AC 2009-413: QUANTITATIVE ANALYSIS OF FIRST-YEAR EXPERIENCE MECHANICAL ENGINEERING LEARNING COMMUNITY

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Quantitative Analysis of First-Year Experience Mechanical Engineering Learning Community

Abstract

West Texas A&M University has developed a "first-year experience" program that provides freshmen a supportive environment for learning and growth, fostering a sense of community among students. This learning community is essentially a cohort system students are grouped and enrolled in the same class sections for selected courses. Throughout the semester there are facilitated study groups, tutoring, academic support services and social events scheduled for the learning community students. For the past two academic years, an external evaluation has been conducted to determine the effectiveness of this program. The evaluation consists of student surveys, focus groups, and individual student and instructor interviews. This evaluation provides both qualitative and quantitative analysis of the impact of the learning community on undergraduate students. Quantitative results from the evaluation show that all students are benefiting (i.e. retention rate, GPA, etc.) from participation in the first-year experience program, regardless of major. Interestingly, qualitative results show students are identifying the benefits of the first-year program on their academic success except for those enrolled in the engineering program. Student interviews with engineering students reflect a perceived negative impact on the academic experience of these students because of their involvement in the learning communities. However, the numbers show that the opposite is true.

Introduction

A learning community is defined as "a variety of curricular approaches that intentionally link or cluster two or more courses, often around an interdisciplinary theme or problem, and enroll a common cohort of students."[1] Historical benefits of learning communities are both qualitative and quantitative and include: increasing study skills, promoting connections with faculty, creating a sense of belonging to the university, increasing grade point averages, and improving retention.[2-11]

A study conducted by Swing[12] utilizing the First-Year Initiative Benchmarking Survey found that many qualitative improvements were made for participating students. For example, there was a 16% increase in peer-to-peer connections. "The Connections with Peers Factor is based on three response items about the degree to which the course improved the student's (a) efforts to get to know students in classes, (b) ability to meet new people with common interests, and (c) ability to establish close friendships with peers".[12] Additionally, because of the shared courses, students felt more comfortable engaging in friendships with classmates. By establishing friendships, students "reported a 6% higher mean score on overall satisfaction with the college they are attending."[12]

A study conducted at Georgia State University in 2006[13] sought quantitative evidence regarding the efficacy or inefficacy of learning communities. The researchers found that "belonging to a freshman learning community increases a student's GPA from about three-quarters to one full letter grade. . ."[13] For academic persistence, "the impact of a freshman learning community on

academic performance diminishes after the first semester, but still has a positive and significant 0.34 boost to the student's cumulative GPA one year after enrolling in a freshman learning community."[13]

Freshman seminars are also becoming an integral component to many university first year experience programs across the country[8-10] because they are seen as an excellent way to introduce incoming students to the college experience. After considering the success of first-year seminars, many universities are establishing learning communities in addition to them.[11] These learning communities are created when the first-year seminars are linked with another course, and the positive effects of these learning communities are far reaching compared to stand-alone first-year seminars.[11]

In recent years, West Texas A&M University (WTAMU) has sought to identify courses most often failed by students that are also an integral part the student's core or major curriculum. Because of this, the administration made a conscious decision to improve learning in these targeted classes, hoping to make the academic basis for all WTAMU degrees a more engaging, challenging, productive and connected group of courses that prepare students for their upper level work.[11] This has evolved into another campus initiative beginning in the 2007–2008 academic year which is the development of a program to link a first-year seminar class with a targeted class in the student's major.[11] For these classes, the faculty members joined as pairs and coordinated the content and process of their courses for the benefit of the students. Ten pairs of faculty members worked to develop relationships with one another, identify relationships between their courses, and create themes that described this connection. Linked classes were marketed extensively at the New Student Orientation sessions held throughout the summer and students enrolled in both of the linked courses or could not enroll in either. This created Learning Communities of approximately 22 students who were in the two classes together and two faculty members who were at minimum, aware of the other course, and at best using examples and ideas from both areas in the teaching of their individual content.

In 2008, researchers at WTAMU conducted a study comparing the test results and course grades between the learning community and non-learning community students.[11] The evidence strongly suggests the linked courses produced greater student success. These results indicate that students enrolled in the learning community experienced greater success than their comparisons group. Not only did the learning community students do better in the targeted course, but their success in this course was transferable to their overall grade point average at the end of the semester. The learning community students had higher overall course grades and higher GPAs than their non-learning community counterparts.[11]

The other area where there was a significant difference between the learning community and non-learning community was in terms of retention from fall to fall semester. Students in the learning community had a much higher retention rate than their non-learning community counterparts. There was also a significant difference between the overall success of students. The overall course grade for students in the learning community was statistically higher than students in the non-learning community ($p<.01$). In addition, the overall GPA for the fall semester was also significantly higher for the learning community students ($p<.05$).[11]

The unique nature of this study is the direct comparison of the quantitative and qualitative impact of the first-year experience program on freshman engineering students. Traditional predictors of student success (i.e., high school rank, ACT/SAT scores, financial need, family support, etc.) have been shown in literature to be less effective for engineering students.[14] This study provides direct comparisons that isolate the influence and effectiveness of learning communities on engineering student success, both perceived and measured.

Results

West Texas A&M University engineering students can participate in two different types of first-year experience programs. The first is for the engineering student to enroll in a first-year experience class that covers topics such as time management, study skills, etc. The course is designed to cover topics related to students' academic, personal, and professional transition to and success at the institution. Topics include career and major exploration, campus resources, critical thinking, personal wellness in addition to the academic skills components. This course will lay a strong foundation for success if the student engages with the course content, and dedicates himself/herself to improving academic skills, and further defining a career vision.

The second is for the student to enroll in a linked set of courses in which one of the courses is an introductory engineering class and the other is a targeted mathematics class with a traditionally high failure rate. Both the literature and studies conducted here at WTAMU support the notion that learning communities enhance student success. An external review of the learning community was conducted by West Texas Office of Evaluation and Research (WTER). Several assessment tools were used to evaluate the benefit of the learning community for engineering students such as student surveys, focus groups, and individual student and instructor interviews. Both options are presented too all incoming students at New Student Orientation. Students who have ACT/SAT scores below the admission standard are required to enroll in a first-year experience course, but the option to take it as a learning community or as an individual course. Engineering majors are most often advised by engineer faculty at orientation who recommend the linked courses and the first-year experience course appropriately.

Quantitative Assessment

Quantitative results from the evaluations show that freshman engineering students are benefiting (i.e. retention rate, GPA, etc.) from participation in the first-year experience program. Table 1 shows the results from for 30 freshman engineering students enrolled in a first-year experience course in the fall of 2008.

Table 1: Quantitative results of impact of first-year experience course on engineering students

2008 Fall Engineering students	1st semester Average GPA	Average ACT	Average HS Rank	Average SAT	Retention to 2nd semester
No first-year class	**2.514**	24	25.94%	1171	100%
Yes first-year class	**2.839**	20	24.33%	986	100%

The students enrolled in the first-year experience class have on average a 0.325 point higher GPA than the engineering students not enrolled in the class. This is a significant finding, but even more so because the students coming into the engineering program that do not enroll in the first-year experience class have noticeably higher ACT and SAT scores. Traditional college success predictors would indicate that these students would be more successful and have a higher GPA at the end of their first semester.[14] Results presented here are only for fall 2008, but these numbers are consistent with data from the previous three semesters (Tables 1 and 2).

Table 2: 1st semester average GPAs as a result of participation in learning communities

2008 Fall Engineering students	**No** first-year experience class	**Yes** first-year experience class
No linked classes	2.507	2.829
Yes linked classes	2.517	**2.854**

Table 2 shows the average GPAs for 30 engineering students who are in the linked classes and/or the first-year experience course. Students who participated in the first-year experience class, but not in the linked engineering classes had a 0.322 point higher GPA. Those engineering students who participated in both the first-year experience class and the linked classes had an even more significant increase in GPA, on average 0.347 higher than those who did not participate in the learning communities at all. The students who participated in the linked classes but not the first-year experience class did not have a significant increase in overall GPA (0.010). So, *quantitatively, the contributing factor in the learning community for engineering students is participation in a first-year experience class.* The direct assessment results all lead to the same conclusion: the first-year experience course and linked courses are helping engineering students succeed academically.

Qualitative Assessment

Interestingly, qualitative assessment tools such as WTER focus groups and student and faculty interviews reveal that unlike students from other majors, engineering students are not identifying the benefits of the first-year program on their academic success. Personal interviews with engineering students reflect a perceived negative impact on the academic experience because of their involvement in the learning communities. However, the numbers show the opposite to be true.

During fall 2008 focus groups at the end of the semester, the students said that they felt the first-year experience course covered study skills that they already had and did not add to their skill set. The engineering majors felt like they knew how to study before taking the course. The only first-year experience class assignment the students spoke positively about was the Career Paper that involved them interviewing a person in a career in which they were interested. Not one student stated that they would recommend that another student take a first-year experience course based on their experience. Some additional comments include:

- "The IDS course was all common sense and was the same as was what we heard in orientation."
- "I am not interested in getting to know other people who are not in my major"
- "We did not do anything in the class that related to engineering. "
- "I don't see the point in making me take this class—I already know how to study"

WTER focus groups were also conducted in the linked engineering classes during the fall of 2008. In terms of the preferences for the linked sections, students were most interested in the social factors and concerned about the scheduling of future linked courses regardless with which math class their engineering class was linked. Students appreciated the group work and group tests and said that they would often do homework and study in groups. The students liked that they could easily check assignments because they were with the same students in more than one class. They felt they were likely to continue the study relationships in future classes, and they also felt that the link is what helped bring them together to study. Some of the comments from students included:

- "Because of the link I can see some of my classmates up to 3 times a day."
- "The classes are smaller so it still feels like a small school if that is what you are used to."
- "We have sort of the same type of thinking because we all want to be engineers."
- "It was helpful to be able to come into either class with questions about the other class. You could ask the instructor of the course or other students."
- "It was great to have the same group of students in both classes."

Discussion

While data shows the benefit of engineering students' participation in first-year experience courses and learning communities, efforts are needed to help these students clearly see the benefit to them not only academically, but personally and professionally as well. Linked classes currently seem to be more effective in making this connection for engineering students as reflected in their positive responses to the experience. Students' negative comments about the first-year experience class indicate a greater need to address students' attitudes regarding the first-year seminar, and will be the focus of the discussion from this point forward.

To create a first-year experience class that appeals to engineering students, it is also important to look at how the concept of a learning community is first introduced. Engineering students typically have very high expectations of themselves[14] and their academic experience. The first-year experience class needs to be marketed to these students in a way that will help them maintain appropriate and accurate expectations of each learning experience.

First year seminars are about so much more than academic success, and sometimes it is difficult for engineering students and faculty to make that connection. As reflected in the focus groups, the students commented on not doing anything in the class related to engineering and 'we have the same type of thinking because we all want to be engineers.' A first-year experience class that is tailored for engineers should be very intentional about stating the benefits of all assignments and activities and describing how they can be translated into a career in engineering. Each topic

should be very practical and address specific benefits to their academic and professional career and success in life in general.

Especially important topics to cover in a first-year experience class are academic success skills and available campus resources to assist them in the process. Shifting the focus from basic study skills to a broader education plan could alleviate some of the frustration felt when cover topics students feel they have already mastered. For engineers, the instructor should focus on the differences in skills needed for courses in and out of the major. Engineering students are often frustrated by general education requirements and first-year experience courses provide an opportunity to help students find value in that curriculum. Skills used in those courses are also transferable to the engineering curriculum and to the profession (i.e. written and oral communication, critical thinking, group communication, public speaking, engaged citizenship, connection with other professionals/across professional lines). The instructor should also address learning styles and how to work with faculty and group members that have styles different from their own, which is often difficult for engineering students.

Communication is a significant component of first-year courses and as and engineering students can focus on how to interact and communicate with individuals outside of engineering. An effective method for accomplishing this is to make the career connection that most of the people they will work with in the future will not be engineers. Engineering students need to work at working with others like potential clients, future supervisors, technicians, and contractors. In the first-year experience class for engineers, the students should also develop a career portfolio that includes a resume which can help the students identify how to relate their personal and work histories through shared experiences and skills.

Other topics addressed in first-year seminars include resources to help students be successful in and out of the classroom and become engaged citizens in their community. When presented to engineering students, some topics (university resources and procedures, catalogs, degree plans, and registration) are readily accepted because of the obvious importance on their academic experience. Other topics that are typically covered are important but need to be presented in a way that is not too ‘touchy-feely’ for engineering students. Some of these topics include ethics and values, diversity, finances, relationships, and healthy lifestyles. An effective way to present these topics to engineering students is that they are required of informed and engaged citizens.

Conclusions

West Texas A&M University has developed a "first-year experience" program that provides freshmen a supportive cohort group for learning and growth, fostering a sense of community among students. Two academic years of external evaluation, consisting of student surveys, focus groups, and individual student and instructor interviews, show that all students are benefiting (i.e. retention rate, GPA, etc.) from participation in the first-year experience program, regardless of major. Linked classes were marketed extensively at the New Student Orientation sessions held throughout the summer and students enrolled in both of the linked courses, creating Learning Communities of approximately 22 students who were in the two classes The evidence indicates that students enrolled in the learning community experienced greater success than their comparisons group. Students in the learning community had a significant jump in GPA

compared to their non-learning community counterparts. Personal interviews with engineering students reflect a perceived negative impact on the academic experience because of their involvement in the learning communities. However, the numbers show the opposite to be true.

While data shows the benefit of engineering students' participation in first-year experience courses and learning communities, efforts are needed to help these students clearly see the benefit to them not only academically, but personally and professionally as well. Linked classes currently seem to be effective in making this connection for engineering

A first-year experience class should be very practical and address specific benefits to their academic and professional career and success in life in general. This experience and linked courses should help students find value in the core curriculum. The instructor should also address learning styles and how to work with faculty and group members that have styles different from their own, which is often difficult for engineering students. In the fall of 2009, WTAMU Department of Engineering and Computer Science will have a first-year experience class taught by engineering faculty for engineering students. The methods discussed above will be implemented in an effort to communicate these important skills to freshman engineering students.

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