S-STEM Summer Scholarship for a Sophomore Bridge: Year 1 in Review

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The 2016-17 Academic Year constituted the launch of a new S-STEM Scholarship Program at Louisiana Tech University. The program is designed to provide rising sophomore engineering majors with a smoother transition into the more difficult mathematics and engineering coursework accompanying the typical “sophomore slump.” The overall objective of the program is to increase engineering retention, thereby leading to an increase in the number of STEM graduates prepared to enter the workforce.

**Program Overview**

The scholarship program takes places over a 12-week summer term in which participants enroll in the first multivariable calculus course, statics, and a professional development course. The professional development course includes four components: 1) curricular content from *Studying Engineering: A Road Map to a Rewarding Career* [1], 2) the entire curriculum from *Developing Spatial Thinking* [2], 3) visits to area companies utilizing engineering methods in the workplace, and 4) faculty mentorship through faculty participation in the industry visits.

**Scholarship Selection**

By the nature of the scholarship program design that includes specific course requirements, the most significant scholarship criteria is that students be on-track in the mathematics, engineering, and science courses required in their curricula at end of their first year spring term. Louisiana Tech University’s first year engineering curriculum includes a common block schedule for all engineering majors. Therefore, so long as students pass their mathematics, engineering, and science courses, they will be ready for the summer courses required by the scholarship program at the end of their first academic year. These on-track students would normally enroll in the courses funded by the S-STEM scholarship during the Fall term of their sophomore year. The scholarship affords the students the opportunity to take the classes one term early during the summer 1) over a longer period of time (12 week summer term vs. 10 week academic year term) and 2) while the students are not taking as many other courses.

Some first year engineering majors are “ahead” in their mathematics coursework due to Advanced Placement or dual enrollment credit. That is, the students may be enrolled in the traditional engineering and science courses for first year engineering majors but be taking more advanced level mathematics courses simultaneously. In such cases, these students already have some “spare room” in their degree plan should they need to withdraw from or re-take a course. Because one of the objectives of the scholarship program is to create some buffer in participating students’ curricula, students who are ahead in mathematics are considered ineligible for this program.

Other scholarship selection criteria include grades in the first year mathematics, engineering, and science courses; participation extracurricular activities; and employment (employed or not, on-vs. off-campus, number of hour per week).
Results

The Summer 2017 program included a cohort of eighteen students from various engineering majors. The students enrolled in a typical first multivariable calculus course (three semester credit hours) and a statics course (three semester credit hours). Both courses are required for all engineering majors at Louisiana Tech University. These courses were taught by mathematics and engineering faculty with considerable experience teaching these courses. They were not considered honors courses or otherwise special courses in any way, and they were taught as normally taught by these faculty. Both faculty recorded their lectures and made these available to students online as well. The online videos did not affect classroom attendance. Students still attended class, and they commented in the evaluation survey that they found it helpful being able to watch the videos outside of class too. To strengthen the cohort experience, students who were not on the S-STEM scholarship were not permitted to enroll in these particular sections of the multivariable calculus or statics courses.

Final course grades indicate an 11% drop-fail-withdraw (DFW) rate from statics, a course that has seen a summer DFW rate varying from 26% to 37% over the past five years. The DFW rate for the multivariable calculus course was 5.5%. As a point of reference, the DFW for the first multivariable calculus has varied from 25%-45% over the last two years. There is no other 12-week summer section of this multivariable calculus course, so a direct DFW rate comparison is not available.

The S-STEM Scholarship students were also required to enroll in a two semester credit hour professional development course. Using the Purdue Spatial Visualization Test [3] as a Pre- and Post-Assessment, we found the median change between Pre- and Post- to be an increase of 3 points. Fifteen of the eighteen students in the program increased from Pre- to Post-Assessment. The three students who decreased from Pre- to Post-Assessment had Pre-Assessment scores of 23/30 (77%), 26/30 (87%), and 27/30 (90%). For the students with the 87% and 90% Pre-Assessment scores, this left little room to improve. Additionally, neither the Pre- nor Post-Assessments actually factored in to the final grade in the professional development course. It is possible that students did not take the Post-Assessment very seriously once they realized it would not affect their course grade.

The program also includes a research component to investigate its impact on student motivation as a central construct driving intent to persist. The research employs an experiencing-sampling method (ESM) in which each participant is surveyed three times a day for fifteen days during the summer term. An application installed on students’ smartphones sends out “pings” to prompt students to respond to a brief (< 2 minute) survey. The participation rate (% of students taking part) was 100% across waves 1 and 2 of data collection. The signal response rate (% of pings responded to) was 90% in Wave 1 and 81% in Wave 2, which is at or above rates typically seen in ESM studies (e.g. [4], [5], [6]).

Feedback from Students

Students report in the evaluation survey their satisfaction with the interpersonal interaction and cohort development within the program. Students report spending significant time with each
other outside of the classes, and they found the peer connections important. They did report wanting more purely social events planned with the project personnel.

Responses to the anonymous evaluation survey also indicated that, overall, students enjoyed participating in the research. They did not view it negatively nor did they find it disruptive to classes. They recommended that the research be better integrated into the classes and program overall, perhaps to more clearly connect the experience to their development as engineers.

Future Work

Project assessment revealed a need to re-work the content of the professional development courses. Students had a bimodal response to the spatial visualization course content: some students were not interested in the content and found it to be a waste of time while other students found the material challenging. Students also reported that they wanted to see more time in the professional development course focused on the professional side of engineering and integrating these professional skills and reflections with the industry trips. Additionally, more events outside of the classes will be planned to foster greater relationship-building and faculty mentoring opportunities between the project personnel and the students. Finally, greater integration and earlier, more expansive descriptions of the research component of the program will be incorporated in 2018.

Conclusions

The first cohort of recipients of this S-STEM Scholarship realized strong academic success, exceeding the performance typically observed in these classes, and strong, positive peer interactions. Additionally, program participants wrote reflection essays describing a profound, if not life-changing, student cohort experience, and positive benefits of the visits to area industries. Many students commented that the summer program far exceeded their expectations.

References


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