Developing Learning Communities of New Students to Increase Retention

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Abstract - **The Electrical and Computer Engineering Department at Kansas State University introduced New Student Assembly for freshman and transfer students in Fall 2005 as part of a Department Level Reform (DLR) planning project funded by the National Science Foundation. The main goal of this two-semester course is to provide a friendly atmosphere to students to ease their transition into college life, learn about the department, and make friends with peers and seniors within the department. The ultimate objective is to provide better connection with the department to the new students to increase retention. The department head and nine upper-class students, who perform the role of mentors for the new students, facilitate the assembly, which is held once a month during each semester. The mentors also met twice in a semester outside the class with students in their assigned group for a fun activity of their choice, such as bowling, pool, or ice cream social. This activity provides time for further interactions in a relaxed atmosphere. During the assembly several icebreaking interactive activities and discussions on learning styles and myths and realities of being an engineering student are conducted. Other activities include short presentations by student groups and selected industry representatives. The students are also given an on-line questionnaire about the department and a group exercise of meeting their advisor. Teams of students build a robot to perform certain specified tasks from the "Lego Mindstorms™" kit during the second semester. These teams compete with each other during the all university Open House in April. Details of all the activities conducted, feedback received from students, and retention data showing effectiveness of the assembly are presented in this paper.**

Index Terms – Learning communities, learning environment, retention, teamwork.

INTRODUCTION

Universities must continually improve their learning environments to provide the best education for their students and the best product for their students' future employers in a rapidly changing world. This is especially important in engineering, where the pace of technological change continues to accelerate. The engineer of 2020, according to the National Academy of Engineering [1], will need strong analytical skills, ingenuity and creativity, leadership and communication skills, strong ethics and professionalism, resiliency and flexibility, and life long learning skills. In order to be effective in today's rapidly changing technology environment, engineers need to be adaptable, self-motivated, effective learners throughout their career [1]. Engineering students who learn to take charge of their learning and to work in teams with others to complete projects and learn together will have the advantage. The learning environment of the department plays a key role in the student experience. We have chosen to address department needs for improvement of the learning environment by the introduction of learning communities early in the students' experience at the university. This improvement of the learning environment will also improve recruitment and retention of students, especially of women and minorities.

Programs early in the students' college experience have been found to have a significant impact on student retention and success [2]. High school to college "bridge" programs have proven successful at several universities. Early experiences, some even before classes start, help to make a difference. Making students feel they are a part of a community that would miss them if they leave is a key issue. Being part of a group in which everyone is working hard, struggling at times, and supportive of each other helps to keep students from dropping out. The environments within a learning community are important to student success. This is particularly true for minorities and women. Helping students become more effective learners has been shown to lead to improved graduation rates [3, 4]. In a case study done at the University of Texas at Austin, beginning students took a course in strategic learning. After 5 years, 16% more of the students who had taken the class graduated when compared to those who didn't. This was in spite of the fact that those taking the course had lower entrance scores [4, 5]. Teaching students to be strategic learners includes many aspects. In particular, skill, will, and motivation are given as primary issues [3, 5]. Students can be taught techniques to foster improvement in their learning, observe faculty and other students modeling methods, and practice and receive feedback in trying new techniques. By including instruction and practice in learning in the curriculum, students are encouraged to set goals for

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themselves and monitor their own progress. Through feedback and appropriate modeling student motivation and self-regulation in learning can improve, with positive consequences for both faculty and students [5]. Much research has been done on the brain and learning. Findings show that engaging the learners — emotionally, socially, and in a challenging but not threatening manner — is important to effective learning [6]. Being careful to build on or confront prior knowledge and encouraging the learner to actively seek the new concepts are also important aspects of pedagogy.

One of the primary goals of the KSU College of Engineering and the Electrical and Computer Engineering Department is to provide our students with an education that is hands-on with a firm foundation of the fundamentals in an environment of personal growth and discovery. In this paper, we examine global changes to our learning environment, which are implemented as a part of a Department Level Reform (DLR) planning project funded by the National Science Foundation. We introduced New Student Assembly for freshman and transfer students in Fall 2005. The main goal of this two-semester course is to provide a friendly atmosphere to students to ease their transition into college life, learn about the department, make friends with peers and seniors within the department, and thus build learning communities. The ultimate objective is to provide better connection with the department to the new students to increase retention. Organization of the assembly, details of all the activities conducted, feedback received from students, and retention data showing effectiveness of the assembly are presented in this paper.

ORGANIZATION

Since its inception in Fall 2005, the department head has coordinated the assembly with assistance of nine upper-class students. These students also serve as leaders and mentors for the new students. Each mentor is assigned about ten students. In addition to facilitating the assembly, which is held once in a month, the mentors serve as resource persons for the new students. The new students can call or email the mentors to seek an answer for any question they might have about university life. The mentors also met twice in a semester outside the class with students in their assigned group for a fun activity of their choice, such as bowling, pool, or ice cream social. This activity provides time for further interactions between students in a relaxed atmosphere.

ACTIVITIES

The activities of the assembly have a wide variety including simple icebreakers, information dissemination and gathering, interactive team activities, and activities and discussions focused on learning. Complete information on these activities is provided in this section.

I. Nametag

This is an icebreaker activity conducted during the first assembly of the semester. Each student is given an index card on which they write information about themselves, such as place of birth, month of birth, hobbies, and name of the advisor. After that they are asked to mingle and look for common entries between each other. The group that has the most common entries is declared winner and is given a prize.

II. Meet Your Advisor

Each new student is assigned an advisor after admission into our department. This activity serves as an icebreaker for establishing a relationship between the students and advisors. The students are asked to meet their advisors in groups of two or more. They are not allowed to call the professors or send email to make appointment. They are only allowed to meet their advisors during the posted office hours. Since it is a group exercise, it forces students to seek partners, which promotes interaction amongst the students. During the meeting with the advisors, the students ask a few questions about the professors, such as their area of interest and advice on how to be a successful student. We have found this to be a very simple way to build community within the department without placing undue burden on students and professors

III. Know Your Department

We have found from past experience that students know very little about their home department even after a few years into their degree program. Without knowing much about the department, it is hard to develop connections. Therefore, we assign students an on-line quiz with trivia style questions about the department. Answers to these questions can be very easily found by browsing the department web site. The students are given credit for their work simply based on their participation. If they answer a question incorrectly, the correct answer is provided. These questions are revisited during the assembly following this assignment to summarize the results.

IV. Presentations by Student Organizations

Since students don't take many department level classes until they are juniors, they don't know much about the department level activities. Student leaders of various organizations including IEEE, Eta Kappa Nu, Solar Car, Engineering in Medicine and Biology Society, Robotics Club, and Study Abroad make short informative presentation in the assembly. This allows the new students to learn about participation opportunities in different activities. Instead of scheduling all the presentations in one meeting, only one or two presentations are scheduled for each meeting to avoid monotony.

V. Presentations by Industry Representatives

In order to expose students to the real world of electrical and computer engineering, two representatives from industry are invited to make presentations about their company and type of work students would do after graduation if they were go get a job in these companies. A representative of the Career and Employment Services at the university provides a general overview of the job market, skill needed by students to market themselves, and strategies for seeking internships and employment. The two companies are selected to provide a diverse view of the electrical and computer engineering field. A consulting firm that deals with large infrastructure projects and a manufacturing company producing specialized electronics products have participated in these presentations in the last two years. These presentations expose students to various applications of electrical and computer engineering ranging from very large systems (power systems) to very small systems (GPS devices). The main goal of these presentations is to expose students early to the real-life to rouse their curiosity.

VI. Discussions on Myths and Realities

Many incoming students have misconceptions about their life as engineering students. This exercise is designed to expose them to some of these myths. A list of statements, originally provided by Dr. Jane Moody as part of a workshop [7], was modified to make it more relevant to engineering. Feedback from the mentors, who already have some experience as students, was used to modify this list, which is given in Table 1. The students are asked to answer "Myth" or "Reality" for each statement as an on-line assignment. Credit is given for participation and not for right or wrong answers. In the following assembly, each group is assigned one of these statements for discussion. The group has to reach a consensus and select a spokesperson to present views of the group to the whole class. S/he has to defend the decision with examples. Although all the statements are myths, not all the students recognized that. Percentages of students of the 82, who took the quiz, answering myth or reality for each of the statements, are shown in Table II. Correct responses to all the statements except the first one ranged from 80% to 98%. Only 62% said that statement number one is a myth, which shows that a large number of people believe that engineers are "nerds".

VII. Discovering Learning Styles

Many researchers have done extensive research on learning and learning styles [8-10]. Knowing the learning style is very important for students, so that can fine-tune their study habits to match their styles to be successful students. Dr. Richard Felder has done the most extensive work on this field related to engineering [11]. Answer to a questionnaire prepared by Solomon and Felder [12] identifies a person to be an active or reflective learner, a sensing or intuitive learner, a visual or verbal learner, or a sequential or global learner.

TABLE I
MYTHS AND REALITIES OF LIFE AS AN ENGINEERING STUDENT

1. Engineers are nerds; they live in labs, and have no social life and fun.
2. If you have to do extra work or get tutoring in a math or science course, you should figure that you're unfit to be in engineering and you should leave.
3. Minorities and women shouldn't aspire to engineering-related careers because they don't have the aptitude for them.
4. There is something wrong with you if you have problems adjusting to college life.
5. There's a straight and narrow path to becoming an engineer or a scientist. From the cradle on, you must love nothing but science, science, science and math, math, math.
6. You have to work all alone when you're an engineer. It's lonely work.
7. An engineering career is boring because you're stuck in the same line of work or teaching your whole life. Engineers can't move into new areas, after their careers have started.
8. Engineering students are always pulling all nighters, even very organized and scheduled students. So, if you aren't good at staying up all night, you should switch majors.
9. Upperclassmen already have plenty of friends and are too busy with their own classes to talk to you and help you.
10. Your professors have been teaching for a very long time and know how to create tests that will fit a perfect curve in the end. So if your first test fails half the students in your class chances are that you will have a test that will be easier in the future. On the other hand if you breeze through a test don't expect the rest of the tests to be just as easy.
11. After the first two years of general classes the specialized classes of the last two years are easy.
12. The people that have hobbies that coincide with engineering are smarter than you, and you have to have those kinds of hobbies to make it in engineering.

TABLE II
RESPONSES OF STUDENTS TO MYTHS AND REALITY STETEMENTS

Statement No.	Myth (%)	Reality (%)
1	62	38
2	85	15
3	84	16
4	93	7
5	96	4
6	80	20
7	90	10
8	98	2
9	85	15
10	85	15
11	87	13
12	90	10

All the students in the class were asked to answer the questionnaire and to place their results on a scoring sheet, which shows their learning styles. All the learning styles were then discussed including examples where different types of

learners can adapt themselves to obtain the maximum benefit from the given situation, such as different types of classes [13].

VIII. Building Lego Person

This exercise requires teams of students to build a person from Lego blocks given to them to duplicate an already built model. The built model is hidden in a box in the center of the room. Upper part of the two-layer model can be seen by looking into the box, but only part of the bottom layer can be seen. Therefore, trial and error and elimination process is required to derive the bottom layer of the model. Such processes are very close to what engineers do in real life; that is to make the best decisions on partially available information. At a time only one person from each team can go to the middle of the room to look at the model. That person returns to the table and conveys that information to the team to build the model. Different people can take turns to go to middle of the room to look at the model to gather additional information. After completion of the model, the team takes the model to a facilitator, who determines whether the model is correct. If not, the facilitator tells the team that there are some errors but the errors are not specified. There is no time limit for building the model, but the team that finishes building the correct model first is the winner.

IX. Robot Competition

During the spring of the students' freshman year, mentors guide their small groups through a semester-long design challenge. As most students have not yet had the academic experience allowing them to pursue a highly technical project, the challenge utilizes the Lego Mindstorms™ kit robotics system. This system uses snap-together parts and a simplified block-based programming language, allowing for the fast prototyping and development of a "robot." Each semester, the students are tasked with a specific function the robot must perform; in 2006 and 2007, the challenge consisted of navigating from one end of 4'x3' playing field to the other. Of course, the addition of obstacles and random starting locations force the students to work together to develop a unique solution. In addition to engineering a robot, teams must develop a 5-7 minute presentation detailing the design process, challenges overcome, and lessons learned. The presentation is judged on technical ability, but a large amount of points are awarded on the basis of creativity. The entire competition concludes during Kansas State University's campus-wide Open House (Fig. 1 and 2), when teams publicly demonstrate their robot's capabilities (assisting the department with student recruitment). Depending on how well the robot performs, teams are awarded points; the performance and presentation components of the challenge contribute an equal amount to the final score. Although the title of "robot champion" is something to envy, students are motivated throughout the semester by cash prizes for the top three teams. Altogether, the robot competition serves as the capstone of the freshman orientation course: students solidify community within their small groups, become excited about the engineering design process, develop professional presentation skills, and form a strong connection to the department.

Fig. 1: The winning team discussing their robot

Fig.2: Running the robot through the maize

STUDENT FEEDBACK

To assess the impact of the activities implemented and to make improvements in the future, students were asked to provide their feedback. Results of the responses on various activities are given in Table III. In Fall 05 and Spring 06 a five-level scale, two positive, two negative and one neutral and in Fall 07 a four-level scale with two positive and two negative levels were used. The numbers in Table III show the sum of positive and neutral responses for Fall 05 and Spring 06, and sum of positive responses for Fall 07. The results given in this table show that the majority of students felt favorably about most of the activities. The percentage of favorable response from Fall 05 to Fall 06 remained more or less consistent with some fluctuations except Myths and Realities, which dropped significantly in Fall 06. This could be due to different style of survey questions or due to this exercise being on-line in Fall 06 versus manual in Fall 05. A better answer will be available after we try it again in Fall 07. The activities of the spring semester received higher ratings than those of the fall semester. One possibility for this is that

the students found the activities of the spring semester to be more interesting and relevant. The other is that class size reduced in the spring semester due to students transferring to other departments or getting dismissed due to low grades. Thus the students who were left were really interested in electrical or computer engineering and hence had more appreciation of the activities. Of the 82 freshman enrolled in Fall 05, nine transferred to other departments and nine were dismissed from the university due to low grades.

TABLE III
RESPONSES OF STUDENTS TO VARIOUS ACTIVITIES

Activity	Favorable response (%)		
	FA 05	SP 06	FA 06
Nametag	62		60
Meet Your Advisor	77		64
Know Your Department	71		58
Presentation by Student Organizations	68		71
Presentation on Enrollment	73		60
Presentations by Industry Representatives		93	
Myths and Realities	59		33
Discovering Learning Styles			62
Building Lego Person			60
Building Robot		79	
Robot Competition		83	
Prizes for Winners		90	
Outside Group Meetings	58		62

Responses from students related to overall benefits of assembly are shown in Table IV. The highest favorable response is for them knowing more about the department, which is followed by feeling more connected to the department. Although not a direct measure, response to the last question is an indicator of retention. Transition to college life became easier for about half the students due to this class. This class had the least influence on their participation in student activities. Since this is a new type of class, students show a lot of anxiety and apprehension towards the class. We have found that some students realize the benefits of this retrospectively. For example, one of the students who applied to become a mentor next year wrote in his application:

> *"When I first attended the new student assembly, I felt it was a waste of time. This is now my second year in the College of Engineering and I have started to notice that it is becoming increasingly hard to maintain good grades. I find myself studying with the friends that I met in the assembly and through the activities we did. Now that I look back at it, the assembly was not at all a waste of time and would like to point that out to the other new students."*

CONCLUSIONS

The results show that introduction of New Student Assembly has been very successful in achieving its objectives. Gradually, as it becomes a part of the department culture, it is expected to produce more beneficial results. Exact impact on retention is not known at present, but it appears to have some impact. Biggest impact is, however, on making students of the department feel like they belong to a community. This belonging will certainly have positive impacts in the future.

One hurdle that we have faced in associated with this class being a zero credit class. As a consequence, some students don't take it seriously and think of it as a burden. Such attitude sometimes has a strong negative influence on the class. We are exploring the possibility of making this class a one credit hour class, which will definitely have positive impact.

TABLE IV
RESPONSES OF STUDENTS OF BENEFITS OF ASSEMBLY

Outcome	Favorable Response (%)		
	FA 05	SP 06	FA 06
Know more about the department	86	81	82
Feel more connected to the department	70	76	73
Transition to the college life became easier	56	64	49
Increased participation in student activities	47	52	20
More likely to pursue EE or CompE degree	61	64	56

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