

Increasing Engagement and Student Success in a Freshman Introductory Course

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Students enrolled in a freshman introductory course come to college thinking it will not be much different from high school and many of them are not prepared to embrace the academic rigor of an engineering program. The techniques and projects described here provide those students with the opportunity for changing their mind-set and for developing the skills they need to succeed. Students learn to become goal-oriented, disciplined, hard-working students in order to maximize their success while creating their own plan to graduate. End-of-the-semester in-class surveys show that students acknowledge the course helped improving skills in: time management, group work and collaborative learning, interaction with faculty and study skills. As a consequence of the course they realize it is important to use available resources (academic support center, advising and career services, library etc.) and recognize the importance of goal setting while creating their own personal plan to graduation.

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Introduction

As referenced by Schauss and Peuker [1], increasing first-year students' academic confidence helps students adjust to the rigor of an engineering curriculum. However, literature reveals that self-efficacy (a person's judgment of his/her ability to perform a task within a specific domain) not only can be strongly related to persistence in an engineering program [2], but it is also high when students enter college and it decreases within the first year [3].

The decrease in self-efficacy is usually related to a lower grade than expected or to failing a course. In these situations, student's personality has a strong effect on the reaction to the set-back. As one of the study on the subject reveals [4], *fixed mindset* students (i.e. the ones who believe they either "have it" or "they don't have it") reacts poorly to set-backs when compared to *growth mindset* students (i.e. the ones who believe their intelligence is malleable, or can be incrementally increased through their own effort to learn). In these latter personality type the self-efficacy is not questioned or shaken when they encounter failure or difficulties that they just interpret as a sign to exert more effort.

If a freshman introductory course can target students' behavioral changes, it can have a positive impact on retention.

At the Raritan Valley Community College, the Introduction to Engineering Course was developed as a student-centered course based on the textbook "*Studying Engineering: A Road Map to a Rewarding Career*" by Raymond B. Landis [5]. The course aims to address three main points in order to increase retention and lower attrition: 1) allow freshman students to feel comfortable in their new academic environment and with their new peers; 2) enhance students' commitment to their goal of graduating in engineering; 3) facilitate students' growth, change and development in areas that will enhance their success in college.

Methodology

The previous three main goals just mentioned of this introductory freshman course are achieved using several activities: engineering guest speakers, advisors and career services guests from the college, group discussion and in-class group projects, weekly assignments and two main projects. The assignments in the form of 8 essays and one project are based on the model developed

by Peucker and Landis [6]. The essay topics are chosen to stimulate a metacognition process, facilitating students' growth, change, and development in areas that enhance their success in college.

Below is the description of all assignments and projects.

Project 1: Engineering Discipline. In this project students are required to create a power-point presentation about an engineering discipline. The guidelines for the project allow students to explore an engineering discipline and to learn about career opportunities, professional societies, and salaries, to explore the four-year-institutions they can transfer to and to create an individualized plan for transferring into a chosen institution. Students learn the details of their program of study, the courses needed to graduate with an associate degree, and following the "60 hour rule" as suggested by T. Mulinazzi in the course textbook [5] they create their own personal course sequence accounting also for their commitments outside of school work (family, job responsibilities).

This empowers students to plan their "roadmap" to graduation, understanding that it might take more than the two years to get an Associate degree and more than four years to graduate with a Bachelor degree. Some students decide that they don't need to take all the required courses at the college since some will not count towards the program at the four-year-institution they elect to go. While this is detrimental to the college graduation rate, it empowers students in becoming responsible for their own plan and not feeling "betrayed" by the institution for taking courses they won't need. These are "happy and satisfied customers" who will be happy to come back as Alumni (see the end of next section) to inspire more students to continue in their engineering degree. Another benefit is that students become their own advisors for planning their course sequence, they can change it and modify it as they see a need, overcoming the possibility of "poor advising" which is a known issue related to attrition [7,8].

Project 2: Final Report on *Design Your Process of Becoming a World-Class Engineering Student.* This project was developed by Steffen Peucker and Ray Landis [6], first implemented in 2012 and Raritan Valley Community College adopted it in 2013. In this project students are asked to design

their own individual process to be successful in graduating with an engineering degree. There are four main topics students need to cover: 1) goal setting; 2) community building; 3) academic development; 4) personal development. For each of the topics students need to assess: a) where a "World-Class Engineering Student" would want to be; b) where they currently are; c) what they need to do to in order to move from a) to b). The report is required to be 10 pages long with a minimum accepted length of 8 pages and no maximum.

While this project is comprehensive and seems quite cumbersome, each of the weekly essays is finalized to support it, which means that at the end of the semester students will use all of their essays in the form of one report under the given guidelines. As much as possible, for each weekly essay there is a small group and a class discussion to make sure that students understand what is required and expected from them and don't feel lost in regards of the topic.

The 8 weekly essays that support Project 2 are described below.

Essay 1: Jane and the Dragon. After reading the story "Jane and the Dragon" students are required to write a two page (about 800 words) essay about their "dragon or dragons" in school and how they want to "tame" them. In their assignment students talk about their issues of procrastination, or their fear about chemistry or math classes, or their shy personality as all obstacles to their own success and try to present a plan to overcome those obstacles.

Essay 2: Bachelor in Engineering. Students are asked to write a two page essay about graduating with a Bachelor of Science degree in engineering, highlighting how important that goal is for them and how they can make it even more important.

Essay 3: Why Engineering. Students need to create their own top ten list of the rewards and opportunities of an engineering career, write a two page essay of why they want to become engineers by expanding on the top three items, and write their own statement for answering the question "What is engineering".

Essay 4: Your Roadmap. This assignment is directly correlated to project 1 as described before. In fact, students need to apply the "60 hour rule" to their life and in case they are overcommitted between course load and other responsibilities, they need to consider possible actions that will

avoid bad outcomes in their academics. With the base of this rule, students will then need to plan each semester until graduation with an Associate degree in engineering at the college.

Essay 5: Mistakes and Learning Styles. Students need to make a numbered list of mistakes students make in college, expand on two items that they fall in, and develop a plan on required actions to change and avoid those mistakes. They are also required to take a learning style survey [9], discuss the results and the changes they plan to make in order not to be limited in their learning process by an unbalanced learning style.

Essay 6: Academic Skills. Students are required to choose two academic skills among note taking, listening and questioning, perform an internet search on those two and write a two page essay on what was learned and how they plan to implement those two skills.

Essay 7: Priority Matrix. Students need to make a list of 20 items/activities related but not limited to their academic life, then place each item in one of the four quadrant of the priority matrix, analyze the matrix and write a reflection page on what they learned and how they could move items/activities into quadrant II.

Essay 8: Stress. Students are required to read a handout and take a test [10] about Stress and College Students, preparing a one page reflection on ways they can cope with their stress reactions.

Other semester activities include guest speakers from local engineering companies as well as guests from the college (advisors, career and internships counselors, transfer specialists).

Analysis

Freshman students enrolling in an Introduction to Engineering course that is student-centered and has a lot of written assignments are startled and surprised about it. Many express their surprise compared to their initial expectations but the ones who complete their final report understand the value they gain in knowing more about the college, about the engineering program, about the hard work that they choose to embrace when enrolling into the program and about themselves and their own plan to succeed. In fact the course allows for some students to change major right away because of the demanding academic workload that they

choose not to embrace. Some students' excerpts from their final report are below: *"Upon signing up for this class, I thought that I was going to learn more about the different fields of Engineering, and about different inventions, equations, etc. But to my surprise, this class took a different approach, and showed me that there is a lot more to the field of engineering than I initially thought. This field takes mass amounts of dedication, hard work, and experience. I think if I hadn't learned the material covered in this class then I wouldn't have been prepared to jump right into engineering From creating goals, to knowing how to fulfill those goals, throughout this project I've learned a lot more about how to be successful in the rest of my time at RVCC, as well as in general life. After outlining all of my problems and struggles I have in school, it was easy to develop solutions to them. It especially helped since I was able to think about what a "world class" student would do in each situation, and I modelled my solutions off of this. I'd say that I definitely have the ability to become a "world class" student, but I need to improve upon my work ethic so I can be able to get to this level."* [Ryan]

"When it came to focusing on myself, "intro to engineering" not only showed me my own learning style but it also showed me the concept of "metacognition." This was a concept that was first introduce to me this semester. According to "Studying Engineering" by Raymond B. Landis chapter 3.3, metacognition is "improving your learning process by observing it, developing feedback on what you observe, and making changes based on that feedback." In the end I still got lots of work to do in order to fully become a world class engineering student, however it feels great to have a guide. With this essay I will be able to go back and check on my progress and see in which parts I am slacking. Thanks to this class and book resources, I am now aware of where I stand on my progress to achieving my goals. I have also become more aware of all the resources available to me. I have been able to look at my mistakes, strengths and goals and gain more knowledge in each. This process at first seems very overwhelming but the more I get to reflect on it, the more I believe I can achieve it. This essay gets me really excited of what is to come next. I feel ready to fail, succeed and learn. And finally, I am

ready to become a world class engineering student.” [Jeshua]

“Through-out the semester, I was given multiple writing assignments that either reflected back to the actual course subject, such as “what is engineering,” or other important matters that were related to the learning process. Originally, I thought this class would examine disciplines and career paths of engineering, as well the levels of education or training needed to become a professional engineer. To my surprise, the class investigated the range of studying techniques and other “key” tools that enable engineering students to succeed in college. Although I would have enjoyed to learn about the multitude of engineering disciplines, I understand the importance of being a successful student in engineering. Learning about the process would allow to get one step closer to my path to becoming an engineer.” [Michelle]

“Becoming a world-class engineering student is a difficult and arduous challenge, however becoming a successful engineer is very rewarding and gives a greater purpose to the hard work. I am writing this report for myself as a guide for my future and a reflection on all the things I have learned over the course of the semester. This report will serve as a roadmap for my future. I had originally thought this class would provide basis for the different types of engineering disciplines. Instead, I learned about the process of how one becomes a good engineering student. All these things I have learned can be applied to many things even outside the field of engineering, and was far more rewarding than simply learning what each type of an engineer does.” [Christian]

“During this course I have written eight essays to help me become a better student and forced me to expose my weaknesses and shed a light on my strengths. These essays helped me understand how dedicated a student has to be to become a “world class” engineering student. They helped me come to the realization that being a good student means you have to work hard and be determined and understand that it needs to be something that you love to do. This course helped me by giving me the confidence that engineering is something I want for myself and I cannot wait for the opportunities in the future.” [Brian]

“I was honestly unaware of how many resources are available at our school. Before taking this class, I was clueless to the available help that is

out there for us students. I believe that it should be mandatory to take some kind of introductory class for any major exposing students to these helpful tools and advisors. I have shared the information I have learned with other fellow nursing students. It’s a shame that this is my last semester at this school because I feel I could have utilized these resources more efficiently, had I been given the opportunity.” [Nicole, a nursing major]

Besides comments from reports, end-of-the-semester in-class surveys show that students acknowledge the course helped improving skills in: time management, group work and collaborative learning, interaction with faculty and study skills. As a consequence of the course they realize it is important to use available resources (academic support center, advising and career services, library etc.) and recognize the importance of goal setting while creating their own personal roadmap to graduation.

These “satisfied of their learning experience” students will not only have better chances to succeed and graduate, but they are also the ones who are willing to come back as Alumni. Once a year the author organizes an Alumni Reunion, contacting all former students to be back to share their stories. The event is a great opportunity for them to showcase their successes and talk about how they overcame their academic and professional difficulties. It is also a place to professionally connect with peers, and to inspire current students to work hard and persist in their goal.

The last reunion held on May 2015 was the 7th Engineering Alumni/Transferee event and it was by far the most successful one with 26 Alumni (who were freshman even as long as 11 and 10 years ago) and 7 current students. The event started around 5:20 pm when the first student showed up and ended at 10:00 pm. A part of the evening was spent as a large informal group with each former student recounting their story from RVCC to present. The thoughtful and meaningful self-reflection and generously given advice to the current students was remarkable: wise beyond their years and very insightful. The rest of the evening was spent in fun and lively discussions, with open and honest interaction, and everybody had a great time. It was like a family reunion: everyone united by the common bond of where they had started their journey. Several students commented that the

event was incredibly inspirational and motivational.

Conclusions

Details of different activities, assignments and two projects of a freshman introductory engineering course were described. While students expect to be in a complete different learning environment, they realize the benefit of all the student-centered initiatives that brings them to write their own plan to a rewarding career. These students understand and learn about the challenges and the rigor of an engineering program and will have higher chances to succeed and overcome setbacks. Many of these students come back as alumni to share their experiences and inspire current students to continue and graduate in engineering.

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