AC 2010-1358: IMPLEMENTATION OF AN EARLY WARNING SYSTEM IN ENGINEERING: A PARTNERSHIP WITH ACADEMIC ADVISORS AND INSTRUCTORS ACROSS THE CAMPUS

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Abstract

Retention of engineering students has become a major concern for universities across the country. At Iowa State University the college of engineering loses about 10% of their incoming 1st year students within the first semester and about 25% after one year. Those students who are academically struggling leave at an even higher rate. Research points to the success of early warning systems that include interactions with a significant university authority figure who can reach out to students early on to provide guidance and support. The college developed an easy-to-use web-based tool for instructors who teach the first year math, chemistry, and engineering courses. The instructors are able to quickly send email notices within the first four to six weeks to hundreds of students and their advisors informing them on how they are doing in their class. This paper chronicles the development and implementation of using this tool, along with the development of partnerships with engineering advisors and instructors across different colleges. Initial findings indicate that the early warning system is having a positive effect. The results and evaluation of this program is also detailed.

Introduction

The transition students make from high school to college creates many new challenges for students. One of the adjustments to college that students must make involves separating from parents. As students experience anxiety related to this separation, they act out their attachment styles[1]. Secure attachment to parents has been found to be positively associated with personal, social, and academic success in college students[2,3,4,5]. Insecure attachment leads to anxiety and the avoidance of relating to others[1,6]. It is estimated that 20% to 28% of people have insecure attachments and with that comes maladaptive forms of coping with problems under stress. Students need to have positive coping skills to deal with the challenges they will face in the classroom and outside of it. These coping skills include seeking help when faced with emotional or academic difficulties[7,8]. Without these skills students will tend to avoid or deny their problems[9, 10, 11,12,13].

College faculty and advisors know that there are always a certain percentage of students when confronted with doing poorly in their classes who do not reach out to people who could help them such as their instructor, an advisor, or even their peers. Therefore, the challenge for college administrators is finding a way to reach students who are having trouble early on. Understanding that many students who do not reach out not only have a certain amount of anxiety about asking for help, but that they also may not have the skills needed to overcome maladaptive coping behaviors can help faculty and advisors when they work with these students.

Providing a way for advisors to learn of students having trouble especially during their first semester, helps advisors be proactive in reaching out to their students. Developing a positive and reassuring relationship early on with the advisor or a faculty member helps to reduce the anxiety

and the isolation a student may feel. And if done right, it also teaches the student that it is safe to ask for help.

Midterms arrive too late in a semester to help a student. At this institution midterms are given out after two months of school. At that point a student can only choose to stay in the class or drop it as it is too late for intervention to help much: they may be so far behind that it cannot salvage their grade in the class. The idea to offer assistance within the first 4-6 weeks is that there is still time to change behaviors, reduce anxiety and stress, and connect the student to resources that can help the student be successful. Therefore, the early warning system goes out about the fourth week of class. While many students may know how they are doing in their class (as instructors may regularly update them in other ways), the one aspect that is different with this concept is that it brings the advisor into the picture. Research has shown for years the importance of students making connections early on with key faculty and staff in continued persistence[14,15,16]. In many larger schools the engineering students are unable to make those type of connections especially due to large classrooms. This provides a way for other key members of the university to try to make those connections with struggling first semester students.

As shown in Table 1, graduation rates fall significantly for students who receive less than a 2.00 GPA their first semester in engineering. Those who receive between a 1.00 GPA and 1.99 GPA have a 37.2% graduation rate after 6 years and those who receive less than 0.99 GPA have less than an 11% graduation rate and only a 23.4% 1st year retention rate.

Table 1. Retention and Graduation Rates of Engineering Students

GPA range	1st Year Retention Rate	6th Year Graduation Rate
2.25 & above	94.9%	80.1%
2.00-2.24	88.0%	58.2%
1.00-1.99	81.3%	37.2%
0.00-0.99	23.4%	10.9%

For this study, students who entered the college as undeclared were analyzed and compared with students who entered with a declared engineering major. The undeclared engineering students have a 1st year retention rate of 90% (five year average) and an average of 75% for a graduation rate. Overall, the college has an average of 87.9% 1st year retention rate and 69.0% graduation rate from the university.

The Process

An early warning system was utilized on a large scale for all engineering students taking first year math, chemistry, and engineering courses during the fall 2009 semester. The warning system required developing a simple computer program that allowed the instructor to go to a website to find their class with a list of all the engineering students. Instructors could then click on an individual student or several students at one time to send them a message as shown in Figure 1.

Figure 1. Class List Example

Figure 2 shows the automated email that will then appear, which the instructor was free to use as is or change the message as desired. It automatically puts in the student's email address and name along with the advisor's email address.

Figure 2. Automated Email Message

To obtain buy-in from the teaching departments, the email was very generic. Even though the authors would like the students to meet with the instructor, they could not impose on the instructors by writing that in the email and thus, instead, the email was written to ask the student to come in and see the advisor. The college hoped that the instructors would modify the message to encourage students to come in and see them (and some did). However, it was also understood that for some students who had not been attending class, a meeting with the instructor may not have been appropriate. In this case, meeting with the advisor may be more helpful as the student might have personal or nonacademic issues that need to be addressed.

A common denominator in struggling students, especially the first semester, is an unwillingness to meet with instructors or advisors to ask for assistance. Therefore, all emails were copied to the advisor. This provided awareness to the advisor of a possible problem, thereby encouraging the advisors to communicate with the advisee concerning academic performance. In some cases, the advisor had already established a good relationship with the student, so a visit with the advisor was perceived as less threatening than a visit with the instructor.

Prior to implementation, it was necessary to develop relationships with key course coordinators in the departments to develop good will and communication. In addition, the author was invited to speak to a group of key faculty to promote the purpose of the early warning system. These faculty members, who had bought into the use of the program, then recommended the use of it to their colleagues.

Results

The early warning program was analyzed by comparing the undeclared engineering students to the other non-undeclared engineering students who received early warning emails. All of the undeclared engineering students were contacted by their advisor once they received an early warning email and asked to come in and visit with their advisor. Non-undeclared engineering students who received early warning emails from their instructors were not contacted by their advisor in the college.

Table 2 shows that of the 360 new undeclared engineering students, 57 received early warning emails. 46 professors in math, chemistry, and engineering participated in sending out a total of 370 emails to students this past fall semester. 28 students received more than 1 early warning email.

Table 2. Number of Students Receiving Early Warning Emails

# of students receiving 1 early warning email	313
# of students receiving 2 early warning emails	27
# of students receiving 3 early warning emails	1

Grades were collected at the end of the semester for each early warning email sent. Table 3 shows that the undeclared students had a smaller percentage of students (33% versus 61%) who received less than a C in the course that they receive an early warning email.

Table 3. Grades of Students Who Received Early Warning Emails

Undeclared Engr Students			All Engr Students Except Undeclared		
Grade	#	%	Grade	#	%
A	-		A	2	0.6%
A-	-		A-	4	1.3%
B+	3	5.3%	B+	4	1.3%
B	2	3.5%	B	6	1.9%
B-	3	5.3%	B-	12	3.8%
C+	3	5.3%	C+	11	3.5%
C	9	15.8%	C	24	7.7%
C-	3	5.3%	C-	24	7.7%
D+	1	1.8%	D+	28	8.9%
D	4	7.0%	D	36	11.5%
D-	1	1.8%	D-	9	2.9%
F	10	17.5%	F	95	29.7%
I	1	1.8%	I	1	0.3%
WD*	1	1.8%	WD*	8	2.6%
X	16	28.1%	X	49	15.7%
Total	57		Total	313	
Sum of C-, D's & F's (< 2.00)	19	33.3%		190	60.7%
Sum of C-, D's, F's, drops, WD*	36	63.2%		249	79.6%

*withdrawal

For fall 2008, 225 (23.5%) of first year engineering students (not including undeclared engineering students) received less than a 2.00 GPA their first semester. For 2009, it decreased slightly to 20.6% or 226. Grade point average was a 2.63 in 2008 and a 2.74 in 2009. Table 4 shows that for undeclared students, 17.1% received less than a 2.00 GPA their first semester in 2008 and in 2009 only 11.1% received less than a 2.00 GPA.

Table 4. Average and Median GPAs

	All 1st Year Engr Students (except undeclared students)		1st Year Undeclared Engr Students	
	2008	2009	2008	2009
Median GPA	2.78	2.92	2.92	3.00
Average GPA	2.63	2.74	2.81	2.85
Total	959	1097	357	360

Table 5 shows that the undeclared engineering students dropped in percentage in the number of students who received between a 1.00 and 1.99 GPA (from 14.3% to 8.3%). In addition, the number of students who received less than 2.00 GPA decreased from 17.1% to 11.1%. The undeclared engineering percentages were lower than the average for the rest of the college. Initially it seemed that getting notice from the instructor may help to some extent, but the added contact from meeting with their advisors appears to yield the most benefit.

A few instructors sent back unsolicited comments such as;
- I think that the early warning system is a very good idea.
- Thanks…. for setting this up. What a good idea!
- Thanks- I used it. It worked well

Table 5. GPA Changes From Fall 2008 to Fall 2009

	New Engineering Students (Except Undeclared)				New Undeclared Engineering Students			
	Fall 2008		Fall 2009		Fall 2008		Fall 2009	
	#	%	#	%	#	%	#	%
Less than 1.00 GPA	68	7.1%	70	5.9%	10	2.8%	10	2.8%
1 .00-1.99 GPA	158	16.5%	156	14.2%	51	14.3%	30	8.3%
Total (Less than 2.00 GPA)	225	23.5%	226	20.6%	61	17.1%	40	11.1%
Overall # of Students	959		1097		357		360	

Conclusions

There are many improvements we could make to the system but lack of time and resources hampered extensive development. However, despite its simplicity it is achieving one of its primary goals which is giving the advisor notice of poorly performing students in addition to notifying students. This in turn helps the advisor to know who to reach out to, especially as advising loads continue increasing each year and in many cases loads are in excess of 200-300 students. Research has consistently shown the importance of students making key connections their first year in college. It has also stressed the importance of the students' academic performance their first semester in retaining and graduating students. Preliminary results show that the early warning system could make an important contribution to improving the academic performance of first semester students. Many benefits may result by increasing communication with an instructor and an advisor or taking advantage of other resources that hadn't been previously utilized. Students that come in and speak with an advisor are practicing behaviors that will help them be successful in the future. In some cases, after talking to an advisor, a student dropped a class. This in turn may have reduced overall stress and allowed the student to perform better in the remaining classes and also helped the student to maintain a certain level of confidence in their abilities while making the adjustment to college. While analysis is ongoing, the initial results seem to indicate the importance of the students having met with their advisors as opposed to just having an early warning notice without any personal contact.

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