Engineering Students' Views on the Effectiveness of Peer Tutors in Scholars Assisting Scholars Program

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Engineering Students' Views on the Effectiveness of Peer Tutors in Scholars Assisting Scholars Program among Undergraduate Engineering Students

Introduction and Literature Review

In engineering education, retaining engineering students in the first two years of college is a critical issue when the attrition rate has been persistently high. [1, 2] In this study, we looked at one tool that has been widely used to help first year students and sophomores succeed in challenging courses in universities, i.e., supplemental instruction and peer tutoring. [3-5]

In an earlier study we examined the effectiveness of a peer tutoring and supplemental instruction program in the College of Engineering at Kansas State University, a large Midwestern land grant research institution. This free tutoring program called Scholars Assisting Scholars, SAS, was created to increase the retention rates of first and second year engineering students. SAS was implemented as a part of an NSF STEM Talent Expansion Program grant that examined the barriers and adversity encountered by first year students.

The Scholars Assisting Scholars tutoring program was developed to support student success and learning for students in first and second year core science, math and computer science courses. The SAS program attempted to provide effective tutoring that would create a strong foundation for courses that followed in the engineering curriculum. The objectives of the program were to help students complete first and second year engineering coursework successfully.

Peer tutoring has been widely used among higher educational institutions to help first year students and sophomores to succeed in challenging courses in universities. Peer tutoring typically contains study sessions, exam review sessions, or both. Peer tutoring is often used interchangeably with supplemental instruction. However supplemental instructions can be offered by students and/or instructors. Previous literature on peer tutoring and supplemental instruction has shown that using peer tutoring improves academic outcomes such as leading to higher retention rates, higher grade point averages (GPA), and improving student engagement and connection with engineering, comparing to those who do no use peer tutoring. [5-9] Students

who use peer tutoring in traditionally challenging courses, such as mathematics/calculus, are more likely to succeed in those courses, which in turn is connected to higher retention and graduation. [10-12] That said, literature also identified gaps about the structure of effective peer tutoring programs, such as the frequency of use, types of students who used peer tutoring programs, and how such factors are associated with the impact of the programs on academic success.[13-15]

In an earlier study, we examined one particular course, Calculus 1. Calculus 1 not only is a required course for all engineering majors, but also can predict whether or not a student will be retained in engineering. The results indicated that students who used SAS were statistically more likely to have higher cumulative GPAs, and statistically more likely to have passed Calculus 1 than those who didn't use SAS.[16] This was consistent with previous literatures which connected success in the first mathematics course to retention and graduation.[3, 11, 12] We also found that SAS program worked equally well for both male and female students, and for both first-generation and non first-generation students in passing Calculus 1 course.

The Current Research

In this follow-up study, we focused exclusively on students who utilized the peer tutoring SAS program and examined these students' perceptions of the peer tutoring and supplemental instruction program across a wide range of core courses that implemented SAS tutoring.

To become SAS program tutors, students must have successfully completed the core courses, receiving a grade of either an A or B in the course(s) they were hired to tutor. SAS tutors have substantial responsibilities as tutors and are encouraged to take ownership of their position as a tutor. SAS tutors were required to attend a specific lecture section of a course and serve as a tutoring resource to all students enrolled in the course. The tutors were trained in effective teaching techniques and in working with students on improving conceptual understanding and problem solving skills.[17] They schedule regular tutoring times each week in a dedicated tutoring space, the Collaborative Learning Lab. The tutors are easily located with an online electronic schedule service and signs posted at their tables identifying their content area. Tutors worked

with faculty to provide assistance consistent with course instruction and lead review sessions before each exam.

The SAS tutoring schedule is similar to an office hour arrangement where the tutors are available during scheduled hours and tutees meet with a tutor on the days and times that fit into their own schedule. The schedule is developed based on student demand developed from questionnaires, previous years' sign-in data and times each tutor is available. SAS tutors usually work with a small group of students that meet with them regularly because that time fits their own schedule.

Students are not assigned tutors. Rather, each student selects a tutor based on which tutor is available at times that fit the student's schedule. As an example, a demonstration tutoring schedule for Calculus 1 is shown with tutor pseudonyms (Table 1). Currently four students tutor Calculus 1 each week. Each of the four is available in the tutoring center on regularly scheduled days and times throughout the week. The SAS director determined that tutors are needed early mornings on Mondays, and a larger demand requires two tutors after 2:00 pm on Mondays. Tutors are scheduled accordingly. Students can look up the days and times that a Calculus 1 tutor is available through the online schedule. If a student wants to receive tutoring on Monday morning, only Sydney is available. However if the student wants tutoring at 2:30 pm, both Sydney and Cierra are scheduled. The student may choose to work with either one of these tutors based on personal preference.

The two objectives of the current research are to examine (a) the effectiveness of SAS tutors perceived by first and second year engineering students who attended SAS tutoring sessions, and (b) whether male and female SAS tutors were perceived differently in their effectiveness by students who attended SAS tutoring sessions. Learning about the effectiveness of the SAS peer tutors can inform the researchers how to improve the SAS program and make it an effective approach in helping engineering students succeed academically.

Table 1. Calculus 1 Weekly Tutor Schedule (Demonstration with Pseudonyms)

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00am	8:00-10:30am Sydney				
		8:30-11:30 am Sydney	8:30-10:00am Sydney	8:30-11:00 am Sydney	8:30-10:30am Sydney
9:00am			8:30-10:00am Cierra	9:00-11:00am Lance	
10:00 am			10:00am-12:30pm Cayson		
	10:30-11:30am Cayson		10:00-11:30am Lance		10:30am-12:30pm Cierra
11:00 am		11:00am -1:00pm Cayson			
12:00 pm					
1:00pm					
				1:30-7:00pm Lance	1:30-3:30pm Lance
2:00pm				1:30-4:30pm Cayson	
	2:30-4:30 pm Sydney / 2:30-4:30 pm Cierra		2:30-7:00 pm Lance / 2:30-3:30 pm Sydney / 2:30-3:30 pm Cierra		
3:00pm					
4:00pm					
5:00pm					
6:00pm					

Method

Participants

This quantitative study took place at the College of Engineering at Kansas State University, a large Midwestern land grant research institution. In this quantitative survey study, we focused specifically on students who utilized SAS tutoring programs for at least one of the core courses in the college (e.g., Calculus, Chemistry). When students came to Collaborative Learning Lab for tutoring sessions, they were asked to participate in a brief electronic survey regarding SAS tutors. The participants consisted of 86 students who attended SAS tutoring sessions and completed the survey regarding SAS tutors during Spring 2019 semester. To ensure honest feedback, none of participant demographic information was solicited. The survey answers cannot be traced back to any individuals.

Measures

The effectiveness of the tutors was measured by an 11-item questionnaire. The selection of questions for the survey was informed by previous years' surveys of students, tutors, and faculty to establish common themes about tutoring techniques and content considered effective. Questions were developed based on the common themes and a new survey was created. The new survey questions were examined for face value by faculty and experienced tutors and modified based on their recommendations. The modified questions were used in a pilot survey of a subset of students. The results were analyzed for internal consistency between questions measuring similar themes and the final survey was created.

Each item in the final survey asked students about their agreement with the statement regarding the effectiveness of the SAS tutors for both tutoring sessions and review sessions before exams. Some exemplary questions are "The tutor can explain ideas and concepts clearly," "The tutor listens to me and tries to understand my problems(s), question(s)," and "The tutor uses an alternative explanation if needed." We first checked internal consistency of the scale. The reliability Cronbach's alpha was .926, indicating high internal consistency of the measure. All

survey items were on a 5-point Likert scale (5 = Always, 4 = Most of the time, 3 = Sometimes, 2 = Rarely, 1 = Never) with higher values demonstrating more effective tutoring behaviors or characteristics. We calculated the average score of the eleven items to reflect how effective a tutor is as perceived by students.

To address the second research question whether male and female SAS tutors were perceived differently in their effectiveness by students who attended SAS tutoring sessions, we coded the sex of each tutor (0 = Male, 1 = Female). There were 10 female tutors and 11 male tutors. The data of students who visited the SAS program were recorded electronically by Academic Success Center.

Results

The overall effectiveness of SAS tutors in the tutoring sessions and the exam review sessions was positive, with an average rating of 4.49 (SD = .71) and 4.66 (SD = .59), respectively. As for highest rating individual statements, 96.05% of participants rated "Always" or "Most of the time" on "The tutor understands the subject matter of the course" and "The tutor comes to the tutoring session on time". 94.74% of participants rated "Always" or "Most of the time" on "The tutor provides clear concise explanations of concepts" and "The tutor can explain ideas and concepts clearly." 93.42% of participants rated "Always" or "Most of the time" on "The tutor is patient and has a good attitude."

We further examined whether or not male and female SAS tutors were perceived differently in their effectiveness. We ran a parametric independent-samples t-test. The results showed that there was no statistical difference in perceived effectiveness of female tutors (M = 4.41, SD = .74) and male tutors (M = 4.64, SD = .62) in the tutoring sessions, t (84) = 1.48, p = .143, 95% CI (-0.08, 0.55). The independent-samples t-test results also showed that there was no statistical difference in perceived effectiveness of female tutors (M = 4.63, SD = .61) and male tutors (M = 4.71, SD =. 55) in the exam review sessions, t (61) = .534, p = .59. This suggests that students who utilized SAS tutoring program considered female and male tutors to be equally effectiveness.

Additionally, in the voluntary comments section, we asked students who used SAS tutoring as a resource what they thought the tutors did well, and what they believed tutors needed to improve. Students frequently attributed success in all coursework to the assistance of SAS tutors. Participants often identified knowledge of the content area and the ability to explain concepts in a way that students could understand as an important characteristic of effective tutors. One participant commented "*The tutor was really good about making the explanations understandable and kind of brings them out of strict science terms, gives good examples, and answers questions I didn't even know I had*."

In terms of the areas to improve, participants made several suggestions, for example, to have more tutors so that students to tutor ratio is not too high. The other area for improvement is to have multiple different approaches to solve a given problem. As one student said "*This would help more students understand as different students might find one approach more pleasing than another*."

Discussion & Conclusion

In this study, we examined how effectiveness the SAS tutors were perceived by first and second year engineering students who attended SAS tutoring sessions, We found that students who used SAS tutoring considered the tutors to be effectiveness overall in the tutoring sessions and the exam review sessions. Specifically, participants perceived the SAS tutors to understand the subject matter well and explain the concepts clearly.

We also examined whether or not male and female SAS tutors were perceived differently in their effectiveness by the students who used the SAS program. We found female SAS tutors were equally likely to be perceived effectively as male tutors, suggesting that the SAS tutors from both sexes worked equally well with students on improving conceptual understanding and problem solving skills.

In conclusion, the result of the current study is critical to the academic progress of students through the engineering curriculum[11, 12,18] as it, along with the findings from our prior study,

suggests that SAS tutoring program provides effective tutoring that would create a strong foundation for courses that followed in the engineering curriculum.

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