

Using Learning Community Course Links to Bring Meaning to the First-Year Engineering Curriculum

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Abstract

The Iowa State University Department of Agricultural and Biosystems Engineering (ABE) has created a successful learning community for incoming ABE students. In this paper, we provide an overview of our learning community structure and describe the collaboration between the departments of ABE and English that has fostered a cross-disciplinary initiative that includes students writing papers relating to agriculture and engineering in composition and using newly learned technical writing skills for report writing in engineering graphics and design and engineering problem solving. Both quantitative and qualitative methods were employed to assess the ABE Learning Community. Results are reported, including survey data which reveals that on average, students agreed or strongly agreed that they developed or enhanced their team skills through collaborative assignments in their learning community classes, and on average, students agreed or strongly agreed that they are excited to be a part of the field of engineering and technology. Focus group data are also reported.

Introduction

University campuses across the nation are adding learning communities, a pedagogical innovation aimed primarily at first-year students. Learning communities typically involve purposive groupings of students, collaborative approaches to learning, coordinated scheduling, and an emphasis on connecting material across disciplinary boundaries¹. In the last several years, faculty from a number of engineering departments have reported their various experiences with learning community initiatives. Programs range from a fully integrated first year curriculum at Texas A & M² and West Virginia University³ to co-enrollment of students in select classes at the University of Wisconsin-Madison⁴ to integration of material across linked courses at Utah State⁵ and MIT⁶. As might be anticipated, each program is unique and has grown out of a desire to meet perceived students' needs at a particular university.

At Iowa State University, learning communities have existed since 1996; internal grants to support learning communities have been available since 1998. As has been the case at a number of universities, learning communities at Iowa State were developed to increase student retention and improve the academic performance of first-year students by meeting some of the social and academic needs of the participating students.^a Much like the reports found in the engineering education literature, learning communities across our campus vary: from students having a

^a Research conducted by Vincent Tinto (1993)⁷ suggested that students' departure from college was influenced by students' lack of academic and social integration into the university. Learning communities have been designed to foster this integration.

common schedule or group of classes to students living together in one residence hall to special activities designed to enhance career exploration. The Agricultural and Biosystems Engineering Learning Community (ABE LC) is of particular interest due to the impressive impact it has had on student retention^b (from 47.6 percent for the 1997/1998 academic year to 86.2% for the 1999/2000 academic year) and due to assessment data, which reveals students' overwhelming satisfaction with the program. In fact, a group of first-year students from the 1999-2000 academic year were so impressed with the program that they requested a sophomore version of the learning community (LC). We accommodated this request.

In the following paper, we will briefly describe our current LC arrangement, which is now in its second year of implementation. We will focus primarily upon the linked courses in our curriculum. In addition, we will report findings from our assessment of the 1999-2000 academic year, as well as the fall 2000 semester.

Overview of the ABE Learning Community Initiative

The Department of Agricultural and Biosystems Engineering (ABE) at Iowa State University administers two separate curricula, the Agricultural Engineering (AE) curriculum in the College of Engineering, and the Agricultural Systems Technology (AST) curriculum in the College of Agriculture. The learning community was designed to enhance our students' academic and social lives, in addition to providing an opportunity for students from our two majors to have at least one class together (first-year composition). Comprehensive objectives, as well as specific ABE LC objectives, have been designed to help guide our program development and on-going assessment.

ABE Learning Community Objectives

We established the following comprehensive objectives for the ABE LC initiative:

- To build community for entering first-year students within the Agricultural Engineering (AE) and Agricultural Systems Technology (AST) curricula
- To increase the retention of the first-year students in the AE and AST programs
- To increase recruitment of students into the ABE curricula, especially underrepresented students (women and minorities)
- To enhance learning and team skills using collaborative, learning-based educational methodology in the learning community courses
- To improve written communication skills by creating a writing link between the first-year composition courses and other technical courses in the AE and AST curricula

Specific objectives for the ABE LC were also identified:

- To build excitement for the fields of engineering and technology
- To increase student involvement within the department of ABE
- To increase student interaction with the ABE faculty
- To increase student interaction with ABE upper-level students

^b Retention is defined as first-time/first-semester agricultural engineering (AE) college students who have remained in the AE curriculum through the tenth day of the first-semester of their sophomore year.

- To have students learn about the differences between the options within the AE and AST curricula
- To develop team skills through the use of collaborative, learning-based assignments
- To introduce students to various problems (areas of interest) within the agricultural engineering and technology field
- To experience hands-on laboratories related to the AE and AST options
- To increase involvement in professional societies and student branches
- To introduce technical writing skills during the first year of study
- To make first-year composition courses more meaningful to students
- To establish career development/job preparation
- To receive academic guidance related to curriculum issues

Learning Community Course Links

Course links have been designed to be the primary support for our LC. By having students take a common set of linked courses, we hope to create community and meaning for our incoming first-year students. Students must enroll for two of the three classes in the learning community core in order to participate.

AE First-Year Learning Community Core

Fall 1999 & 2000

- Engr 101 (R cr.)^c Engineering Orientation for AE Students
- Engr 170 (3 cr.) Engineering Graphics and Design
- Engl 104 (3 cr.) First-Year Composition I (course link with Engr 170)

Spring 2000 & 2001

- A E 110 (1 cr.) Experiencing Agricultural & Bioystems Engineering
- Engr 160 (3 cr.) Engineering Problem Solving with Computational Laboratory
- Engl 105 (3 cr.) First-Year Composition II (course link with AE 110/Engr 160)

English 104 and English 105 are the two classes in the learning community that not all students are required to take due to university placement policies. At Iowa State University (ISU), students are placed into first-year composition based on their ACT scores; therefore, many of our students majoring in engineering test out of English 104 due to their high ACT scores. In addition, some students bring college credit for English when they matriculate from high school; therefore, not all ABE students take English 104 or even English 105 at ISU. During the fall 1999 semester, AST and AE students were placed in the same section of English 104, a strategy needed to fill one section of English (26 students). We also hoped that combining AE and AST students into one section of English 104 would create community between these two groups of students. During the spring 2000 semester, the AE students were all placed in one section of English 105 (ultimately 24 students). All four of the engineering courses are offered as ABE sections and are primarily taught by ABE faculty. Tutoring for math and physics courses is also provided for AE LC participants.

^c R cr. is an abbreviation for *required credit*. Engineering 101 is a course that all engineering students must take, but it is a course for which students receive no formal course credit.

Link with the English Department

We felt a link between engineering and English would allow ABE students to address their communication competency at an early stage in their programs. To achieve this objective, we worked with the Department of English to link special sections of two first-year composition courses (English 104 and English 105) with the ABE curricula. Ultimately, composition courses were created that have an agricultural and biosystems engineering and technology theme underlying the composition curricula. These specialized composition courses allow ABE students to read and write about subjects related to their major, instead of the more general topics common in first-year composition courses. In addition, the curricula for the engineering courses were adjusted to incorporate an increased emphasis on writing. We strove to create an environment where writing is introduced as an important life skill, the type of environment endorsed by the Boyer Commission⁸.

Prior to the beginning of the 1999 Fall Semester, the English and engineering instructors of the proposed linked courses met to develop LC goals and objectives related to this new initiative. Five ABE LC objectives that related to first-year composition were created and are listed below:

- To begin to understand the integrated nature of communication within the agricultural engineering and technology profession
- To learn academic writing processes, techniques, and skills
- To learn basic technical writing skills
- To begin to understand the concept of audience analysis
- To learn social skills related to team building and team success

These objectives were in addition to the more traditional first-year composition objectives that are common to most first-year composition courses at Iowa State University: to develop strategies for reading critically, to increase analytical skills applied to professional disciplinary discourses, to develop strategies to revise your [the student's] own writing, to adapt your [the student's] writing to specific purposes and readers, to use a variety of informational sources, to use a variety of organizational strategies, and to avoid errors that distract or confuse readers.

Learning Community Mentors

In an effort to help meet our objectives (specifically, to build community within the department, to increase student interaction with upper-level ABE students, to build excitement for the fields of engineering and technology, and to receive academic guidance), learning community mentors were hired to assist with each of the AE core groupings listed above. The students were paid through funds from a university grant. The responsibilities for the student mentors included:

- Attending one of the core group classes each week
- Participating in group activities in and outside the classroom
- Answering academic/curriculum questions
- Referring students to the correct academic resources
- Coordinating out-of-class activities
- Providing feedback on classroom assignments
- Providing in-class guidance when appropriate
- Meeting with the core group coordinator once a week

Assessment of the Learning Community Goals and Objectives

In order to measure that our LC objectives were (and are) being met, on-going assessment has been an integral aspect of our ABE LC initiative. Both quantitative and qualitative data have been gathered.

Survey Results

A post-survey was conducted at the end of the 1999-2000 academic year to evaluate students' perceptions and attitudes related to each of the specific ABE LC objectives specified at the beginning of the year. The survey included questions about the students' overall learning community experience, as well as their experience with the English 104 and English 105 course links. All 37 AE students who participated in the LC responded to the general survey. All eleven AE students who had taken the linked English 104 course responded to the English 104 questions, and all 24 AE students who had taken English 105 linked course responded to the English 105 questions. Results are shown in Figures 1 through 3.

Meeting Specific ABE LC Objectives. Figure 1 shows the average responses to the ABE learning community statements related to each of the specific ABE LC objectives. A response of a 3 or higher is considered a success in meeting that specific objective. The responses for all LC statements are higher than a 3, demonstrating the success of the ABE LC efforts. The highest responses were a 3.41 for statements 8 and 11. (Statement 8: "I have experienced hands-on laboratories related to the AE option." Statement 11: "I have received support from the ABE faculty this year.") The responses for both of these statements helps to confirm that the students have noticed increased activity by the ABE faculty in labs and in other LC activities. The lowest response was a 3.11 for the statement "I have become involved in a professional society or a student organization" (statement 9). This suggests that more emphasis could be made to inform students about the benefits of being involved in professional society or club activities.

Meeting Specific ABE LC Objectives

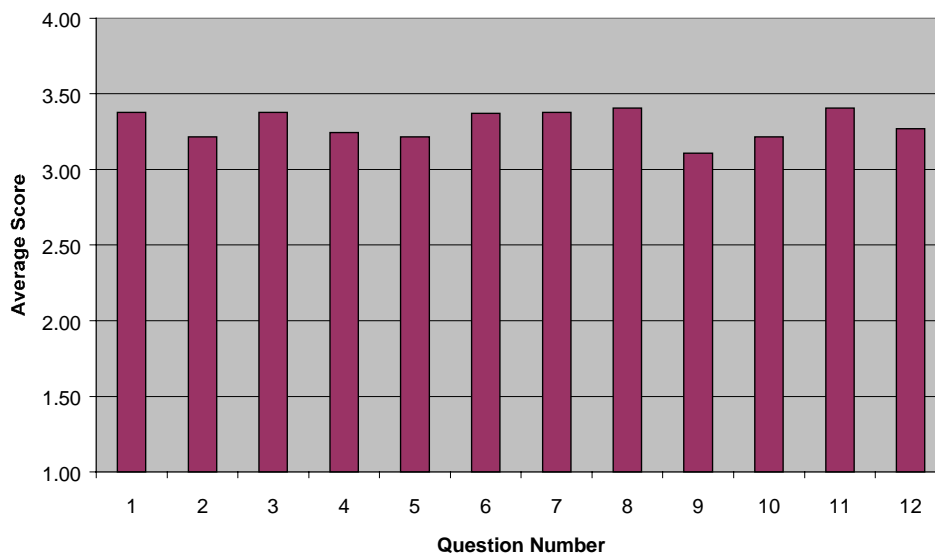


Figure 1. Average responses (N=37) to the following ABE learning community statements (1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree):

1. I am excited to be a part of the field of engineering and technology.
2. I have been involved with the ABE Department this year.
3. I have interacted with the ABE faculty this year.
4. I have interacted with upper-level ABE students this year.
5. I understand the differences between the options within the AE or AST curriculum.
6. I have developed or enhanced my team skills through collaborative assignments in my learning community classes.
7. I have been introduced to various problems (areas of interest) within the ag engineering and technology field.
8. I have experienced hands-on laboratories related to the AE or AST options.
9. I have become involved in a professional society or a student organization.
10. I have learned technical writing skills this year.
11. I have received support from the ABE faculty this year.
12. I have received guidance related to curriculum issues.

Engl 104/Engr 170/Engr 101 Link. Average responses for the English 104 link are shown in Figure 2. Once again, each response is above a 3. The highest response in Figure 2 was for statement 1. (Statement 1: “My English instructor explicitly referred to another faculty member or course in my schedule.”) The instructors for the linked courses often referred to each other in class in an effort to make students more aware of the coordinated courses and the relationship of the material; the students apparently were listening. The lowest response was for statement 5 (Statement 5: “My English class helped me to understand ideas and information presented in another class.”) Since the linked classes in this case were the engineering classes, it is not surprising that the English class didn’t completely help the students to understand the engineering material presented in them. Based on instructor observation, the English link was most helpful to students during their Engineering 170 design projects, where the students were required to write lengthy reports and to give oral presentations to a specific audience.

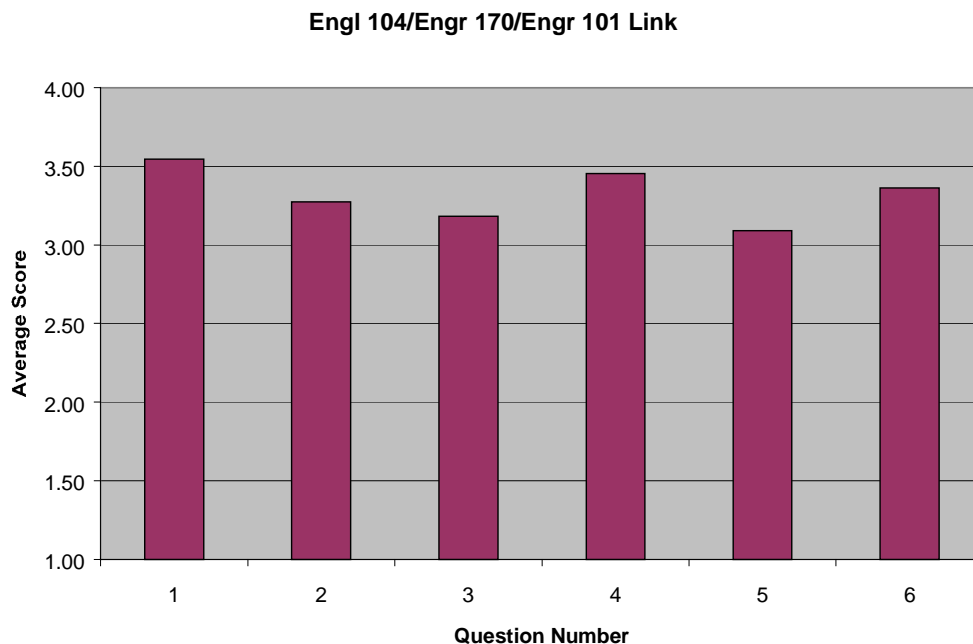


Figure 2. Average responses (N=11) to the following ABE learning community statements related to the English 104 link (1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree):

1. My English instructor explicitly referred to another faculty member or course in my schedule.
2. My English class discussed ideas or topics that were also presented in another class.
3. My English class read materials about ideas and topics that were presented in another class.
4. My English class composed written work that helped me apply concepts and principles to the written work in another class.
5. My English class helped me to understand ideas and information presented in another class.
6. I thought about how different ideas in my English class fit together with ideas in other classes.

Engl 105/Engr 160/AE 110 Link. Almost identical responses for the English 104 link are found in Figure 3 for the English 105 link with the engineering problem-solving course (Engr 160) and AE 110 (Experiencing ABE). All responses were above 3. The response for statement 5 increased the most when compared to that English 104. (Statement 5: “My English class helped me to understand ideas and information presented in another class.) The reason why students perceived English 105 (introduction to argumentative writing) to be more helpful to understanding material from other courses than English 104 (general composition) may have been the result of the material taught in the composition courses, as well as the engineering courses to which the composition courses were linked. The argumentative writing addressed in English 105 was a very nice fit with the material being taught in Engineering 160 (engineering problem solving)—in both classes, students were often asked to make a claim and to provide support. The difference was almost certainly not due to differences between instructors, because the same individual taught both English 104 and 105.

Engl 105/Engr 160/AE 110 Link

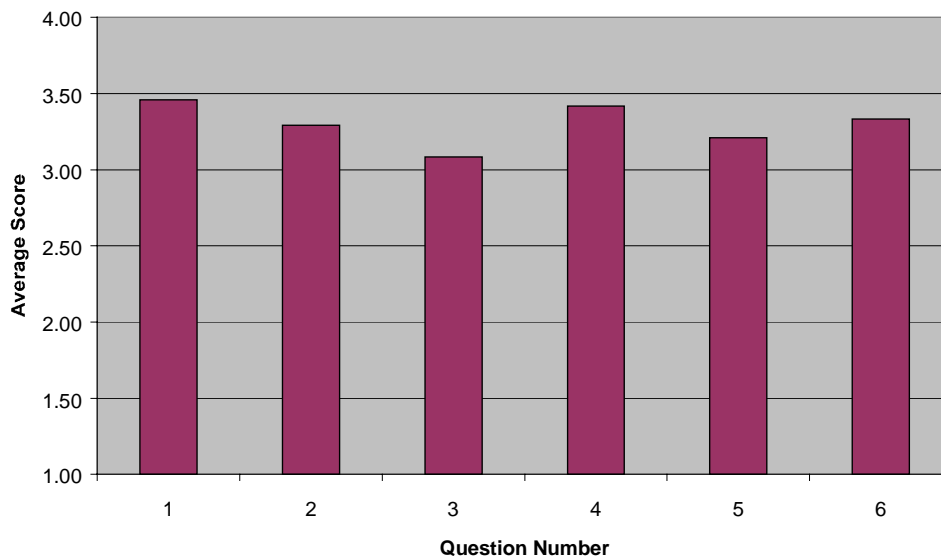


Figure 3. Average responses (N=24) to the following ABE learning community statements related to the English 105 link (1 = strongly disagree; 2 = disagree; 3 = agree; 4 = strongly agree):

1. My English instructor explicitly referred to another faculty member or course in my schedule.
2. My English class discussed ideas or topics that were also presented in another class.
3. My English class read materials about ideas and topics that were presented in another class.
4. My English class composed written work that helped me apply concepts and principles to the written work in another class.
5. My English class helped me to understand ideas and information presented in another class.
6. I thought about how different ideas in my English class fit together with ideas in other classes.

Peer Mentors. We had twenty peer mentors in our program for the 1999-2000 year. At the end of the spring semester (2000) the LC participants were asked an open-ended question in a survey: “How helpful was your peer mentor?” As a whole, the peer mentors were found to be very effective. The only negative comments had to do with peer mentors occasionally missing labs. Below are some of the student comments related to the peer mentors:

- He was always willing to meet whenever the group was able to meet. He always helped out when typing up the labs.
- We had a great time. He introduced me to more people and got me more involved.
- He was a nice guy to talk to and he was always helpful when we didn't know how to solve some equations or didn't understand the questions.
- She helped us out very much and encouraged us to be there for the workshop hour that we had once a week.
- He was a good guy to work with. He often offered encouragement, and was always interested in how we were doing in classes, etc.

Focus Group Results

In addition to our 1999-2000 year end survey, we collected data from three focus groups conducted during the Fall 2000 semester. Nine first-year, first-semester students volunteered to participate in the focus groups, which were conducted by a graduate student researcher. In general, students' comments echo the perceptions reported in the surveys; however, the surveys do not adequately capture the students' perceptions of the benefits of having linked courses. During their focus groups, the students reported that they often wondered why they were taking a non-linked course (in this case chemistry), an issue they reported not having with a linked course (in this case English).

Student 1: [The engineering professor] has lots of good input I think. It kind of makes you realize how you're going to have to use English in the future. 'Cause I always thought that English doesn't matter. Who's gonna need it when you get a job? But I guess you'll have to write papers, too.

Student 2: He kinda does a good job of making it relate—English to engineering—which is nice, 'cause there are a lot of times you go to classes and you're like, 'why am I here?' I go through that every day in chemistry.

Researcher: You go through what every day in chemistry?

Student 3: Why am I here.

Student 2: Why do I go to chemistry...

(data from focus group transcript dated 9/28/00)

In addition, the students reported that they liked being in an English class exclusively for engineering and technology majors, because it made them feel less intimidated.

Student 2: English...is such a small class and it's focused towards us a lot which is nice.

Student 4: Everybody is the same, everybody who's in that class doesn't like English, so that's nice.

Student 5: It helps us out quite a bit.

Student 4: I mean in other classes you'd have some kids who really love English, [who are] majoring in it, and us—we'd be lost. It's nice that way.

(data from focus group transcript dated 9/28/00)

Conclusions

The retention rate for first-year students in the AE program has increased from 47.6 percent for the 1997/1998 academic year to 86.2 percent for the 1999/2000 academic year. (Currently, the retention rate for the 2000-2001 academic year is even higher than last year—91.3 percent of the entering first-year students have been retained after the Fall 2000 semester). The development of an ABE LC has given first-year students an opportunity to develop strong academic and social communities that give them a higher potential for academic success. The specific objectives of the LC were met as indicated by the student survey.

Our comprehensive objectives were also largely met based upon the formal assessment efforts and upon instructor observation. The one objective we have not yet addressed adequately is comprehensive objective #3) To increase recruitment of students into the ABE curricula, especially underrepresented students (women and minorities). We are actively working to meet this objective and will continue to focus our efforts toward recruitment issues.

The link between the first-year composition courses and the engineering courses was a great success as determined by the survey and focus group responses. Students were aware of the link and saw the benefits of the link. Students in the composition courses wrote papers related to their chosen field of study and also used their newly learned technical writing skills when writing reports for their engineering courses. In addition, the instructors of the linked courses have expressed a great deal of satisfaction as a result of having the opportunity to work within the collaborative environment fostered by the learning community.

Finally, we would like to again return to the students' perceptions. The following student comments related to the learning community were written as part of an assignment for English 104 (Fall 1999):

- I especially like the classes that have an Ag. [agriculture] focus, like English 104. This makes the class more interesting because your reading and writing and even discussing things you enjoy.
- Having classes with people that have the same interest helps to establish a good support system. The English class is easier to relate to when it is based around agriculture topics. Knowing the other students in classes helps when studying. You always have someone to contact for questions or help.
- Personally, I have found that I like the learning team atmosphere. I can only compare it to two classes (Math 165 [Calculus I] and Chem 155). Those classes are larger in size and you don't feel as important.
- To me there isn't much change from a normal class. As far as the English class goes, I love the fact that we do stuff on agriculture and subjects related to our studies. I tell other people in my house about, and they all say that they wish they were in the same class.

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