Learning Communities Focused On Student Learning and Teamwork Skills

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Abstract

Engineers are increasingly being valued as much for their ability to learn new things and operate as a member of a team as for their technical skills. For this reason, a significant goal of engineering education should be to help students become life-long learners and productive team members.

For the last two years in the College of Engineering at Kansas State University, learning communities have been organized to help students become effective learners and team members. Engineering faculty volunteers recruited students and led their own learning communities. Communities were comprised of freshman chemical engineering students, Multicultural Engineering NACME scholars, students in the Engineering Student Council, students with an interest in international studies, and upper-classmen electrical and computer engineering students who serve as mentors to freshmen.

Each learning community meets twice each month: one time as small learning communities and one time when all learning communities meet together in a session facilitated by Jan Wiersema from the College of Human Sciences at Iowa State University. At these interactive meetings, students engage with important concepts such as active listening, conflict resolution, team problem solving and learning theories. The large group meetings allowed students to discuss these topics, participate in an activity to reinforce the notions, and brainstorm how they can apply the concepts in their academic and professional lives.

To assess what students are gaining from the learning communities, students completed a survey that targets student knowledge and practice before and after the experience. In addition to increased retention of minority students, results showed statistically significant increases in both student knowledge about learning and teamwork and how often students implemented this knowledge. Faculty benefited from the learning communities by gaining perspective on how students think about learning and teamwork and by developing a closer relationship with students in their learning communities.

Introduction

Engineers are increasingly being valued as much for their ability to learn new things and operate as a member of a team as for their technical skills. Indeed, accreditation of engineering programs depends on students attaining proficiency in functioning on multidisciplinary teams and recognizing the need for and the ability to engage in life-long learning[1]. For these reasons, a significant goal of engineering education should be to help students become life-long learners and productive team members. Learning communities clearly help move post-secondary education in this important direction.

Learning communities, with a long history in higher education, were developed with the intent of increasing student success—both academically and socially. Most learning communities today are developed to meet a specific need at an institution and resemble one of the four typical structures[2]: (a) paired or clustered courses, (b) cohorts in large courses or freshman interest

groups, (c) team-taught programs, or (d) residence-based learning communities. Regardless of the structure, multiple benefits have been recorded for both students and faculty involved in learning communities.

Just as there are a variety of ways to structure learning communities, so are the multiplicity of advantages reported from those involved. Numerous studies have been conducted to uncover the benefits of learning communities for college students[3-6]. Quantitative measures supporting student involvement in learning communities are described in terms of student retention, achievement, and intellectual development[3,6]. For learning community students across the nation, end-of-term retention rates average ten to twenty percentage points higher than typical institutional rates. Two possible reasons for the higher retention rates in learning communities are commitment to peers and total absorption with the program content. This supports a claim made by Tinto[7] about the importance for entering students to make a successful transition into both the social and academic communities of college.

Examples of rewards in academic achievement and intellectual development for students involved in learning communities are numerous[4]. These results were observed in many different types of learning communities and all types of students: increased GPAs, higher quality learning, more complex thinking, increased quality and quantity of learning, improved connectedness within social and academic realms, greater engagement in learning, increased opportunities to write and speak, a more complex world view, and a greater openness to ideas different from one's own. Even though these findings are impressive, it is important to note that a general evaluation of learning communities is impossible. Learning communities are established for different reasons and each must be evaluated according to the original purpose.

Research suggests that benefits from learning communities are not limited to students[4]. Faculty also reap the rewards. Learning communities provide a safe structure for faculty to change their work environment—to become empowered and to empower students, to shape their work and the work of students, and to develop relationships with colleagues who interact over meaningful issues in pursuit of a more effective education for students[3,6]. Other advantages for faculty engaged in learning communities include: continuity and integration in the curriculum, faculty development opportunities, broadened knowledge of pedagogy, promotion of collaborative teaching and learning, increased collegial trust, satisfaction with student success, and decreased isolation[4].

Clearly, learning communities produce multiple benefits for institutions, faculty, and students. They also create many challenges in finance, organization, and maintenance. However, it is likely there is a challenge and need that has not yet been identified. There is a noticeable void in the literature discussing learning communities related to the notion of a community of learners. What might be the power of and what might be additional benefits if learning communities were created and implemented where the focus was less on structure and more on becoming an effective learner who learns from and supports the learning of colleagues? The Learning Community Initiative at Kansas State University was started with this end in mind.

Learning communities were formed in the College of Engineering at Kansas State University in 2005-2006 and 2006-2007. The intention of these learning communities was to combine the knowledge of human learning and the power of learning organizations to construct a community of learners who would encourage and promote the development of all members into citizens who interact effectively with others and continue to learn for a lifetime. The stated student learning outcomes were:

- Learn and practice skills for making group and team projects more fun and more productive.
- Be part of a safe place to give and receive encouragement and support for the variety of challenges you experience as a college student.
- Develop skills to learn more in classes without relying on cramming before tests.
- Figure out how you tend to work with others and how to better use your strengths.
- Develop and carry out plans to actually use your new skills and knowledge for higher success and satisfaction as a student.
- Learn and practice skills that are desired by those who will hire you after you graduate:
  - listening,
  - communicating clearly,
  - cooperating with others,
  - thinking critically, and
  - taking responsibility.
- Use your thinking to construct your own meaning from the content of your classes and connect your classes to your experiences thus far and your future life as a professional (relying less on having to memorize).

  AND
- Have some fun!

This paper describes the implementation of the learning communities, the activities used in the learning communities, and the impact of the learning communities on student development.

Procedure

Formation of Learning Communities

Learning communities were formed from a variety of student groups, ranging from the executive council of the Engineering Student Council to freshman chemical engineering students. Formation of these groups was driven by the learning community leaders: these leaders recruited the student participants and facilitated the communities. Learning community leaders were nearly all Kansas State faculty who were either already leading a student group or wanted to work with a specific group of students. The exception was a learning community during the fall of 2006 led by two undergraduate students. Both students had participated in a learning community during 2005-2006. Table 1 lists all learning communities in 2006-2007, their learning community leaders, and the number of students who participated in those learning communities.

Table 1. Learning Communities in 2006-2007

Learning Community	Learning Community Leader	Number of Students Participating, Fall, 2006	Number of Students Participating, Spring, 2007
Chemical Engineering	Keith Hohn	14	9
Multicultural Engineering NACME Scholars	LaVerne Bitsie-Baldwin	25	25
Engineering Student Council	Julia Keen	6	10*
Freshman Leadership Council	Shannon Timmons/Lisa Kitten	18	0*
Electrical Engineeing Mentors	Anil Pahwa	6	6
Industrial Engineering	Margaret Rys	6	0

* The Freshman Leadership Council and Engineering Student Council learning communities were combined after the first semester.

Student participants enrolled in a one-credit hour course (DEN 398) each semester. A grade was assigned based on student attendance at meetings and on completion of several brief journaling assignments throughout the semester. To encourage student participation, students were provided with a learning community scholarship, given by the College of Engineering. This scholarship paid for the one credit hour.

Structure of Learning Communities

Each learning community met twice each month: one time as small learning communities and one time when all learning communities met together in a session facilitated by Jan Wiersema from the College of Human Sciences at Iowa State University. At these interactive meetings, students were engaged with important concepts such as active listening, conflict resolution, team problem solving and learning theories. The large group meetings allowed students to discuss these topics, participate in an activity to reinforce the notions, and brainstorm how they can apply the concepts in their academic and professional lives.

Content of Learning Community Meetings

There were eight large group meetings of all the learning communities throughout the year. Table 2 indicates the topics studied during each large group meeting.

Table 2. Activities and attendance at large group meetings.

Date	Topics Covered
August 28, 2006	Three Ways of Structuring Learning—competitive, individual, cooperative (and basics of learning theories), Active Listening
September 25, 2006	Teamwork, Appropriate use of names
October 23, 2006	How the brain works, Practices inventory
November 27, 2006	Memory lanes, jigsaw
January 27, 2007	Problem solving, intentional mental processing
February 19, 2007	Edible scale competition, Task-Maintenance skills, Memory lanes, Leadership actions
March 26, 2007	Task-Maintenance actions, Structured controversy, Metacognition
April 23, 2007	Conflict resolution, Responsible learners

For small group meetings, each learning community leader was given the freedom to engage in any activity he or she thought would be useful for the community. However, Jan Wiersema provided possible activities for use in these meetings, and most groups used those plans. Table 3 lists these activities.

Table 3. Activities at small group meetings.

Small Group Meeting Number	Activities
1	Community building
2	Read and explain pairs, read and discuss the article, "Learning as Biological Brain Change"
3	Community building, "Recipes for Teamwork"
4	Memory lanes, feedback on semester
5	Brainstorming, problem solving
6	Memory lanes, Task-maintenance skills
7	Engineering ethics
8	Celebration, surveys

There was a desire by the faculty participants to include an engineering component in the learning communities. Towards this end, teamwork and brainstorming were discussed in the framework of an engineering team project: construction of an edible scale. This project, adapted from a project assigned in the Industrial and Manufacturing Systems Engineering department at Kansas State, challenges students to build a working scale constructed only of parts that can be eaten. Student teams were formed within each learning community. These teams were taught a simple brainstorming technique, and utilized this technique to generate ideas for how to build their scale. They then built the scale outside of the learning community meeting time, and brought it to a large group meeting where all groups competed to see which scale could most accurately measure a small weight (several grams). Students were asked to reflect on how their teams function on this task, how they contributed to the team, and how they could improve their performance on teams.

Another engineering-related activity was to have students consider engineering ethics. This activity was structured as an "academic controversy." An academic controversy[8] is a specific learning strategy used to engage students in critically examining both sides of an issue before making an important decision. Typically, a controversial matter is described and students research the matter to learn as much about both sides of the topic as possible. Then, with a partner, they are assigned to defend one side (whether they believe in it or not) as forcefully as possible. They must, of course, also listen to an opposing pair defend the contrary viewpoint. Next, both pairs reverse their stance and present their best case for the opposing side. Their final challenge is to engage in a discussion to make the best decision possible. In this activity, the two sides were whether or not some action by an engineer was ethical–a case study taken from the journal, "PE: The Magazine for Professional Engineers".

Results and Discussion

Quantitative Data on the Impact of Learning Communities

To assess the effectiveness of the learning communities on student learning and development, a survey of student knowledge and practices was given at the start of the year, at the end of the semester for students who did not participate in the spring, and at the end of the academic year. On this survey, students were asked to give both quantitative and qualitative information on what they thought they knew about learning, teamwork, and leadership and what they practiced. The following questions were asked on the survey:

1. How much do you know about…
    - your values, beliefs and attitudes about learning and education?
    - practical strategies to enhance your own learning?
    - planning to learn the most you possibly can?
    - how your brain learns?
    - the relationship between reflection and learning?
    - being part of an effective team?
    - interactive skills that enhance team performance?
    - your values, beliefs, and attitudes about teamwork?
    - your own team skills?

helping others develop effective team skills?

2. Select 3 of the above that you consider most important. Provide rationale for your rating.

3. How often do you…
   deliberately consider your own values, beliefs and attitudes about learning when you are involved in a learning opportunity?
   use specific strategies that will enhance your own learning?
   develop specific plans to deepen your understanding of new concepts?
   purposefully apply information on brain research to enhance your own memory?
   personally reflect on what happened in a learning opportunity to increase future learning?
   deliberately use your skills and abilities to intensify team effectiveness?
   purposefully practice specific interactive skills that will heighten team productivity?
   deliberately consider your own beliefs and attitudes about teamwork when given the opportunity to develop team skills?
   practice specific interactive skills that encourage all members of a team to use their strengths to magnify productivity?
   purposefully plan to help others develop team skills and abilities?

4. Select 3 of the above that you rated relatively high. Provide evidence to support the rating.

The mean scores for questions 1 and 3 for the pre-year survey, post-semester survey, and post-year survey are shown in Table 4. As seen in this table, the mean scores for all items increased for students participating for either a semester or the whole year. The increase was generally greater for students responding after participating in the learning communities for a full year. To determine whether this increase was statistically significant, a t-test was employed, using the 95% confidence level. Whether the difference was found to be statistically significant is indicated in the last column in Table 4.

For students participating only for the first semester, the increase was statistically significant only for four of the questions related to knowledge and four of the questions related to practices. For students participating for a full year, the increase was statistically significant for nine of the ten questions on knowledge and for seven of the ten questions related to practices. The fewer number of statistically significant differences for the semester-end survey was partly related to the statistical calculation: the smaller sample size (only six responses were obtained) meant that more caution had to be taken in assuming statistical significance. It could be also explained by the fact that these were students who had chosen not to continue in the program: they may not have felt they got that much out of the program. Finally, this might suggest that the second semester was needed to reinforce the concepts.

One of the largest changes over a semester or the whole year was student understanding of the relationship between reflection and learning. This item was rate fairly lowly by most students prior to their participation, indicating that they were unaware of how important it can be to reflect on new material to aid in learning. After participating in a learning community, students were much more aware of this link. In addition, the item on student practice that asked students

how often they personally reflected on a learning opportunity to improve future learning also showed a statistically significant increase following participation in a learning community. This

Table 4. Knowledge and Practices Survey Results

	Pre-test	Semester-end	Significant increase?	Year-end	Significant increase?
Number of respondents	55	6		26	
How much do you know about:					
1. your values, beliefs and attitudes about learning and education?	4.51	4.83	No	4.96	Yes
2. practical strategies to enhance your own learning?	4.05	4.67	Yes	4.70	Yes
3. planning to learn the most you possibly can?	4.35	4.67	No	4.89	Yes
4. how your brain learns?	3.69	4.67	Yes	4.30	Yes
5. the relationship between reflection and learning?	3.53	4.50	Yes	4.33	Yes
6. being part of an effective team?	4.55	5.17	Yes	5.15	Yes
7. interactive skills that enhance team performance	4.44	4.50	No	4.93	Yes
8. your values, beliefs, and attitudes about teamwork?	4.80	4.83	No	5.07	No
9. your own team skills?	4.47	4.67	No	4.88	Yes
10. helping others develop effective team skills?	3.95	4.00	No	4.50	Yes
How often do you:					
deliberately consider your own values, beliefs and attitudes about learning when you are involved in a learning opportunity?	3.51	4.17	No	4.12	Yes
use specific strategies that will enhance your own learning?	3.71	4.33	No	4.35	Yes
develop specific plans to deepen your understanding of new concepts?	3.44	3.50	No	4.42	Yes
purposefully apply information on brain research to enhance your own memory?	2.51	3.83	Yes	3.19	Yes
personally reflect on what happened in a learning opportunity to increase future learning?	3.09	4.33	Yes	3.76	Yes
deliberately use your skills and abilities to intensify team	3.98		Yes		No

effectiveness?		4.83		4.42	
purposefully practice specific interactive skills that will heighten team productivity?	3.47	3.67	No	4.27	Yes
deliberately consider your own beliefs and attitudes about teamwork when given the opportunity to develop team skills?	3.76	4.00	No	4.50	Yes
practice specific interactive skills that encourage all members of a team to use their strengths to magnify productivity?	3.55	4.33	No	3.96	No
purposefully plan to help others develop team skills and abilities?	3.13	3.50	No	3.73	No

is a significant outcome of the learning communities: encouraging students to actually think about course material and not just cramming for exams.

Qualitative Information on the Impact of Learning Communities

Student comments during the final large and small group meetings provide qualitative information on how the learning communities had impacted student development. One interesting comment came from several students from the chemical engineering learning community, which was comprised of freshmen. These comments suggested that the most valuable thing for them had been the sense of community that they developed as a result of the learning community. The faculty leader for the freshman leadership council also found that the experience was very positive for these new students. These qualitative results suggest that the learning communities can be very useful for new engineering students by helping them meet and get to know students who are in the same classes as them and who have many of the same concerns.

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