# Work in Progress: Student Perception of Instructional Staff's Knowledge, Skills and Attitudes and its Impact on Their Performance

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# Student Perception of Instructional Staff's Knowledge, Skills and Attitudes and its Impact on Their Performance

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**Abstract**

As flipped-learning strategies increase, this work in progress paper aims to evaluate the relationship between first-year engineering students' perception of instructor competency and their individual performance in a scholar-assisting-scholar program. Our motivation lies within the spirit of continuous improvement as we investigate a recent curriculum change in a first-year engineering fundamentals class. More specifically we are interested in the fundamental question "Is the scholar-assisting-scholar framework providing scholars that are qualified or capable to teach this material?" Some faculty question whether or not students who have recently completed the course are qualified enough to be able to help teach the subject matter. Others argue it offers current students a more relaxed environment, therefore promoting learning and increasing content retention. This work aims to evaluate the relationship between student perception of instructors', both student (teaching assistant) and faculty, competency and enthusiasm and their performance in the class.

## 1.0 Introduction

Starting in the Fall of 2017, the first-year engineering course sequence at <REDACTED FOR BLIND REVIEW> transitioned from a traditional classroom to an active learning environment (flipped classroom). The strategy deployed a scholar-assisting-scholars approach known as the LEAP (LEarning with Academic Partners) program in an effort to increase student retention and to develop computational skills using software applications like Matlab and NX. Retaining engineering students is a critical issue in engineering education, especially in the first two years of college when the attrition rate in engineering is increasingly higher [1,2]. To combat this, peer tutoring and supplemental instruction are widely used techniques to help students succeed in challenging courses in universities [3-5]. Furthermore, peer tutoring has shown to improve academic outcomes such as achieving higher GPAs, higher retention rates, and improving student engagement [6-9]. However, as observed by several researchers, the teacher-student and

student-student interactions involved with instruction are complex phenomena that can be furthered complicated by innovative teaching methods like flipped-classrooms or collaborative learning [10-12].

In the current LEAP model students that have declared an engineering discipline as their major are enrolled in ENG 1101 (fall semester) and ENG 1102 (spring semester) during their first year. The course sequence is six credit hours in total, three credit hours each semester. The course meets for four hours each week, in addition to a mandatory one-hour LEAP session administered solely by the LEAP Leader, for a total class time of five hours. The typical class size for this model is 120 students for each instructor. The overall class is split into five sub-levels of 24 students each, all reporting to a single LEAP Leader, meaning that the instructional staff for this study consists of one full-time instructor and five LEAP Leaders. The sub-levels are split one additional time into four-person teams, for six teams per LEAP Leader. Figure 1 illustrates the course structure described previously. Additional literature describing the philosophy behind the LEAP program is available [13].

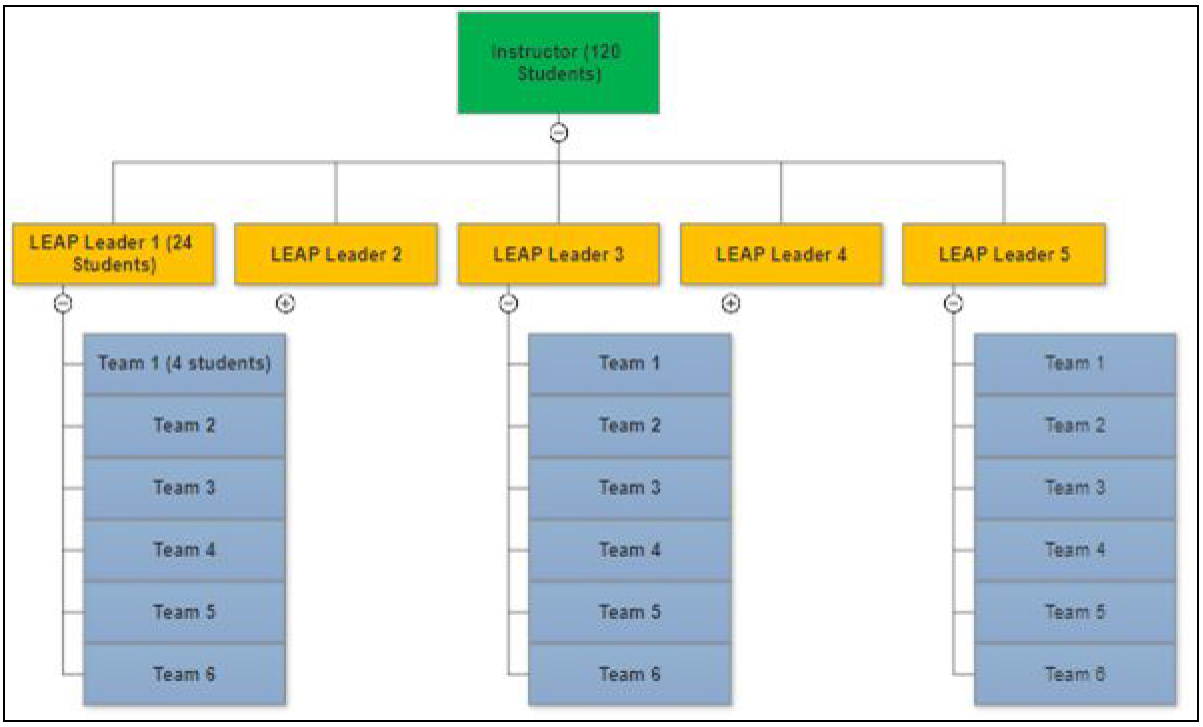


Figure 1. Organizational chart for the course evaluated in this study.

Now that the LEAP program has operated at steady state for multiple semesters, there is significant interest in improving the quality of the experience for the students. At the freshman

level, several aspects of a course can define the quality of instruction, such as course pedagogy and course format [14-15], or the degree to which the course relates to the students chosen major [16]. Another related factor to overall course quality is the knowledge, skills, and attitude of the instructional staff as these individuals can be viewed as a role model [17]. Since the LEAP format is designed to incorporate scholar to scholar learning, where the scholars are either undergraduate or graduate students in an engineering field, the importance of understanding the student's perception related to this person's knowledge, skills, and attitude is paramount moving forward. This same rationale could be applied to the course Instructor, although there is a limitation within this comparison because at this particular institution the instructors may also be graduate students.

## 2.0 Research Questions

This paper describes first-year engineering student performance within the curriculum in relation to their perception of the instructional staff in terms of knowledge, skills, and attitude. We are interested in the fundamental question "Is the scholar-assisting-scholar framework providing scholars that are qualified or capable to teach this material?" Specifically, we conducted a longitudinal investigation seeking to understand:

1. The participants' impression of teaching ability.
2. The participants' impression of a desire to teach.
3. The participants' impression of knowledge of course materials.

## 3.0 Methodology

### 3.1 Participants

Participant recruitment targeted 120 first-year multidisciplinary engineering students at the beginning of the study, which eventually attrited by the end due to the non-required aspect of the experiment. Overall, about 74 complete participant data sets were obtained using the methods described subsequently.

### 3.2 Experiment Design

Student perception was evaluated using a 10 statement survey approved by the IRB; tactical statements were used to evaluate their instructional staff perceptions. All statements were phrased to evoke a subjective response to properly evaluate the students' perception of their

instructors. The categories evaluated were (1) knowledge of the material, (2) desire to teach the material, and (3) ability to communicate material. Students evaluated their instructors using a numerical scale from 1-10 with 1 disagreeing with the statement and 10 agreeing with the statement. Survey statements can be seen in table 1 below.

Table 1. Statements found in the student survey

| Statement | Category Evaluated |
|---|---|
| I feel confident in my instructor's knowledge of the content that will be covered in this course. | (1) |
| I feel my instructor is enthusiastic about the course material. | (3) |
| I feel my instructor wants to be teaching this course. | (2) |
| I feel my instructor genuinely cares about his/her students. | (2) |
| My instructor makes him/herself available to students. | (3) |
| I feel confident in my LEAP leader's knowledge of the content covered in this course. | (1) |
| I feel confident my LEAP leader can help me in this course. | (3) |
| I feel my LEAP leader cares about teaching students. | (2) |
| My LEAP leader makes him/herself available to students. | (2) |
| My LEAP leader will do what they can to help me pass this class. | (3) |

Instructor and LEAP leader question 1 were used to determine the perception of knowledge and instructor and LEAP leader question 3 were used to determine the desire to teach the material. The ability to communicate material was evaluated using student performance - an over/under evaluation from the median class grade. The median grade for the total class was used at the time of the survey and then percentages were determined based on the proportion of the class the graduate or undergraduate leaders were responsible for.

### 3.3 Data Collection

The survey was given three times throughout the semester: a first impression, a mid-semester impression - this happened around week 7, and a final impression during week 14. Students were given the survey before an exam for both the mid- and final evaluations.

### 3.4 Data Analysis

Data analysis was performed in Excel using basic descriptive statistics and the standard ANOVA t-test technique to identify unique means. Significance was determined within a 95% confidence interval, and error bars represent one standard error.

## 4.0 Results and Discussion

### 4.1 Perception of Knowledge

A student's impression of instructional staff knowledge can be a primary factor in engagement and retention in engineering courses. Figure 1 shows the perception of knowledge for the instructional staff. This outcome was traced to participant responses to this statement: "I feel confident in my instructors [LEAP leaders] knowledge of the content that will be covered in this course." Interestingly, both the instructor and the undergraduate LEAP leaders saw a decrease over the course of the study, that was significant ($p<0.01$), compared to the positive trend observed for the graduate student LEAP leaders, which is also significant ($p<0.05$).

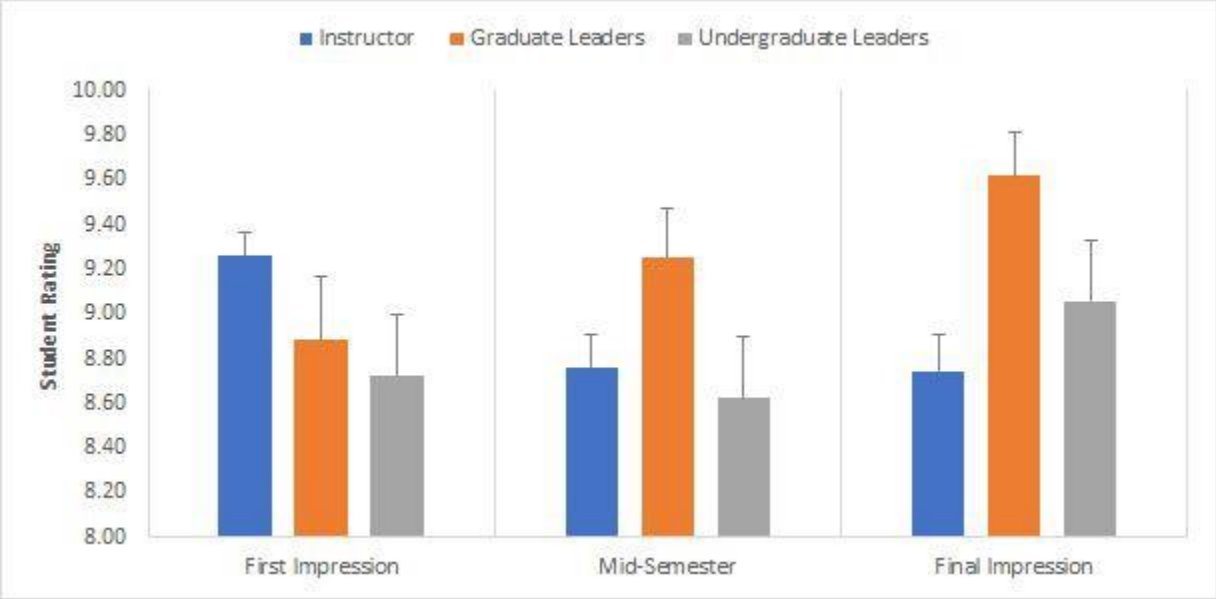


Figure 1. Confidence in Instructors Knowledge Throughout the Semester. The results of statement 1 on the survey: "I feel confident in my instructors [LEAP leaders] knowledge of the content that will be covered in this course." There was a significant drop from the first impression to mid-semester impression for the instructor ($p<0.01$). There was a significant increase between for graduate leaders throughout the semester ($p<0.05$). There was a significant difference between the perception of knowledge between the graduate leaders and undergraduate

leaders in both the mid-semester and final impressions ($p<0.05$). Error bars represent one standard error. All statistics were performed using a standard ANOVA t-test.

Figure 1 tells several important stories about student perception of instructional staff knowledge in the context of the LEAP program. The first is that there is actually a deterioration in the student's confidence in their instructor over time. This finding indicates that in this particular course model that the instructor needs to take extra time and effort to ensure that their preparation and engagement is sufficient to maintain higher perceptions of knowledge. Other researchers have noted that flipped classroom course models often require extra preparation by the instructor to ensure that the course material and format are deployed with efficacy [18-19]. In this particular study the instructor was female, and as noted by other researchers [20], may contribute to an overall lower impression of knowledge. However, this defense is further complicated because the graduate student leaders in this study were also female in gender. It is possible that graduate students, despite being female, were able to develop trust/confidence in the students through spending more time with them. Normally, the format of the LEAP model allows for about five hours of planned contact between the leader and their students, but it is possible that the female leaders made additional time investments. This possibility will alter the information that we collect during subsequent investigates, as additional effrt will be made understanding what activities the leaders are conducting with their students outside fo the normal structure of the LEAP program.

The second takeaway from the results in Figure 1 is that undergraduate LEAP leaders, essentially scholars closest in skill level and age to the participants, scored significantly lower than the other instructional staff groupings. This finding also is important in relation to the design of the LEAP program because the program depends heavily on undergraduate populations for leader recruitment, which directly contradicts the participants' perception of that group to have sufficient knowledge to teach them. This finding also suggests that the course instructor needs to be more involved with the plan and actions of the undergraduate leader.

Conversely, when the lower perception of knowledge related to undergraduate leaders is compared to the graduate student leaders, graduate-level scholars scored better at perceived knowledge but were also able to increase the impression of this ability over time. The second factor is interesting because it indicates a trust component that is not present with the faculty instructor or the undergraduate scholar. This result coupled with the previous observation that

undergraduate students have a lower perceived knowledge indicates that the primary recruitment pool for leaders should be graduate students to ensure that participants are not deterred by a bad impression or perceived lack-of-knowledge. Additional program elements could also be introduced to encourage mentoring between undergraduate and graduate leaders during the course offering.

### 4.2 Perception of Desire to Teach

Much like the perception of instructional staff knowledge, the perceived desire to teach can be another important factor that influences a student's persistence in a course. Figure 2 illustrates the trends and relationships of the participants' impression of their instructors and LEAP leaders desire to teach.

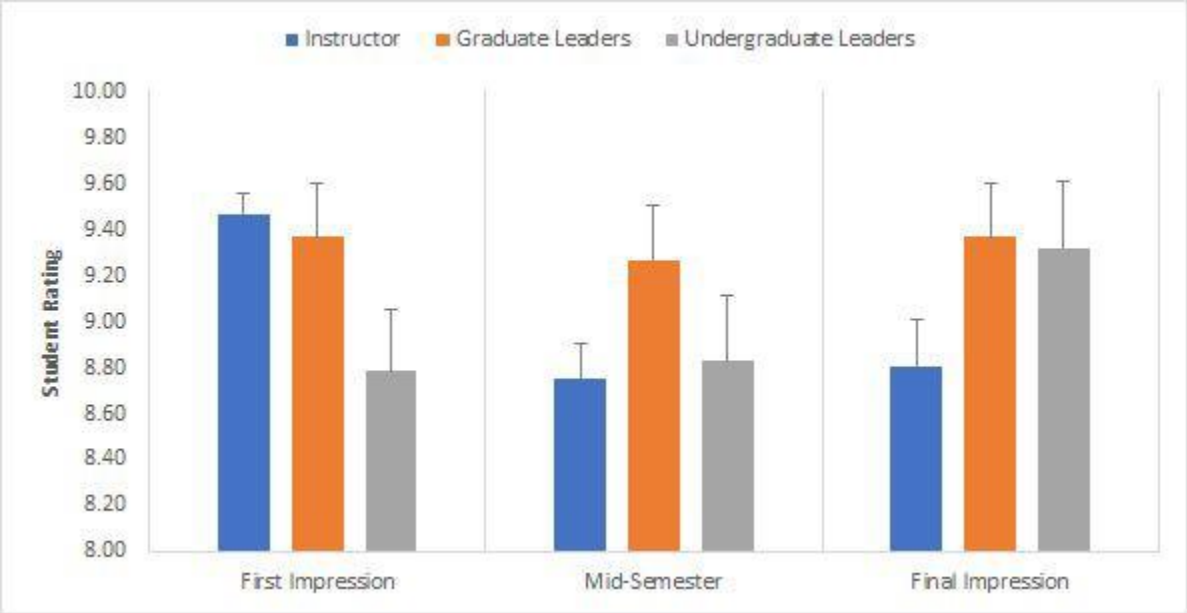


Figure 2. Perception of instructors desire to teach the course. The results of statement 3 on the survey for both the LEAP leaders and instructor. The only significant difference was a decline in perception for the instructor from the first impression to the mid-semester impression ($p<0.05$). Graduate leaders had a stable perception while there was a slight increase for undergraduate leaders. All statistics were performed using a standard ANOVA t-test.

Overall, the evaluations remained stable throughout the study for graduate leaders, which reinforces the conclusion that graduate students are effective scholars in a Scholar-assisting-scholar model. However, much like the impression of knowledge, there was a significant drop ($p<0.05$) from the first impression to mid-semester for the instructor, with a small rebound realized by the end of the semester. In this instance, the instructor also created a lower impression of a desire to teach than both the undergraduate and graduate leaders did achieve. It is

possible that the inequity associated to gender differences is behind this observation too, but the same complications exist. There was a difference in perception between the undergraduate leaders and the instructor for the first impression ($p<0.10$). There were no other differences found between the groups for the mid and final impression.

### 4.3 Perception of Ability to Teach

To determine the influence of instructional staff members perceived desire to teach we attempted to link the class median grade (student performance) to their perceptions of the categories previously reviewed. Table 2 reports this comparison, for example, a Table 2 entry of 50/13 indicates that 50% of the students were above the median grade and 13% were below median grade. The median was selected instead of the mean because the data set did not control for outliers and that the course grades did not follow a normal distribution.

Table 2. Percentage of students above and below the median grade at the time the survey was taken. The median grade at the mid-semester survey was a B. Graduate leaders taught 39% (n=46) of the class whereas undergraduate leaders taught 61% (n=72) of the class. The percentages represent what proportion of their respective student body was above or below the median. The median final grade was an AB. There was one student who dropped the course between the mid and final impressions.

| | **% Above / %below** | |
|---|---|---|
| **Group** | **Mid-Semester** | **Final Impression** |
| Graduate Leaders | 41/20 | 31/40 |
| Undergraduate Leaders | 55/10 | 48/31 |

Coupling the results from Figure 2 with Table 2, an interesting outcome emerged. Figure 2 suggests that over the course of the semester the perception of knowledge for both leader types increased; however, when examining student performance it was found that graduate leaders had a larger proportion of students who were below the median grade and the least proportion of students above the median grade for both the mid and final impressions. We say this is inconclusive because if our hypothesis was correct, then participants with higher perceptions of instructional staff knowledge and desire to teach should reflect in higher participant performance. The observation was the opposite however, perhaps due to grade inflation or lack of grading consistency, and indicates that a more controlled experiment is needed to link

participant impressions to performance. For this study, student performance on assessment items such as quizzes and homework were used for comparison.

In terms of course design, an important takeaway is identified as it relates to developing more consistent grading within the section between instructional staff. Using assessment points that are purely objective and quantitative in nature will provide better detail and help determine the relationship between perception, engagement and overall performance and retention in the engineering course.

## 5.0 Conclusions and Future Work

This study has identified several findings in regards to the fundamental question, "Is the Scholar-assisting-scholar framework (LEAP) providing scholars that are qualified or capable to teach this material?" The results of this study are limited by the size of the sample, so inherently, we cannot extend the results we observed past our classroom in that moment in time. That being said, our study opens the door for additional work to better understand these important relationships. Namely, when an undergraduate student is the assisting scholar there appears to be a unfavorable impression of knowledge and ability to teach when compared to a graduate level assisting scholar. To complicate the undergraduate contribution, there is also evidence of inconsistent grading among that group as their students earned higher grades than their counterparts did with graduate and instructor level assistance. This outcome signals the need for more supervision of the undergraduate leader, which can be achieved through mentoring activities. Another finding is in regards to the students' perception of the course instructor. In this case, the overall downward trend during the semester indicates that faculty instructors using the LEAP program model require extra attention towards course elements. We conclude that the overall impression of lack of knowledge is not derived from knowledge of materials, but more so, how the flipped classroom strategy is designed and delivered.

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