

New Mid-Semester Camp to Increase the Success of Underprepared Engineering Students

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Abstract

This paper explores the effects that a mid-semester camp had on students who were admitted to the University of Texas at Arlington (UTA) under a conditional admit status. To provide greater opportunities, some students are admitted on a case-by-case basis with transfer GPAs below the published minimum who then have one semester to demonstrate satisfactory performance. Unfortunately, these students historically suffer from low first year engineering retention rates (<35%) and low engineering graduation rates (<18%). To address this issue, the College of Engineering at UTA piloted a program during the Spring 2022 semester to address generalized problem-solving habits using cognitive and problem setup exercises aimed at aiding engineering students in a general way rather than connected to a specific class. This paper will show that this camp increased the likelihood of students to transition back to their separate departments and significantly increased their deductive and hypo-deductive reasoning skills.

Background and Implementation

Conditionally admitted transfer students to the College of Engineering at UTA have shown to be academically at risk for engineering. To increase their success rate, the College of Engineering decided to implement activities that would apply to all brands of engineering instead of connected to a particular class. These activities centered around a set of active discussion topics (four in-person and one online) focused on cognitive and problem setup exercises designed to increase the student's ability to solve problems.

The first topic was delivered online and addressed how to read a textbook by incorporating reflective questions to increase subject retention more than just by reading alone. The second topic focused on dissecting a problem statement by using summaries and keyword recognition. The third topic demonstrated how drawing a sketch can help with understanding a problem¹. Fourth, the "ladder" method of calculation to keep track of units as well as numbers was demonstrated to engage an additional visual component to calculations. Finally, a new method called "equation map" was discussed that tied concept mapping² to equations to break down the cognitive load of a multi-step problem, rather than requiring the student to reduce all equations to one.

To create a control and treatment group, the camp was required for approximately half the conditional admits. These students came to a specified room during lunch, which was provided, to discuss these topics. To measure the effectiveness of this camp, we tracked the transition of students from conditional admit to some other academic standing with UTA. Also, to measure their reasoning

skills, the test for scientific reasoning was used [3].

Results and Discussion

In Figure 1, we can clearly see that those who attended the sessions were more likely to transition to their department than those who did not attend. The other trend that should be noted is that there was no change between being dismissed or transferring away from engineering. These two factors suggest that the camp better prepared students for their chosen major, but did not help those who would normally not continue in engineering at UTA. More specific studies need to be undertaken in order to understand these trends.

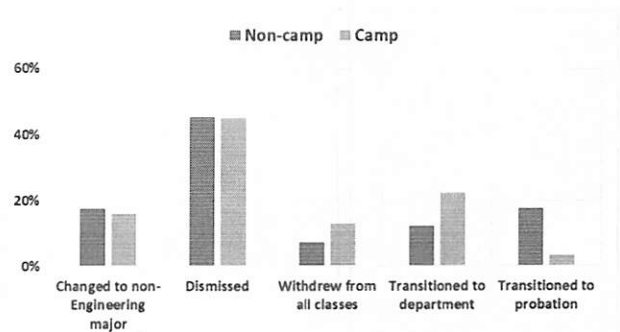


Figure 1. End of semester academic standing of non-camp versus camp students

In Figure 2, we can see that there was a large increase in hypothetico-deductive thinking and reasoning, showing the effectiveness of the cognitive exercises. Further, Figure 2 also shows an increase in the ability to identify key variables and probabilities from those ideas. The test for scientific reasoning shows a positive trend in the directly targeted areas that the camp wished to address. This increase then translated into a higher probability to transition fully into their department with no academic flags, referring back to Figure 1. Further research needs to be conducted to understand fully what the cause of this was.

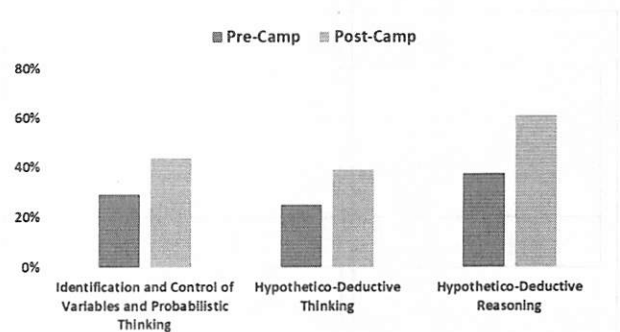


Figure 2. Categories of improvement in the test for scientific reasoning for camp students.

Moving forward, the College of Engineering at UTA is considering expanding this program into a multi-day set of topics presented at the beginning of the semester instead of in the middle of the semester which we feel would help more students due to being more of a proactive approach.

References

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3. Lawson, A., 1978, - “The Development and Validation of a Classroom Test of Formal Reasoning”, *Journal of Research in Science Teaching*, Vol. 15, No. 1, pp. 11-24.