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Utilization of an Engineering Peer Tutoring Center for Undergraduate Students

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ABSTRACT

This research paper reports on the development of an engineering-based peer tutoring center and the impact of the center on undergraduate engineering students. In three years, the Academic Center for Engineers peer tutoring center has grown from employing 4 peer tutors and providing tutoring for 3 courses, to employing more than twenty tutors providing tutoring for more than twenty courses. Tutors services are offered to students on a walk-in basis for courses with at least 60 students enrolled and by appointment for smaller courses or courses that generate less tutoring interest. Tutors are trained in the use of evidence-based tutoring techniques, such as the Socratic Method.

In order to quantify the usage and impact of the tutoring center, data was collected through two methods. First, student visit data was recorded using a digital card swipe system that then populates a database with the visit specifics as well as connecting with the College of Engineering's main database containing student demographics and academic performance. Second, data was gathered using surveys administered to students receiving tutoring, as well as surveys administered to the peer tutors.

The data collected was analyzed to determine how the center was being utilized. The population of students utilizing tutoring services through the engineering tutoring center was compared with the general College of Engineering student population. Additionally, student and tutor survey results showed that both students and tutors believed that the students' understanding of course material was stronger after a tutoring session. Initial analyses show that students who attend tutoring perform slightly better than students who do not attend tutoring in a specific course, but future work will focus on fully understanding the effect of tutoring on a student's grade point average and retention.

I. Introduction

There is a strong desire to recruit, retain, and graduate successful students in engineering fields at the university level. Retention in particular has been a problem area for engineering students[1,2]. Therefore, many universities have created systems to increase retention, such as early warning systems[3,4], learning communities[5], and peer tutoring centers[6,7]. However, these support systems often struggle to maintain permanent status and funding at their institutions. This paper will focus specifically on the efforts of the engineering peer tutoring center at Drexel University to increase undergraduate student success. While there have been previous reports describing the structure and success of engineering peer tutoring centers[6,8], a conclusive set of best practices and expected outcomes remain undetermined. This paper will contribute to the existing literature to increase the published knowledge of the structure and effectiveness of engineering peer tutoring centers.

A. Goal of Paper

The goal of this research paper is threefold: first to describe in detail the history and development of our tutoring center, second to detail the utilization and demographic information of students, and third to quantify the impact of tutoring on student performance, including grade point average and retention.

There are unanswered questions in the literature concerning utilization and demographics of peer tutoring centers. For example, what percentage of students visiting a tutoring center would be considered normal? Are certain groups of students typically over or under represented in utilizing tutoring services? This paper aims to contribute to the literature in order to help build a knowledge base to answer these types of questions.

Secondly this paper will quantify the impact of tutoring on students' academic performance. Specifically, the academic performance of students that utilized tutoring services will be compared to students who did not visit the tutoring center. Students' grade point averages, particular course grades, retention rates, and academic standing will be studied. The effect of multiple tutoring visits throughout an academic term will also be investigated. Students receiving peer tutoring are a self-selecting group, which leads to difficulties in extracting meaningful results without a proper control group. However, the data will be analyzed while considering this lack of a proper control group in order to reach actionable conclusions.

The remainder of this paper will read as follows. The remainder of Section I will discuss the structure and normal operation of the tutoring center. Section II will detail the methodology used to gather data concerning the tutoring center's usage and impact. The electronic data collection system will be described, as well as surveys administered to the students and tutors. Section III will present the data that was collected. The demographics of students receiving tutoring will be presented, followed by a comparison of the academic performance of students who have and have not attended tutoring sessions. Section IV will discuss the results presented in Section III, specifically focusing on sources of errors, the validity and reliability of the data collected, and the ramifications of these results. Finally, Section V will summarize the key contributions of this paper. Following the paper, an appendix will be presented with additional information describing the tutoring center.

B. Tutoring Center Background

Tinto[9] introduces academic and social integration influence as two factors impacting student persistence in higher education. Peer tutoring provides an opportunity for academic integration by way of peers and also provides an opportunity for social integration within the context of student majors and networking. Through the context of a peer tutoring center, stress, student readiness, and the integration of courses can be examined[10].

Peer tutoring was decentralized at Drexel University due to a variety of factors including funding limitations. Engineering students seeking math assistance for their engineering courses were turned away from the math department's tutoring resource because the math center supported math department courses only. These two factors led to the provost office charging the College of Engineering with providing tutoring services for its students and courses. The Academic Center for Engineers (ACE) opened in spring of 2013 to provide course-specific

support and is currently in its third year of operation. The center has grown from its support of five (5) courses with four (4) work study tutors on a walk-in only basis to supporting thirty (30) courses with twenty-four (24) tutors on a combination walk-in and by appointment basis.

ACE serves to provide assistance to students enrolled in designated college of engineering courses. ACE offers support and services that promote academic excellence and community in the college of engineering. We strongly value individual potential and talent and, as such, are committed to the growth of all students, who are our colleagues in their academic endeavors.

In order to encourage both community and academic excellence, ACE strives to employ trained and academically proficient students as tutors. As peers, these tutors are approachable to students who may feel self-conscious about seeking assistance and can foster relationships with students, encouraging them to come into the center for help whenever needed. Help must be readily accessible so as not to discourage students from seeking aid. We seek to:

- Staff ACE with tutors during specific hours of operation.
- Give immediate, on site assistance to all students seeking help in designated courses on a first-come first-served basis.
- Schedule tutors best equipped to help individual students with problems or concepts.

From a customer service perspective, greeting students when they walk into ACE has a significant impact on their impression of the center. It is ACE's belief that students should feel welcome and comfortable upon entering ACE, thus increasing their chances of coming back when they again need assistance.

Within the framework of increasing independent learning on the part of the student, ACE tutors are asked to use positive language to improve tutee attitude and motivate students frequently during their sessions.

To ensure that students actually understand the material that has just been covered in a tutoring session, tutors at ACE are trained and encouraged to pay attention to a student's tone, body language, ask for understanding, and ask follow-up questions similar to covered material to check for mastery of said subject. Additionally, tutors are heavily expected to employ the Socratic Method[11] of inquiry to enable students to arrive to the answer, requiring strong communication skills.

Following the Socratic Method of tutoring, tutors are never supposed to provide answers to the students or to ask leading questions. Instead, they are to ask questions in a way that challenges assumption and completeness of thinking while allowing the student to demonstrate a core understanding, slowly leading the student down a logical thought pathway that ends with the answer to the question. This strategy requires the tutor to allow the student to think and provide answers for themselves when prompted.

ACE also offers occasional supplemental instruction or peer assisted study sessions at the request of students or instructor and with departmental support. The way the tutoring center is

structured puts the responsibility on the students for learning as they are not forced by their instructors or advisors to receive tutor support[10].

C. Evaluation of Tutors

Tutor expectations training was mildly overhauled to address tutor behavioral issues noticed by ACE administrators. With clear expectations being set, a new tutor survey was created for the purpose of allowing students to provide feedback on tutor interactions. The survey is sent to students who come into the center for walk in tutoring. More details and results are provided in the Methodology section.

D. Physical Space

The center is located in a space repurposed from a freshman computer lab into tables arranged to facilitate student-tutor interactions. The current arrangement has tables seating groups of 2, 4, 6 or 8 people. In addition to the tutoring hours provided by undergraduate students, ACE is also available to teaching assistants and faculty members as a space for office hours. Administration encourages the use of ACE as office hour space to promote a connection between both instructor-led and student-led course support as well as represent ACE as an accessible and active learning community.

Over the course of the first year, the space was used 4-10 hours per week for course teaching assistant office hours and 4-6 hours per week for course faculty office hours. The use of the center by department-level course instructors will continue to be encouraged during the following terms. The current usage for TA and faculty office hours varies widely.

E. Plans for Growth

ACE continues to expand its course support and monitor hours of usage to keep the space operating within its capacity. The university is interested in ACE expanding its course support to improve the retention of first year students which has ACE expanding to provide tutoring support for non-engineering courses such as physics and chemistry. ACE is limited by its own facilities in terms of student traffic but also by the financial constraints of the college.

II. Methodology

Student utilization of ACE is tracked and stored using a card scanner and operations systems developed in house and overseen by ACE Coordinator. The system labels each student with a unique ACE ID number so individual usage can be tracked anonymously. In addition to check in time, the system also records each student's sex, ethnicity, college, major, class status (freshman, sophomore, etc.), cumulative GPA, high school GPA, academic standing and the specific course the student is seeking tutoring for. Checking in using the card reader starts the duration for that student's visit and is stopped by the tutor who then closes each visit upon completion, which results in total visit duration, while also adding additional information such as specific content covered during the tutoring session. Categorized by homework, quiz help, exam preparation, course concepts or specific subject matter, these notes added in by the tutor at the

end of each tutoring session is sent weekly to the corresponding course instructor for the purpose of giving insight to faculty on which subjects student seem to be needing the most assistance. Students that receive tutoring at ACE are randomly selected to complete an online, anonymous survey on their experience at ACE and their tutor. This information is then used to help the ACE Coordinator and Director evaluate not only a tutor's performance, but the overall tutoring center's presentation. Data for this report was collected over the period from April 10th, 2014 to March 20th, 2015.

A. Tutor Training

ACE Tutors are trained to push the students who seek tutor support toward becoming independent learners which can be compared to self-regulated learners[12,13]. Because the training tutors receive impacts how the peer tutors engage each student, it is important that the training is well-rounded and consistent to enable each peer tutor to adapt to each student's learning preferences. Building a culture of learning amongst the tutors can help to foster motivation[14] . Self-regulated learning holds promise for reducing student attrition[13].

Not only are tutors trained on the Socratic method of inquiry which students can repurpose for themselves as they grow as learners, tutors are also trained on setting an agenda and the steps of an agenda (see Appendix B for details). This agenda can be repurposed by an individual to fit within Zimmerman's model of self-regulated learning. Students are encouraged to arrive with forethought, engage in performance, and reflect at the end of the tutoring session, time permitting.

Additionally, tutors are trained on Gardner's intelligences, learning styles, and thinking styles. Tutors are provided ample material and training to understand how to engage a student based on their demonstrated intelligences, learning styles and thinking styles. Training emphasizes to tutors that students receive and process information in a variety of ways. As peer tutors they have the opportunity to create and increase learning opportunities for students[15]. The training these tutors receives impacts their feedback efficacy[16].

III. Results and Discussion

Over the time period from April 10th, 2014 to March 20th, 2015, ACE had 3117 walk-in visits with 882 unique students. Additionally, ACE had 211 appointment visits with 61 unique students. The average student came to ACE for 3.5 visits, with an average visit time of 1.3 hours, for a total time of about 4.5 hours. The average GPA of students visiting ACE was 3.07.

A. Demographics

Of the students visiting ACE, 73% were male and 27% were female, compared to the College of Engineering's population of 82% male and 18% female, as seen in figure 1. This agreed with a previous study at Lehigh University showing that females were overrepresented in choosing to receive tutoring[17]. The majority of students visiting ACE are not Hispanic or Latino, representing 89% of the population. This is on par with the demographics for the College of Engineering in which non-Hispanic or Latino students includes 90% of the total student

population, visualized in figure 2. The majority of students seeking assistance in ACE, representing 60% of visits, are underclassmen (sophomores and freshmen).

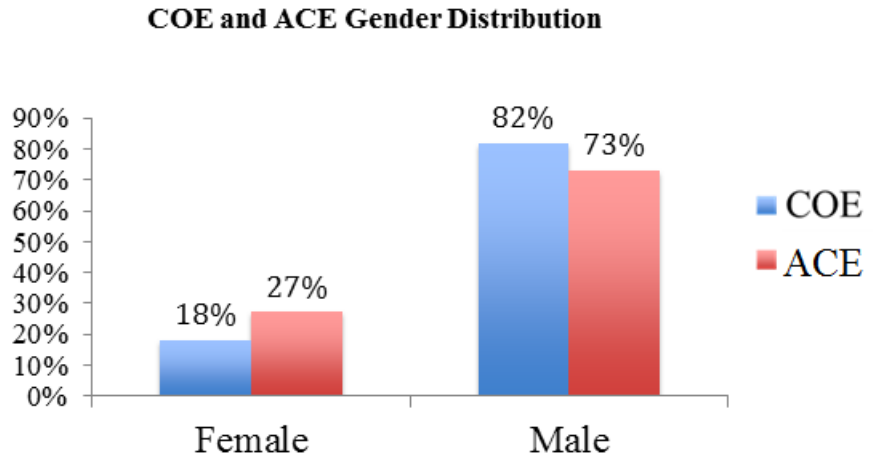

Figure 1: Gender distribution of students in the College of Engineering and of students visiting ACE. As seen in the figure, females are overrepresented in receiving tutoring relative to the total engineering student population.

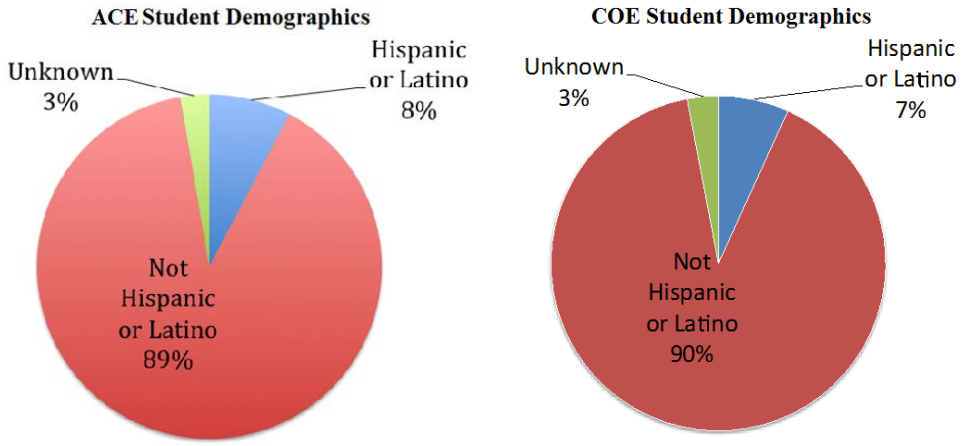

Figure 2: Student demographics of students visiting ACE versus demographics of the College of Engineering. As seen in the figure, students visiting ACE are representative of the college population as a whole.

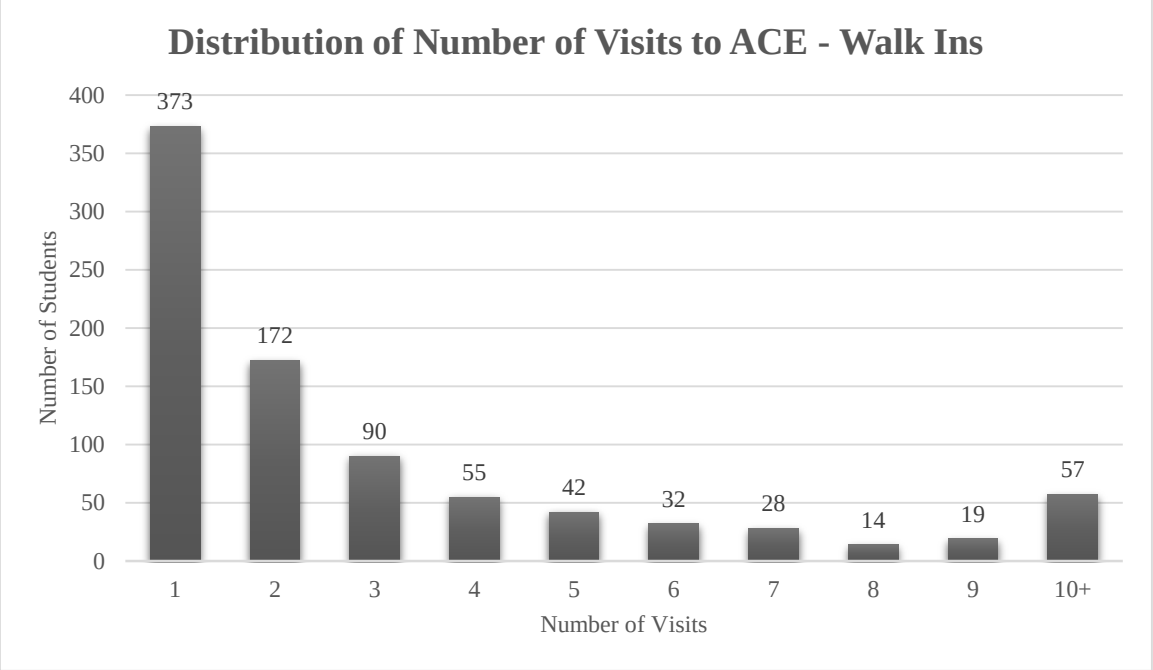

Figure 3: Histogram showing the distribution of the number of times students visit ACE for walk in tutoring.

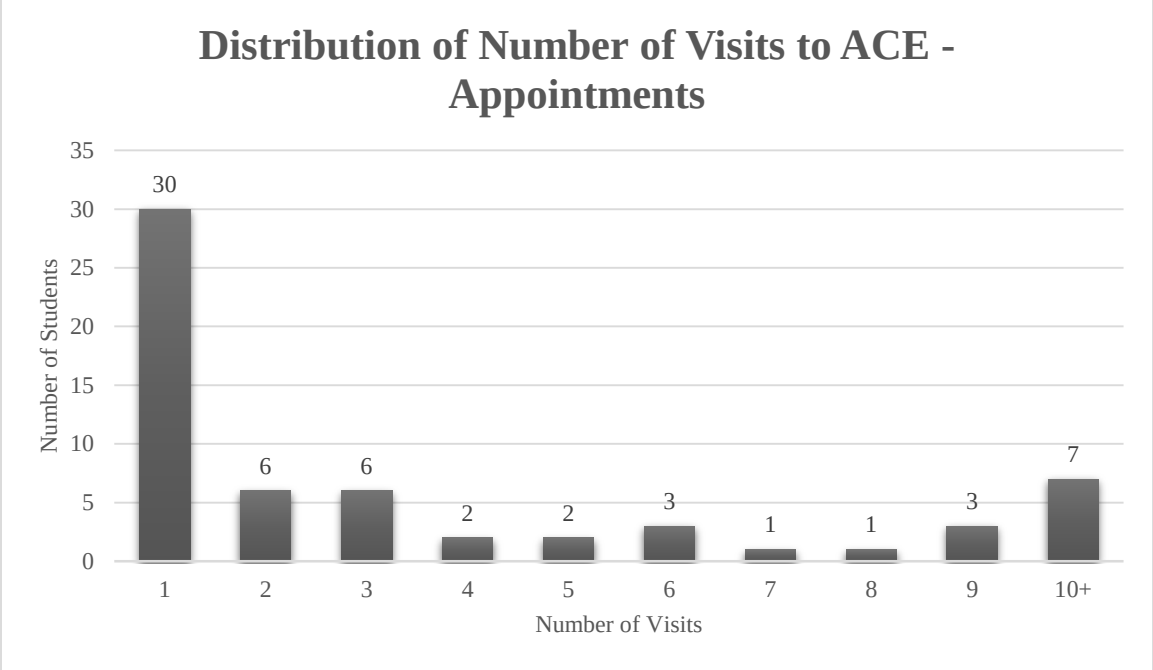

Figure 4: Histogram showing the distribution of the number of times students visit ACE for appointment tutoring.

A histogram of the number of visits students made to ACE is shown in figures 3 and 4. It is clear that most students visit ACE once or twice, while a lower percentage of students receive tutoring services regularly. This is especially prevalent among walk-in visits.

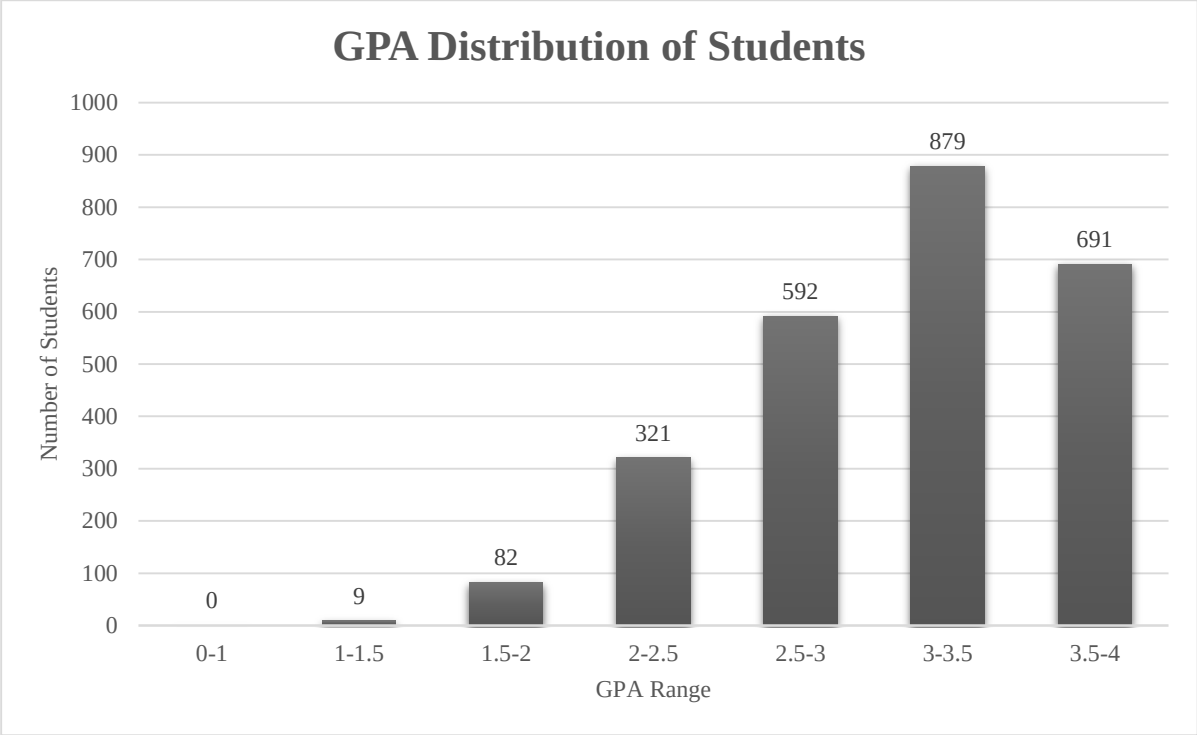

Figure 5. Distribution of GPAs for students visiting ACE. A majority of students visiting the center have a GPA above 3.0.

It may be expected that most students that choose to receive tutoring at ACE are struggling academically, however, as shown in Figure 5 the distribution of students' cumulative GPAs show that most students who visit ACE have a cumulative GPA between 2.5 and 4.0, with the largest group of students having a GPA between 3 and 3.5.

B. Tutor Survey Results

After the winter quarter of 2015, the tutors were asked a number of questions regarding how working in ACE has affected them. Although the primary goal of ACE is to provide tutoring services to students, it is important to understand how our student tutors are affected as well. Twenty-four tutors completed the evaluation survey and the results are shown in Table 1. Each question was answered on a 5-point Likert scale, with 1=Strongly Disagree and 5=Strongly Agree.

Table 1: Tutor survey results, twenty four tutors completed the survey.

	Average	Standard Deviation
I am better at explaining technical concepts because of my experience tutoring in ACE	4.38	0.63
I am now more comfortable teaching/tutoring other students because of my experience tutoring in ACE	4.54	0.58
I believe that students have a stronger understanding of course materials after a tutoring session with me	4.30	0.62
I believe that students receive higher grades in their courses because of tutoring sessions with me	4.00	0.65
Tutoring in ACE has given me a better understanding of material from courses I took previously	4.39	0.64
Tutoring in ACE has helped me in my own classes	3.43	0.88
I have used new learning/studying strategies because of my experience tutoring in ACE	3.13	1.12

The survey results show that on average, tutors agreed with statements indicating growth in their tutoring abilities, academic abilities, and positively affecting student performance. Although it is difficult to determine the real effect tutoring has on students' academic performance, in order to build tutoring morale it is important to know that the tutors believe that their tutoring has increased students' understanding of course material and led to students receiving higher grades. Previous studies have shown that tutors often believe that their tutoring sessions are an effective way to increase student learning[18], and these results concur with those previous findings.

C. Student Survey Results

After visiting the tutoring center, students are randomly selected and sent a survey regarding the tutoring session. Students were asked to evaluate the tutor's communication and engagement skills. Additionally, students were asked if their understanding of course material changed as a result of visiting the tutoring center. The results are shown in figures 7, 8, and 9. As seen in the figures 6 and 7, students rated their tutors highly in their communication and engagement skills. The tutor training focusing on the Socratic Method is reflected in the responses from the student surveys. As shown in figure 9, students believed that tutoring increased their understanding of course material.

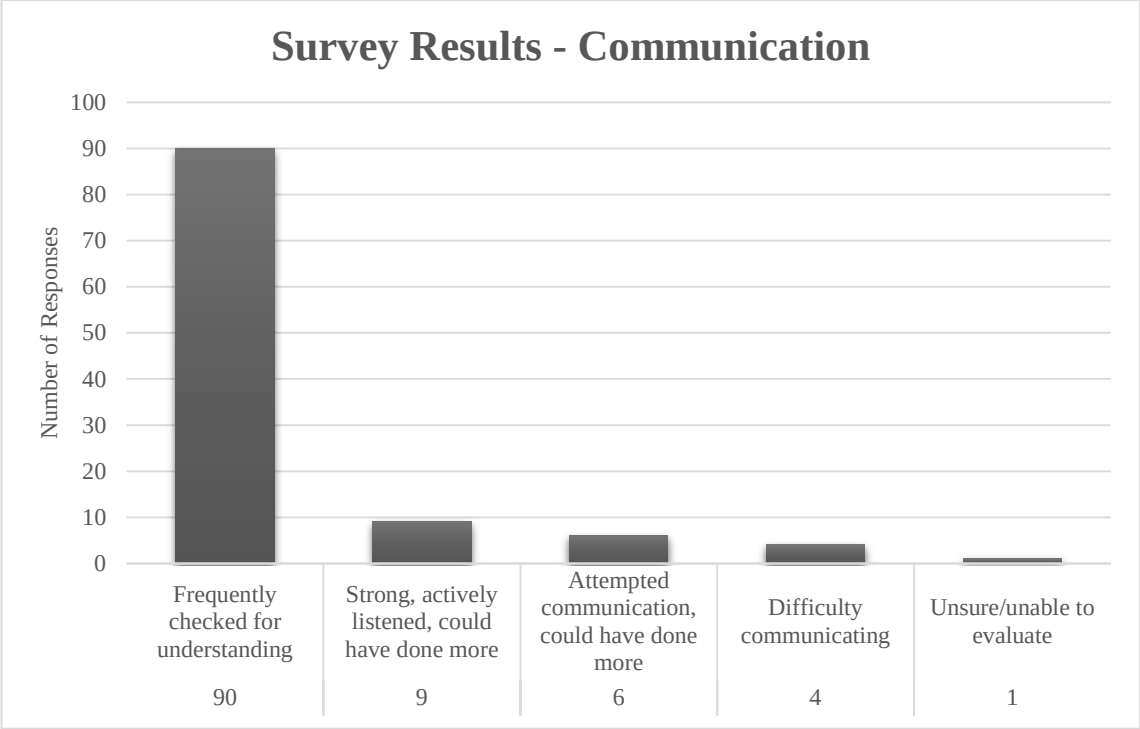

Figure 6: Survey results from students after receiving tutoring. As shown, students rated their tutor as having strong communication skills and frequently checked for the students' understanding.

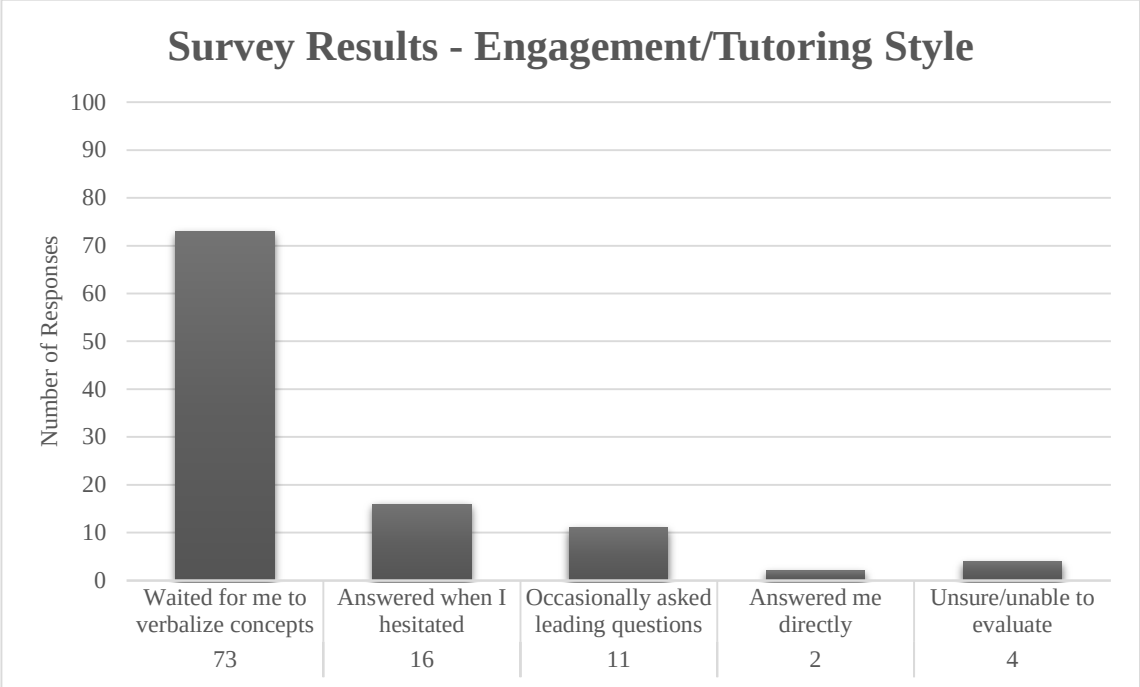

Figure 7: Survey results from students after receiving tutoring. Most students responded that tutors waited for them to verbalize concepts. This demonstrates tutors are utilizing the Socratic Method during tutoring sessions.

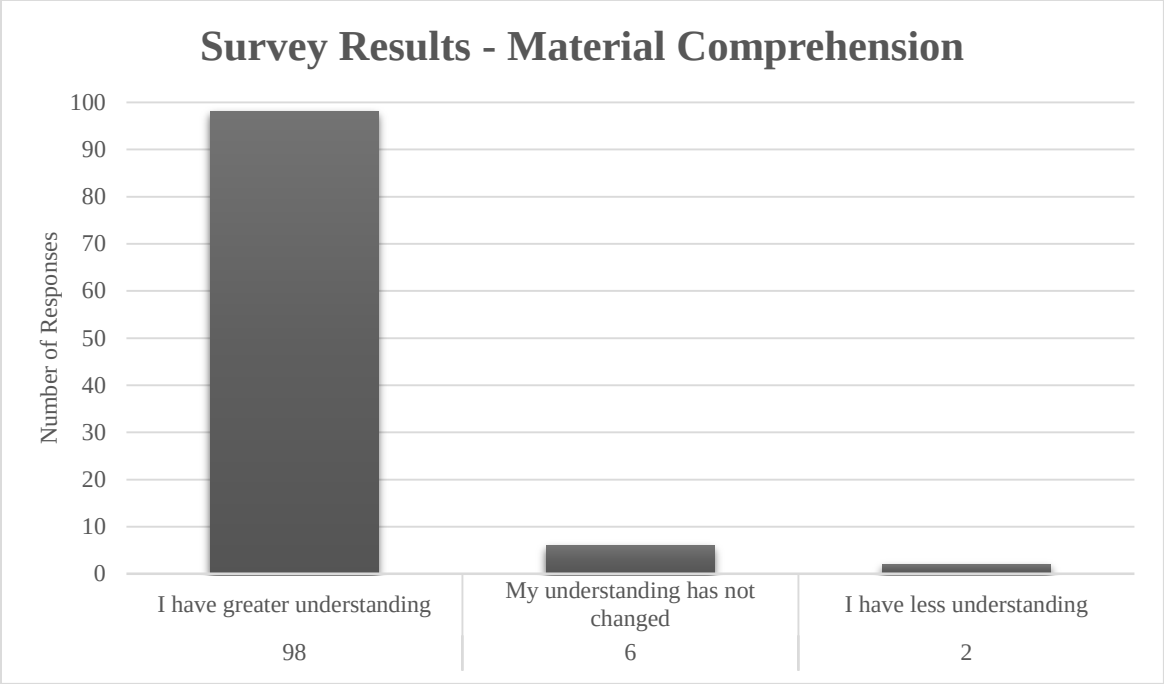

Figure 8: Survey results from students after receiving tutoring. Most students responded that after tutoring, they had a greater understanding of the course material.

D. Effect of Tutoring on Academic Performance

The effect of tutoring on a student's academic performance is not easily determined. For example, students may receive a higher grade in a certain course because they visited the tutoring center to help them with material they did not fully understand. Alternatively, students who typically receive high grades may be more likely to visit the tutoring center versus students who typically receive lower grades. As shown in figure 5, a majority of students visiting the tutoring center have a cumulative GPA above 3. Just observing a students earned grade (A, A-, B+, etc.) for a particular class without a control cannot provide any evidence for the effect of tutoring. Previous attempts to control for other factors have included using a student's demographic and academic history, including high school rank, SAT score, gender, and GPA, among other factors[17]. For the purposes of this paper, the student's cumulative GPA was used as a benchmark for that student's expected grade performance for a particular class. The difference between a particular student's GPA and his or her grade in a single class was calculated to determine a normalized grade performance for that class. For example, a student with a cumulative GPA of 3.0, who receives a B+ (3.33) in a particular class, has a normalized grade performance of +0.33 for that class. The normalized grade performance was calculated for all students in classes that 15% or more of the students visited the tutoring center for that class. The normalized grade performance of students who visited the tutoring center was compared to the grade performance of those students who did not visit. The two sample t-test was used to test the null hypothesis that the mean of the normalized grade performance of the population of students visiting tutoring is the same as that of the population of students not visiting tutoring.

Table 2: Average normalized grade performance comparing students who did not visit the tutoring center versus students who did visit the tutoring center.

	Students did not visit tutoring	Students visited tutoring	Students visited tutoring two or more times in the term
Number of Students	2506	672	357
Average Cumulative GPA	3.02	3.03	3.03
Average Normalized Grade Performance	+0.10	+0.15	+0.18
Standard Deviation of Normalized Grade Performance	0.92	0.86	0.84
P value from two sample t-test		0.21	0.12

As seen in table 2, the average cumulative GPA for students who visited the tutoring center and for students who did not visit the tutoring center is very similar. However, students who visited the tutoring center had a higher normalized grade performance, and students who visited the tutoring center two or more times for a particular course had a normalized grade performance nearly twice as high as those students who did not visit the tutoring center. Statistical analysis shows that these results are not significant under the $p<.05$ criteria, so further work must be done to accurately measure if tutoring has a significant effect on students' academic grade performance.

V. Conclusion and Future Work

Within the context of ACE, there is the opportunity to evaluate the self-efficacy of the students who visit ACE. ACE should assess student growth within the context of self-regulated learning. Additionally, individual student motivation can be explored to provide additional insight into course performance. Graduate students could be hired and trained to evaluate student SDL pre- and post-tutor sessions.

As more qualitative and quantitative information is gathered and paired with tutor evaluations, the mentorship and coaching functions of peer tutors may need to be explored. However, the current student survey response rate of 7.4% needs to be improved first before the qualitative and quantitative data generated can have a larger impact. Lastly, an exploration of hours of tutoring support received should be considered in addition to comparison by student demographics. While student perception of learning is current practice for evaluation of tutoring impact, these additional metrics should be able to provide more direct evaluation of tutor support.

Since tutoring is offered as a retention initiative, course withdrawals, changes in major, course grades, changes in student confidence, satisfaction ratings, and tutor training process should all be considered in evaluating the impact of ACE. Norton and Agee suggest evaluating impact of tutoring hours received instead of student demographic characteristics[19]. More emphasis must be put on the training of the tutors since tutor preparation greatly impacts student learning[16] . The current Socratic Method training is non-experimental and needs a deepened level of questioning for peer tutors to practice. De Smet et al.[20] have found that experimental training conditions have higher efficacy of tutors.

In conclusion, this paper has described in detail the structure of ACE at the university and laid out the assessments used to determine the effectiveness of the peer tutoring in the center. The demographics of students choosing to visit ACE were given, in an attempt to build a benchmark for student participation in peer tutoring services. The demographics of students visiting ACE were representative of the demographics of the college of engineering, although females were overrepresented in choosing to visit ACE. A majority of students visited the center one or two times, although there was a sizeable population of students visiting ACE more frequently. All of the assessments of the effect of tutoring on students' academic success were positive. Tutors responded on surveys that they believed students they tutored received higher grades because of tutoring. Students responded on surveys that they had a better understanding of course material after receiving tutoring. Finally, analyzing student who visited the tutoring center received slightly better grades (when normalized using the cumulative GPA as a benchmark) in a given course than students who did not visit the tutoring center. The appendix that follows describes in more detail the workings of the tutoring center at the university for those interested.

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Appendix A

A.1 Hiring Practices

As ACE continued to grow and operate, a method for determining the number of tutors to hire was also developed. This method is based on the number of recitations per course and based on the number of students enrolled. For all ENGR courses, one tutor is hired for every four sections scheduled. Since some departments, such as Chemical Engineering, only have a single lecture with no recitation or only a single recitation for a large number of students, enrollment must be considered. For sixty students or less, one tutor is hired. For more than sixty students, two tutors are hired. If a course enrollment exceeds one hundred, three tutors are to be hired.

Table A1: Tutor Calculation Scheme for Department Courses

Course Enrollment	Tutors
<60	1
60-100	2
>100	3

A.2 Utilization

From the beginning of the summer 2013 term to the end of week 9 of winter 2014 term, ACE has been utilized 3470 times by 909 individual students. The distribution of visits per student is weighted towards students that visit 1 to 10 times (92%).

A.3 Tutor Training

The role of tutor training in ACE is to help grow tutors as both employees in a customer service center and as peers in an academic setting. The training that ACE provides is guided loosely by the College Reading & Learning Association - what is deemed necessary to train tutors in order for them to successfully engage students in course-specific content. Providing a tutoring service to students serves as another retention effort on the part of the College of Engineering, providing students with the essential skills needed to understand course content and instill effective study habits.

Peer tutoring results in significant cognitive gains for both the tutor and the tutee. There is frequent review of previously learned material which reinforces base information, building upon material in more advanced courses. The tutor and the tutee have the opportunity to improve their learning, studying, and test taking techniques as well as improving their communication skills. Sharing knowledge with peers builds self-confidence and instills a sense of pride in helping others.

For the better part of the past year, the method of tutor training included all lecture-based material, with little interaction from participants, lasting approximately two hours. The training provided includes a review of tracking systems, how to interact with students, and an overview of the most effective tutoring methods. In preparation for spring 14-15 quarter, the tutor training was expanded to include a variety of ice-breakers to better socialize tutors with one another and interactive activities, such as scenarios.

A.4 Onboarding & Expectations Training (O&E)

The O&E training serves as a general introduction for tutors to the systems and expectations related to working in ACE. This training was the original training developed for onboarding new tutors and served as a refresher training for returning tutors every quarter. The current learning objectives are:

- Be familiar with other ACE tutors
- Know how to report hours and track student interactions (ACE Op)
- Understand the academic expectations of being a tutor
- Understand opening and closing procedures for ACE

A.5 Learning Styles & Socratic Method (LS&SM) Training

The LS&SM training was developed over the winter quarter 14-15 and delivered in Spring quarter 14-15. This new training module was built to create a more interactive training experience for the tutors as emphasize development of students into independent learners. The learning objectives are:

- Develop a tutoring session
- Identify and engage learning styles in students
- Understand and make use of the Socratic Method
- Recognize the benefits of tutoring

A.6 ACE Operations

ACE partnered with the college to create a custom application to handle pairing students walking into the center with tutors. When a student enters the center he or she swipes his or her ID and is then shown a list of course that that student is enrolled in which are currently being supported by the center. The student selects a course is then paired with a tutor who is currently in the center actively tutoring for that course who is notified of the arrival via an iPad. When a tutoring session is complete the tutor closes the session on his or her iPad and completes a short survey about the tutoring session.

This system allows ACE to have detailed data about its traffic and utilization. This data is critical for projecting space, staffing, and support needs in the future. It also allows ACE to provide feedback to course instructors about what help their students are seeking from the tutors.

A.7 Accudemia

ACE purchased Accudemia for the Winter Quarter of 2014-2015 to assist with facilitation of appointment based tutoring. Accudemia is a web-based academic center management system used by ACE to schedule tutoring appointments. Tutors can log on to their profile and adjust their open hours according to their availability. Students in the college of engineering can then sign up for one-on-one appointments with the tutors based off of their

availability and what classes they are able to tutor for. Students and tutors log in and out when they enter and leave ACE to monitor time spent in the center.

A.8 Blackboard Learn Portal for ACE Employees

Blackboard Learn, utilized by the university as a way of hosting class content for professors, has allowed ACE to create a community page that all of the tutors and staff have access to. Course materials are uploaded by a work-study, separated by class and week for easy access. Tutoring expectations, policies, and training modules are also hosted on this community page. In addition, tutors are also granted viewer access to the class that they tutor for upon request, giving them direct access to course materials and announcements.

A.9 Personnel

The administration for the engineering tutoring center consists of a director, coordinator, faculty liaison, and student employees. The director, faculty liaison, and coordinator have worked as a team on the continuous development and assessment of the day-to-day activities in the center.

The director has been the main position guiding the growth and direction of ACE. The director meets with departments to discuss course support in ACE and works to garner faculty support and participation. S/he determines course support needs, works to provide new opportunities through ACE such as workshops and help sessions, provides direction for data collection and analysis for ACE activities, advises ACE coordinator, and researches scientific literature to improve tutor training methods and overall improvement of the center. In addition, the director keeps a direct line of contact with college of engineering academic advisors to make sure that they are apprised of the services in ACE.

The ACE coordinator position is a co-op position within the college of engineering. As it is a co-op position, a new individual is hired into it every 6 months. ACE has had 6 co-op students since its inception.

The ACE coordinator is responsible for the day-to-day functions of the center. The coordinator serves as a central point of communication between tutors, students, faculty and staff. Additional responsibilities of this position include training tutors, maintaining appropriate collections of materials and tools to assist tutors and students, advertising the center through the appropriate means, building the term schedule, and assisting the staff director in determining the growth of ACE and its future endeavors. The coordinator is also responsible for data collection and analysis to accurately prepare the center for each term and provide the tutors with constructive feedback.

A faculty member has served as a liaison to ACE since its inception. The faculty liaison position serves to provide a continuous faculty perspective as well as facilitate interactions with other faculty members when advertising and promoting ACE to the college. Furthermore, the position helps with the collection, representation, and evaluation of data to assist in reporting and future planning. As continuous members, the faculty liaisons also assist in term-to-term transition, hiring the coordinator, and training the coordinator at the beginning of their first term.

Tutors are requested from departmental honor groups and students with a high GPA and have the capacity to tutor for multiple courses from within their majors. Tutors are remunerated at a rate per hour decided by the college of engineering. The current rate is $10 per hour. Tutors are restricted from working more than 20 hours in a week by the institution.

Appendix B

A. Framing a Session

- How many of you have tutored before?
  - How do you typically frame the session?
- Why is framing important?
  - Engage students in learning, participation, and academic independence.
- 1. What do you want to get out of this session? The course? This term?
  - Identify the tasks.
- 2. What are you doing to get what you want? What are you doing **today** to get what you want?
  - Identify the thought processes
- 3. What can we do in this session to help you get what you want?
  - Set an agenda.
- 4. Is it helping (getting you closer to your goals)?
  - Tutee summary of content/underlying processes
- 5. Examine your options and create a plan to do better.
  - What next?
- 6. Don't give up!

B. Steps of a Session

- The following section mostly applies to appointments and one-on-one tutoring sessions.
- **Greeting**: Introduce Self & Greet Tutee, Set Tone
- **Identifying Task**: What exactly does the tutee need to learn?
- **Setting Agenda**: Let the tutee decide what to focus on
- **Identifying Thought Process Involved in Task**: What type of task is it? What is the general approach needed to master the subject? Do not give answers!
- **Addressing Task**: Tutoring begins here!
- **Tutee Summary of Content**: Tutee may have a Eureka! moment
- **Tutee Summary of Process**: Ask tutee "If this appears on a test, how will you go about solving it?"
- **Confirming and Reinforcing Confidence**: Mention specific accomplishments
- **Evaluating Session/Closing**: Summarize session, end on a positive note, and thank student for participating