

## **Student Success Initiative to Engage and Provide Academic Support for First-Year Engineering Students**

### **Dr. Lindsay Corneal, Grand Valley State University**

Lindsay Corneal is an Associate Professor in the Padnos College of Engineering and Computing at Grand Valley State University. She received her B.A.Sc. in Mechanical Engineering from the University of Windsor, a M.B.A. from Lawrence Technological University, and a Ph.D. from Michigan State University in Materials Science and Engineering.

### **Dr. Nicholas A. Baine, Grand Valley State University**

Nicholas Baine, Ph.D., is an Assistant Professor in the School of Engineering. His expertise is in the design of electrical control systems and sensor data fusion. As an instructor, he specializes in teaching freshman courses as well as control systems and design of digital and embedded systems. While at Wright State University, he was part of the group which developed a new model to teach mathematics to engineering students. As a faculty member at Grand Valley State University, he is working with faculty to continuously develop and improve the freshman design courses.

### **Dr. Samhita Rhodes, Grand Valley State University**

Dr. Samhita Rhodes is the Assistant Director of the School of Engineering and Chair of the Biomedical Engineering Program at Grand Valley State University. She received her Bachelor's degree in Electronics and Telecommunications Engineering from the University of Pune, India, and her Master's and Doctorate from Marquette University, Wisconsin.

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## **Abstract**

This Work in Progress paper will describe the Student Success Initiative at Grand Valley State University. The Student Success Initiative is focused on the retention of first year engineering students through social engagement and academic support. The social engagement was initiated with an incoming student welcome luncheon for the past two academic years, and in the most recent academic year, a freshman living community was established to help students build an identity as part of the School of Engineering. Academic support was provided through the addition of the Introduction to Engineering Problem Solving course to be taken in parallel with the precalculus math course. Additional help was provided to students through combined office hours by all faculty involved with the introductory engineering courses so that students can seek out help from any instructor. Finally, a series of modules were developed to provide information and activities to help students develop effective learning skills for academic success.

## **Introduction**

At Grand Valley State University (GVSU), the School of Engineering is working to improve the performance of first year engineering students. As with many engineering schools, the School of Engineering at GVSU has consistently low retention in the first year of their program. It was found to be as low as 36% between the two engineering courses that are central to the first-year of the engineering programs. To improve the performance and retention of engineering students in their first year, the Student Success Initiative in the GVSU School of Engineering was created. After consideration of the issues facing engineering students, a two-pronged approach was chosen to help new students feel welcomed and engaged in the School of Engineering and to provide them with the academic support needed to be successful.

Students entering their first year of college are often faced with a number of challenges such as a new, higher-level curriculum, managing their time effectively, as well as developing relationships with faculty and other students [1]. The greatest proportion (over 50%) of the students leaving an institution has been found to be between the first and second years of study [2, 3]. In a study of engineering student attrition at the University of Pittsburgh over a six-year period, of the freshman attrition, half was accounted for by freshman that are placed on academic probation at the end of their first term [4].

Within first year engineering programs, mathematics is often one of the largest contributors to attrition in the first year [5]. Many schools across the country have adopted a first year engineering mathematics course that increases student retention, motivation, and ultimate

success in their engineering programs [6]. Another prevalent tool for promoting first-to-second year undergraduate student retention is the use of a first year seminar [7]. Most first year seminars take place in a small, discussion based setting. They consist of curricular and co-curricular topics that are designed to help students integrate academically and socially into college life [8].

The first engineering courses taken by students at Grand Valley State University are Introduction to Engineering Design I and II taken in consecutive semesters. The greatest attrition in the engineering program at GVSU has been noted after the first of these courses. To provide academic support as well as a sense of community, all faculty involved in teaching the various sections of these courses provide combined office hours open to students in any section to attend. This not only give students greater access to help, but it also demonstrates the willingness of the faculty to help all students, not just the ones in their particular section.

Despite the number of faculty willing to help, some students fail to seek it out due to the effort required. Grand Valley State University students face unique challenges as a result of the University having multiple campuses. First year engineering students often find themselves living on one campus with most of their courses, while their only engineering course and the professors for that course are on another campus. Going to the engineering class or office hours requires a 30-minute bus ride to the other campus. Unfortunately, this extra bit of effort results in many unanswered questions. To make seeking help easier, faculty teaching introductory engineering courses and tutors have been scheduled to staff a new Student Success Center. While this center has locations on both campuses, the addition of resources on the main campus where engineering faculty are seldom seen has resulted in many students receiving help they otherwise would not.

When looking at the performance of different groups of students, it was found that students that start in pre-calculus were more at risk. Similar findings have been found at other institutions and a solution was proposed and developed through support from the National Science Foundation [6]. The result was the development of an introductory applied mathematics course, which focuses on the use of math in engineering courses. Material from this research initiative is taught in a new engineering course titled “Introduction to Engineering Problem Solving” and is taught in parallel with the precalculus math course, which is the prerequisite for calculus.

Beyond the need to provide academic support is to facilitate the engagement of students with that support. To improve engagement, the first step was the introduction of a welcome luncheon before the beginning of the Fall semester, allowing the students to meet other incoming students as well as faculty and graduating seniors. After two years of hosting this welcome event, the attendance is growing and the feedback has been positive. Additionally, the Student Success Initiative is actively pursuing the development of the engineering community through the

development of a living community for new engineering students and making support more accessible and community based.

### Creating a Community

The first undertaking of the Student Success Initiative in the GVSU School of Engineering was to assist students in establishing relationships with other students as well as with faculty. For the past two academic years, all incoming students to the School of Engineering were invited to a welcome luncheon prior to beginning classes. The timing of the luncheon was scheduled to align with the annual Project Day events in which the graduating seniors set up and present their capstone projects. These capstone projects are industry sponsored and multi-disciplinary. First-year students were able to interact with the seniors, to ask questions about the program, and to see the types of projects and real world applications that students in the engineering program were involved with.

During the welcome luncheon the seating for the meal was organized by the sections of the Introduction to Engineering Design I course, the first of the engineering courses that the students will be taking. The faculty member who will be instructing the course is placed at the table with students enrolled in their class so that they can get to know each other in an informal and social setting before the beginning of the academic semester. Additionally, a couple of senior students are also assigned to each table to provide a student's perspective for when the first-year students have questions about what to expect.

Although the agenda for the welcome luncheon is mostly unstructured, there are some suggested questions provided at each table to help the incoming students feel more comfortable than if they had to identify questions to ask of the faculty and seniors themselves. Those planted questions tended to initiate the conversations and allow the students to then ask follow-up questions to address their specific areas of interest or concern. These questions included: what are you most nervous or excited about, how are you preparing for college, and how do you expect college to be different from high school?

After two years of the welcome luncheon, the attendance is growing and the feedback from the participants has helped the organizers make adjustments to better engage the new students. One adjustment made in the second year was the addition of an informational presentation about support available for students. It was found that the luncheon was a perfect opportunity to send new students the message that "we want them to be successful" and to promote the resources that we are making available to them.

In addition to welcoming the students, a first year engineering living community was established, named the Freshman Engineering Pod (referred to as the Pod). For this initial year, 20 spaces

were allocated to the Pod. These spaces were all filled and the Student Success Initiative is working to expand the number of spaces available.

The Pod is located in a learning and living center than has classroom spaces available to hold faculty office hours or tutorial sessions to support students in the first-year sequence of courses. These activities are located conveniently near the Pod, but they are also open to all first year engineering students. By making holding events near the learning community that are open to all engineering students, it is possible to develop a greater sense of community among the first year students, which extends to those that are not living in the Pod.

### Academic Support

To provide students with greater access to faculty that can answer their questions, the office hours for all faculty teaching the first year engineering courses are provided to all students in all sections of the courses. This allows the students to seek out help at times that are convenient to them, even if their instructor is not available at that time. This not only provides greater academic support for the students but also conveys the sentiment that all faculty are committed to the success of the students. This aligns with the efforts to develop a sense of community within the School of Engineering.

Since the university is spread over two campuses with all engineering classes being held on one campus, providing engineering-specific academic support on both campuses was also identified as a way to better provide access to academic resources. Drop-in tutoring with graduate assistants as well as peer tutors was organized on both campuses. The attendance at these drop-in sessions is tracked for scheduling and assessment purposes.

Through review of first year seminars, relevant topics and activities to help students develop appropriate learning skills were identified [7-9]. These topics were prepared into a series of modules that could be used in a first-year seminar. To add a credit for a mandatory first-year seminar required a broader overview of the engineering foundations courses (required for secondary admission into the engineering programs). This review is being completed as part of the Student Success Initiative within the School of Engineering. However, while the first year seminar was under development for consideration, the modules were implemented in the EGR 100 – Introduction to Engineering course during the Fall 2018 semester in order to determine where adjustments could be made for future use. This course is not a required course for engineering majors and there are non-majors that take the course, however, many students that are considering an engineering major and are taking the pre-calculus courses in preparation for the engineering foundation courses also take EGR 100. Therefore, it allowed for the modules to be utilized so that the results of their implementation could be reviewed for further updates.

These updated modules will be available for use in future offerings of EGR 100 or when a first-year seminar course is added to the engineering foundations curriculum.

### Course for Preparedness

In addition to the efforts to improve support for the current curriculum as students take it, a course has been introduced to help students that have a math start of pre-calculus. The course is similar to the freshman course developed at Wright State University [6]. The course covers the application of math to solving engineering problems. The course begins with applications of algebra to engineering problems, which is followed by an exploration of the use of trigonometry. While it is assumed that students have not been taught calculus, students are introduced to the basic concepts of calculus and how it is applied to basic engineering problems.

This course differs from the Wright State model in sequence and content. When covering algebra, additional teaching materials were developed and introduced regarding the use of logarithms in engineering and all algebra topics are taught prior to starting trigonometry. The resequencing of topics was done to mirror the content delivery of the pre-calculus math course at Grand Valley State University.

### Results

The initial efforts of the Student Success Initiative have resulted in retention from the Introduction to Engineering Design I to Introduction to Engineering Design II of 44% during the most recent academic year, up from 36% the previous year. As this is the single greatest point within the GVSU engineering program for student attrition, these results are encouraging. However, this retention rate is still lower than desired and the Student Success Initiative is continuing to investigate curricular changes to incorporate a first-year seminar into the engineering program.

The efforts to develop a sense of community among the students within the School of Engineering have also been fruitful. The responses from surveys of the students that participated in the welcome luncheon have shown that the incoming students enjoyed the opportunity to talk to seniors, see their senior projects, and learn more about the School of Engineering and what they should expect.

At the time of the writing of this paper, the first academic year in which the Pod was in use was still underway. Preliminary feedback from the students living in the Pod was favorable but a full assessment will be completed at the end of the academic year. The feedback provided will be reviewed as the planning for the next academic year is finalized.

The preliminary results of implementing a new course to introduce first-year engineering students to applied mathematics is positive. After completing the course, students self report to be more motivated to learn mathematics and that the course improved their chances to be successful in engineering and math courses. Initial data also shows that students that have taken the course have a higher average GPA for math courses than students that did not take it.

## Conclusions

The initial work of the Student Success Initiative in the GVSU School of Engineering has shown some promising results. An increase in the retention from the Introduction to Engineering Design I to Introduction to Engineering Design II course is one indicator that these efforts have been effective. Additionally, the introduction of a new course to improve outcomes for students that struggle to apply math has shown promising results, and feedback from students that have participated in the community building activities within the School of Engineering have been positive.

To build on these efforts, further opportunities to engage and support the students are being pursued. An engineering freshman living community has been initiated this academic year. A number of learning modules have also been developed and made available to the freshman students to help with time management, note taking, reading of STEM textbooks, and other skills that will help them be successful as they matriculate through the engineering program at GVSU. As further feedback is received and analyzed, the Student Success Initiative will continue to identify ways to support the students within the engineering program at Grand Valley State University.

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