

AC 2009-1256: INTEGRATED LEARNING IN FRESHMAN ENGINEERING: THE THEMED LEARNING COMMUNITY

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Integrated Learning in Freshman Engineering: The Themed Learning Community

Abstract

The first year of engineering study at Indiana University Purdue University Indianapolis (IUPUI) is the time when we see the greatest exodus of students. Thus we who work with first year students are constantly looking for strategies that will captivate, motivate, and retain students in our engineering programs. Recently IUPUI began supporting the development of what are called themed learning communities (TLCs). Themed learning communities are linked sets of courses often designed with a common theme or focus area that have been designed to attract the interest of a particular set of students. In the fall of 2007 we inaugurated two engineering TLCs. Both TLCs linked our two first semester engineering courses; additionally, in one we also linked our public speaking course and to the other we linked English composition. The overarching theme of both TLCs was the “Engineer of 2020: A national vision.” We continued the TLC model in the fall of 2008.

This paper begins by describing the IUPUI campus culture that supported the development of our TLCs. Further we explore some of the organizational challenges that we faced in getting started. We continue by describing some of the interdisciplinary and integrative activities that took place. We also talk about our theme and how we used the theme to broaden students’ understanding of engineering and its role in the modern world.

We and our students reaped both expected and unanticipated gains from our experiences. In our paper we present quantitative and qualitative data regarding student reactions to being in a themed learning community. Additionally, we compare the retention data of non-TLC students to the TLC students to determine whether participation in a TLC did make a difference in overall retention of students in our engineering program. Finally we discuss what we did that worked well, what we won’t do again, and why we want to continue having themed learning communities.

Introduction

Indiana University Purdue University Indianapolis (IUPUI) is an urban college campus. IUPUI has traditionally been known as a commuter campus catering to the non-traditional student population, but in the last several years, the campus demographics have started to change. The majority of students are still commuters, with only 23% of students living on campus. However the age of incoming first-year students has dropped rapidly, with students under the age of 25 comprising 98% of our student population in Fall 2008⁷. Most students come to IUPUI from within the state of Indiana and over half (56%) are first generation college students⁷.

Because of many of the factors above, our campus has prioritized developing first-year initiatives that will improve the experience for incoming students as well as to improve retention rates for the campus as a whole. Retention is a complex issue, impacted in part by the following variables: pre-college factors and preparation, background characteristics, students' intentions, students' expectations, students' needs, students' financial issues, institutional factors, and external environmental factors ⁷.

First generation students provide an especially critical population in regards to retention issues. While a clear-cut definition of this population is not always evident, first generation students are generally the first in their family to pursue a postsecondary education. First generation students receive less college preparation, perceive less support, and feel a lower sense of belonging than students attending college who are not first generation ¹².

Learning Communities and Themed Learning Communities

The learning community (LC) program has been ingrained in the university since the mid-1990s. It was developed to address several components of the retention issue, including student intentions, student needs, and institutional factors. Participation in a LC is one of the main factors at IUPUI related to academic success ⁷. LCs are required for first semester students. The main focus of the LC is to give students the skills to be successful in a college environment. Students report numerous benefits received from enrollment in a LC. Most notably, they report the following ⁷:

1. Making connections with other students, peer mentors, faculty, and advisors.
2. Academic advising (e.g., knowledgeable, available when needed assistance).
3. Experiencing environment that promotes and respects diversity.
4. Becoming familiar with campus and academic support resources.
5. Deciding on a major or future career.
6. Adjusting to college.

As part of “making connections,” LCs also provide a chance for students to create a network at IUPUI since LCs consist of an instructional team of a faculty member, academic advisor, librarian, and peer mentor. Tinto illuminates the importance of student engagement and networking on campus, “The frequency and quality of contact with faculty, staff, and other students have repeatedly been shown to be independent predictors of student persistence” (p. 5) ¹⁴.

The establishment of a LC also acknowledged the importance of structured classroom engagement as a contributor toward student retention. This important shift also admitted realistically that many times a classroom is the only place on campus where students can be engaged ¹⁶. At a campus like ours, where many students commute to school, in addition to having work and family commitments, the academic classroom is the one guaranteed prolonged contact point with students.

Campus assessment has shown that students who participate in a LC at IUPUI have higher first year retention rates than students who do not participate. In Fall 2007, 88% of the entering first year cohort was enrolled in a LC and one year retention for LC students was 70% as compared to students not enrolled in a LC (65%). Differences in retention among participants and non-participants are significant for regular admits to IUPUI ⁷.

Themed Learning Communities (TLCs), which were piloted at IUPUI in 2004, build on the concepts already present in a regular learning community by adding linked courses that cover a common topic. A TLC is a group of 3-5 classes connected by a theme in which students enroll together. Through planned teamwork, TLC faculty and instructional team members work together to integrate the curricula to make a difference in the intellectual lives of the students enrolled. As TLC students take the group of classes together, they quickly make new friends, form study groups, get to know faculty and staff and learn how to get the most from their college experience ⁶. Themed Learning Communities came about as a follow up to the national model program piloted at Evergreen ¹¹. Evergreen State College found that the program was successful at energizing education for both the students taking the courses and for the faculty teaching the courses.

Organizational challenges

Many of the organizational challenges faced in creation of a successful TLC were due to the various instructional team members involved. Instead of the usual one faculty member, the model for the TLC works with separate faculty for each course offered. For each TLC offered, there are 3 main instructors, including the instructors for the learning community (ENGR 195), the Introduction to Engineering course (ENGR 196), and the instructors for the outside content area (Elementary Composition or Fundamentals of Speech Communication).

Since one of the goals of a TLC is to create the coursework around a common theme, we planned initial contact meetings for all instructional team involved. The campus also supported a TLC retreat, during which instructional team members could coordinate efforts. Both engineering instructors and the academic advisor assigned to the TLCs are all full-time employees of the university and teach out of the same department, therefore have continuous contact. The instructors for the outside content areas; however, were not in the same office for planning purposes. In addition, the English and Speech instructors assigned to the TLC were part-time lecturers for the Fall 2007 semester, and were graduate students for the Fall 2008 semester. Because of this, one of the major challenges facing the team was finding meeting times that worked for the team.

Choosing the theme of “The Engineer of 2020” was the next step in creation of a successful TLC. One of the initial planning concerns was ensuring that the theme was timely, but also met with student interests. Furthermore, once the theme of “The Engineer of 2020” was chosen, the instructional team faced the challenge of fully integrating the theme into all the classes. Due to

standing curriculum requirements in the outside content areas, the instructional team was unable to include as much content from the theme that was initially intended.

We deliberately chose “The Engineer of 2020” as our theme since the book of the same title from the National Academy of Engineering highlights the importance of good communication skills, “Good engineering will require good communication”². We have found in our work with engineering freshman that they typically place little value on communication skills. Our connection with the English class or the communications class therefore was intentional and served to highlight the importance of communication skills in engineering. Again, our challenge was to maintain the curricular requirements of all the courses that comprised the particular TLC while, at the same time, integrating course work so that students could see the connection between what they were studying and its application to engineering.

The most successful components of our TLC experiences are connected to the tours that were included as part of the curriculum. First of all, we deliberately scheduled the courses in the TLC to allow time for field trips. Typically at a commuter campus such as IUPUI students often have difficulty participating in outside events due to scheduling issues. Many of our students work as well as go to school and it was necessary to insure that they had a block of time available to them for outside the classroom opportunities. This was achieved by scheduling the courses consecutively.

We wanted to offer field trip experiences or tours for students for several reasons. First of all, for several years we have surveyed incoming engineering freshman. One of the questions we ask concerns their level of commitment to their major. Generally on a Likert scale of one to five they report an average score of about four. We then ask them how much they know about their engineering major and the scores are lower. In other words, we find students expressing commitment to engineering but lacking a clear understanding of what engineering is. The tours are designed to introduce them to the variety of opportunities in engineering. Additionally, some students have a very specific idea of an engineer. Through the use of the tours we are able to introduce them to a variety of different job opportunities in engineering.

In 2007 and 2008 we took the students on selected tours of engineering research areas at IUPUI. In both groups students were to write a reflection paper about the tours. The papers included evidence that students were excited about what they had visited. It was clear that for many of them, the research areas they saw were new and informative. In the first year the reflections were done as an assignment in their learning community class. In the second year those taking English did it as part of their English class. However it was graded by their learning community instructor.

We also included industry tours in 2008. We visited facilities that were a part of the Eli Lilly Corporation. For the industry tours students were given a set of questions and were asked to get the answers during the tours. They were also instructed to come up with their own set of questions.

Both groups discovered that communication skills are essential for engineers in industry. One of the tour guides when asked by a student in the TLC linked with communication about the need for communication skills said that they were essential. He told them that meetings were an integral part of his job and he laughed and said that they had meetings to plan meetings. That brought home to all the students the importance of communicating effectively.

The students in the English TLC visited a different Lilly plant. The production supervisor told the students about all the writing and documentation required in his job. Neither tour facilitator was coached in any way to say what they did about communication skills in the engineering workplace. What they said effectively conveyed the importance of communication skills within the context of work in the engineering profession. Students completed a reflection assignment for the industry tours but this was done for the ENGR 196 class.

Procedures and data collection

We used a mixed method research design to investigate whether participation in a themed learning community provided any advantages to students and made a difference in the overall retention of our first year engineering students. As described in John Creswell³, mixed methods include the collection of both quantitative and qualitative data. We choose this methodology because it provides the opportunity to not only review the direct measures such as retention information and GPA but to also investigate the reasons for the possible differences. We first began our study by getting Institutional Review Board approval to use the information from the IUPUI Student Information System (SIS) and to solicit survey information from TLC participants. The SIS system is the central university system-wide repository of student information.

We began with the quantitative portion of the study by analyzing the retention information from SIS. This involved looking up each student enrolled in a TLC and comparing their GPAs to that of first year students with similar demographics who were enrolled in the stand-alone ENGR 195 course. Additionally, we had access to campus data for all students enrolled in a TLC that is part of ongoing data collection occurring at our campus.

For the qualitative portion of the study we developed a survey (Appendix A) containing six questions and requested comments for each question. The survey was emailed to all students enrolled in both the fall 2007 and fall 2008 TLCs. Students could either return them by email or leave them anonymously with our unit secretary. Surveys were sent to 97 students. Seventeen (17.5%) were returned. We then analyzed the emerging themes that appeared as part of our qualitative data.

Findings

Students participating in a TLC had higher CGPAs campus-wide when compared to peers who only participated in a regular LC. In addition to the higher one year CGPA for TLC students as

shown in Table 1, overall retention rates are also higher for students enrolled in a TLC. One-year retention rates for TLC students campus-wide reached 76% for the 2007 cohort as compared with 67% for non-TLC students ¹. More specifically, the retention of IUPUI students participating in an Engineering TLC (78.7%) was higher, although not significantly, than the campus average of 76%.

Fall 2006		
	N	Adjusted GPA
TLC Participants	312	2.75
<i>Non-Participants</i>	1324	2.53
Fall 2007		
	N	Adjusted GPA
TLC Participants	535	2.79
<i>Non-Participants</i>	1499	2.55

- Comparison group – students who participated in a freshman seminar or learning community.
- *G.P.A. adjusted to control for significant covariates including: course load, gender, ethnicity, SAT scores, high school percentile ranks, units of high school math, and first-generation students.
- Bolded items are significant $p < .01$

Table 1. TLC First Semester GPA⁷

It is more helpful to look deeper to see that the overall engineering retention was also higher in the Engineering TLC. One-year retention was measured by enrollment in Fall 2008 in an Engineering major. 65.9% (n=47) of the Fall 2007 cohort were retained not only at the university, but within Engineering. Conversely, only 55% (n=119) of students enrolled in a traditional LC stayed in Engineering.

Fall 2007		
Overall TLC Retention		
	N	Retention Rate
TLC Participants	565	76%
<i>Non-Participants</i>	1690	67%
Engineering TLC	47	78.7%
Engineering Retention in the Major		
	N	Retention in Major
<i>TLC Participants</i>	47	65.7%
Non-Participants	119	55%

- Comparison group – students who participated in a freshman seminar or learning community.
- *Bolded items are significant $p < .05$, even while controlling for differences in demographics, enrollment, and academic preparation.

Table 2. TLC Retention⁷

Several major themes arose from the qualitative student responses (n=17), the most evident being the role of the TLC in developing relationships. When asked in the first question what would have been missed if the students had not participated in a TLC, 76% of the students responded indicating the importance of meeting other people, including other students and faculty, even though this question did not ask about personal relationships. Several responses are sampled below:

- “The TLC program helped me to meet the other students and create friendships with students like me that were involved and interested in similar things as I am.”
- “I would have missed the opportunity to make some great friends inside my own major. I still have my friends from the TLC.”

Other responses (n=4) indicated a belief that the TLC allowed an opportunity to find out more about Engineering as an area of study; however, the overwhelming response focused on the importance of relationships.

Later, students were asked whether they formed any lasting friendships or relationships as a result of being in the TLC, they responded just as strongly in the affirmative with all 17 students in agreement. Below is a sample of the responses:

- “I think the aspect of getting to know fellow students better is one of the strengths of the TLC. The projects in ENGR 195 and ENGR 196 helped to accomplish this, as well as the group work done in speech class.”
- “I formed several [friendships] and that’s why I am an avid believer in the program.”
- “I now have a group that I tend to study with that all started from the TLC. Especially with an engineering major, I feel it is very important to network and meet people. Otherwise, I feel the course load would be too much.”

While the importance of relationship development was clearly evident in student responses, students did give some constructive feedback on ways to improve the TLC. Many had no suggestions for improvement; but, others pointed toward an increased need of communication and connection between the courses, “I think that the teachers should communicate with each other more often.”

Additionally, the lab tours and industry tours were considered valuable by the majority of students. Students reported an increased knowledge about engineering research from the labs:

- “I liked the lab tours and think they helped me enforce my major. I learned what goes on in the engineering labs and increased my knowledge of engineering by learning what tools and skills are needed for different engineering fields.”

- “The lab tours were incredibly cool and I think they helped me gain some insider knowledge about the research end of engineering.”

Although the TLC was purposely linked to Elementary Composition and Speech to emphasize the importance of both writing and speaking skills to engineering, many students failed to see the connection, “I didn’t think the English class ‘matched’ with the other 2 classes very well.” Another student wrote, “The English class did not feel like it belonged in this group...”

Discussion

As noted above, one particular theme from the qualitative data prominently emerged. Over and over students reported that participation in the TLC helped them make friends. The overwhelming response to the first survey question was developing friendships. This consistency and power of this result was somewhat unexpected. However, further investigation of the literature shows that the development of peer relationships contributes to student well-being and overall retention.

Vincent Tinto, in his landmark work *Leaving College* (1987), states that failure to persist in college is caused by at least one of four general triggers¹³. These include adjustment problems, lack of institutional fit, academic difficulty, and isolation. Tinto (1999) further noted “the frequency and quality of contact with faculty, staff, and other students have repeatedly been shown to be independent predictors of student persistence”¹⁵. Zorn and Gregory (2005) writing about assimilation and friendship among first-year medical students further state that friendship development takes place simultaneously with adjustment to medical school¹⁷. According to Barefoot (2000), increasing “camaraderie built around academic course work” (p. 15) is essential to first year success². Pittman and Richmond (2008) suggest that “intervention programs aimed at enhancing students’ sense of belonging and assisting students in developing positive ties to friends would increase adjustment and ultimately success in postsecondary education,” (p. 358)¹⁰. All of these authors agree that making friends and developing peer relationships contribute to improvement in retention – a significant concern for all in higher education.

Furthermore, student development theories such as Chickering and Reisser’s seven vectors recognize that students grow in their ability to make “mature interpersonal relationships” (p. 187) during their college experience⁴. Antonio (2004) states that students craft this progress in context of their relationships with others¹. Our findings dramatically reinforce the work of all of these authors. Even though the TLC students had the opportunity for field trips and other informational events related to engineering, in the survey the students repeatedly comment about how they were able to make friends in the context of the TLC. Additionally, students related that they did not think the same friendship development opportunities would have existed outside of their participation in a TLC.

Students in both years participated in tours of the research labs and in the 2008 year they also had the opportunity for an industry tour. We did find that many students, seeing themselves

employed by industry, did not fully understand the relevance of research labs to their potential field. Educational reflection would have been useful to see the lab experiences as part of a potential career in engineering. Overall, over half of the students reported that the lab tours were interesting and improved their knowledge of engineering. The remaining students either had no opinion or felt that the lab tours were irrelevant to them.

The 2008 cohort also had an opportunity to go on an industry visit. Those who participated found them interesting but answers to this question are less emphatic than the responses to the first question regarding total impact of the TLC and friendship development.

We also solicited student feedback regarding the quality of integration of courses. Again, responses varied from those who thought all courses were well integrated to other who didn't see any connections. Finally, we asked for suggestions for improvement. Many had no suggestions; others thought that instructors should communicate better. Increased communication between instructors and connection between courses can help to make the coursework more relevant for students. In this way, they can understand why the courses are linked together and the connections, such as writing or public speaking, can weave through all the course components. Even though the intention of linking engineering courses with writing and speech was to emphasize the connection between topics, many of the student responses made it clear that this was not developed enough.

Limitations

There are several factors that may possibly affect the retention results and interpretations. First of all, the TLC sections closed earlier in the new student registration period than the conventional learning community sections. It is easy to postulate that the more engaged student is the one who is more eager and likely to attend an early new student orientation program when more scheduling options are available. Additionally, one of the linked courses, ENGR 196, the engineering tools course has a math co-requisite of pre-calculus. Thus, only students with sufficient math preparation were able to participate in the TLC. While new students must be calculus-ready to be admitted to engineering at IUPUI, the University enrolls students with weaker math preparation and these students who had declared majors in engineering were represented in the non-TLC sections of the learning communities. The university has found that under-prepared students may be less successful than fully qualified admits. The number of under-prepared students included in the data is not known.

Finally, we have tracked students for no longer than two years. It is important to continue to follow students to determine their persistence to graduation.

Recommendations

After participating as team members in the TLCs for two semesters, we have several recommendations for individuals or institutions trying to establish a TLC program.

1. Our overall recommendation is for first year programs in engineering to find ways to encourage the development of relationships in the classroom. More research needs to be done to determine the overall impact of relationships on retention, but our study suggests that the relationships developed through linked courses could have a positive overall impact.
2. Ensure that opportunities are available for students to work together both inside and outside of class. Relationships made during the semester may be a key part of the success of the Engineering TLC for our institution.
3. As much as possible, integrate the curriculum. For instance, it is very possible to read a book or article required for English that has an engineering connection. Speeches can be made on an engineering topic. Integration is essential so students understand the connection between the classes.
4. Include an outside of class experience during the semester. More than any of the activities that our TLC participated in, the Engineering lab tours and industry visits, were key moments to integrate the theme and curriculum in all three courses of the TLC.
5. Ensure that the instructional team is able to meet early, ideally the semester before the class starts, and often. Communication among the TLC should also occur throughout the semester in order to address any concerns, issues, or even successes that happen during the semester. Good communication and coordination will ensure that students are receiving the same message consistently.
6. Utilize the student mentor often throughout the semester. Due to their unique position as a current student as well as an instructional team member, the student mentor has a great connection with students and will be able to solve or at least address individual challenges better than the rest of the instructional team.
7. Plan the scheduling of courses so that students will have a block of time during which they are unable to schedule another class. This block of time can be used for group lunches, study groups, or class projects.
8. Guarantee that the classes in the TLC remain linked so that all the same students are enrolled for all classes in the TLC. Part of the effective piece of a TLC is the continuous time the students spend together in class and the interaction they are able to have in different class environments.

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Appendix A

TLC Interview Questions

1. If you had not participated in a TLC what do you think you might have missed in your first semester experience?
2. Discuss whether the lab tours increased your knowledge of engineering.
3. Discuss whether the industry tours increased your knowledge of engineering.
4. How well do you think your TLC courses were integrated as far as curriculum?
5. What could we have done differently to improve the integration?
6. Did you form any lasting friendships or relationships as a result of being in the TLC?
7. Are there any other comments that you wish to make about your TLC experience?