidenced by excitement, or stress reactions such as perspiration, shallow breathing, sleepiness (Artino, 2012; Bruning, Schraw, & Ronning, 1999).

Medical students begin training with a high level of academic confidence as well as some level of self-efficacy for the medical curriculum based on personal experience and success in undergraduate coursework, as well as the validation that comes with acceptance into medical school. Students create learning goals and study strategies based in part on the strength of these self-efficacy beliefs (Dunlosky & Metcalfe, 2009). Should performance not meet expectations, especially early in medical school, students are prone to diminished general confidence as well as task specific self-efficacy.

Our school has offered some version of near peer tutoring for over 30 years, mostly in the format of individual tutee and paid student near-peer (MSII). Nearly three years ago we developed a group tutoring program. Nine paid second year tutors were hired and trained to coordinate a group tutoring session twice per week. Acknowledging academic gains for student tutees, this study was undertaken to better understand the positive non-cognitive gains. By modeling learning behaviors near peer tutors are in a unique position to help students regain and strengthen their self-efficacy beliefs about learning in medical school, especially following a failure. This learning and study behavior, when modeled by an expert or more experienced actor, is one of the hallmarks for strengthening self-efficacy (vicarious experience) and is most effective when the model closely resembles the student, as with near peers (Zimmerman & Schunk, 2001). We see the affective, mentoring and guiding influence of near peer tutoring as impactful as content review for many students.

**Methods**

We collected weekly self-efficacy surveys from students participating in near peer tutoring sessions. Although we expect to see self-efficacy waiver according to in-course learning tasks and grades, it should follow a positive trajectory toward stronger efficacy. We are interested in the effect of peer tutoring on this efficacy belief improvement. Self-efficacy beliefs have been measured with medical students, many published accounts focus on clinical skills (Mavis, 2001) and medical practice (Young, et al, 2012). This study focuses on the first year of medical school with the pre-clerkship curriculum, specifically the first two blocks/courses.
Hypotheses and Research Design

Our first hypothesis concerns student self-efficacy of our students as it relates to group peer tutoring. We propose that group peer tutoring will have a measurable and significant effect on student self-efficacy. The second hypothesis concerns student self-efficacy as it relates to course grades. We propose that students showing an increase in self-efficacy after group peer tutoring will see that improved self-efficacy reflected in higher grades.

Analysis 1:

$H_0$: Group peer tutoring will have no effect on student self-efficacy

Analysis 2:

$H_0$: Student self-efficacy has no relationship to student grades in the block

This study was approved by the University of New Mexico Health Sciences Center Human Research Review Committee, December 2014.

We used a retrospective pre-post survey analysis to measure whether students who participated in group peer tutoring reported greater self-efficacy regarding current study material after their participation. At the end of the academic year, we sent all students in the class a Google Forms survey. The survey asked students to complete basic demographic data such as age, whether they were a medical student or Physician Assistant (PA) student, and gender. The survey also asked them if they attended at least one Group Peer Tutoring session. If the answer was no, the survey ended. If the answer was yes, the survey continued to another set of questions. In the first medical school year there were five academic blocks: Human Structure, Function and Development; Genetics and Neoplasia; Immunology; Neurology/Neuroscience; and Cardiovascular, Pulmonary and Renal. Students answered by block how many times they attended group peer tutoring (0 times, 1-5 times, 6-10 times, 11-15 times, or over 15 times). For each block students rated their confidence (using a five point Likert-scale), for understanding the current block material prior to attending OARS group peer tutoring (1=Low, 5=High), and then rated their confidence, by block, on the same Likert-scale for understanding block material after attending OARS group peer tutoring. They were also asked to rate their overall comfort level in PA or medical school. Students were identified only with the last four digits of their social security number; a code which was used to identify student grades for each block, and then de-identified once the data was collected and matched with survey results.
Results

The survey was distributed to the entire 2018 medical school class (111) and the entire 2016 PA class (17), 128 students in total, and we were able to get 49 responses (a 38% response rate). Of those who responded, 31 students attended at least one OARS group peer tutoring session, and 18 did not. A sample-size analysis prior to the study indicated that we would need at least 18 respondents to achieve over 90 percent power, and we were able to achieve that level with students that participated in group peer tutoring in the first block (HSF&D, 28 respondents). In the second block (Genetics and Neoplasia) we achieved 16 respondents.

Hypothesis 1

The variable of interest for the first hypothesis is student self-efficacy. The self-efficacy variable consists of two paired groups and is made from student responses on a Likert scale, (1- low and 5 - high), asking them to rate their ability to understand block material both before and after group peer tutoring. The 28 responses in Group 1 (Pre-group tutoring) ranged from a low of 1 to a high of 5, with a mean of 3.04 and a median of 3. The 28 responses from the same students in Group 2 (Post-group tutoring) ranged from a low of 3 to a high of 5, with a mean of 4.07 and a median of 4.

Figure 1: Student Self-Efficacy (HSF&D Block)

Pre- and Post-Group Tutoring

[Box plot showing pre and post scores]
We performed a Student t-test for pairwise data to test the null hypothesis that the mean of the differences between the two groups is 0. The results of the t-test allowed us to reject the null hypothesis:

Mean difference (95% CI): 1.04 (0.73, 1.34)
Standard Deviation: 0.79
\( t (t_{\text{crit}, 27\text{df}} = 2.05): 6.91 \)
\( p: < 0.001 \)
Achieved Power: 99.99%
Cohen’s D Effect Size: 0.83

We also performed a Student t-test for pairwise data on the second block (Genetics and Neoplasia), even though we fell short of the 18 estimated surveys. The variable of interest remained the self-efficacy score. The 16 responses in Group 1 (Pre-group tutoring) ranged from a low of 2 to a high of 5, with a mean of 3.5 and a median of 3. The 28 responses from the same students in Group 2 (Post-group tutoring) ranged from a low of 3 to a high of 5, with a mean of 4.31 and a median of 4.
Because of the smaller sample, the sign and sign rank tests were employed to compare to the Student t-test. The results of all tests allowed us to reject the null hypothesis that the mean of the differences between both groups is equal to 0:

Mean difference (95 CI): 0.81 (0.41, 1.21)
Standard Deviation: 0.75
$t (t_{crit, 15df} = 2.13)$: 4.33
$p$ (Student $t$): < 0.001
Achieved Power (Student $t$): 98.13%
Cohen’s D Effect Size (Student $t$): 1.08

The sign and sign rank tests were robust with the Student t-test, each achieving a statistical significance of $p = 0.004,$
and an achieved power of 97.59 percent. Please see Appendix for graphic representation.

**Hypothesis 2**

The second hypothesis focused on the question of whether or not self-efficacy rating helped predict exam scores. Our first step was to see if there were any differences in means in test scores among the three summative exams taken by students who participated in Group Peer Tutoring.

Student t-tests of the means of the scores of group peer tutoring participants yielded no difference in means between Exam 1 and Exam 2, and Exam 1 and Exam 3, but significant differences between Exam 2 and Exam 3.

<table>
<thead>
<tr>
<th>Exam 2 &amp; 3</th>
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<tbody>
<tr>
<td>Mean difference (95 CI): 3.35 (0.47, 6.23)</td>
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<tr>
<td>Standard Deviation: 6.81</td>
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<tr>
<td>t (t_{crit, 23df} = 2.07): 2.41</td>
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<tr>
<td>p (Student t): 0.02</td>
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<td>Cohen’s D Effect Size (Student t): 0.39</td>
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To model this possible relationship, we also ran a regression analysis on the difference between Exam 2 and Exam 3. Our independent variables were 1) the difference between the pre- and post- self-efficacy score, yielding a variable that varied between 0 and 2; 2) the number of times each student attended a peer tutoring session, an ordinal variable with categories ranging from 0 to over 15 times, and 3) demographic variable Age (continuous) and Gender (binary). Correlation tests showed weak relationships between these variables and block score. However, we surmised that a better measure of the concept we were trying to model could be found in the difference in scores between the exams. When we ran a linear regression model with the dependent variable as this difference we found that the change in student efficacy scores from pre- to post-group peer tutoring strongly predicts the change in exam scores in a positive direction, with a one-unit increase in efficacy score leading to a 5.63 unit change in exam score over the course of the block (roughly one-half letter grade). Please see the appendix for a graphical representation.

The test achieved an omega-squared effect size of 0.22. Please see Figure 4 for a graphical representation showing the relationship between the change in student efficacy and the change in test scores between Exam 1 and Exam 3.
Unfortunately, because of the length of the block for Genetics and Neoplasia, we weren’t able to run the same type of regression model. The block consists of 4 individual and group quizzes given on a weekly basis which are all fairly high scoring, and then a block final, leaving us with no change in summative style exam scores to measure or model.

Discussion and Conclusion

First year medical students who regularly attend weekly peer-tutoring sessions show an increased strength in self-efficacy for studying in medical school, and this increased self-efficacy positively impacts achievement outcomes. The mentoring role of near-peer tutors impacts the affective as well as cognitive realms of learning for first year medical students. Admittedly, many students will naturally gain in self-efficacy beliefs as they become accustomed to the particulars of medical school and experience some success with the curriculum.

In terms of data collection, the survey originally used to measure change in self-efficacy for studying medicine was adequate for the task, however, the timing for weekly data collection proved inconsistent and therefore problematic. Switching to a retrospective pre-post survey design improved data collection and enabled analysis. As a study limitation, we did not track quality or consistency of peer tutor interventions to ascertain to what extent they utilized efficacy enhancing strategies in their tutoring interactions. The environment of the interaction between tutors and tutees was considered a stable variable.

Conclusion
Students who continue to struggle with the curriculum, or who have diminished self-efficacy for some non-academic reason, may be especially helped by working closely with trained, non-judgmental near-peer tutors.

Take Home Messages

Practice Points:

1. Students begin medical school with different levels of self-efficacy for studying medicine.
2. Self-efficacy underlies learning motivation, and informs a student's persistence and quality of effort.
3. MSI students benefit from near-peer tutoring in both cognitive and affective ways.
4. Increasing a student's self-efficacy for studying medicine may directly and positively influence grades.

Notes On Contributors

Pamela DeVoe, PhD, is a Learning Specialist, Educational Psychologist, and Program Director
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Peter Couse, is a Learning Specialist, Educator

The three authors comprise the Learning Specialist team in the Office of Academic Resources & Support, University of New Mexico School of Medicine, Undergraduate Medical Education, Albuquerque, New Mexico. As Learning Specialists, the team continually explores innovative methods for engaging students with successful learning strategies.

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Appendices

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<tr>
<th>Table 1: Change in Scores Between Exam 2 and Exam 3</th>
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<tbody>
<tr>
<td>Variable</td>
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<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Change in Student Efficacy</td>
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<tr>
<td>Peer Tutoring Attendance</td>
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<tr>
<td>Age</td>
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<tr>
<td>Gender</td>
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<td>Constant</td>
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N=24  \( \hat{R}^2=0.352 \)
Declaration of Interest

The author has declared that there are no conflicts of interest.