THE EFFECT OF PEER TUTORING INFLUENCING STUDENTS' SCIENCE PERFORMANCE ON ASSESSMENTS AND THEIR SELF-EFFICACY

By

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A professional paper submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

In

Science Education

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DEDICATION

This is dedicated to my loving family who encouraged me to pursue this degree and believed in my abilities as a teacher. I will forever be indebted to them for the support they have given to me during this incredible academic journey.

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ABSTRACT

One of the struggles with standard-based instruction and grading is the reassessment process. Peer tutoring is relied upon during the reassessment process but less to reach proficiency on the first summative assessment. This project examined the effect of peer tutoring on assessment scores and self-efficacy when used before the summative assessment. The treatment group earned high scores and self-efficacy than the control group. The conclusion was that peer tutoring had a significant role in improving scores and self-efficacy.

INTRODUCTION AND BACKGROUND

I teach biology and anatomy at Sioux Center Community High School, a public school district in Sioux Center, Iowa. Based on census data, the median household income is $73,856. The largest employers in the area are the Pella Corporation, Farmer's Coop, Golden Grisp Premium Food and Sioux Preme Packing. The school is composed of grades 9 through 12 and educates approximately 400 students annually. Sixty-one percent of the students are Caucasian, 37 percent are Hispanic, 1 percent are American Indian, and 1percent are Asian (Student Enrollment Summary Report). I have been teaching for six years at the high school level. I currently teach five sections of biology and two sections of anatomy. Sioux Center High School has forward-thinking administrators who are willing to change the school to better serve their students and community.

In 2014, our school started transitioning from a traditional grading system to standards-based grading. I developed rubrics for each standard based on the Next Generation Science Standards (NGSS). I have taught biology using standards-based methods for five years now. A part of this grading system is giving students the opportunity to reassess or to retake assessments to demonstrate proficiency, which can be an ongoing process over many weeks depending on the student. Students must be held accountable to reassess. To do this, I created a reassessment "ticket" that requires the students to meet with a peer tutor or me for twenty minutes. Once the student has completed the rest of the reassessment ticket requirements, which includes corrects and review

activities, I will go through the entire ticket and schedule the reassessment. The majority of students have positive experiences with peer tutors. In the beginning, peer tutors included only classmates who were considered "proficient" on the standard and tutoring occurred during a class time. My school implemented a peer tutoring program for English, math, and science. The students in this program have completed the course they will tutor and were also selected by the teacher for their outstanding performance in the subject.

Over the past several years, I have only used the tutoring program to help students reassess after they did not show proficiency the first time. I wondered if I was using this tutoring program backward, it may be more beneficially if the tutoring occurred prior to the assessment. I discussed this thought within my science department, and the opinions were varied on the quality of tutoring that can be done by a peer. It piqued my interest, and I wanted to make changes to how I used peer tutoring.

The purpose of this study was to determine the effect of peer tutoring on academic success. My focus question was *How does peer tutoring influence mentees' science self-efficacy and performance on assessments?* My sub-questions included the questions below.

1. How does peer tutoring influence the mentee's performance on assessments?
2. How does peer tutoring influence the mentee's science self-efficacy?
3. How does peer tutoring influence mentors' science self-efficacy?

CONCEPTUAL FRAMEWORK

Peer tutoring has always been a critical aspect of education. Since the period in time when there were one-room schoolhouses, older peers have been called upon to help younger ones. It has evolved into what it is today: a tool for teachers to use to help struggling students in person or online. The essential aspects of peer tutoring remain the same. Peer tutoring gives students of all backgrounds access to free help, it affords teachers more options to help students, and it allows for students to develop positive relationships with their peers.

Peer tutoring can be defined as "a class of practices and strategies that employ peers as one-on-one teachers to provide individualized instruction, practice, repetition, and clarification of concepts" (Davis, Greenwood, Vannest, & Bowman-Perrot, 2013, p. 39). The set-up of peer tutoring was originally based around the idea that only the "best students" could be tutors. However, the current trend is to analyze the individual strengths of students in particular areas. Researchers are looking into the advantages of pairing students that are at the same cognitive level when tutoring. The peer may find that tutor easier to connect with and therefore be more willing to participate in the process.

Peer learning, or the idea that both students benefit from the experience, is more than just matching two students and hoping for the best. Numerous variables need to be considered when a school or teacher is going to introduce peer learning. Teacher training programs and in-service training for practicing teachers should include peer tutoring (Davis et al., 2013, p. 39). Teachers should be trained to increase the success of any peer tutoring program. Once teachers are

trained, they have many variables to consider. Those variables include time, year of study, ability, place, voluntary or compulsory, and curriculum to list a few. The program must benefit the tutor and tutee or the mentee and mentor. Avoiding any social divisiveness according to perceived ability and status leads to higher future involvement (Topping, 2005, p.634).

Planning a peer learning program takes time and consideration for all parties involved. Once the program is in place, however, the teachers and students will reap the benefits of their hard work. Ullah, Tabassum, and Kaleem (2018) found that peer tutoring in biology caused the mean score (36.05) of the experimental group to be significantly greater than the mean score (27.24) of the control group. The research evidence is clear that peer tutoring can yield significant gains in academic achievement in the targeted curriculum area (Topping, 2005, p.635). The amount of academic achievement gains can vary significantly based on the implementation of the peer tutor program. Simply labeling something "peer tutoring" does not guarantee success.

An effective peer tutoring program has been shown to help all types of students across all content areas. Peer tutoring also creates a better learning environment for students with disabilities. The one-on-one or small-group setting can increase academic success for all students, especially for students with disabilities (Okilwa & Shelby, 2010, p. 452). Okilwa and Shelby (2010) found that regardless of the disability types of participants, peer tutoring resulted in positive academic outcomes for the students.

English as a Second Language (ESL) learners can also benefit from peer tutoring. Communication issues can cause friction between the tutor and tutee. The tutors need to be well-prepared for their role when they are matched with ESL students. Training could include workshops on language enhancements, confidence boosts, and appropriate behavior or time management techniques (Chai & Lin, 2013, p. 130). One suggested training technique included five training sessions (Bond, R., & Castagnera, E, 2006). Bond & Castagnera goes on to explain the different topics of each sessions. Those topics included special education, equity, teaching strategies, and the importance of building relationships with mentees. Tutors must be adequately trained to avoid negative experiences for both parties and ensure involvement in the future.

Training isn't the only component in a successful peer tutoring program. Grubbs (2009) stated that adult supervision is essential in order to answer any mentor questions. The supervisor must be able to oversee behavior, provide mentor feedback, and communicate with parents if necessary. One study suggested that tutors should be matched according to gender, ethnicity, socioeconomic status, or similarity in achievement level (Hartman 1996). Grubbs found that peer tutoring during the school day was better attended when it occurred during the school day.

The overall success that peer tutoring can produce for ESL students and students with disabilities shows that all students can benefit from the program. Does this mean that it will work at any grade level with any content? Does it

apply to any grading system? Could it be that peer tutoring leads to greater success in traditional grading vs. standards-based grading?

The majority of peer tutoring research has been conducted at the elementary and middle school levels, which leaves the secondary-level research to be underwhelming. I propose to study whether the use of peer tutoring in a standards-based grading system leads to higher academic performance at the secondary level. Students will be scored based on a rubric. Proficiency in the rubric requires the students to apply the content learned to real life situations rather than memorization. This study will compare the academic performance of students who receive peer tutoring to those who did not.

METHODOLOGY

The purpose of this study was to determine the effect of peer tutoring on academic success and science self-efficacy in high school students. The research methodology for this project received an exemption by Montana State University's Institutional Review Board, and compliance for working with human subjects was maintained (Appendix A).

Data collection began at the beginning of the second semester in January 2020. Seventy-seven high school students, who made up five biology classes, participated in this study. The treatment group consisted of forty-two students within two sections and the control group consisted of thirty-five students within three sections. During the study, the treatment group was assigned to meet with a tutor before they could take their summative assessment. The students could meet individually or in small groups of three or fewer. The students would select a

tutor from a list posted in my room or on Canvas. The students were able to choose from any mentor on the list. I did not assign any specific mentor unless the mentee asked for my opinion while selecting. Canvas is the online platform our school uses to deliver digital tools and content in the classroom. The mentors were given refresher information to look over before they had a tutoring session. All material was given through Canvas. The refresher information consisted of videos, slideshows, rubrics and all classroom activities. The mentors did not receive any training before the study.

The mentor list consisted of male and female students who were either juniors or seniors. All of the mentors had successfully completed biology and had been previously selected as science mentors. The students could meet with their mentor during Warrior Time (a 25-minute free period when all teachers and students have no class) only. The sessions had a minimum time requirement of twenty minutes. The goal of every tutoring session was to review the content for the upcoming assessment and ask for further explanation. The tutoring session were completely different depending on what the mentee needed to review in relation to the standard. I saw mentors use whiteboards, flashcards, blank graphics and questions during the tutoring sessions. Depending on the mentee, the mentors spent the time asking the students above and beyond type questions to prepare them for the level 4 questions. I walked around the classroom to answer any questions and offer guidance if needed.

Once the session was over, the mentors would complete an online form to mark the requirement completion for the student(s) on that standard. I collected data on two summative assessments in the control and treatment groups. Concluding each assessment, the scores were compared to the control group. I used a two-sample t-test and box and whisker plots to analyze the results. The control group had the same mentors available to them to use at any time. They did not have any requirement to use them before they could take the assessment. No student in the control group used a mentor before the assessment, for either standard. They had complete access to the list of mentors but did not take advantage of the program. Student motivation may have be behind this lack of engagement in the control group.

Prior to any treatment, mentees and mentors were administered a Self-Evaluation Survey asking for reflection towards peer tutoring and confidence in science (Appendix B). The Pre- and Post-Treatment Likert Survey was used to determine students' science self-efficacy. The questions asked students to rate their attitude towards science and experiences with peer tutors. The students responded with *Strongly Disagree* (1), *Disagree* (2), *Neutral* (3), *Agree* (4), or *Strongly Agree* (5). I used the chi square test of independence and bar graphs to analyze the results. I compared the post-control and post-treatment data. I also compared pre-treatment and post-treatment data.

To gather additional qualitative data, some students were randomly selected to take part in a post-treatment questionnaire (Appendix C). These

questions were designed to gather further insight concerning tutoring sessions and personal growth. I was able to collect student quotes from this data.

The variety of data collection tools used to answer the primary and secondary questions are outlined in Table 1.

Table 1
Data Triangulation Matrix

Focus Questions	*Data Source 1*	*Data Source 2*	*Data Source 3*
Primary Question: *How does peer tutoring influence a mentee's performance on assessment?*	Summative Classroom Assessment Scores	Student Post-Treatment Interviews	Teacher Journal
Secondary Question: *How does peer tutoring influence mentee's science self-efficacy?*	Pre-treatment Likert survey	Post- treatment Likert survey	Individual semi-structured questions
Secondary Questions: *How does peer tutoring influence a mentor's science self-efficacy?*	Pre-treatment Likert survey	Post- treatment Likert survey	Individual semi-structured questions

The different types of data sources and analysis techniques made it easy to answer my study question which was to determine the effect of peer tutoring on academic success and science self-efficacy in high school students.

DATA AND ANALYSIS

For each standard assessed, a final summative assessment was administered to each group. The Standard 1 Ecology Assessment was given first. The control group (*N*=35) had a median score of 2.5, compared to a median score of 3 for the treatment group (*N*=42). In standards-based grading, a student can earn a 1, 1.5,2,2.5,3,3.5 or 4 as a score. A score of 3 or above is considered proficient. A score of 2 or 2.5 is considered developing. A score of 1 or 1.5 is considering beginning. A Two-Sample t-test assuming equal variances was implemented to compare all the scores. The resulting p-value showed a highly significant difference between the control and treatment group (p=0.004) (Figure 1).

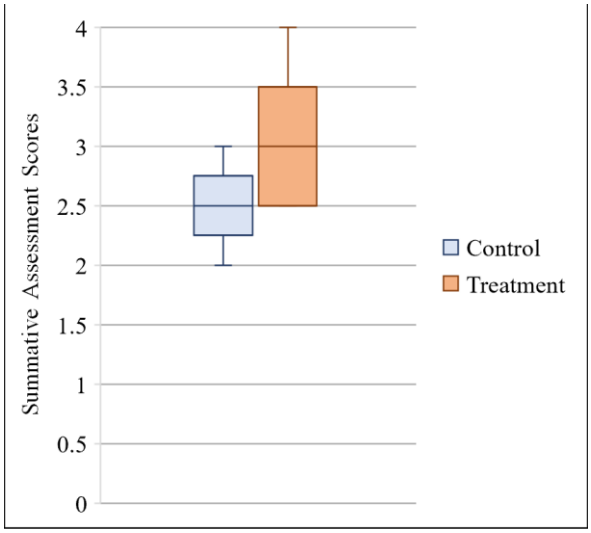

Figure 1. Boxplot of assessment scores for standard one, *(N*=77).

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The Standard 2 Cellular Energy Assessment was given second. The control group (*N*=35) had a median score of 2, compared to a median score of 2.5 for the treatment group (*N*=42). A Two-Sample t-test assuming equal variances was implemented to compare all the scores. The resulting p-value showed no significant difference between the control and treatment groups (p=0.205).

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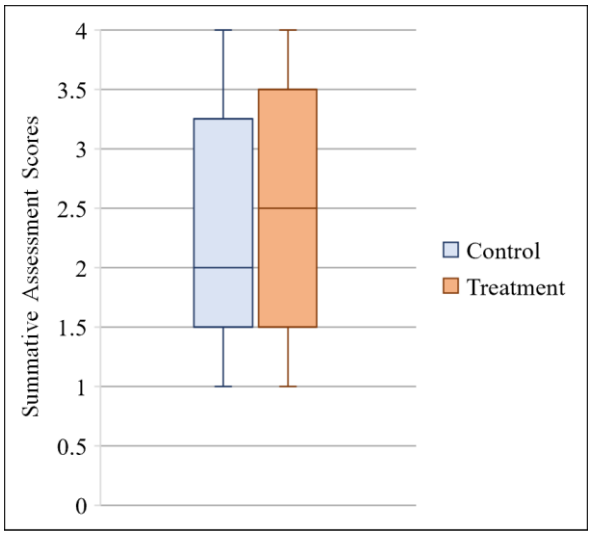

Figure 2. Boxplot of assessment scores for standard two, *(N=77).*

The Chi-Square Test of Independence for the Mentee Student Confidence Survey indicated that there was a statistical difference for the question, *Using a science tutor will help me understand the class better*, with a p-value of 0.013 (*N*= 34). After the standard, more students *agreed* or *strongly agreed* with the statement. In the interview after the last standard, one student wrote, "I felt like I actually knew what the assessment was going to be about after tutoring."

The question, *Meeting with a science tutor is not worth my time* also had statistically significant results between the control and treatment survey results,

with a p-value of 0.032. More students in the treatment group *disagreed* or *strongly disagreed* with the statement. After the last standard, one student wrote, "I know the tutoring sessions helped me score higher on the second standard; I don't know about the first standard.

The question, *I feel confident while taking my assessment* had a borderline statistically significant result between the pre-treatment and post-treatment administrations of the survey, with a p-value of 0.05 (N=34). More students *agreed* or *strongly agreed* with that statement after the treatment. One student wrote, "Reviewing one on one with my tutor made me look at the rubric again, which I don't usually do."

The opposite question, *I don't feel confident while taking my assessment,* had a borderline statistically significant result between the pre-treatment and post-treatment administrations of the survey, with a p-value of 0.056 (N=34). Fewer students *agreed* or *strongly agreed* with that statement after the treatment.

The final survey questions that was statistically significant between the pre-treatment and post-treatment administrations was, *I am not good at science, and there is nothing I can do about it,* with a *p*-value of 0.022. When the students took the survey after the treatment, fewer students *agreed* or *strongly agreed* with the statement. The post-control group Likert data is shown below (N=25). The second graph is the post-treatment group Likert data. One student wrote, "I got a 3 for the first time all year after Sam tutored me. I guess I'm not as dumb as I thought."

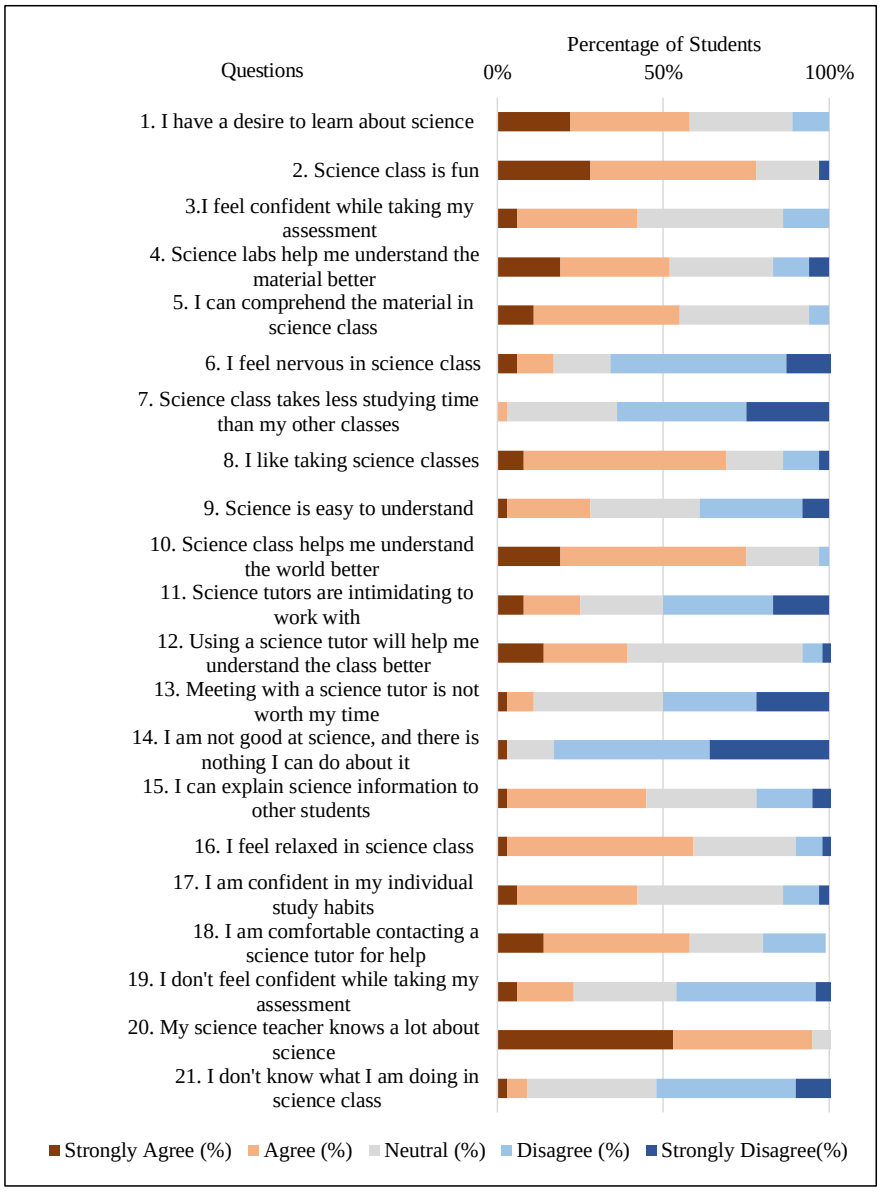

Figure 3. Results of the Control Group Student Self- Efficacy Survey, (N=25)

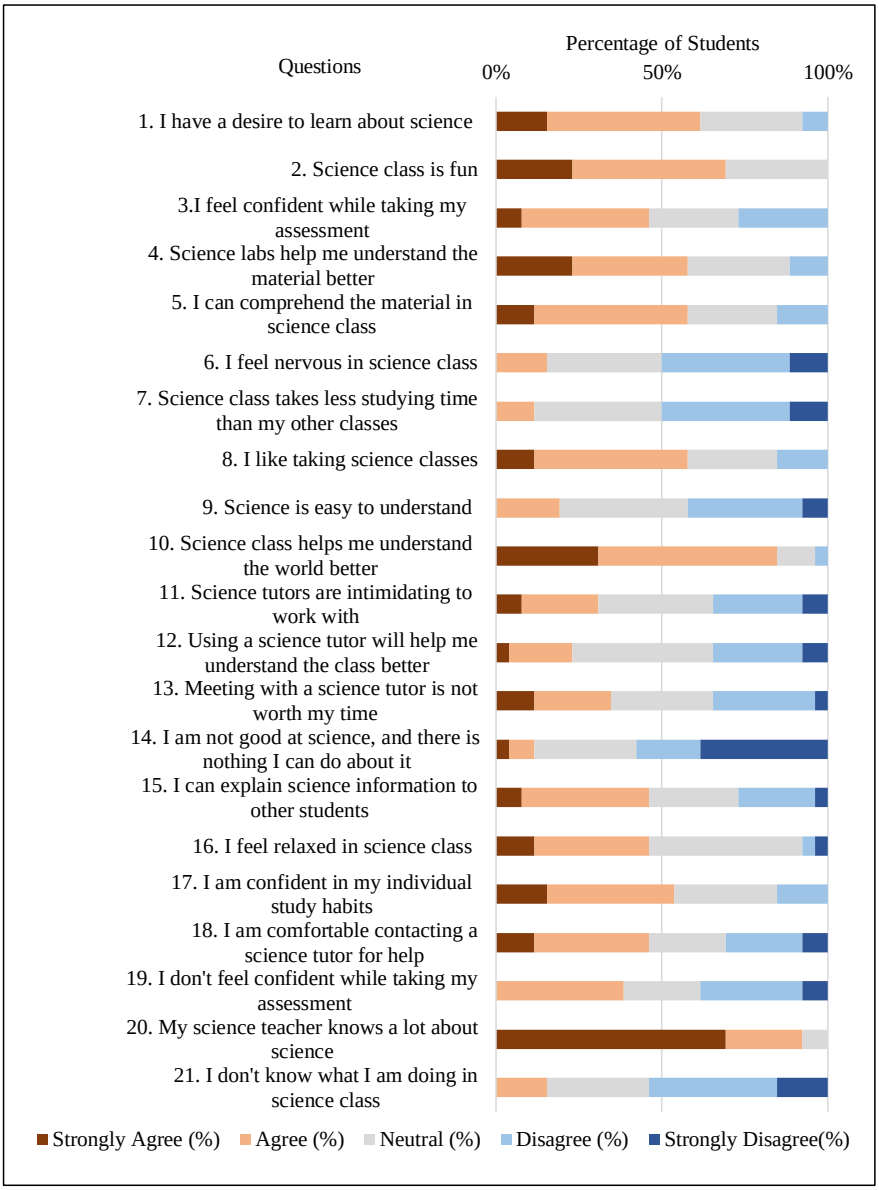

Figure 4. Results of the Treatment Group Student Self- Efficacy Survey, (*N*=35)

The mentor student confidence survey did not produce any significant p-values after a Chi square Test of Independence analysis was performed. Although not statistically significant, it was noted that in the Likert selections for, *I understand the material better after I tutor someone*, ten students *strongly agreed* post-treatment, whereas only eight students *strongly agreed* and one student *disagreed* pre-treatment. In a post-treatment interview, when I asked, "Do you feel more comfortable with science topics after tutoring on them?". One student responded by saying, "I can't believe I thought this topic was hard last year when I was in biology."

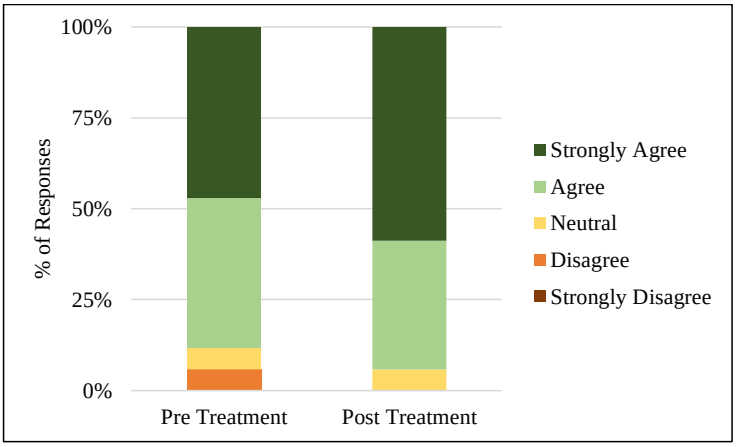

Figure 5. Likert responses from the Pre-Treatment and Post-Treatment to Mentors rating of "I understand the material better after I tutor someone," (N=17)

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It was also noted that in the post-treatment mentor interviews, one student wrote "It kinda showed me that I didn't really know how to study in bio." Before the treatment, nine students *strongly agreed* with the question, *I am confident in my own studying habits.* After the treatment, this number dropped to five students who *strongly agreed*.

I tracked the data for how often the mentors were chosen to mentor, and the results showed that five of the seventeen students were used 48 percent of the time. One

of those students wrote, “People heard I was a good mentor so I had a lot more students request to have me tutor them for the 2nd assessment.”

Although data collection was interrupted by a global pandemic, the data produced offered many statistically significant figures. The summative scores were higher in the treatment group than the control group. The self-efficacy in the mentee treatment group increased in relation to peer tutoring, study habits, and preparedness for the assessment.

INTERPRETATION AND CONCLUSION

My first focus question was how peer tutoring would affect student performance specifically assessment scores. A statistically significant p-value of 0.004 was collected for the first summative assessment but not for the second assessment. I had planned to collect three additional assessment scores but unfortunately a pandemic caused our school to cancel classes and move to optional online learning. It would be interesting to see what the p-values would have been for an entire semester of summative assessment scores. These results align with the prior analysis of student self-efficacy by Perkins et al. (2005), who found that students who come into a course with more favorable beliefs are more likely to achieve high-learning gains. I believe that the treatment group would have continued to earn higher scores as their belief in themselves grew over the course of the entire semester.

The side-by-side box-and-whisker plot of the summative assessment scores revealed that the higher scores were in the treatment group for both assessments. The median was higher on both assessments in the treatment group. I found it interesting that only students in the treatment group were able to earn a four or exceeding score on the first summative assessment. I witnessed some incredible conversations between mentors

and their mentees during the tutoring sessions, which I believe led to a higher understanding of the content. The mentors encouraged the mentees to look back at their notes, plan a time to study more at home, and push the student to take accountability for their learning.

A sub-question of my research was how peer tutoring would influence a mentee's science self-efficacy. There were statistically significant findings from the Student Confidence Survey, showing that students were more confident on the assessments. These results were also confirmed in the student questionnaire given to a random group of students. I had planned on asking for student feedback in the form of an in-person interview but was unable to due to the school closure. The students filled out the questions and returned them to me via email. There were statistically significant findings from the Student Confidence Survey that students in the treatment group realized that studying led to more understanding. They no longer believed that science was a "lost cause" or that they could never succeed in biology. That was a very powerful change. In the future, it would be interesting to require peer tutoring for the entire school year and track if self-efficacy would change more dramatically.

My last research sub-question was how peer tutoring would influence mentors' science self-efficacy. I found no statistically significant data from the Student Confidence Survey. I wonder if it is because all of the students within the mentor group had already been tutoring during the first semester. Perhaps I would have found more significant data if I would have given the mentors the survey at the beginning of the school year. The mentors did share, through the questionnaire, that they found the experience to expose their own shortcomings when it came to study habits. The mentors

also took advantage of the review information before tutoring sessions. In the future, it would be interesting to assess the mentors' understanding of the content both before and after tutoring sessions.

VALUE

Requiring students to select a mentor and complete peer tutoring before taking the summative assessment led to higher assessment scores and high student self-efficacy. A single twenty-minute session made a lasting difference for the students. The control group did not experience any of the increases in self-efficacy or assessment scores. I have heavily relied on peer tutoring as part of the reassessment protocol. However, my findings show it would be beneficial to require peer tutoring before the assessment instead of after a below-proficient performance. Peer tutoring decreased the number of reassessments that I would normally see following a summative assessment.

Standards-based instruction and grading requires students to take control of their learning. I see now that most students do not have the confidence to reach out to a mentor without it being required. I was surprised to see the number of students that believed that peer tutoring was a waste of time. I distinctly remember one student shouting "Can you believe that I got a three the first time on this standard?" Self-efficacy plays a much larger role in student behavior than I previously thought. I am excited to share the results of my research with the other faculty members at my school. Most teachers do not use peer tutoring in a structured way, and some do not use peer tutoring at all. My goal is to create a required tutoring program in the science department first, then roll it out to the other departments.

I have learned that to increase student understanding, which in turn will lead to higher summative assessment scores, I need to build up the confidence of my students. If one of my students truly believes that there is nothing they can do to improve their science understanding then they will never succeed in biology. I now know that positive interactions through peer tutoring will increase their confidence and lead to success in biology. I am eager to use peer tutoring in all of my sections next school year. Knowing that it does make a difference for my students confirms my belief that peer tutoring is essential in my classroom.

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Ullah, I., Tabassum, R., & Kaleem, M. (2018). Effects of peer tutoring on the academic achievement of students in the subject of biology at secondary level. *Education Sciences,8*(3), 112.

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Wolfe, B. (2018). *The impact of a peer-tutoring model on the academic performance of secondary students*(Unpublished doctoral dissertation). University of South Carolina.

APPENDICES

APPENDIX A

MONTANA STATE UNIVERSITY IRB EXEMPTION

INSTITUTIONAL REVIEW BOARD
For the Protection of Human Subjects
FWA 00000165

MONTANA STATE UNIVERSITY

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MEMORANDUM

TO: Christine Brasser and Marcie Reuer

FROM: Mark Quinn Mark Quinn CTJ
Chair, Institutional Review Board for the Protection of Human Subjects

DATE: November 18, 2019

RE: *"The Effect of Peer Tutoring Influencing Students' Science Performance on Assessments and Their Self-Efficacy" [CB111819-EX]*

The above research, described in your submission of November 18, 2019, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

__X__ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

__X__ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation; and (iii) the information obtained is recorded by the investigator in such a manner that the identity of the human subjects can readily be ascertained, directly or through identifiers linked to the subjects, and an IRB conducts a limited IRB review to make the determination required by section 16.111(a)(7).

____ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX B

MENTEE STUDENT CONFIDENCE SURVEY

Pre and Post Treatment Questionnaire (Mentee)

Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way

Directions: The statements in this survey have to do with your opinions and beliefs about science class and your tutoring experiences. Please read each statement carefully and circle the description that best expresses your own feeling.

1	I have a desire to learn about science	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
2	Science class is fun	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
3	I feel confident while taking my assessment	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
4	Science labs help me understand the material better	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
5	I can comprehend the material in science class	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
6	I feel nervous in science class	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
7	Science class takes less studying time than my other classes	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
8	I like taking science classes	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
9	Science is easy to understand	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
10	Science class helps me understand the world better	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
11	Science tutors are intimidating to work with	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
12	Using a science tutor will help me understand the class better	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
13	Meeting with a science tutor is not worth my time	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
14	I am not good at science, and there is nothing I can do about it	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
15	I can explain science	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree

	information to other students					
16	I feel relaxed in science class	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
17	I am confident in individual study habits	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
18	I am comfortable contacting a science tutor for help	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
19	I don't feel confident while taking my assessment	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
20	My science teacher knows a lot about science	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
21	I don't know what I am doing in science class	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree

APPENDIX C

MENTEE QUESTIONAAIRE

Structured Interview Questions (Mentees)

Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way

Tutoring

- How would you describe your past science tutor sessions?
- Do you find the tutor sessions helpful?
- How can the tutoring sessions be improved?
- How long do you think the tutoring session should be?
- Does it matter where the tutoring sessions occur? (Ex: learning center, commons, my classroom or coffee shop)
- Have you had any small group tutoring sessions? If so, do you find them to be as effective as one-on-one tutoring sessions?
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Science self-efficacy

- How do you feel about science?
- When you work on science homework, how do you feel about yourself?
- How confident are you when completing science homework on your own?
- How confident are you when discussing science with your classmates?
- How confident are you when reading science texts in class?

1. How confident are you when explaining things in science class?

APPENDIX D

MENTOR STUDENT CONFIDENCE SURVEY

Pre and Post Treatment Questionnaire (Mentor)

Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way

Directions: The statements in this survey have to do with your opinions and beliefs about science class and your tutoring experiences. Please read each statement carefully and circle the description that best expresses your own feeling.

1	I understand the material better after I tutor someone	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
2	I feel confident in my science classes	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
3	I am nervous when teaching others about science	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
4	Other students think I am good at science	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
5	I leave a tutoring session feeling accomplished	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
6	I know how to help the students in my sessions learn the content	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
7	I am confident in my own study habits	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
8	I like taking science classes	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
9	Science is easy to understand	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree
10	I like tutoring others about science	Strongly Agree	Agree	Neutral	Disagree	Strongly disagree

APPENDIX E

MENTOR QUESTIONAAIRE

Structured Interview Questions (Mentors)

Participation in this research is voluntary and participation or non-participation will not affect a student's grades or class standing in any way

Tutoring

- When do you find tutoring to be the most valuable, before or after the assessment?
- How long do you think tutoring sessions should be?
- Do you prefer to tutor before school, during warrior time, study halls, or after school?
- Which do you prefer, one on one tutoring or small group tutoring?
- Do you feel like the students understand the material better after you tutor them?

Science self-efficacy

- Do you feel more comfortable with science topics after tutoring on them?
- Does the content feel easier to understand?
- Do you feel like you know the content at a deeper level after tutoring?
- Does it make you more confident in science content after tutoring?