

Utilizing an Institution's QEP and Applying Career Development and Learning Principles into an Engineering FYE Course

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Abstract - The first-year experience course is a program designed to help new students build the academic, social, and professional connections needed for a successful college experience at Tennessee Tech University. In this one-credit hour course, students are introduced to many aspects of higher education and the engineering profession. Course sessions are geared toward enhancing students' university experience and aiding in the transition from high school to university. This paper will review the *why* behind the different activities and discuss how they relate to student development and the course objectives and outcomes. The course under consideration in this paper is targeted at a variety of students in the College of Engineering that also includes Computer Science and Engineering Technology majors. The content focuses on psycho-social variables that are within the power of the individual student to control or change. Related to academic connections, course sessions provide insights into communication with professors, email etiquette, organization through time management, understanding the syllabus, exposure to study environments, and personal management skills. Campus engagement activities are also encouraged including attendance at college seminars and university programs and participation in relevant engineering professional societies in order to build both the social and professional connections. Phase 1 in career development is to understand one's self. Activities in the course provide opportunities for personal exploration and the use of career planning tools. Tennessee Tech University is tasked with developing a Quality Enhancement Plan that is used across the university to enhance the student learning and overall collegiate experience. Currently, the QEP is exploring ways to use Guided Inquiry to achieve this purpose. For many years, several of the faculty have been using an activity called the Three Minute Engineer where students are required to give a three to five minute talk about an engineering topic. This exercise serves to connect the students to their discipline of study, to explore the human factor associated with engineering, and to have an informal introduction to public speaking. Our paper will help to better explain the reasons behind our chosen curriculum and provide examples others can easily adapt.

Index Terms - Advising, High impact practices, Professional development, Student success

BACKGROUND

In the fall semester of 2006, Tennessee Tech University began conducting a first-year experience course for all incoming freshman students that is now generally referred to as the Connections Course. Across the university, departments were asked to create their own version of the course that would meet the desired program goals and student learning outcomes established by the university but would also incorporate activities specific to the department and corresponding career path of the students. The class sessions would aid with connecting the students to Tennessee Tech University and their chosen profession, and provide critical academic and social support during the transition period from high school to university. Each section was allowed to utilize an undergraduate mentor that would be responsible for attending each class, interacting with the students in and out of class, and aid with course presentations and grading according to the discretion of the faculty member. The student mentors are chosen by the faculty member and are typically engineering students but can also be chosen from a poll of interested students in the University. Mentors are expected to be junior or senior rank and must continue contact with the freshman students throughout the academic year. The class mentor is intended to play a major role in the course. The course sections were specifically required to remain small, 20 - 25 students, in order to promote a casual environment and allow for a personal connection with the professor, the section's mentor, and the subject matter. Over the years, there have been some changes in the expectations of the course delivery, and in the 2016/2017 academic year, an updated set of program goals and student learning outcomes was approved.

This paper will focus on course sections being offered in the General and Basic Engineering (GBE) department that serve students in General Engineering, Computer Science, Engineering Technology, and Mechanical Engineering. These course sections are coordinated by the Chair of the GBE department. Faculty include members of the GBE department, professional advisors working for the Clay N. Hixson College of Engineering Student Success Center, and representative faculty from the other college departments whose students enroll in these sections. Many of the course

activities and assignments have been specifically chosen to meet the requirement of connecting the students to their specific college and chosen profession. Students in this course receive a grade based on a participation point system. If they complete the assignments then they receive a semester grade based on their level of effort and whether the submissions meet the defined criteria for each assignment. Although there is liberal use of success centers and other university resources, the faculty continue to update their materials and specifically target topics and activities that are geared toward engineers. This paper will describe the relationship between the Connections course and student learning and success, an innovative career inquiry project that has been integrated into the course, and institutional retention data.

STUDENT LEARNING AND SUCCESS

Several of the student learning objectives and program goals for the Connections courses deal with first-year retention and overall academic success. Robbins, et al. identified three predictors of college success: traditional predictors that include academic ability and achievement, demographic predictors, and psychosocial predictors. [1] It is the third category that is the most changeable, and therefore the focus of Krumrei-Mancuso, et al.'s study. [2] They identified six psychosocial factors that indicate college success and are within the power of the individual to adjust. The activities and topics covered in the Connections course focus on these six factors and provide resources to help students improve. The areas are as follows: academic self-efficacy, organization and attention to study, stress and time management, involvement with college activities, emotional satisfaction with academics, and class communication. [2]

Time management and organization are issues that can cause stress for many students. Throughout the course, sessions are offered that address setting priorities, analyzing study space, test taking skills, and understanding a syllabus. Often simply becoming aware of how their time is spent can help students make necessary adjustments. Also, learning how to prioritize activities and schedule toward deadlines can be helpful. Students are encouraged to decide what works best for them personally and follow through with a plan. Learning these planning skills are extremely beneficial, as Krumrei-Mancuso, et al. found organization and attention to study predictive of first-semester GPA. [2], and first-term GPA has been shown to be a significant predictor of graduation. For example, at Tennessee Tech University students with a 3.2 or higher first-term cumulative GPA have on average a 69% graduation rate, while students with below a 2.6 have on average a 35% graduation rate. In addition to offering in-class sessions on organization and time management, students are made aware of the Counseling Center at Tennessee Tech University. This center offers class presentations and workshop opportunities to help students understand and handle stress. Methods to deal with test anxiety are also provided. This connection with the counseling center also provides awareness for other mental health services that are available. Use of a peer mentor who reaches out to the class

members individually and provides support plus the casual classroom environment allow for opportunities to adjust and hopefully alleviate some of the stress and can mitigate the student becoming overwhelmed.

Astin's student involvement theory states that student learning increases when a student is more involved in various aspects of college. [3] Krumrei-Mancuso, et al. related engagement in college activities to life satisfaction. [2] The Connections course address this in two ways – required activities and peer mentor contact. Students are required to attend a fine arts event, athletic event, and multicultural event. Tennessee Tech University offers a Center Stage series that presents lectures, concerts, exhibits, readings, dramatic performances, etc. that promote greater appreciation of the fine arts and better understanding of diverse ideas and world cultures. Faculty in the course session remind students of upcoming events sponsored by the Athletic Programs. College of Engineering students are required to attend an engineering organization meeting and encouraged to choose one of the 30 in which to become involved. The College of Engineering also sponsors a professional development series that covers topics to help students develop "soft skills." Some of these topics include diverse career paths, leadership, finding mentors on the job, finding leadership opportunities on the job, interpersonal communication strategies, networking, interview strategies, working on a team, project management and working in a global context. Further opportunities to become connected are provided through the Clay N. Hixson College of Engineering Student Success Fair where each organization and department shares information about their activities and research. It is a course requirement for freshman engineering students to attend the annual fair early in their fall semester.

While Class Communication was not found by Krumrei-Mancuso, et al. to be linked to GPA or life satisfaction, the authors suggested it influences other factors like organization and self-efficacy. [2] The Connections course includes activities that encourage the students to actively participate in the class session, and discuss teamwork which is important in the engineering profession. The course also offers a session on email etiquette and communicating with professors to help freshman students be more professional and feel more comfortable in this educational environment.

Many factors influence student learning. Newton, et al.'s research lead to several propositions about how students learn. [4] Students are more motivated to learn when they understand the purpose of what they are doing and can make connections to their personal lives and goals. Learning is affected by an individual's personality and learning style. It is also influenced by a person's ability to cope with situations and their personal efficacy. Further, college is a time when students increase their self-awareness and have opportunities to explore through experience. [4] The Connections course is one way the Tennessee Tech University is encouraging students to reach their educational goals and attain academic success.

Self-awareness is the initial phase in career development and can be defined in a number of ways. Today, technology can be used to identify/evaluate personality, interests and values within oneself. These screenings are then related to potential career options and begin to broaden students' sense of identity. One tool available to students at Tennessee Tech University is Sigi³, a comprehensive up-to-date career planning software program. This program will guide the student through a series of assessments to evaluate their values and personal career needs. It then makes recommendations to the student and allows the student to explore many different career options in one or many different majors. As reported by Reardon and Bullock, John Holland's typological theory, which is integrated in Sigi³, when used to understand dominant traits can aid students in finding an academic environment that aligns with their interests and personal characteristics. [5] Another tool our university offers is TypeFocus. This assessment program utilizes the Myers-Briggs personality inventory which is commonly used in many academic and professional settings. [6] Understanding one's personality can help increase one's understanding of self and how one relates to others. This is important in career decision making as well as success in the classroom.

Another attribute that is equally important to understand is one's learning style. The Index of Learning Styles developed by Richard Felder, Chemical Engineering faculty at North Carolina State University has been used to help the students improve the effectiveness of their study time. [7] Students take an online assessment that is evaluated and gives a score on four different learning scales, visual/verbal, sequential/global, active/reflective, sensing/intuitive. Felder includes numerous practical suggestions for how to adjust individual study habits for each different learning style on his web site. [8] Understanding one's individual learning style and adapting specific habits in regards to the process of learning can optimize the time allotted to studying. Further, recognizing professors who teach using a different style will help students to adjust their own efforts in understanding the information presented in lectures and project assignments.

CAREER INQUIRY PROJECT

A pedagogical tool was piloted in an engineering design course at Northeastern University in 2004 called the "One-Minute Engineer" (OME) presentation. [9] This tool was intended to stimulate class involvement and motivation. Over several years, faculty have used the OME presentation for first-year engineering courses at a number of institutions either in its original form or modified to fit their needs. [9]-[11] The basic concept is to have individual students give a one to three minute presentation on an engineering topic at the start of each class period. The topics the students are asked to choose must fall into one of four categories: a product or device ("The Demo Minute"), a current event, a vocabulary word, or a biography. Among the learning outcomes and program objectives, the Connections courses serve to connect students to their chosen profession and to begin developing communications skills. Having students present on a topic

that is interesting to them and has an engineering aspect to it was seen as a good way to begin this process. The small size of the class and the fact that the students are familiar with the audience is another added benefit to utilizing this tool.

After using the OME in its original form for several years, it was realized that implementation in this particular course warranted expansion to a longer and more in-depth project. In order to accomplish this, instead of having just one or two students present for one to three minutes at the beginning of each class session, it was decided to move the presentations to the end of the semester and have each student present for three to five minutes on their chosen topic. With this new structure, the Three-Minute Engineer (TME), it was felt that a vocabulary word was not realistic for the longer presentation format and that option was eliminated. The new format also requires the students to devote more effort and make it a more substantial presentation, which in turn requires more research on the student's part. This will be discussed further later in the paper.

Estell, Laird, & Yoder [11] observed that many freshman engineering students have a lack of perception regarding what they aspire to be professionally. This often results from engineering courses that focus on science and math and not on the ideas and events that motivate engineering innovation. Thus they chose to explore this through requiring the students to present their OME presentation only using the Biography option and comparing those students' recall and awareness of engineers to that of a control group of students who were assigned the OME presentation in its original format with all four options. The authors found that there was an increase in awareness of famous engineers, however the students had a lessened awareness of engineering as it relates to one's surroundings and to current world events. [11] For our purposes, it was decided that each presentation should incorporate an engineer (or working team of engineers) associated with the student's chosen topic into their project in an effort to build the student's perception of the human factor integral to all engineering.

RETENTION

The first and primary program goal for the Connections courses is to foster student success, as measured through first-semester to second-semester retention rates. Since the course was implemented in 2006, the university has seen changes in the retention rates. However, referring to Figure 1, there is no clear trend seen in these retention rates either for the College of Engineering or for the University. It should be noted, however, that there seems to be an increase in the retention rate for the College of Engineering over the last 3 years. In 2013, Tennessee Tech University initiated a program to target academic success across the university. At this time, Student Success Centers were given a high priority, and all of the Colleges hired professional advisors to handle the advising for the first two years. These advisors were given targeted training and tools to aid with first to second semester and first to second year retention rates. The College of Engineering joined the effort and hired four academic advisors. Then in

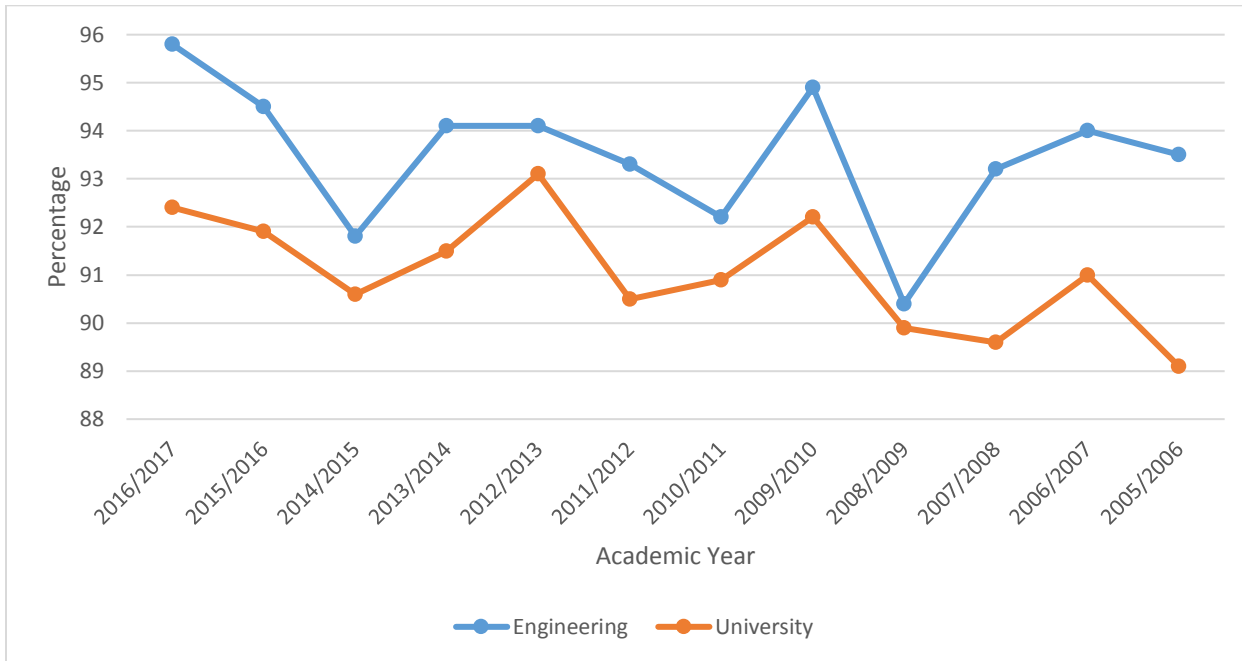


FIGURE 1
FIRST-SEMESTER TO SECOND-SEMESTER RETENTION RATES

2014, these advisors began teaching the Connections course sections in the GBE department. This is likely the driving force behind the recent increase in retention rates.

With recent turnover in upper administration, Tennessee Tech University took a look at the retention rate data and decided that further investigation of the Connections course was needed. During the 2015/2016 academic year a committee was formed to look at the current format and structure of the course as well as other similar courses at other institutions. Unfortunately, opinions varied among the committee members regarding the many options that were explored. The committee considered different formats for the Connections course most of which included adding a research project. This could be done by increasing the credit hours for the single semester course, incorporating the project as a separate course taken after the existing Connections course, or altering the course to use online modules for the student success topics and using the course sessions for the research project. A final decision was reached and proposed to the university curriculum committee; however, it did not receive favorable responses resulting in the tabling of the proposal. It was decided that more work was needed and a smaller committee was chosen to reconsider the options. The second proposal to the university curriculum committee resulted in the approval of a new set of program goals and student learning outcomes for all Connections Courses. As a result of this investigation, the new set of student learning outcomes and program goals was approved during the 2016/2017 academic year.

One strong recommendation to the departments was a request to incorporate the Quality Enhancement Project (QEP) in their Connections course through the implementation of a student project that would produce an oral presentation of the students' work. The QEP is a requirement for the university to maintain its SACSCOC accreditation. The current QEP being implemented at Tennessee Tech University is an undergraduate creative inquiry curriculum where students are exposed to all aspects of research throughout their academic experience. Unfortunately, the Connections course is only a 1 credit hour course which does not afford a significant amount of course time for implementing significant research effort into the course. However, the Engineering Connections course is already implementing this concept through the TME project. The TME project meets the creative inquiry QEP by requiring research, preparation of a presentation with visual aids, and a brief written report summarizing the project material. Through the presentation and the report, the students are practicing literacy, which is a significant component of the QEP. Another component is proper research methods and citation of sources. This is also required in the TME project and supported with workshops through the Library.

RESULTS & CONCLUSIONS

It is common for the faculty to hear “I found the activity (art exhibit, instrumental concert) more enjoyable than expected and plan to attend more”. This is an indication that students are finding the Connections course

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requirements to be helpful, especially in connecting them to the university. Other common comments include “gave me knowledge of university”, and “more to life than being in the dorm all day studying”. Another comment, “learned helpful skills and ways to succeed”, shows that the students are finding the activities regarding academic success to be beneficial as well.

Although the data suggests that there is no clear indication that the Connections Course is having the desired effect on the retention rates at Tennessee Tech University, whether within the College of Engineering or the overall University, it is still seen as a very valuable part of the first-year engineering experience. Students who are seeking it do receive the necessary career guidance as well as social and academic support.

In light of our conclusion, we recommend institutions evaluate the effectiveness of their FYE courses. We encourage implementation of any ideas shared that would enhance student learning and success through such a course.

REFERENCES

- [1] Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., and Carlstrom, A., “Do Psychosocial and Study Factors Predict College Outcomes? A Meta-analysis”, *Psychological Bulletin*, 130, 2004, pp. 261-288.
- [2] Krumrei-Manucuso, E. J., Newton, F. B., Kim, E. and Wilcox, D., “Psychosocial Factors Predicting First-Year College Student Success”, *Journal of College Student Development*, Vol 54, No. 3, May/June 2013, pp. 247-266.
- [3] Astin, A. W., “Student involvement: A developmental theory for higher education”, *Journal of College Student Development* 40, 1999, pp. 518-529.
- [4] Newton, F. B., and Smith, J. H., “Principles and Strategies for Enhancing Student Learning”, *New Directions for Student Services*, No. 75, Fall 1996, pp. 19-32.
- [5] Reardon, R. and Bullock, E., “Holland’s Theory and Implications for Academic Advising and Career Counseling”, *NACADA Journal*, Vol. 24, Spring & Fall 2004, pp. 111-122.
- [6] “My MBTI® Personality Type”, The Myers & Briggs Foundation. Retrieved from <http://www.myersbriggs.org/home.htm?bhcp=1>
- [7] Felder, R. M., Spurlin, Joni E., “Applications, Reliability, and Validity of the Index of Learning Styles”, *International Journal of Engineering Education*, Vol. 21, No. 1, 2005, pp. 103-112.
- [8] Felder, R. M., “Index of Learning Styles”, Retrieved from <http://www4.ncsu.edu/unity/lockers/users/f/felder/public/index.html>[9] Jaeger, B., and Bilen, S., “The One-Minute Engineer: Getting Design Class Out of the Starting Blocks”, *American Society for Engineering Education Conference Proceedings*, paper 2006-911, 2006.
- [10] Yoder, J., Jaeger, B., and Estell, J. K., “One-Minute Engineer, NTH Generation: Expansion to a Small Private University”, *American Society for Engineering Education Conference Proceedings*, paper 2007-1599, 2007.
- [11] Estell, J. K., Laird, L., and Yoder, J., “Engineering Personified: An Application of the One-Minute Engineer”, *American Society for Engineering Education Conference Proceedings*, paper 2008-171, 2008.