



An Introduction to Engineering Supplemental Course for Students Under-prepared to Enter Calculus

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Denise H. Bauer is working on improving the student experience in the first two years in the College of Engineering. She has developed a new introduction to engineering course as well as conducted student focus groups to get their opinion early in the process.

An Introduction to Engineering Supplemental Course for Students Underprepared to Enter Calculus

In the Fall of 2014, a pilot Introduction to Engineering course (ENGR 204) was offered at the University of Idaho for engineering students also enrolled in Pre-Calculus (Math 143). The basis of the course was to provide a little more guidance navigating Math 143 (95% online class) as well as a connection to the College of Engineering in the first semester. As many of the students taking Math 143 have not been involved in any engineering course until their second semester, ENGR 204 allows the enrolled students to have direct access to an engineering faculty member twice a week, meet other engineering students immediately, learn to navigate the physical and academic system, and get an understanding of the engineering majors earlier than has been experienced in the past. A group of 30 students self-selected to take the course and this ENGR 204 cohort will be compared to their non-ENGR 204 cohort throughout their time in the college and/or at the university. The purpose of the course and the evaluation is to improve the scholarship, attitudes, behaviors, and retention of these so-called “underprepared” students and how ENGR 204 affects these metrics. Results of the first offering of ENGR 204 show promising results with 100% retention and an average first-semester 2.79 GPA (compared to 2.65) with no disqualifications. Improvements will be made for the Fall 2015 semester, which include more project activities, more student ownership of the course, and a tighter connection with Math 143 requirements.

Introduction

Each year, approximately 42% of the entering first-year engineering students at the University of Idaho are considered underprepared in math according to the College of Engineering’s four-year plans that begin in Calculus. Approximately 72% of these students (about 100 each fall semester) are placed one level behind in Pre-Calculus (Math 143) due to their ACT or SAT math score. Most of these students also must enroll in Trigonometry to take Calculus the following semester. Normally, this may not seem like a troublesome issue – the students will just be one semester behind; however, about 95% of Math 143 course is online work and 100% of the Trigonometry course is online. This means that first-semester eighteen-year-old students that were in high school and living at home three months ago must now not only move away from home, but also be self-motivated to learn the material through self-paced (with weekly deadlines) online methods. This type of class environment can be a shock to these students as they are comfortable with a well-structured, teacher-led lecture format. As such, many of the students struggle to keep up with the work in both online Math 143 and Trigonometry classes since they most likely have not fully developed their time management skills.

In addition, the College of Engineering’s Introduction to Engineering courses at the University of Idaho are major-specific with no general introductory course for those that may be undecided. While any interested student may enroll in any of the introductory courses (with permission), the Mechanical Engineering course requires Calculus for enrollment and the Electrical Engineering course is not offered at all in the fall semester. This is a concern as these are the two largest programs in the college, and means that 50-60% of the students in Math 143 that may need a little more guidance in their first semester are left to fend for themselves without much contact (if any) in the College of Engineering. Even if a Math 143 student is able to take an introductory

course his or her first semester, he or she may not have all of their concerns about succeeding in an online course addressed although each introductory course does include valuable information on time-management, scheduling, college resources, and study skills. Usually, these topics are secondary to engineering-specific content and many times are only included in the first few weeks of the semester. Therefore, they get a quick overview of these important “soft-skills” at the beginning of the semester before they may put them into full use and never revisit them later in the semester.

Due to the described situations, many of the Math 143 students tend to struggle in the online classes and do not know who to ask for help until their first advising appointment, which comes after the midterm – too late for most to turn a failing grade to a passing grade. This lack of connection to the college as well as the belief by some faculty and staff that these students just cannot cut it as an engineer also leaves many of these students feeling isolated and lost. With all these potential barriers, students can struggle throughout their studies and some highly-capable students even leave engineering due to starting in isolation and never finding a lasting connection to other students or the college. This could be particularly detrimental for female and under-represented students as others have noted that a lack of belonging, struggling early in the program, and not finding a friendly face to help them along the way are major reasons these groups leave engineering, not because they are incapable of the work.¹⁻⁴

To help alleviate this lack of preparation and sense of belonging, a new non-major specific introductory engineering course, ENGR 204, was developed for these students that come in needing to take Math 143. Based on other successful programs at the university outside of the College of Engineering and at other institutions as well as the research of Raymond Landis on successful introductory course material⁵⁻⁷, ENGR 204 was designed to bring engineering students together who would normally go unseen in the College of Engineering until the eighth week of class. ENGR 204 is a supplemental course to Math 143 that addresses the unique situations they will encounter in the first semester. The idea of creating a supplemental course was based on the overall first-year retention of engineering students in Math 143 as well as conversations with students on the structure of the Math 143 course and their dissatisfaction or frustration. It has also been shown by researchers in Sweden that a supplemental course can have effects in future classes as they transfer the study skill developed from one course to another.⁸ The overall goals for ENGR 204 are to 1) allow students to become engaged in the College of Engineering from the first semester; 2) develop a supplemental course for students underprepared in math; 3) improve student preparation for succeeding courses; and 4) increase the overall retention in the College of Engineering. The first offering of ENGR 204 was in the Fall 2014 semester with 30 students completing the course (31% of the engineering students in Math 143). These students were able to meet other first-semester engineering students, receive “inside information” on how to succeed in their engineering studies, set up a meaningful schedule to manage their time, navigate the educational system, and take advantage of the resources available to them (instructors/professors). They also participated in two final projects: designing a Rube Goldberg Machine and writing a Becoming a World-Class Engineering Student paper.

This paper will present the overall design of the class, comparison of math grades and first-semester GPAs between the students in ENGR 204 (ENGR 204 cohort) and their Math 143 peers

not enrolled in the course (non-ENGR 204 cohort), as well as lessons learned and the future of the class in the Fall 2015 semester.

Class Demographics

As ENGR 204 was developed to help the retention of the engineering students that must start in Math 143, our recruitment focus was on those students. Fall 2014 first year students with math placement scores indicating they should take Pre-Calculus were recruited in the spring and summer of 2014. ENGR 204 was limited to 40 students and split into two sections limited to 20 students each. Those enrollment limitations were decided upon as 40 would be approximately 40% of all the engineering students enrolled in Math 143 and splitting that group into two would allow for more interaction between the students in the class. The main target audience consisted of undeclared, Mechanical, Electrical, and Computer engineering students, but was open to all first-year engineering student. These students were actively recruited since they would not be taking an engineering class if they did not enroll in this new course and would have very little if any direct connection to an engineering faculty member.

From the recruitment efforts, thirty-four students were registered for ENGR 204 on the first day of the Fall 2014 semester; sixteen in the first section and 18 in the second. However, there were a few drops and one add leaving 14 students in the first section and 16 in the second by the end of the semester; this is the cohort for which all the ENGR 204 data was collected. The first section consisted of 14 Caucasian male students. The second section was more diverse with four female students, three Hispanic/Latino/Latina students (two were also from migrant worker families), two African-American students, one student of Middle-Eastern decent, and eight Caucasian males. Although there was not a lot of diversity in the class, the percentages do, unfortunately, follow closely with the percentages in the college of engineering. All engineering majors were represented in the two classes including undeclared.

Enrollment in the course was voluntary and one might think that the higher achieving students would be the ones that register; however, a two-sample t-test showed that the average high school GPA of those in the introduction cohort was significantly lower than their non-introduction peers with an average of 3.096 (std. dev: 0.448, median: 3.089, n : 30) and 3.366 (std. dev: 0.409, median: 3.392, n : 66), respectively (p -value = 0.01). Therefore, based on incoming grades alone for this one semester of data, the students that volunteered to take the new course were lower achievers compared to those not in the course. The Cohen's d effect size was 0.3 indicating a difference of 0.27 is not necessarily practically meaningful, but the fact that the introduction cohort had a lower high school GPA still indicates that this group most likely did not self-select based on achievement alone. Further investigation into the possible differences between the groups, such as grit or parental influence, will be conducted Fall 2015; this may alleviate the lack of meaningful statistical results based on GPA alone as other factors affect the reason a student may choose to take ENGR 204. However, we believe that any student that takes ENGR 204, higher achieving or not, will benefit from the interaction with an engineering faculty member, face-to-face information transfer of engineering activities, interaction with other engineering students, supplemental information on Math 143, and hands-on experience with an engineering design project in addition to the study and college survival skills taught in the class.

ENGR 204 Description and Objectives

ENGR 204 was a 2-hour credit course that met twice a week for 50 minutes. The topics discussed in the class (Table 1) included topics from *Studying Engineering*⁶ with additional items that applied to the College of Engineering and the University of Idaho. The overall idea of ENGR 204 is to provide the basic concepts and skills that form the foundation for any engineering field. The class is a problem-based engineering science class that helps engineering students develop learning and study skills, as well as allow them to get hands-on experience with engineering design, which includes critical thinking and problem solving ability. ENGR 204 was driven by the following learning outcomes from which the course topics were developed.

Student Learning Outcomes

By the end of the course, students should be able to:

- 1) Great each student in the class by their first and last name.
- 2) Convey to another person a broad notion of “What is engineering?”
- 3) Set both short- and long-term goals in their academic careers.
- 4) Create (and stick to) a personal schedule for studying.
- 5) Understand their preferred learning style and be aware of all learning styles.
- 6) Be aware of the resources available to them for tutoring, academic advice, personal advice, and professional advice.
- 7) Work cohesively and effectively as a member of a team.
- 8) Communicate their ideas in both verbal and written form.

Table 1. ENGR 204 Topics (learning objective)

First half of semester	Second half of semester
Expectations	Class Management (3,4)
Introductions (1)	Personal Development (3,5)
Keys to Success (3)	Diversity (7)
Pre-Calculus, Trigonometry (3,4)	Well-being (5,6)
Engineering Profession (2)	Design Project Planning (7)
Learning and Teaching Styles (5)	Teamwork (7)
Career Fair (2,6)	Design Project (7,8)
Professors and Other Resources (6)	Reflection Paper (2,3,4,5,6,7,8)
Advising (3,6)	

The course began by providing supplemental instruction for Math 143 to help ease the student into a self-learning environment. Students then were introduced to the multiple engineering disciplines as well as the difference between engineering careers and science careers, the engineering student groups in the college, and many other resources that will help them during their time at the university. The course ended with students designing and completing an engineering project as a team and then presenting on the process and final design. Each student also completed a reflection paper on their first semester as an engineering student and what they learned about themselves.

Table 2 lists specific activities that were used to help explore the topics listed in Table 1. To introduce the topics, students were required to read a chapter or portion of a chapter from

*Studying Engineering*⁶ and answer a few questions as well as record their thoughts on the readings in a journal. The topics were then discussed in class followed by a short activity. Some of the topics also included a larger activity such as creating a weekly schedule, visiting three instructors outside of class, or visiting a student services office on campus. Most all activities were completed during the class meeting time so not to add to the students' already high workload. The last four weeks were even dedicated to working on the final project so that the students could complete most of the work in class.

Table 2. ENGR 204 Activities

First half of semester	Second half of semester
Name game	Visit one resource on campus and report to class
Attend Student Club Fair	Place personal activities into four quadrants
GPA goals, individual and class	Counseling center guest speaker
Pre-Calculus, Trigonometry completion schedules	Examined demographics of state versus university
Engineering Photo Scavenger Hunt	Rube Goldberg Machine design, build, test
Attend Engineering Seminars	Place "order" for design project materials
Reverse Engineering project	House of Cards mini-project
Describe/listen to a simple task	Oral Presentations on project
Create a Resume	Test design project – hit a target
Visit three instructors in their office	World-Class Engineering Student paper
Create 4/5-year academic plans	

Details of example activities are:

Name game

This activity is directly related to the first objective of the class: learn the first and last names of every other student in the class. This activity is used by Ray Landis at all of his workshops and many of his conference presentations on first-year introduction to engineering courses. The activity creates an immediate connection to others and almost every student in the class could recognize all the other students by first AND last name when usually you just learn someone's first name!

Engineering seminar series

The seminar series is a college-wide event that was started before the first offering of ENGR 204. Faculty from the college as well as other offices on campus come give an informal 1-hour talk about their specific expertise such as what a mechanical or civil engineer do, tips for scholarships, writing resumes, and studying abroad. The students in ENGR 204 were required to attend 5 total seminars – 3 had to be a seminar discussing a specific engineering major and 2 could be selected from the other topics. These lasted only during the first six weeks of the semester.

Engineering photo scavenger hunt

To get the new engineering students in ENGR 204 more familiar with the engineering buildings and important offices, the students worked as teams to find and take a photo (with all members of the team in the photo) of items such as engineering buildings, the students services director, and the Dean. The winning team (points were awarded based on difficulty of the picture – a picture with the Dean was worth the most) was allowed to drop their lowest homework grade.

GPA goals

There were two GPA goals developed in the class. First, each student had their own goals for their semester GPA that were not shared. The second GPA goal was decided upon by each section – they determined a class average GPA that they would all work to achieve. The idea was to help develop accountability within each class. The first section’s goal was 3.14 and the second section’s goal was 3.33. Although they did not meet these goals, the overall ENGR 204 GPA was a C+/B-.

Reverse engineering project

The first major engineering project consisted of reverse engineering an item of the class’ choice. The first section chose a mini Nerf gun and the second class chose a RC car. Students worked in teams of two or three to evaluate how the item worked, disassemble the item to further explore each working part, and then try to reassemble the item. One team with the Nerf gun was able to reassemble a working gun that shot about half the distance of the original gun. A team in the second class used a disassembled RC car as a part of their final project.

Describe/Listen to a simple task

This activity was to explore the differences in learning and teaching styles. The ENGR 204 students were paired - one had to describe a task while the other listened. The roles were then reversed for a different task. The first student had to describe how to get from downtown to the football stadium while the second student had to explain how to wash clothes. After each task, there was a short discussion on how the “describer” explained their task (talked only or pictures, general or detailed, etc.) and how the “listener” took in the information (visualized pictures or words, took notes physically or mentally, etc.). The second task (washing clothes) was actually the one where the students really got involved and were giving very detailed instructions including sorting colors, selecting water temperature, and when to add detergent or softener.

House of Cards mini-project

Students were first placed on their final project design teams. After about a week of getting to know each other better, the House of Cards project was completed to help the teams develop their team-working skills and possibly define their roles within the team (specifically, who would be the leader). Each team had to first develop a plan for a structure made out of index cards and Scotch tape that was a minimum of 36 inches and could hold a minimum of 10 pennies for 30 seconds. The objective was to end up with the best cost-benefit ratio. The overall team for both sections was a team with a unique design (Figure 1) – they rolled their index cards and taped them together to form a tripod structure with a penny bowl at the top.



Figure 1. Overall best cost-benefit ratio House of Cards design

Rube Goldberg Machine Design Project

This was the final design project for ENGR 204. Each team of 4-5 students had to plan, design, build, and test a Rube Goldberg Machine that would launch a ping pong ball. The teams were the same as in the House of Cards, and the only stipulations for the project were that the Rube Goldberg Machine had to fit into the given dimensions, contain eight steps with three being simple machines, and each team could not spend over their allotted budget. The teams could ask for any materials to be bought but were highly encouraged to find recycled materials. All the teams looked through the engineering shops and labs on campus, gathered recycled cardboard, and brought many of their own items from home. A demonstration was held at the end of the semester where each team's Rube Goldberg Machine was put to the test – it had to launch the ping pong ball without any assistance once activated (examples shown in Figures 2 through 4). Bonus points were awarded for using more recycled material than bought material, launching a ping pong ball the furthest and/or highest, and hitting a designated target. In addition to the demonstrations, each team was required to give an oral presentation on their designs to their classmates. In the presentations, they were required to discuss how they came up with the design (showed various iterations and talked about testing different designs), what their eight steps were in their final product including the three simple machines, how they transitioned from one step to the next, and what they learned from the process including things that went well or not so well with their teamwork.

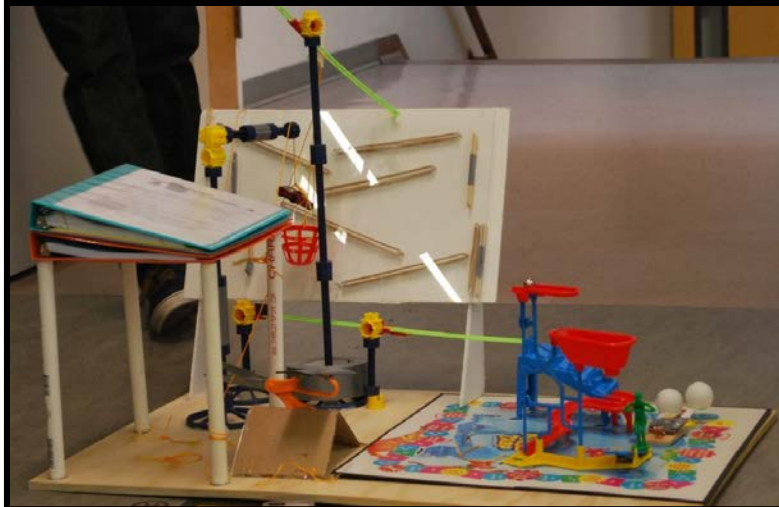


Figure 2. Mouse Trap Rube Goldberg Machine

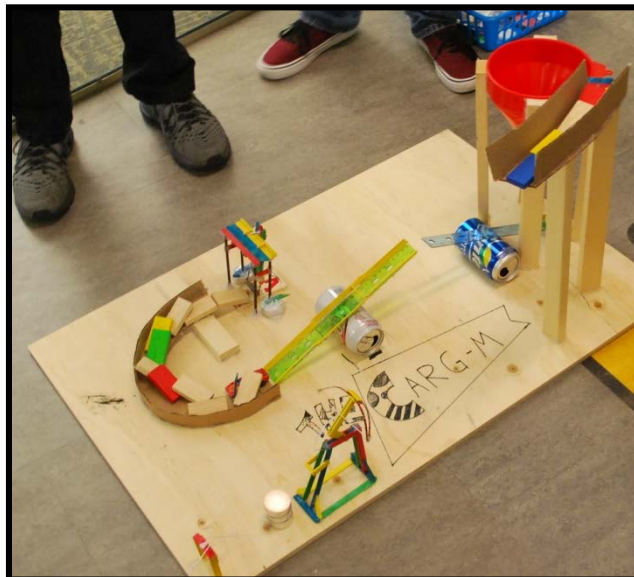


Figure 3. The CARG-M Rube Goldberg Machine



Figure 4. The Baseball Cage Rube Goldberg Machine

Becoming a World-Class Engineering Student

The final individual project (in lieu of a final) for ENGR 204 was a report on what they thought “Becoming a World-Class Engineering Student” would entail and where they were in the process. The report required each student to reflect on where he or she began the semester, where he or she was at the end of the semester, and where he or she should be according to what a World-Class Engineering Student should look like in terms of attitudes and behaviors. Some of the topics the students discussed were study habits, time management, believing in oneself, thinking other things were more important than schoolwork, and the differences between high school and college. All of these topics were items that were discussed throughout the semester and so students should have had notes and responses to homework questions about the topic. Therefore, the report was really a summary of what they learned in the class and about themselves. Previous courses that have used this project have shown significant higher GPA in the second semester for the students that participated than those that did not as well as a greater retention rate.⁹

Cohort Comparisons

As a goal of ENGR 204 is to help retain the students that have a great affinity for engineering, we have begun to collect and compare the data of the two cohorts (ENGR 204, $n = 30$; non-ENGR 204, $n = 66$). The goal is to examine how taking ENGR 204 versus not taking ENGR 204 affects the students’ Math 143 performance, their overall first semester performance, and, later, performance in subsequent courses. The preliminary data including Math 143 grades, first semester GPAs, number of students on probation or disqualified, and retention numbers can be seen in Tables 3 through 5.

Pre-Calculus Grade

The first data collected and analyzed were the Math 143 grades as this was reported to the faculty throughout the semester (weekly) by the math department. One observation that is not seen in Table 3 is that the ENGR 204 cohort began the semester with a lower average than the non-ENGR 204 cohort but steadily increased each week while the non-ENGR 204 cohort dropped throughout the semester. As a result, the ENGR 204 cohort ended the semester with a slightly higher overall final score, although not statistically significant (p -value = 0.81, Cohen’s

$d = 0.054$, effect size = 0.027), in Math 143 than the non-ENGR 204 students as seen in Table 3. However, if the D/F grades are examined (Table 4), the ENGR 204 cohort had a final score that was almost 16 points higher than the non-ENGR 204 cohort (p -value = 0.049, Cohen's $d = 0.938$, effect size = 0.425).

Table 3. Math 143 Overall Grades

	Average Final Score	Median Final Score	Standard Deviation
ENGR 204 ($n=30$)	77.91	81.59	14.7
Non- ENGR 204 ($n=66$)	76.97	83.32	20.0

Table 4. Math 143 Grades for D/F Students

	Average Final Score	Median Final Score	Standard Deviation
ENGR 204 ($n=11$)	62.09	65.09	8.34
Non- ENGR 204 ($n=14$)	46.17	60.26	22.5

The difference in the D/F grades may indicate that interventions in ENGR 204 at early-grade warnings and midterm grades helped the students become more aware of their grades, and as a result they worked to try and pass Math 143 only to fall short (six of the 11 students ended with a 65% or higher). The interventions included discussions of the Math 143 requirements throughout the semester, a required weekly schedule to complete the Pre-Calculus assignments (completed in class), student-led study sessions at the math lab, and an incentive in the ENGR 204 final grade if a student increased their Math 143 grade. This incentive was put in place after early-warning grades and each student could improve their ENGR 204 grade by 1% every two weeks if their Math 143 grade improved at least 3%. There was also a one-time 4% bonus when they improved their Math 143 grade to a B-average. However, if the Math 143 grade dropped more than 5%, a student would lose 1% in the final ENGR 204 grade. All but one of the ENGR 204 students received some Math 143 incentive, indicating that the ENGR 204 cohort was working to improve or maintain their Math 143 grade each week. As ENGR 204 is a supplemental course to Math 143 to help them navigate the system and succeed, the incentive was deemed appropriate.

As a longitudinal study will be conducted on these two cohorts, a preliminary examination of the spring Math 143 grades for the D/F students was conducted. At six weeks, the ENGR 204 cohort has an average of 71.51 and the non-ENGR 204 cohort's average is 68.17. Seven students from each cohort are retaking the Math 143 course, leaving four students from the ENGR 204 cohort and seven students from the non-ENGR 204 cohort not enrolled. All four of the ENGR 204 students took the math placement exam to place into Calculus, which means all of the ENGR 204 D/F students enrolled in some math course their second semester. One of the 14 non-ENGR 204 D/F students is enrolled in Calculus, a student that withdrew from Math 143 in the fall is now enrolled, five students were suspended from the university due to grades (discussed more later), and two are not enrolled in a math course at all. Persistence in math courses will be explored further in the longitudinal study but these early results show that all the ENGR 204 students did indeed decide to retake Math 143 immediately or test into Calculus.

First Semester GPA

The next data that was analyzed for the two cohorts was their overall first semester GPA. As seen in Table 5, the overall GPA for the ENGR 204 students is only slightly higher than their non-ENGR 204 peers and not statistically significant (p -value = 0.469, Cohen's d = 0.152, effect size = 0.076). However, there are a few exciting observations about the ENGR 204 cohort. One is that the median GPA for the ENGR 204 cohort is a 3.00, meaning that half the students have a B or higher average GPA in their first semester. A second observation is that the average GPA for the ENGR 204 students that received an A, B, or C in Math 143 is almost 0.25 higher than those that did not take ENGR 204 (0.3 difference in the median GPA). Again, not statistically significant results (p -value = 0.137, Cohen's d = 0.399, effect size = 0.195), but encouraging results. The last observation is most exciting to us – the average first semester GPA for the D/F students is 0.76 points higher (p -value = 0.006, Cohen's d = 1.19, effect size = 0.511) for the ENGR 204 cohort and the median shows an even larger difference of almost 1 point. This means that half of the ENGR 204 students that received a D or F in Math 143 still had a GPA of over 2.20, which shows that they did well in their other classes and stayed off probation (between 1.0 and 2.0 GPA).

Table 5. First Semester GPA

	Average GPA	Median GPA	Standard Deviation
ENGR 204 Overall ($n=30$)	2.79	3.00	0.816
Non-ENGR 204 Overall ($n=66$)	2.65	2.85	1.01
ENGR 204 A/B/C ($n=19$)	3.28	3.47	0.529
Non-ENGR 204 A/B/C ($n=52$)	3.04	3.18	0.667
ENGR 204 D/F ($n=11$)	1.98	2.20	0.486
Non-ENGR 204 D/F ($n=14$)	1.22	1.25	0.762

The data from the two cohorts that is quite hopeful is that the ENGR 204 cohort did not have any students that were disqualified (less than a 1.0 GPA in the first semester) while five students were disqualified in the non-ENGR 204 cohort. This result is especially encouraging as only about 6% of all students disqualified that are allowed to return to the university are able to increase their GPA and remain at the university past their first disqualification. The number of students on probation was also examined for the two cohorts. Although there were no ENGR 204 students disqualified, there were five ENGR 204 students that were placed on probation. The good news is that all of the probation ENGR 204 students remained at the university, are registered for a full credit load, and are enrolled in a math class in the Spring 2015 semester as mentioned before, while three of the ten non-ENGR 204 students on probation were either not enrolled at the university or not enrolled in a math class.

Retention

In addition to the five disqualified students, five more non-ENGR 204 students are not enrolled at the University of Idaho in the spring with three of those five due to circumstances other than grades (GPA of 3.00 or higher). There have also been five non-ENGR 204 students that have changed their major out of engineering. This results in 77.3% retention for the non-ENGR 204 cohort while the ENGR 204 cohort has 100% retention after the first semester.

Further Comparisons

We are in the process of collecting survey data for the two cohorts on their attitudes and behaviors as well as their reason for taking or not taking ENGR 204, their thoughts on the Math 143 class, and their confidence on remaining in the College of Engineering. All students in the two cohorts will also be tracked throughout their college careers to collect data on continuing retention and time to graduation. Faculty of engineering classes these students are taking in the Spring 2015 semester (such as the Mechanical and Electrical Engineering Introduction courses) will also be asked to complete questionnaires on a random selection of students in both cohorts. The data from the faculty will consist of the students' grades, work ethic, teamwork, attitudes, etc. in the respective courses.

Lessons Learned

Many of the lessons learned about the class related to the material presented and better connection to Pre-Calculus. Although the material from the *Studying Engineering*⁶ book was discussed throughout the semester, there were many times the students were disconnected from the concepts and felt it did not apply to them. To try and remedy this issue, the class structure will allow the students to take more control of the activities while also learning about positions they may hold in a student club. An example is that a group of students would be on a social committee. This group would then be in charge of any social activities involving the ENGR 204 class, such as industry tours, outreach activities, and stress-relieving game nights. There was also not enough engineering examples brought into the classroom; we relied too much on the engineering seminars, which some students could not attend due to work, labs, or other commitments. This meant that the only time some of the students learned about a specific major was when it was reviewed during one class period. Therefore, we need to bring more guest speakers to class so that all students are exposed to the different areas and have an opportunity to ask questions. A solution we will implement in Fall 2015 will be to have local alumni and current junior and senior students talk about their jobs/projects and what their greatest obstacle was and how they overcame that obstacle. This will help relate the material to the students on a personal level with others that have been through the experience more recently than the faculty.

Additionally, ENGR 204 was mainly created to help the students succeed in the Math 143 course. Although it was discussed weekly and reminders of the assignments due were given, the students need to be held responsible for Math 143 in ENGR 204 as well. This would allow for double credit of the work and create a constant reminder of the due dates. However, this will not help the students unless it is student-led. Therefore, the Math 143 checks will be peer-related to create a self-awareness of the work as well as setting up schedules to work with other students on the class. This organization will also result in ENGR 204 truly being a supplemental course to Math 143.

What did work are the engineering design projects and to some extent the activities the students completed on time management, settings schedules, and getting to know other engineering students. The students were always most engaged during the design projects; therefore, more projects should be included throughout the semester. This will be implemented not only through one or two more small engineering-related projects but also through class projects that relate to the class topics. This will allow a hands-on experience throughout the entire class and, hopefully,

better connect the students to the material. Additionally, the students from the Fall 2014 class will participate in the College of Engineering's Design EXPO where the senior projects are showcased. With over 600 K-12 students planning to attend, they can demonstrate what they created their first semester at the University of Idaho and be a part of a College-wide event.

The final individual project, "Becoming a World-Class Engineering Student", will continue in lieu of a final exam as it requires the student to self-reflect on their first semester of college and how they adapted. One of the most common revelations mentioned by the students in their reports was how they realized most of their work in college would need to be completed outside of class and that they must set aside time to complete that work. This was a big change for most as almost all their school work in high school had been completed during class. This realization led the students to make schedules of all their activities including when to eat lunch, sleep, and just have a good time.

The last, and probably most important, outcome was that the students connected with other engineering students. Most of the ENGR 204 students would not have been able to do this easily without ENGR 204 as they were not in another first-year engineering course. It is great to walk around campus this spring and see the Introduction cohort students together studying, working out in the gym, or just walking and talking. Hopefully, these friendships will continue and give them a peer to encourage them throughout the program.

Future Plans

The first ENGR 204 class has shown us things that worked very well and where we could improve. For the Fall 2015 semester and beyond, we plan to incorporate the following ideas:

- Have all students in class together one day a week and use the second day for smaller class activities. This will allow all the students in ENGR 204 to get to know each other.
- Incorporate the Engineering Seminar series into the ENGR 204 class so that the students do not have to attend outside of class. The timing of the seminars in Fall 2014 interfered with other classes or work schedules; therefore, about five students could not attend any of the seminars.
- Bring in more junior/senior level engineering students to talk about their experiences. This would be tied to a specific class topic so that the students not only talked about their experiences in general but would focus on one area such as time management or finding internships.
- Bring in alumni to give a similar talk as the junior/senior level students but also include what their job is and how they got there (set goals, prioritized activities, how they found the job, etc.). This would allow the students to start visualizing the path they need to take for the next 4-5 years.
- Involve more projects throughout the semester. The final design project was what most students were excited about, so more frequent smaller projects related to the topics would help keep them excited about coming to class every day. Another approach would be to give the students the final project towards the beginning of the semester and have the students complete steps throughout like a real-life engineering design project including obstacles that they could encounter.

- Administrating a “Grit” test to students in both cohorts to see if there is a difference in the groups, which may be a reason certain students sign up for the class.
- Organize the class into committees that relate to those similar to student organizations such as social interaction/community building, professional development, and academic development. Each student would take on one of the roles and work with the others in that role to develop activities for the whole class. This would allow the students to take ownership of the class and their learning.

Overall, we believe this class is a benefit to the students that take it and we have heard as such from those students. Those that we have talked to candidly this spring ask if it will be offered again and have mentioned how the study skills they learned as well as the preparation for an engineering work-load are helping them succeed this semester. They say they feel better prepared and more relaxed in their environment. Our near-future goal is to be able to offer the class to all Math 143 students and not just a sub-set.

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