

**HOW DOES STUDENTS' PARTICIPATION IN THE IN-CLASS PEER TUTORING
PROGRAM RELATE TO THEIR SELF-EFFICACY BELIEFS
IN MECHANICS OF MATERIALS?**

By

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Abstract

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An in-class peer tutoring program was implemented at Washington State University to incorporate active learning exercises into the classroom. Many studies have investigated the positive outcomes and the value that tutoring schemes can provide, ranging from academic achievement to attitudes regarding subject matter. Self-efficacy is a part of Bandura's social cognitive theory framework and relates to a person's belief in their own ability to accomplish a specific task (Bandura 1997). Previous research has shown the students who are highly efficacious have higher academic expectations for themselves, have higher academic performance, and are more motivated to learn. Self-efficacy can be positively influenced through mastery and vicarious experiences, social persuasions, and physiological states. The purpose of this study is to investigate the student development of mechanics of materials self-efficacy in an in-class peer tutoring program by investigating: (1) how student interactions with in-class peer tutors influence their mechanics of materials self-efficacy, and (2) how in-class peer tutors develop positive self-efficacy beliefs through mastery experiences, vicarious experiences, social persuasions and physiological states. This research includes mid-semester sample selection

surveys, semi-structured interviews, and end-of-semester member checking surveys in two sections of mechanics of materials. Mastery experiences and vicarious experiences were found to be largely influential in positively influencing students' mechanics of materials (MoM) self-efficacy. The peer tutors created an opportunity for students to successfully complete tasks and increased the chance of success by being available to answer questions. They also were viewed as role models, which was a positive pathway for student comparisons. Physiological states were also influential, but to a lesser degree. Social persuasions did not influence MoM self-efficacy beliefs in students in the mechanics of materials course. This research indicates in-class peer tutors have the potential to have a positive influence on MoM students' self-efficacy.

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I. INTRODUCTION

Tutoring is a topic that has received much attention in educational research. Many studies have investigated the positive outcomes and the value that tutoring schemes can provide, ranging from academic achievement to attitudes regarding subject matter (Cohen, Kulik et al. 1982). In a meta-analysis study by Robinson et al.(2005), tutoring programs were observed to increase mathematics achievement scores among tutees. The social benefits of peer tutoring have also been investigated. Cohen(1986)pointed out that tutoring helps students to “develop the social skills of listening, understanding, soliciting and delivering help, and communicating clearly.”

There are a variety of tutoring programs that have been employed at all levels of education, from kindergarten to higher education. Tutors can be of the same experience, or at a higher level than the students they tutor. The nature and structure of the peer tutor training program can also vary widely. However, it has been reported that structured programs produce stronger effects on the tutees and the tutors (Cohen, Kulik et al. 1982). A structured program means peer tutors have scheduled meetings with students that are more consistent rather than sporadic interactions.

An in-class peer tutoring program (ICPT) was implemented at Washington State University in the fall of 2007. The in-class peer tutoring program consists of students who have taken a course such as statics in the mechanical or civil engineering department working with students who are in that course (i.e. mechanics of materials) during class on active learning exercises. The focus of this study is two sections of mechanics of materials (MoM) courses that utilized ICPT. MoM is a sophomore level course in the engineering curriculum. Nearly all students in the MoM course were mechanical or civil engineering students and generally in their second year of the engineering program. In both classes, students interacted with peer tutors through in-class assignments and out-of-class tutoring sessions. Peer tutors were required to have office hours where they could help MoM students with homework, studying, class projects, or anything else

related to the class. Each of the tutors were asked by the instructor to participate in the ICPT program because of their perceived understanding of the course material and their interest in teaching and helping other students. Peer tutors are not paid an hourly wage, but students were awarded a \$100 gift certificate for their work throughout the semester.

The focus of this paper is what self-efficacy development looks like in mechanics of materials classes utilizing in-class peer tutors. This research paper aims to present the current research in self-efficacy related to engineering classes and identify the influences peer tutoring programs have on students' self-efficacy.

A. Self-Efficacy

Self-efficacy is a subset of efficacy and is a part of Bandura's social cognitive theory framework (Bandura 1997). It relates to a person's belief in the ability to accomplish a specific task. It is the difference between a judgment of capabilities rather than a statement of intention (Bandura 1997). That is, self-efficacy can be defined as a person's belief that they *can* rather than they *will*. It is important to identify the type of self-efficacy of interest because self-efficacy cannot be assessed on a general level, it must be related to a specific topic. The distinction that self-efficacy is in reference to a specific task is an important one because a person can be highly efficacious in one aspect of their lives while holding views of low self-efficacy in relation to another.

Self-efficacy is often confused with self-esteem and self-concept and is not synonymous with either concept. Self-esteem is a judgment of self-worth rather than a judgment of capability (Bandura 1997). A person could have a low opinion of themselves, equivalent to low self-esteem, but still have a strong belief in their capabilities to perform mathematics, equivalent to high mathematics self-efficacy. Self-concept is another term that does not mean self-efficacy. Self-concept refers collectively to the beliefs and assumptions that a person holds of

themselves(Pajares 1996). Similar to self-esteem, self-concept is an overall evaluative judgment of one's own self-worth and is not related to a specific aspect of a person's life(Pajares 1996; Pajares and Shunk 2001). Self-efficacy, on the other hand, relates to having the confidence in one's own abilities to accomplish a particular task.

Self-efficacy beliefs are natural. Experiences that change self-efficacy beliefs are constantly occurring. Strengthening or weakening self-efficacy beliefs is an intuitive process because as people encounter experiences, they interpret the experience and utilize those interpretations in forming self-efficacy beliefs. How these interpretations are developed will relate to how an individual will respond to the specific topic in the future (Pajares 2005). Positive experiences increase self-efficacy beliefs while negative outcomes tend to decrease self-efficacy beliefs. It is important to recognize that people interpret experiences in varying ways, which means that a positive experience for one person is not necessarily viewed as a positive experience for another.

B. Why is Self-Efficacy Important to Engineering Education?

Engineering is a field that requires substantial mathematics and science skills. Research on self-efficacy in engineering courses is sparse. Therefore, studies on mathematics and science self-efficacy are used to highlight the importance of self-efficacy in engineering education. Mathematics self-efficacy beliefs have been identified as a strong predictor of a student's mathematics accomplishments (Pajares 2005). Chemistry students recognized as high achievers had higher levels of chemistry self-efficacy at the end of the semester, showcasing the importance of self-efficacy (Zusho and Pintrich 2003). Efficacious students tend to have greater academic expectations and better academic performance than students with low mathematics self-efficacy beliefs (Chemers, Li-tze et al. 2001; Margolis 2005). Also, students who believe they have the ability to be successful in mathematics typically perform better. Motivation and

perseverance are also related to levels of self-efficacy (Zimmerman 1995; Margolis 2005). Students who are more confident tend to work harder, persist longer and use better learning techniques than those who are less confident (Chemers, Li-tze et al. 2001; Schunk 2003). Lent, Brown and Larkin (1986) found that those students who were identified as being highly efficacious in mathematics achieved higher overall grades in their programs and stayed in technology career fields longer.

Building self-efficacy in engineering is also important for perseverance and retention. People who have high levels of mathematics self-efficacy view difficult tasks as challenges rather than threats (Chemers, Li-tze et al. 2001; Schunk 2003; Pajares 2005). Viewing tasks as challenges rather than threats can lead to more success because students are not afraid to try new activities. Seymour and Hewitt (1997) found that a significant portion of students left science and mathematics majors because of difficulty of the material presented in the major. Students who are highly efficacious are more willing to put energy into mastering difficult material, or a topic that is challenging, rather than avoid the subject (Chemers, Li-tze et al. 2001). This willingness to persevere has the potential to improve retention of engineering students. These studies exemplify the importance of self-efficacy to the engineering education community.

II. SELF-EFFICACY AND THE ICPT PROGRAM

The four sources of self-efficacy are, in order of descending ability to change self-efficacy, mastery experiences, vicarious experiences, social persuasions, and physiological states (Bandura 1997; Schunk 2003). Mastery experiences are incidents in which a person successfully accomplishes a given task or is unable to achieve a given task. Vicarious experiences relate to how a person compares their ability to accomplish a task to others. Social persuasions are what

others tell a person about their ability to perform a task. Finally, a physiological state is how the body responds to a person's perceived ability to perform a task.

Peer tutoring has the potential to influence student MoM self-efficacy beliefs through all four self-efficacy sources owing to both the in- and out-of-class components. Prior to presenting an argument on how this may occur, a description of the ICPT program will be presented here. For the in-class component, the peer tutors attend the class approximately once a week while students work through in-class exercises which reflect current concepts for the class. In-class assignments are typically a problem from the book that is related to the upcoming homework assignment. These problems are not meant to be overly difficult. Schunk(2003) notes that "goals that are perceived as moderately difficult raise motivation and convey a clear sense of progress, which raises efficacy." Approximately a week before class, tutors are given these exercises so that they can work through it on their own. They also meet with the course instructor as a group to discuss the exercise and ensure that they each understand the concepts. Preparation with the instructor occurs within the week preceding each in-class tutoring session and lasts approximately thirty minutes. The students are allotted twenty to forty minutes during class to finish the problem. The assignment must be turned in by the end of the class and students are usually given points towards their grade for completion of the problem or an attempt to complete the problem. The peer tutors circulate through the classroom, and students can ask the tutors for assistance solving problems or the tutors can initiate contact with students on their own.

The second part of the ICPT program takes place outside of the scheduled class time. Each of the tutors holds one or two office hours during the week where they are available for students to ask for help with homework, studying, or class projects. Unlike the in-class portion, there is little structure in these interactions, and the course instructor is not present. This is an informal time for students to work on MoM with the help of the peer tutors and other classmates.

A positive mastery experience is an event in which an individual successfully accomplishes a certain task. In the educational system there are many types of mastery experiences. A test, a homework assignment, a laboratory experiment or a group project could all serve as positive or negative mastery experiences. Students who achieved higher high school GPA's have been found to be more efficacious and have better academic performances, and students who had extensive amounts of mastery experiences were more efficacious (Chemers, Li-tze et al. 2001). College students also believed mastery experiences most accounted for their mathematics-related self-efficacy (Lent, Brown et al. 1996). Many other researchers have identified mastery experiences as the most influential source of self-efficacy (Hackett 1995; Pajares 2005; Hutchison, Follman et al. 2006).

The most unique and potentially influential aspect of the ICPT program takes place during class time when tutors interact with students. Mastery experiences can occur as a result of these interactions between a student and peer tutor. Students working with peer tutors on problems related to class material provide opportunities to succeed within the classroom setting. By relating tutoring sessions to in-class curriculum, the success rate of students is more likely to increase as well as self-efficacy beliefs (Wasik 1998; Margolis 2005). Specifically, material at instructional level allows students to routinely have the successful experiences needed to strengthen self-efficacy through mastery experiences (Margolis 2005). If instructors select tasks at the learner's instructional level, and the learner gets adequate instruction and support, success is likely (Wasik 1998; Margolis 2005). However, it is important to note that students cannot accomplish tasks beyond their capabilities simply because they believe they can (Pajares 1996; Schunk 2003), further highlighting the importance of including problems that are solvable (instructional level) by students. This indicates that both the in- and out-of-class portion of the

peer tutoring program has large potential to influence MoM self-efficacy through positive mastery experiences.

Vicarious experiences are highly influential, although to a lesser degree than mastery experiences (Schunk 1991; Schunk 2003). A vicarious experience is an individual's perceived capability of themselves compared to another's. As an example, if it takes one student an hour to complete a homework problem and a second student only 10 minutes, the first student would likely view themselves as less capable at completing the problems. Vicarious experiences can become very important when students are uncertain of their capabilities or have limited mastery experiences in the subject area (Pajares 2005; Hutchison-Green, Follman et al. 2008). With limited experience, a student is more likely to compare themselves to others and so are more sensitive to negative vicarious experiences. Role models, on the other hand, can have a strong positive influence on vicarious experiences by initiating the 'if they can do it, so can I' mentality (Pajares 2005). Vicarious experiences with peer tutors have also been found to be influential. Schunk(1991) found that adult models can be effective, but peer models have the potential to be more effective because students observe their peer succeeding and believe they also have the ability to succeed. Peer tutors are successful models because they have passed the MoM class and been asked by the teacher to participate in the ICPT program. By watching peers succeed, whom students view as similar, the students are encouraged to try the modeled task (Cohen 1986; Schunk 1991; Schunk 2003). There is substantial opportunity for rating and comparison of abilities in a classroom setting, and vicarious experiences. Additionally, previous research indicates that both the in-class and out-of-class portions of ICPT can positively influence student MoM self-efficacy by providing students with a peer to view as a successful role model.

Social persuasions are the third source of self-efficacy and are defined as significant others expressing faith or doubt in a person's capabilities (Bandura 1997). Generally, verbal

confirmation of a person's ability would increase their self-efficacy while negative comments could degrade their self-efficacy. Pajares(2005) found that negative appraisals were more efficient at weakening mathematics self-efficacy beliefs than positive encouragement was at strengthening them. Other research has found that the impact of social persuasions can only be as strong as a person's confidence in the one who is giving the feedback (Bandura 1997; Zeldin and Pajares 2000; Schunk 2003). Matsui et al (1990) found that social persuasions was the only source that did not make a significant contribution to mathematics self-efficacy beliefs. Peer tutoring offers individualized attention that is direct and immediate for the student (Cohen 1986). This close and personalized attention has the potential to influence MoMself-efficacy through social persuasions. One element of peer tutoring which can be especially beneficial is the inherent one-on-one contact with the student. Margolis (2005) states that intimate groups of peer tutoring or one-on-one interactions are ideal for increasing self-efficacy beliefs of a struggling student. In the same article, Margolis also noted that tutoring positively influences self-efficacy, motivation, and academic success. This could be a result of the potential relationships built between students and peer tutors during an ICPT program.

Physiological states are the fourth and final source of self-efficacy, which are defined as a person's interpretation of their physiological and emotional reactions to situations (Bandura 1997). This can be very important in certain categories of self-efficacy such as diet or exercise self-efficacy. An emotional reaction to a task related to engineering self-efficacy could include high levels of stress or fear indicated by high heart rates or sweating(Bandura 1997). Emotions such as boredom or excitement could also be interpreted as physiological states. The outcome of a specific activity would be related to mastery experiences, while the feelings exhibited during the activity are categorized as physiological states(Bandura 1997). Hackett (1995) states that current attitudes more heavily influence self-efficacy beliefs because they are a result of

reflective memory. Therefore, physiological states are difficult to investigate in real-time and even more so during subsequent interviews when students are recalling their emotional states rather than currently experiencing them. A meta-analysis done by Cohen, Kulik and Kulik(1982) found that students who were tutored held a more positive attitude towards the subject matter, which has the potential to change physiological states. If the students held a more positive attitude towards the subject matter, they could be more relaxed and less likely to be stressed when working on problems during in-class assignments. This would, in turn, improve physiological states in students who were interacting with peer tutors.

In order to summarize the potential link between ICPT and MoM self-efficacy, a typical interaction will be described here as well as a brief speculative description of how this could influence MoM self-efficacy. Working on a problem during class time gives the student an opportunity to develop mastery experiences before attempting homework problems. Peer tutors are available to answer questions and almost certainly increase the chance of success with the in-class problem. Because a mastery experience is one in which a student successfully completes a task, and peer tutors potentially help students be successful on tasks, the presence of peer tutors is likely to positively influence student mastery experiences in the classroom. Students who ask for help typically will get done faster than those who do not, which can lead to positive vicarious experiences. Because peer tutors are available for questions, it is also more likely that social persuasions could occur through more interactions. Peer tutors are similar in age to students and may be viewed as role models or significant figures, which might lead to social persuasions being more meaningful and influential to students. Finally, physiological states will depend on how students respond physiologically about having peer tutors around helping them on in-class assignments. There are no specific examples that will apply to every student because each person will respond to their experiences differently. Speculatively, the same types of interactions could

influence a students' MoM self-efficacy during out-of-class peer tutoring as it does during in-class peer tutoring.

III. RESEARCH QUESTIONS

Nearly all studies discussed above are primarily quantitative and use surveys. Although valuable for examining correlations and relations between self-efficacy and other important outcomes, these studies fail to develop understandings of the mechanisms through which self-efficacy is developed. Notable self-efficacy researchers have highlighted the need for such detailed and descriptive studies to obtain a rich account of student MoM self-efficacy beliefs and influences (Schunk 1991; Pajares 1996).

The goal of this project is to investigate student development of MoM self-efficacy in the ICPT program and answer the following questions:

- How do student interactions with in-class peer tutors influence their mechanics of materials self-efficacy?
- How does ICPT facilitate the development of positive self-efficacy beliefs through mastery experiences, vicarious experiences, social persuasions and physiological states?

IV. RESEARCH SETTING AND PARTICIPANTS

The MoM classes studied in this research are a part of the civil and environmental engineering department of a mid-sized land-grant university in the Pacific Northwest. The class includes primarily civil and mechanical engineering undergraduate students. As of Spring 2009, the civil engineering department consists of 260 junior and senior students while the mechanical engineering department consists of 230 junior and senior students. MoM is taught by civil engineering faculty. The faculty members are assigned to teach classes by the department chair and students are free to choose a section.

Of the three sections of MoM classes offered during the Spring 2009 semester, two of the classes utilized peer tutors in and out of class. The teachers chose to utilize the ICPT program in slightly different ways. The first class had in-class assignments once a week on average while the other had in-class assignments every two weeks on average. Also, the second class put more emphasis on students attending peer tutor office hour sessions. The first class consisted of 45 students and involved 5 peer tutors. The second consisted of 60 students and involved 4 peer tutors.

V. RESEARCH METHODS

The data collection in this study includes:

- Mid-semester sample selection surveys
- Semi-structured interviews
- End-of-semester member checking surveys

The purpose of the mid-semester survey was to identify candidates to be interviewed through purposeful sampling. 75 out of 105 students participated in the mid-semester survey. Patton (2002) defines purposeful sampling of candidates as selecting the cases that are rich with information through strategic and purposeful methods. Since there is little research identifying individual characteristics that relate to self-efficacy development, the goal was to interview students who interacted with the tutors frequently across characteristics that may relate to MoM self-efficacy. These characteristics including MoM confidence, the perceived usefulness of the tutors, and academic achievement. The survey consists of five questions about personal achievement in college and perceptions about in-class peer tutors, shown in the top row of Table 1. Questions include how often they interacted with the peer tutors in class and during office hours, how confident they were in their MoM abilities, how helpful they believed peer tutors to be, and their cumulative GPA in college. The amount students interacted with peer tutors was

used to select students who would be more information rich as a result of spending more time with peer tutors. The GPA was used as an indicator of academic achievement while their confidence level was used as a rough indicator of their self-efficacy.

The researchers created a table with all of the survey data for both classes in order to make selection easier. Nearly all students responded either with “completely agree” or “somewhat agree” to the question about how helpful peer tutors have been to the students. Because of the uniform response, this parameter was not used to identify interviewees. Every student surveyed also selected either “completely agree” or “somewhat agree” in response to the statement “I am confident in my mechanics of materials abilities.” This parameter was used to evenly select students based on their MoM confidence. Finally, the researchers wanted a variety in academic achievement based on the premise that students’ self-efficacy is linked to academic achievement.

The researchers identified 18 students that represented MoM confidence levels and academic achievement within the previously indicated criteria, as shown below in Table 1. Eleven students ‘completely agreed’ that they were confident in their MoM abilities while seven ‘somewhat agreed.’ Four of the selected students reported a GPA between 2.5 and 2.99, seven between 3.0 and 3.49 and seven between 3.5 and 4.0. The final interviewees included ten female and eight male students. The students were selected evenly from each of the two class sections – 9 from each class.

Table 1. A summary of the 18 students interviewed and their answers to the mid-semester survey questions.

Student	Class	Gender	Self-reported GPA	The peer tutors have been helpful to me in this course	I am confident in my mechanics of materials abilities	When the peer tutors are in class, I interact with them...	I attend peer tutor office hours...
1	1	F	3.0-3.5	C A	S A	always	monthly

2	1	F	3.0-3.5	C A	S A	always	never
3	1	F	3.0-3.5	C A	S A	always	never
4	1	F	3.5-4.0	C A	S A	sometimes	never
5	1	F	3.5-4.0	C A	C A	sometimes	never
6	1	F	3.0-3.5	S A	S A	sometimes	never
7	1	M	2.5-3.0	C A	S A	always	weekly
8	1	M	2.5-3.0	C A	S A	always	weekly
9	1	M	3.5-4.0	C A	C A	sometimes	monthly
10	2	F	2.5-3.0	C A	S A	always	monthly
11	2	F	3.0-3.5	C A	C A	always	weekly
12	2	F	3.0-3.5	C A	S A	sometimes	weekly
13	2	F	3.5-4.0	S A	C A	sometimes	never
14	2	M	3.5-4.0	S A	C A	always	never
15	2	M	3.5-4.0	C A	S A	sometimes	weekly
16	2	M	2.5-3.0	S A	S A	sometimes	monthly
17	2	M	3.5-4.0	S A	C A	sometimes	weekly
18	2	M	3.0-3.5	C A	C A	always	weekly

CA – Completely Agree

SA – Sometimes Agree

The interviews were conducted by the primary researcher using the interview guide approach. Patton (2002) suggests that in interview guide be used in situations where the same basic topics should be covered in each interview. This method is preferred because it allows the interviewer to probe further into a topic of interest while still covering the same questions with each participant. The interview guide for this research was developed using two previously used interview guides (Zeldin and Pajares 2000; Schulz 2005) and can be seen below in Table 2. Only the main questions – not probes – used in the interview guide are presented here. Three practice interviews with peer tutors who had previously been students in the peer tutoring program aided in further developing the interview protocol. After evaluating the responses to the practice interviews, some questions were omitted because they resulted in off-topic discussion while others were added to try and capture information that was not being drawn from the original interview guide. The

third iteration of the interview guide resulted in information-rich answers that thoroughly addressed each source of self-efficacy.

Table 2. Main questions included in the interview guide for interviewing students.

-
1. How would you define success in mechanics of materials?
 2. What experiences have helped you be more confident in MoM?
 3. What experiences have helped you be more successful in MoM?
 4. How have other people influenced how you feel about your ability to succeed in MoM?
 5. What have people said to you that has affected your confidence in MoM?
 6. Do you think you will be more or less successful than others around you?
 7. When thinking about [or doing] MoM how do you feel?
 8. Have experiences with peer tutors influenced how confident you are in MoM?
 9. How have the peer tutors influenced you in MoM?
 10. How would you describe your interactions with the peer tutors?
-

The interview questions focused heavily on mastery and vicarious experiences because they are the most influential in developing self-efficacy beliefs (Bandura 1997). Questions about social persuasions and physiological states were also included in the interview to confirm/disconfirm whether or not these topics were important in students developing MoMself-efficacy. It was likely students would not focus on social persuasions and physiological states because students tend to only focus on inward feelings or outward situations one at a time (Bandura 1997). If students have a lot to say about mastery and vicarious experiences (outward situations), it is likely that they will have much less to say about social persuasions and physiological states (inward feelings). If the interviews revealed these topics were influential in student's MoM self-efficacy development the researchers believe a different research approach,

including strict observations, would be required to collect reliable information. The interviews were conducted between week 11 and week 13 during the 15-week Spring 2009 semester.

The purpose of the end-of-semester survey is to gather information about: (a) students' perceptions of the value of the ICPT program and (b) the peer tutors from all the students in both sections that can supplement the interview process. During the Spring 2009 semester, 78 out of 105 students in both MoM sections participated in the end-of-semester. The first portion of the survey is part of an on-going evaluation of ICPT. The survey also included five short-answer questions, shown below in Table 3, about students' interactions with peer tutors that were selected from the interview guide to be included in the end-of-term survey. The researcher chose questions that resulted in rich data during the interviews and that paralleled major themes from the preliminary analysis.

Table 3. Short-answer questions included in the end-of-semester survey.

-
- I. In what ways did the peer tutors help you this term?
 - II. How could the peer tutors have been more effective helping you?
 - III. How were the peer tutors helpful in you developing confidence in your ability to solve problems in mechanics of materials?
 - IV. How did the peer tutors influence your success in mechanics of materials?
 - V. Describe a typical interaction with a peer tutor.
-

VI. DATA ANALYSIS

Data was analyzed using a phenomenographical lens. Phenomenology, the theoretical basis for the phenomenographical approach, can be described as trying to capture the lived experience of a phenomenon from a naive perspective (Patton 2002; Edgar and Sedgwick 2008). Phenomenographical researchers collect and interpret the lived experiences of others in order to

understand the phenomena of interest. The nature of phenomenography is to research a collection of experiences and gather data about a way of experiencing rather than looking for individual results of one experience (Linder and Marshall 2003; Edgar and Sedgwick 2008). The phenomenon in this research is student-to-peer tutor interactions within the ICPT program.

Thematic analysis is the method used for identifying and reporting major themes within a data set (Braun and Clarke 2006). This method compliments phenomenography because it allows for a broader analysis related to the student experiencing the ICPT program rather than initially narrowing down the data to self-efficacy context. The term ‘thematic’ indicates the importance of themes. A theme identifies important topics in the data that are related to the research question and is considered central in the data (Braun and Clarke 2006). Analysis focuses on recognizing important features in the data and how they relate to each other (Wolcott 1994). Therefore, thematic analysis can be summarized as searching through multiple sources of data to find patterns and identify themes (Braun and Clarke 2006).

Interviews were transcribed by an outside source and analyzed by the researcher using the constant comparative method, characterized by iterative and continuous comparison of findings within data (Maykut and Morehouse 1994; Miles and Huberman 1994; Montfort, Brown et al. 2009). The first and second iterations of coding were for themes that were present in the data (Rubin and Rubin 2005; Montfort, Brown et al. 2009). Themes are groupings of pattern codes that are formed based on a theoretically important inference (Miles and Huberman 1994; Montfort, Brown et al. 2009). At this point, preliminary results were developed by creating a table that showed how many times each code was used by each participant. The codes that were most prevalent were identified from the table of codes and categorized into the four sources of self-efficacy. Not all major themes identified fit into the four self-efficacy sources discussed previously and so were included as “other findings” in the results section. This is

phenomenographical because the researcher's task was primarily to collect and interpret others' lived experiences, and the application of self-efficacy theory was an effort to make sense and report those others' experiences. A final coding stage was conducted to verify the major codes and sweep for any smaller themes that may be important to support or contradict the four sources. This final stage is also another opportunity to code the data in light of any new patterns or themes identified in previous coding stages.

Following the 18 interviews and preliminary data analysis, the researchers believe that data saturation had been reached and no more interviews were necessary. Data saturation means that no new data is brought forth with additional interviews (Rubin and Rubin 2005), and the researchers found that this criteria had been met because no new codes were being identified in interview transcripts. Additionally, no new themes or overall patterns were extracted from the end-of-term survey, providing further evidence that data saturation had occurred.

VII. RESULTS

In order to develop MoM self-efficacy through a mastery experience, vicarious experience, social persuasion or physiological state it is necessary to have student and peer tutor interactions. In-class assignments force students into a challenging experience, which they have to work through in order to achieve success. The survey results indicated that a major theme during in-class assignments was the students asking for help from the peer tutors. Some students asked for help from the peer tutors in order to clarify certain misconceptions while others needed help with more basic steps including starting a problem or applying equations correctly. In both situations, a large portion of the students chose to interact with the peer tutors while working on in-class assignments, which increase the chance for a change in MoM self-efficacy.

A. Mastery Experiences

Mastery experiences were found to be significant for MoM self-efficacy. A successful experience in the classroom can be considered a positive mastery experience and has the potential to influence a student's MoM self-efficacy. For this study, we asked the students how they define success in engineering and in mechanics of materials. It is important to understand how students define success in order to determine if experiences with peer tutors have the opportunity to influence success and, therefore, MoM self-efficacy beliefs. If the student defines success as achieving high grades but the student reports that the tutor did not help them achieve high grades, the peer tutors have not helped that student achieve their personal success and a mastery experience will not have occurred. On the other hand, if a student's definition of success matches how a peer tutor influenced that particular student, they will have achieved a positive mastery experience through interactions with the peer tutor.

Students in the MoM class had two major definitions of success. The first was a clear understanding of the material. These students felt that if they left the class with a firm grasp on MoM concepts they were successful in the course. The second definition was based on grades, and this group of students felt that a high score on exams and homework meant they were being successful. Some students identified both understanding and grades as indicators of success, as articulated by Lily in her interview:

I think I've been pretty successful. I've gotten good grades on the tests, and I can understand it.

Bandura (1997) notes that people are more likely to raise their self-efficacy as a result of a mastery experience if they have to expend effort for the success. Similarly, Linnenbrink and Pintrich (2003) found that students who put effort into learning and understanding were more likely to be efficacious. The problems chosen for in-class assignments involve new concepts that

the students have not yet encountered in homework, only in class lectures. The peer tutors are available to help students and increase the chance of success with these new challenging topics.

Students who defined success as understanding the material would feel more confident and have a positive mastery experience if the concepts were clearer following the in-class assignment. The most prevalent theme throughout the interviews and surveys indicated that students felt peer tutors helped to explain concepts. Through a better understanding of the material and solving the problem, Don had a positive mastery experience:

I can ask [the peer tutors] questions and they can answer it. And then I know why that's the answer. They help me pull together everything I've learned in class and make it useful.

Connie also mentions that the in-class peer tutors help her feel more confident:

Because like I said, we usually learn the curriculum, and the [in-class] activity makes sure you grasp what you're doing. I find that, yeah, they kind of just help you with the little questions you have. I guess it brings confidence when you know what you're doing. That's helpful.

Students who defined success as achieving good grades also had positive mastery experiences as a result of interactions with the peer tutors. A common theme, identified below by Becky, is that peer tutors made them feel more comfortable with homework and exams after doing in-class assignments:

They talk me through stuff that I don't understand. And then even though I don't have that paper when doing the homework, it's like, this was like when we did [the in-class assignment].

John felt more prepared and confident when going into exams:

They've helped and explained things I'm confused on, clear something up. That always makes you more confident for tests coming up... So they help, definitely help.

The MoMconcepts involved with in-class assignments are new and often difficult for students to fully understand quickly. In the cases of students who are having a difficult time with the material, the peer tutors are immediately available to help during in-class assignments and attempt to help students to feel successful and have a positive mastery experience. In the following example, Don approached the peer tutors during office hours for extra help on topics covered in class:

I was feeling iffy about Mohr's Circle. It was just something we were covering. And one of the peer tutors, I went in [to his office hours] and told him I was struggling a little bit. They always knew something different. I knew how to do it but they're kind of complex so I always miss something. And in an hour and half or so, he gave me 3 or 4 examples or problems to do on the whiteboard. I did them and he'd stop me when I made a mistake. So by the end I was pretty good at them, and felt pretty confident about them after that.

It is important to note that changing self-efficacy beliefs is not based on the experience itself, but how students respond to the experience. A positive experience for one student may be considered a negative experience for another depending on many personal factors. Students could prefer working through problems with peers while others may prefer to get the answer directly from an authoritative figure, such as a professor. Therefore, it is not alarming that some students found peer tutors to be inexperienced and difficult to work with. Although significantly fewer in number, four students did find that peer tutors were less experienced in teaching and therefore sometimes made problems more confusing.

The majority of students indicated that the peer tutors helped them understand concepts better and make homework and exams a better experience. Therefore, the peer tutors lead to positive mastery experiences for students who feel success is defined as understanding the material and students who feel success is getting good grades. Without peer tutors there are two

possibilities for students. They can either learn the concepts on their own or in groups and have a positive mastery experience with the in-class assignment or continue to struggle with the concept. By having the peer tutors available, more opportunities are provided and utilized by students for positive MoM self-efficacy development.

B. Vicarious Experiences

Vicarious experiences are typically less influential than mastery experiences because they are not direct experiences (Bandura 1997). Vicarious experiences are not direct experiences because the student must rely on indicators such as time taken to complete a task or a score on an assignment to evaluate how they compare to others, while a mastery experience could be the time or score itself. There are certain situations that allow for vicarious experiences to supersede mastery experiences, such as when a topic is new and there are no mastery experiences to rely on. The interviewees were given multiple opportunities to discuss all MoM self-efficacy developing experiences. Mastery experiences with peer tutors were mentioned far more than vicarious experiences. For this reason, mastery experiences were identified as more influential than vicarious experiences. However, this may result from vicarious experiences being less influential, or more difficult to recall and articulate.

There are two main venues for students to make social comparisons within the ICPT program. The first is social comparison between classmates while the other is with peer tutors. Comparisons with other students made during an in-class assignment include the time it takes to complete an assignment, how often students have to ask others for help, and how often students can help others. Students view accomplishing tasks faster, requiring less help and being able to help others as positive comparisons. On the other hand, a student views taking longer to complete tasks, having to ask for help, and not being able to answer questions from others as negative comparisons.

Students can also compare themselves with the peer tutors. The students who made comparisons with the peer tutors felt that the peer tutors were strong role models. Fred is one student who viewed the peer tutors as role models:

They're students...I don't know how that works. But they're more your age. You can relate to them. You can talk to them. You talk to a professor a certain way, and you talk to a peer tutor just like a classmate. So it's definitely, not only for me but for everyone else, I'm sure it's a lot more comfortable to talk to a peer tutor.

The students also found the peer tutors easy to relate to, which made them feel like it was reasonable and acceptable to struggle with concepts in MoM. They indicated feeling like they could be successful because they interacted with others who were similar to them and had succeeded in the field of engineering. The two students below, Jack and Peter, compared themselves to the peer tutors and felt more comfortable with their MoM experience as a result.

Um, well maybe they do give you a bit of confidence. Because you actually see someone closer to your age that just got done. So you know they can do it, so it makes sense you can do it.

It's helpful if you get to know them as a student, if they went over and told you well, I took this class last semester, and I struggled on these a little, but I understand them now and am here to help you through if you need help.

Both seeing the peer tutors as role models and easy to relate to improves student MoMself-efficacy. If the students believe they can do better because of the peer tutors, they are having a vicarious experience that positively influences MoMself-efficacy. A few students, however, felt that having the peer tutors there made them feel like they couldn't do the problems on their own. Some students, like Erich, feel like they need too much help from the peer tutors and so feel behind their classmates in learning the material.

I have problems understanding what someone's teaching me. I start to get frustrated or feel stupid, because obviously they're trying and I'm not getting it. It must be my fault.

If the student feels less capable because of the peer tutors a negative vicarious experience would result in decreased MoM self-efficacy. The peer tutors have the ability to produce positive or negative vicarious experiences. However, the positive vicarious experiences were found to be much more prevalent.

C. Social Persuasions

Social persuasions are most influential when expressed by significant others such as family, friends or authority figures (Bandura 1997; Zeldin and Pajares 2000). Because peer tutors are likely not considered "significant others" by the students, this self-efficacy source is expected to be less influential than both the mastery and vicarious experiences. The type of relationship a student has with a peer tutor has the power to change how influential a peer tutor can be through social persuasions. Students were asked directly "what have the peer tutors said to you that has affected your confidence in your success in MoM." There was no mention of peer tutors using any type of language that positively influenced or negatively influenced student MoM self-efficacy through social persuasions. This matches other research that indicated social persuasions did not influence mathematics self-efficacy (Matsui, Matsui et al. 1990).

D. Physiological States

People can only focus on inward feelings or outward situations at one time (Bandura 1997). During an in-class assignment an inward feeling could be stress and frustration while an outward situation would be working to complete the assignment. Therefore, during in-class assignments many students may not have recognized their own physiological states because they were occupied dealing with the situation at hand. It was also likely very difficult to recall these inward feelings during and interview process. In order to determine if prevalent or strong

recollections of physiological states existed, students were asked how they felt about the engineering curriculum, their MoM class, and working with the peer tutors. There were slightly more negative feelings such as frustration and stress mentioned than positive feelings such as enjoyment. It is possible that this is because students changed focus to inward feelings only when they felt the outward situation was unsuccessful. Some of the negative and positive feelings the students expressed are indicated in the following two quotes from Leslie and Fred:

I feel like some of the in class exercises...I always feel like I'm stressed out at the end, like worried that I'm not going to get it done or figure it out or whatnot.

It makes you relieved that it's not as hard as you're making it. You can be more confident.

As predicted by the literature, physiological states were not highly influential in students MoM self-efficacy.

E. ConceptMap of MoM Self-Efficacy Development

There is strong and consistent evidence that interactions with tutors improved students MoM self-efficacy through primarily mastery and vicarious experiences. The results previously discussed have been condensed into a concept map, shown below in Figure 1, which represents the paths through which MoM self-efficacy develops. The line thickness represents the strength of connection that was found in the interviews. Thick solid lines, thin solid lines, and dashed lines represent decreasing connection strength. The plus and minus signs on the lines represent if MoM self-efficacy is positively (+) or negatively (-) influenced. The different shapes represented in the diagram also represent the four different self-efficacy sources. Social persuasions were found to be non-influential and so are not shown in the diagram. As shown in the key, mastery experiences are shown in sharp-cornered rectangles, vicarious experiences are rounded rectangles and physiological states are represented with ovals. Diamonds are also used to clarify the

diagram by using intermediate steps that are not directly related to any of the four self-efficacy sources.

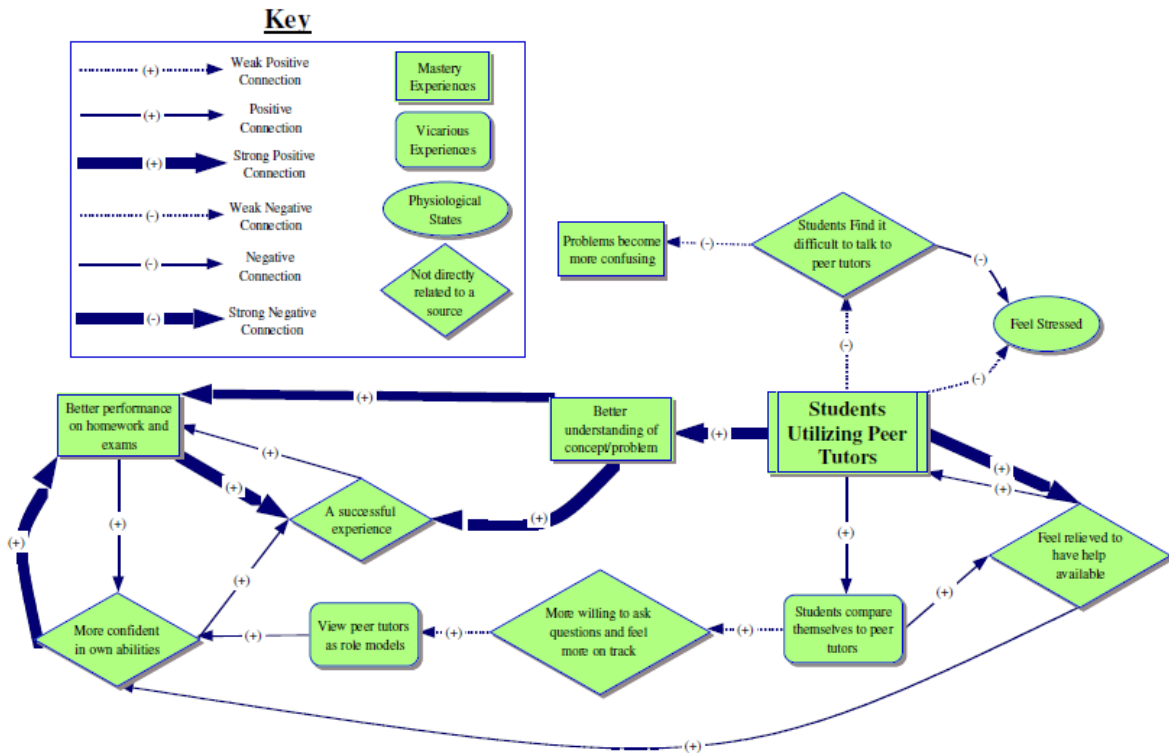


Figure 1. A conceptual flow map summarizing the results. Line thickness indicates strength of connection from bold (strong connection) to dashed (weak connection). Different shapes represent different sources of self-efficacy represented as shown in the upper left of the diagram.

All paths in the diagram begin when students utilize the peer tutors in class or during office hours. The strongest and most influential path begins with students feeling like they achieve a better understanding of the problem or concept through interactions with the peer tutors. Anna believes that peer tutors are responsible for mastery experiences that might otherwise not have happened.

It's not like you're being lectured like in most college courses, where it's just blah blah and you're supposed to absorb it. There's the interaction, which I think helps a lot with learning and absorbing the material, which you don't get in a lot of other courses.

Anna's belief that she understands the material better stems from a positive mastery experience when working with the peer tutors, most often identified by students as during in-class assignments. Two main paths resulted from this mastery experience. One was a feeling of success, which is an emotion that results in a positive physiological state. The other option is the student performs better on exams or homework assignments, which is another positive mastery experience that both Rene and Becky indicated:

I think definitely the in class assignments help a lot. As far as going home to do the homework, because you're like, hey, I've done this before. I haven't just followed along in an example. I've actually done it, so I know I can do it.

Just like after they've explained problems to me, I can usually figure out other problems that are similar. I can usually figure out how to do those on the homework by myself. And it makes me feel like I actually did learn, instead of oh, they just told me how to do it.

Students identified that when they perform better on exams or homework they feel successful, which is a positive mastery experience and results in improved MoM self-efficacy. Some students reported that when they feel successful they tend to perform better on exams and homework assignments. The connections in this branch of the conceptual map, dominated by mastery experiences, were very prevalent in the data and result in an increase in MoM self-efficacy.

Moving counterclockwise, the second section begins with students comparing themselves with the peer tutors. This is a positive pathway because students commonly found a connection with the tutors as their peers. Although a weak connection, several students, including Kevin, did identify that they were more willing to ask the peer tutors questions than the professor because they found them friendly and approachable.

The peer tutors...they're more on our level than say a professor would be...we joke around and stuff. So you're not typically going to do that with a professor if you went to their office hours to get homework help. There's definitely a more personal connection with the peer tutors than with a teacher.

Kevin described a personal connection with the peer tutors that could cause him to view peer tutors as role models. Other students felt similar to Kevin and specifically identified peer tutors as role models. As a result, students believed they could succeed after watching the peer tutors succeed. Students who viewed the peer tutors as role models tended to believe that they had the opportunity to be more successful and therefore became more confident in their own abilities. Peter expressed how meeting and working with the peer tutors made him feel better about his future:

I can make it to where they are. And it's not out of my reach to stay in school for a couple more years and be graduating or be a graduate student.

This path represents how vicarious experiences positively influenced MoM self-efficacy beliefs.

Another theme from the students was a feeling of relief to have someone available to help answer questions. Several students were specific in saying that it was nice to have peer tutors available, while others did not indicate a preference. The students who did not have a preference simply wanted someone available who was able to answer their questions. Several of the students who indicated the preference for peer tutors, including Leslie, felt more comfortable with the peer tutors which lead to a feeling of relief:

I'd get stressed out a lot more if I had to like figure it all out on my own.

Students feeling more comfortable with peer tutors typically lead to more interactions with peer tutors, increasing the opportunity for positive MoM self-efficacy experiences through any of

the previously discussed pathways. Even the students who did not specify the preference for peer tutors benefited from the presence of peer tutors in the classroom. Whether or not a preference was included, peer tutors were available to help and did provide a means for positive mastery experiences.

Only a few students expressed a preference against having peer tutors in the classroom or indicated negative feelings towards the peer tutors. As a result, nearly all of the experiences that negatively influenced MoM self-efficacy were represented as a weak connection in the concept map. Students with negative opinions of the peer tutors indicated peer tutors were difficult to talk to, which lead to feelings of stress and confusion with problems. Leslie was one of the students who indicated peer tutors induce feelings of stress. However, in the previous quote Leslie also expressed a desire to have peer tutors in the classroom. She could be indicating that in-class assignments are a stressful experience because of their difficulty and that help from the peer tutors relieve her stress. Leslie's conflicting statements could also be a result of working with different peer tutors. It is reasonable to expect that some peer tutors will not communicate as effectively with some students as with others. Students who found problems more confusing as a result of interacting with the peer tutors are most notable because this negative mastery experience has more influence on a students' MoM self-efficacy than the negative physiological states.

This conceptual flow map attempts to capture the complexity of MoM self-efficacy development in the ICPT program. Many of the students represented had similar experiences, yet interpreted them very differently. For example, the diagram shows that while some students felt relieved at the presence of peer tutors in the classroom, others became stressed. However, the diagram also gives a good visual representation of the comparative presence of positive

influences and negative influences from the peer tutors. There is much more evidence that peer tutors improved students' MoM self-efficacy than to the contrary.

F. Peer Tutor Availability

A strong theme among the interviews and surveys was that students simply liked having someone available to answer questions. Many students noted that it didn't necessarily depend on who it was, but it was important to have someone accessible during in-class assignments. Having someone available could result in positive physiological states because of increased comfort levels or feeling a part of a group. The peer tutors also increase the opportunities for positive mastery experiences. Therefore, students may not directly refer to peer tutors, but there are still possible pathways for increasing MoM self-efficacy with the peer tutors in the classroom. Many of the students in their interviews even noted that having help available was a confidence builder. John and Becky both indicated they felt more comfortable and confident as a result of knowing someone who was capable of answering questions was available:

It helps to have them there whether or not you use them. I guess it's kind of confidence builder, knowing someone's there to help you whenever you do need it.

I guess I really like the in class assignments, working on them in class. Because even if I don't know what I'm doing, I can just raise my hand and get help.

The survey responses illustrated similar results. The majority of the students wrote that peer tutors helped them by answering questions and made them more successful by answering their questions. On the survey there were actually very few references to peer tutors being easier to relate to or better than any other person who would be available during in-class assignments. This could be because the survey was already in reference to peer tutors and so students did not directly state that peer tutors were more helpful than others. Alternatively, students could feel that anyone in the classroom would be helpful, regardless of being peers or not.

G. Peer Tutoring Program Methods

The two classes involved in this study utilized the peer tutors with two different methods. The results gathered from the data, however, did not differ between the two courses. The only distinction is that the first classroom did not have a peer tutor office hour program that was regularly attended by students. As a result, the students focused on the in-class assignments when responding about the peer tutors in interviews. The second classroom did not have an regular and consistent in-class assignment program so the students focused on working with the peer tutors during the available office hours. Both classrooms, however, resulted incomparable influences on MoM self-efficacy because the students were still working with the peer tutors on problems related to the MoM course. No significant or meaningful differences exist between the two courses in terms of the development of MoM self-efficacy resulting from interactions with peer tutors.

VIII. IMPLICATIONS FOR EDUCATORS

The results also indicated that a few students had negative views of the in-class peer tutoring experience. It is possible that the negative experiences could be curbed by training peer tutors before asking them to interact with the students in an educational capacity. The most common complaint about peer tutors was their inexperience in teaching. The peer tutors involved in this research did not undergo any type of training on how to interact with students or on how to most effectively communicate with students. Training peer tutors effective teaching tools such as drawing pictures or using physical models to describe problems could help improve their teaching skills. These teaching tools could also be effective in improving communication with the students because the peer tutor and the student will be more involved in the conversation surrounding the physical model. A means to get more dialog between peer tutors and students

could make both parties more comfortable, creating a more relaxed in-class learning environment.

Students involved in the ICPT program have more interactions with peer tutors and instructors through the in-class active learning assignment. This can be very beneficial to larger classes because it encourages active learning and discussions that are more available in smaller classrooms. ICPT can be run as a no-cost tutoring program for students that improves the classroom atmosphere and encourages different learning techniques that can be especially beneficial for large classes that are traditionally based on lectures alone.

Promoting self-efficacy in the classroom also has the possibility of increasing retention in the engineering fields. Previous research presented in the literature review has shown that students who are efficacious work harder and persist longer in their academic field of choice. Therefore, if instructors make changes in the classroom to positively influence students' self-efficacy students are more likely to view their educational experiences as challenges and persevere rather than leave the engineering field because of difficult material. Recognizing the impact of self-efficacy on students in engineering departments should lead to changes in the classrooms that positively influence self-efficacy and potentially increase retention in engineering departments while also fostering students' positive learning skills. The ICPT program has been shown to influence self-efficacy and can be a part of the change towards promoting better learning techniques and increasing students' self-efficacy.

IX. CONCLUSIONS

This study aimed to determine how in-class peer tutors influence MoM students' self-efficacy. The results indicated that students found in-class peer tutors to be helpful and positively influential in achieving success in MoM. The conceptual flow map represents the complex interactions between students and peer tutors when working on in-class assignments.

Positive interactions in the form of mastery experiences and vicarious experiences were a common theme found in the data. Social persuasions and physiological states were not found to be significantly influential in self-efficacy development. As a result of this research, it appears that in-class peer tutors have a positive influence on MoM students' self-efficacy.

The research conducted in this study was reflective in that students who were interviewed had to remember the experiences they had with peer tutors in the past. Future research could include guided observations and informal interviews immediately following in-class assignments. These two sources of information would allow students to express immediate feelings and recent experiences working with peer tutors. For example, the guided observations could be used to look into physiological states in detail. The informal interviews could be helpful in further identifying paths students take to change MoM self-efficacy.

Future research on this topic should also include comparing students' MoM self-efficacy in courses utilizing ICPT to students' MoM self-efficacy in courses not utilizing ICPT. After determining the pathways in which MoM self-efficacy development occurs in this research, a comparison would help evaluate the impact of peer tutors on MoM self-efficacy. More qualitative data coupled with quantitative data could aid in recognizing the extent of influence the peer tutors have on students developing MoM self-efficacy in the classroom.

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APPENDIX A
INTERVIEW PROTOCOL
MID-SEMESTER SAMPLE SELECTION SURVEY
END-OF-SEMESTER MEMBER CHECKING SURVEY

Interview Protocol:

- Introductory questions
 - How do you define success in your engineering curriculum?
 - How would you define success in mechanics of materials, or what would you have to do to consider yourself successful in the course?
 - Think of a particular class that you have been in which you felt confident in your ability to perform the tasks presented to you. Tell me about this class. How were your experiences similar and different from those in MoM?
 - I am interested in how you think you will do in your quest to achieve success. To what degree do you think that you have been successful in mechanics of materials right now?
- Mastery experiences
 - What experiences have contributed to how confident you are that you will be successful in engineering?
 - Are there any other factors or influences?
 - What experiences have contributed to how confident you are that you will be successful in MoM?
 - How did these experiences affect you?
 - Are there any other factors or influences?
 - What is similar or different between the experiences related to engineering and mechanics of materials?
 - Have experiences with peer tutors influenced how you feel about your ability to be successful in this course?
 - Compared to other courses, was the in class peer tutor experience influential in how you feel about your ability to be successful in class?
- Vicarious experiences
 - How have other people influenced how you think you will do in engineering?
 - How have other people influenced how you think you will do in MoM?
 - Probe: Can you tell me about a specific experience you remember where someone influenced you positively or negatively in how you felt about your success in MoM?
 - Follow-up: What about the peer tutors?
 - In what ways are the peer tutors helpful in you developing confidence in MoM?
 - Would you feel comfortable teaching MoM to others?
- Social persuasions
 - How have other people influenced how you feel about your ability to be successful in engineering
 - How have other people influenced how you feel about your ability to be successful in MoM?
 - What have people said to you that has affected your confidence in your success in MoM?
 - Follow-up: What have the peer tutors said to you that has affected your confidence in your success in MoM?
 - Have the peer tutors said anything that made you feel more or less confident in your ability to do mechanics of materials?
 - Follow up: How have the peer tutors influenced you in MoM?

- Physiological states
 - When thinking about [or doing] MoM how do you feel?
 - How would you describe your interactions with the peer tutors?
 - How do you feel when you are working with the peer tutors?
 - Do you enjoy your interactions with the peer tutors?
 - Tell me how you feel overall about your MoM class.
- Wrap-up
 - Are there things that could be done to improve the class experience?
 - What aspects of class do you think should be kept just how they are?
 - Can you think of anything we may have forgotten to ask about mechanics of materials or the peer tutoring program?
 - How old are you?
 - What is your Major?
 - [note gender somewhere]

Mechanics of Materials Survey (Mid-Semester)

Thank you for taking time to fill out this survey. Your responses are greatly appreciated. Your input is valuable to us because it will help the engineering department and Washington State University better understand how to assist engineering students in their educational endeavors.

Directions: Please place an "X" in the box that best represents your answer to each of the following questions.

1 What are the last 4 digits of your WSU student ID number (for administrative purposes only)?

2 Please indicate if you are:

Male

Female

3 Do not consider your grade for the following two questions. To what extent do you agree or disagree with the following statements?

(a) "The peer tutors have been helpful to me in this course"

- Completely agree
- Somewhat agree
- Neither agree or disagree
- Somewhat disagree
- Completely disagree

(b) "I am confident in my mechanics of materials abilities"

- Completely agree
- Somewhat agree
- Neither agree or disagree

Somewhat disagree

Completely disagree

4 Answer the following two questions to the best of your ability.

(a) Estimated cumulative GPA at WSU

*If it's your first semester at WSU, what is your transfer GPA from your previous college

3.5 - 4.0

3.0 - 3.5

2.5 - 3.0

2.0 - 2.5

(b) When peer tutors are in class, I interact with them:

Always

Sometimes

Never

(c) I attend peer tutor office hours:

Weekly

Monthly

Never

Mechanics of Materials Survey (End-of-Semester)

Thank you for taking time to fill out this survey. Your responses are greatly appreciated. Your input is valuable to us because it will help the engineering department and Washington State University better understand how to assist engineering students in their educational endeavors.

Directions: Please place an "X" in the box that best represents your answer to each of the following questions.

1 To what extent do you agree or disagree with the following statements?

(a) "The peer tutors have been helpful to me in this course"

- Completely agree
- Somewhat agree
- Neither agree or disagree
- Somewhat disagree
- Completely disagree

(b) "I have learned more in this course because of the peer tutors"

- Completely agree
- Somewhat agree
- Neither agree or disagree
- Somewhat disagree
- Completely disagree

(c) "The peer tutors were able to answer my questions"

- Completely agree
- Somewhat agree
- Neither agree or disagree
- Somewhat disagree
- Completely disagree

(d) "I wish that my other engineering courses used peer tutors"

- Completely agree
- Somewhat agree
- Neither agree or disagree
- Somewhat disagree
- Completely disagree

(e) "The peer tutors want me to do well in this class"

- Completely agree
- Somewhat agree
- Neither agree or disagree
- Somewhat disagree
- Completely disagree

(f) "The peer tutors have gone out of their way to help me"

- Completely agree
- Somewhat agree
- Neither agree or disagree
- Somewhat disagree
- Completely disagree

2 What is your current major?

3 What is your current age (in years)?

4 Please indicate if you are:

Male

Female

5 What do you expect your overall GPA to be this semester?

4.0 or above

3.50 -3.99

3.00 -3.49

2.50 -2.99

2.00 -2.49

1.50 -1.99

1.00 -1.49

0.50 -0.99

6 What racial or ethnic group do you identify with? Please choose only one.

Native American or Alaska Native

Asian or Asian American

Pacific Islander or Native Hawaiian

Black or African American

Hispanic or Latino

White (non-Hispanic)

Multiracial (please specify):

Other (please specify):

7 What are the last 4 digits of your WSU student ID number (*for administrative purposes only*)?

8 In what ways did the peer tutors help you this term?
(Please write answer in the box below).

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9 How could the peer tutors have been more effective helping you?
(Please write answer in the box below).

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10 How were the peer tutors helpful in you developing confidence in your ability to solve problems in mechanics of materials?
(Please write answer in the box below).

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11 How did the peer tutors influence your success in mechanics of materials?
(Please write answer in the box below).

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12 Describe a typical interaction with a peer tutor.
(Please write answer in the box below).

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END OF SURVEY-THANK YOU!!!