A Qualitative Investigation of Students in a First-Year Engineering Learning Community

Michael Thompson\(^1\), William Oakes\(^2\), and George Bodner\(^3\)

Purdue University

Abstract - Computer science, engineering and technology (CSET) education faces many challenges to prepare graduates for the changing global workplace and to accurately retain students. Learning Communities, where students are grouped in cohorts for classes and residence hall assignments, provide a useful vehicle to achieve these goals. In addition their potential to facilitate service-learning has motivated the Department of Engineering Education at Purdue University to implement Learning Communities on a large scale for first-year engineering students. The 2003 cohort involved over 140 students. The focus of this paper is to fill a void in the literature by conducting and reporting a qualitative investigation of how students perceive their experiences and their resulting impacts after being involved in the Engineering Learning Communities. Results from 20 interviews are summarized as well as recommendations for programmatic improvements.

Index Terms - First-year students, Learning Community, qualitative investigation, retention, service-learning.

INTRODUCTION

Computer science, engineering and technology (CSET) education faces many challenges to prepare graduates for the changing workplace and to accurately retain students. The new demands for graduates to work in the emerging global economy have prompted many efforts to significantly change engineering curricula. Learning Communities have the potential to enhance students' appreciation of diversity and multiple perspectives, to actively engage students in their chosen major and to increase students' ability for diagnosing and addressing their learning needs.

A Learning Community is a deliberate restructuring of the curriculum to foster positive interactions among students and faculty [1]. A growing body of literature on the learning community movement [2] has reported great success [3,4]. Learning communities, where students live and/or take classes as a cohort, have been deemed successful because they contribute to the more facile transition into social and academic college communities. This facile transition has been correlated with higher retention and students' academic success in college [5,6]. In 1999 the Department of Engineering Education at Purdue University implemented the Engineering Learning Communities (ELC) as part of a university-wide retention initiative. In 2003, the program was expanded to more than 140 students and organized around a set of service-learning experiences.

While there have been many reports on learning communities in the literature in the form of discussion articles, theoretical underpinnings, and quantitative studies, there is a dearth of qualitative research on learning communities that have described the experiences and the resulting impacts in an engineering environment at a university. Previous quantitative studies have shown that Learning Communities are popular with the participants and that participation correlated with increased retention. The missing pieces, which can be addressed with a qualitative study, are to understand the critical components for these successes and the impacts of the programs on the individual participants. The focus of this study is to fill this void in the literature by reporting how the students' perceive their experiences and their resulting impacts after being involved in the ELC. Recommendations from the students' perspective about how to make the program better are also included.

First-Year Engineering Learning Communities

All of the approximately 1600, entering students admitted to the engineering program at Purdue University. They all complete a set of required common courses before moving on to the individual engineering departments. In the first semester, students typically take calculus, chemistry, an introductory engineering course, a seminar course, either English or communications and an elective.

As part of a university initiative, all engineering students are offered membership in one of three Engineering Learning Communities (ELC). Placement in the ELC is done on a first-come first-served basis. The ELC is comprised of a residential component and a curricular component. Each ELC participant is offered a space in the residence halls with fellow ELC students. Each ELC student is registered in a cohort of 28 students in common sections of the first engineering course (ENGR 106, Introduction to Engineering Problem Solving and Computer Tools) a one credit seminar class, and either

\(^1\) Michael Thompson, Graduate Student, Chemical Education, Purdue University, thompsmg@purdue.edu
\(^2\) William Oakes, Associate Professor, Engineering Education, Purdue University, oakes@purdue.edu
\(^3\) George Bodner, A. Kelly Professor of Chemical Education, Purdue University, gmbodner@purdue.edu

0-7803-9077-6/05/$20.00 © 2005 IEEE

October 19 – 22, 2005, Indianapolis, IN

35th ASEE/IEEE Frontiers in Education Conference

S2E-1
Communications or Chemistry, depending on which ELC they request. The three classes involved in the cohort are linked through a common service-learning project. Out of class activities are also conducted to help the students meet each other and with course instructors [7]. In the Fall semester of 2003, 143 students participated in the ELC with 218 participating in 2004. This study focuses on the Learning Community aspects of the 2003 cohort. A companion paper has been published focusing on the service-learning experience facilitated by the Learning Communities [8]

METHODOLOGY

I. Participants

This study was conducted at Purdue University. There were 143 first-year engineering students who were involved in the ELC with a required service-learning component. Out of these students, 20 student interviews were conducted. Participants were selected using purposeful sampling to insure representation from female and underrepresented minority students. Students were sorted into three performance groups based on their team’s performance in the service-learning project. The service-learning projects were sorted into high, medium, and low performance based on the instructor and community partner evaluations. Because the service-learning experience was such a central part of the curricular integration, it was believed that taking students from these different performance groups would provide the most representative sample of experiences. Participants were randomly solicited for the interviews from students in each of these populations. The interview population consisted of 10 females and 10 males, five of whom were from underrepresented populations. Stability in the data was reached with the length of the interview time, an average of 50 minutes, and number of participants interviewed [9].

II. Procedure

Each of the 143 students was solicited via e-mail after their service-learning projects were completed during the first semester. Phone calls to 10 women and 10 men were made out of those students who responded and fell into the cohorts referenced above. Follow-up email confirmations were sent with the time and date to meet for the interview. Interviews were held in a room of a building that was not an engineering building at Purdue University to help ensure the privacy of the participants. At that time students were informed in more detail of the purpose of this study. Informed consent was well discussed and students were told of the opportunity to be able to review their transcripts at a later time if they so chose. Students were asked if they wanted to choose a pseudonym for themselves. If they chose not to they were told that they would be assigned a pseudonym to maintain their anonymity. These pseudonyms are used in this study.

III. Data Source

To obtain data for this study a set of interview questions were generated. These questions were specific enough for conducting the interviews in a standardized fashion, but general enough to let the interviewer address and readapt topics as he thought were pertinent to the study. These audio-taped semi-structured individual interviews were conducted in the spring of 2004. Individual interviews ranged from 35-70 minutes and roughly 12 questions were asked to solicit students’ descriptions of experiences they had during and as a result of participating in the learning communities. These questions are listed below:

1) What impact did the learning community have on your first-year experience?
2) What was your most positive experience that you got out of being involved in the learning community? Negative?
3) Has being in this learning community affected your grades, how and why?
4) Do you feel like you were in a community, why or why not?
5) Is being involved in a community important to you, explain?
6) Why did you choose to be in a learning community?
7) Was the learning community what you expected, why?
8) Would you be involved in this program again, why?
9) Would you recommend this program to your friends, why those people?
10) Should this program be mandatory?
11) What would you change about this program?
12) Is there anything else about this program that you think is or is not necessary about this program?

IV. Data Collection, Analysis, and Presentation of the Results

The data came from the verbatim transcription of these interviews. Interviews were checked with the audiotape to ensure accurate transcription. Approximately 13 hours of audiotape resulted in about 400 pages of transcripts. Data were then uploaded into a computer software program called Atlas.ti [10] to aid in the organization and analyses of the data.

The data were then mined for emerging themes. Initially these themes were grouped with the specific interview questions that were asked. Once answers to those interview questions were grouped together, general assertions were made. These assertions represented the perceptions of the students’ experiences who participated in the ELC. These assertions are:

1. Students joined the ELC because they thought it was a great way to develop friendships;
2. Friendships are defined in terms of developing personal relationships, social activities and study groups, and
3. Students perceived that the ELC was beneficial because their experiences translated into impacts in the form of enhancing students’ appreciation of diversity, generating motivation, and getting better grades.

To give a more accurate view of these students’ perceptions of their experiences as well as the impacts of their experiences the presentation of these results are given in the form of a narrative in the next section.
RESULTS

The transition from high school to college is not trivial. First-year students entering a large university, such as the West Lafayette campus of Purdue University, have to leave home, their parents, and their high school friends. The Purdue University West Lafayette campus has a population of about 35,000, with about 5,000 new first-year students. These students have to enter, adapt to their new environment, and then succeed in their classes. First-year engineering students enter a common first-year program and must achieve a minimum grade average in their required courses before they can enter their desired engineering department. These stresses of adjusting to college can be daunting, especially with little to no personal support system in the form of relationships.

Students joined the ELC to develop friendships. It is interesting to note that most students who stated that they joined the ELC because they wanted to get to know people also mentioned the importance of having small classes. This is exemplified by first-year engineering students Amber, LaShawna, and John. Amber stated, "Sounded like a good idea to have small classes and get to know more people". LaShawna stated, "That we’d all have the same classes, having close friends and someone we know in class". John also illustrates this idea but provides a more detailed reason why having the same class is important.

It’s a big campus and coming from a school of 2000 I was used to see all the same kids pretty much everyday. It’s a lot different here. I was able to focus that down a little to get to know people a little faster. That’s the main reason I got into it.

Many students in the study also directly mentioned how developing friendships is directly related to facilitating a more facile transition from high school to college when asked why they got involved in the ELC. "I think it may have said something about smaller groups, which I figured would be good to start adjusting to college life", stated Dawn. James stated,

Well, I got a letter in the mail talking about it. When it was talking about living close to each other and taking the same classes it seemed like the transition to college would be easier. I know there are certain people I can refer to.

These friendships that the students developed and discussed were used for three main reasons: developing personal relationships, social activities, and study groups. Personal relationship in this study is defined as an understanding of trust and willingness to go out of their way between two or more people for each other/s. The vignettes taken from the research participant Jennifer demonstrate how personal relationships were developed in the ELC.

I think it made it a lot easier for me to adapt to college because I automatically had friends. Some of them are still friends. There were people I’d know just walking thru the dorm from the 30 that were actually in my LC and it helped a lot. Just this past week, for a random example, I was having back pain Sunday night so I wanted to go to the hospital and it was about 4:00 a.m. One of the guys from the LC was online and he said he’d go with me and it turns out I had kidney stones! It was so painful and lasted for days and it was so nice of him to offer to go to the hospital with me at 4:00 in the morning when he had a class that morning. I didn’t expect that. I thought that was cool. That the friends I’d made were willing to do that.

Yeah I think that (the ELC) helped because there are 2 guys online from the LC at night that I talk to. I have a bunch of them in my buddy list on AOL and the one guy that was in my Engineering 106 group I messaged him first and told him what was going on and he told me I should do something about it since it was hurting so bad and then he told the other guy and the other guy was the one who offered to help me. I knew both guys and that’s how I ended up having one of them take me to the hospital. So I do think it had something to do with the community – all knowing each other and getting along well.

Many students also developed friendships for social activities. These social activities were not organized by the ELC program but were organized by individual/s or group/s of students. Students appeared to need a social outlet from their scholastics and the ELC allowed them to better accomplish that need as discussed by Lance.

I thought it was great. I made a lot of friends. If I hadn’t I probably would have only those on my floor and they wouldn’t have been in my classes, even. It would’ve been a more loose connection. Now, I’ll be with 4 of them in the same fraternity and we can continue being together until we graduate. It was definitely a good idea.

The most prevalent reason why students developed friendships beside the development of personal relationships is for the development of study groups. The students in this study indicated a sincere desire to do well in college. Students recognized that working in a group towards a common goal such as understanding of course material would be easier than working by themselves. Students not only formed study groups, which they perceived as helpful, but also continued those study groups throughout the next semester after the ELC ended as indicated by Rachel and Patricia.

Rachel: It actually helped a lot. First semester we did our chemistry HW together and studied together and all...
Students who participated in the ELC showed many positive experiences that had a direct positive impact on their lives and their transition to college. These included an enhanced appreciation of diversity – students got the opportunity to meet different kinds of people that they may have never got the chance to meet outside of the ELC. Both Lance and Paul illustrate this.

Lance: It was hard coming in the beginning because I didn’t come with friends. I knew a couple of people but we weren’t really friends so having a LC made quick friends right away and we’ve stayed in touch since then. That helped me. I wouldn’t have met someone from Illinois or Ohio maybe but not at this stage if I’d gone somewhere else. You meet all kinds of people – some that have different beliefs – it’s a healthy kind of thing. Getting outside of what you’re used to.

Paul: It was nice to have a core group of friends. They were just as motivated as I was and had the same ambitions and drive to succeed. They were just really fun people. Since you’re in classes with them all the time you get to know them well. Because of that experience we still all meet and get together even though this semester we’re not all in the same classes. We still do HW together.

Students also reported that they maintained their motivation or were motivated by having a group with similar group attitudes, and that by helping each other understand the course material they got better grades. The feeling of the students was validated in their course work in the common first engineering course, ENGR 106 – Introduction to Engineering Problem Solving and Computer Tools. This course is required for all first-year engineering students. The ELC students were all placed into the same lecture section which had a 4% higher average than the non-ELC sections, which was a significantly larger difference than one would expect on the basis of incoming metrics. The ELC average SAT Math score, for example, was only 2 points higher than the average of the non-ELC students. All of the assignments, testing and grading was common across all of the sections of the course except for the service-learning project completed by the ELC students. The ELC students outperformed the non-ELC students in almost all aspects of the course. The data indicated that the students felt more comfortable with each other and had better access to each other to give and get help on their courses from their peers. These feelings are illustrated by student vignettes by Natasha, Dominick, and Anthony.

Natasha: It's nice to have a core group of friends. They were just as motivated as I was and had the same ambitions and drive to succeed. They were just really fun people. Since you’re in classes with them all the time you get to know them well. Because of that experience we still all meet and get together even though this semester we’re not all in the same classes. We still do HW together.

Dominick: Chemistry would’ve killed me (without the ELC). I think it helped in my speech class because I hate public speaking with people I don’t know but it helped there because we were just talking to friends. Our 106 thing we had the same people in our lab as in class and it worked out really well because if you have a question you’re not afraid to ask somebody. Math killed me in the beginning but because half the people were taking the same classes as I was it got easy. We had small study groups and it worked out well.

Anthony: I did really well my first semester...better than I thought I would. I think it helped because there was always people I could go to if I had a problem and they could come to me and it helps understand more so there’s always people to work on homework with. That’s still going on, too. We still do Physics together.

RECOMMENDATIONS FOR CHANGE

In this study students were purposefully sampled from the high, medium, and low performance groups to get the most representative experiences of those in the ELC. It was assumed that those in the medium or low performance groups would report more negative experiences. However the results were remarkably positive from all groups, with only one negative comment given by one participant from a high performance group.

Charles: Looking back, if I’d known exactly what it was I might not have signed up. Maybe I could’ve met more people without it if I wasn’t with all my English and Engineering peers. I could’ve met other people and gotten to know Purdue more. It wasn’t that big of a deal, tho’.

The overwhelming positive data from the interviews is consistent with the quantitative data from the course and program evaluations [7]. Although qualitatively and quantitatively the students found the ELC experience to be very positive and believed that the ELC should be continued, students did express some recommendations to improve the ELC experience.

October 19 – 22, 2005, Indianapolis, IN
Amber: They need to have a fun party the second semester for everyone who was in it to see how they’re doing.

Dawn: I think if we’d been able to do some other class that I could’ve gotten involved in the 2nd semester and maybe done more community service projects or continue what we’d been doing as a follow-up that would be better. That way you still interacting with those people more.

Many students have made very similar comments to the statements made by Amber and Dawn. Students expressed their desire to either have a structured social event after the end of the ELC program or stay in the ELC a second semester with second semester service-learning projects. Based on scheduling constraints it is not yet feasible to offer the ELC for more than one semester.

We do suggest that those who want to start a Learning Communities program, that having a structured social activity after their program possibly in the second semester or continuing their program throughout a second semester would be highly beneficial. We are currently discussing how we can offer the ELC program for a second semester.

DISCUSSION

Retention has always been a concern among engineering educators. We want to retain the right student more so than all students. Too many students, especially from underrepresented populations are leaving engineering because they don’t feel connected or they don’t see engineering fitting with their interests. The ELC with the service-learning component creates an environment where students can become connected and see engineering within a local community service context [7]. In addition, as shown in students’ excerpts, many students felt that it was important to have the same core courses because it to was a mechanism to be connected and more engaged in the classroom.

It has been shown that retention increases when students engage in service learning [11]. In general the service-learning program appears to be a vehicle that attracts a high percentage of women and minority students [7]. This may suggest that the ELC with its’ service-learning component also has the potential to have a positive impact on the retention of underrepresented groups in engineering. This is a topic that should be researched and addressed in the future.

Another topic that should be further researched is how important it is for students to live together in a learning community. Our current ELC model allows students to decide if they want to live with a group of ELC students. The data suggest students did have a very high level of satisfaction with the learning community experience [7]. The majority of the 2003 cohort lived together but this factor was not controlled for in the interviews.

Students in the ELC have demonstrated an overall sense of belonging and motivation. They also had the opportunity to experience what it is like to do engineering [8]. Students in the ELC not only learned how to work with a diverse group of people but they also began to understand why diversity is important. Students thought that the ELC was an actual community, one that they felt safe and supported to address their learning needs as they made the transition from high school to college. These outcomes are supported by Tinto’s model linking classrooms, learning and persistence [12] as well as other additional research that has also shown that making new friends is important for college adjustment and self esteem [13] [14] [15]. For these reasons the ELC appears capable to provide a vehicle for the retention, the learning, and in addition the appreciation for diversity in our engineering students.

REFERENCES
