Student Engagement Strategies in One Online Engineering and Technology Course

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Abstract

As online learning continues to grow in popularity with both students and universities, the question of how engaged students are within these courses remains a large concern for those in academia. Given the technology that is available, how can we provide a more connected environment for student learning while online? Are there specific methods to ensure students embrace the subject matter at hand?

This two year study examined the various methods of student engagement employed in two online sections of the same ethical decision-making engineering and technology course in the School of Engineering and Technology at Indiana University-Purdue University Indianapolis (IUPUI). Two different instructors taught the online sections, and various instructional strategies were employed. As one instructor utilized asynchronous forum postings, both made use of real-time chats and web meetings with their students. Variation continued even within the synchronous discussions as one faculty member led the discussions themselves, while another appointed a rotating student leader for student-centered discussions. As both of the sections were held completely online within a learning management system and shared the same course textbook and major assignments, it became necessary to discover what differences students may have experienced within the other elements of the course such as the synchronous chats through the administration of a one-time survey toward the end of each of the courses. Researchers were curious if one particular method of engagement was preferred by the students, and thus, engaged them in the course material further than any of the others. Basic site activity data, chat data and message data from the learning management system was also statistically examined against students' final grades to determine if any significant relationship existed.

Besides learning basic demographic and descriptive information about the student groups in the two course sections, researchers gained perspective on their experience within the course itself. Details emerged on both the frequency and process of synchronous chats, communication by students and instructor, and how the students felt "connected" to the course, instructor and fellow students. Final results also demonstrated a mixed response on how students felt with the instructor led chats versus them leading the chats themselves. And the final statistical results demonstrated a positive outcome in regards to final grades and total site activity as well as chat activity in the course.

Introduction

The explosion in growth of online learning in recent years at most universities has only fueled the continuing debate of how best to engage students in this virtual classroom environment. Add to the mix the growing use of various aspects of technology now available within most learning management systems and the traditional correspondence course is no longer the only option. Tools such as electronic podcasting, assignments with instructor plagiarism-check features,

discussion forums or blogs, and online chats are now common features for students taking online courses and can provide plenty of opportunity for engagement.

Even with all of these online tools, it has been suggested that interaction in online environments creates additional student centered learning and fosters greater participation from students (Karayan & Crowe, 1997; Smith & Hardaker, 2000). [1, 2] Warschauer (1997) believes in interaction in online environments for student benefit as well.[3] Findings in a study by Haythornthwaite, Kazmer, Robbins and Shoemaker (2000) suggest that students that fail to connect with others in an online environment "feel isolated and more stressed than those who are more active" (p. 1).[4] Based on earlier work by part of the researchers, perceptions of the instructors, course effectiveness and course products were essentially similar in results no matter how they were delivered – traditional, distance or compressed (Feldhaus & Fox, 2004).[5] And finally, based on a study by Davies & Graff (2005) students who failed their online courses interacted less frequently than their counterparts.[6]

Method

With all of this in mind, researchers desired to explore student engagement in one ethical decision-making engineering and technology course in the School of Engineering and Technology at Indiana University-Purdue University Indianapolis (IUPUI) during a two year period. Of particular interest was how the students' final course grades were impacted by their overall site usage, chat and message activity. Researchers were also curious to learn both the students' and instructors' perspectives on communication, tools, chats and activity within the learning management system (LMS.)

Beginning in the fall of 2012, researchers piloted the study with just two online sections of the engineering and technology decision-making course in order to fully develop the survey and study for future semesters that will feature up to six or seven online sections and between four to six different instructors for those sections. Both students and the two instructors were invited to participate in the pilot survey with a response rate of 90% from students, and 100% from the instructors on their respective surveys. The students in each section were offered extra credit points as an incentive to participate and the survey was available for approximately one week. The instructors were provided no incentive for their participation. Each survey took the study participates approximately 5-10 minutes to complete depending on their short answer questions.

At the same time, researchers pulled the students' final course grades, site learning management system usage totals, the chat activity totals, and messaging activity totals within the learning management system for statistical analysis in order to better understand if any of these elements contribute to a higher grade for a student in the course. Would the more a student participated in synchronous chats lead to a higher final grade in the course? What about the more site usage in the learning management system as well? These, along with a few other questions were ones that investigators hoped to answer from this simple data.

Results

Results will be categorized by the survey responses first, followed by the statistical analysis performed on the data taken directly from the learning management system.

Demographics

Within the two online sections approximately 32 students or 73% answered they were male, while only 12 participants or 27% responded they were female.
The age range on both student surveys combined was as follows:

Table 1. Student Ages

Age Range	Student Responses
18 - 25	55%
26 – 35	36%
36 - 45	7%
41 - 50	2%
51 & older	0%

Students' class standings in both online sections were fairly distributed among the class ranks with the largest concentration within the junior standing:

Table 2. Student Class Standing

Class Standing	Student Responses
Freshman	7%
Sophomore	18%
Junior	57%
Senior	18%

Researchers also discovered that only 31 students or 70% in both online sections were actual School of Engineering and Technology students, while the other 13 or 30% of the students were majoring in other schools such as nursing or general studies. Although the researchers had been prepared for a percentage of the survey respondents from the ethical decision-making course to be from outside the School of Engineering and Technology at IUPUI, they had not expected the number to be quite as high as 30% within these two online sections.

Individual Engagement Initiatives

As with any class, there are a few things that one can do to at least attempt to engage oneself within the material. Within an online course, the first of these becomes how often one logs into the learning management system to check for messages or announcements, work on assignments, download resources, etc. While both instructors answered that they logged into the LMS daily, student responses for both online sections were as follows:

Table 3. Student LMS Log Rates

Class Standing	Student Responses
Daily	48%
Three or more times per week	39%
Once or twice per week	14%
Every other week	0%
Monthly	0%

Next, as both instructors indicated 100% weekly use for the LMS tools in Table 4 for both their online sections, student utilization was recorded as follows:

Table 4. Student LMS Tool Use

LMS Tools	Student Responses
Announcements	77%
Assignments	84%
Chat Room	89%
Gradebook	93%
Messages	84%
Resources	91%
Syllabus	66%
Tests & Surveys (Quizzes)	89%

The learning management system was also capable of forwarding all internal course messages to an outside email system such as Google, Yahoo, etc. so that anyone receiving a message within the LMS would not have to be logged in to both receive and read the message. This option must be enabled by each user with an additional email supplied so that the messages will be forwarded from the system. Both instructors (100%) set up their systems to forward the messages from their courses, but only 50% of the students in these two sections initiated this feature even though both instructors discussed the advantages during the course according to the instructor comments.

Communication

In traditional face-to-face classrooms many forms of communication take place, but this still can be true in an online environment as well given how the course is set-up. The following chart demonstrates the communication methods used in these two online sections and include the instructor responses as well:

Table 5. LMS Communication Methods

LMS Tools	Student Responses	Instructor Responses
Met in Person	2%	100%
LMS Messages	82%	100%
LMS Chat Room	86%	100%
Email	30%	100%
Phone	5%	100%
Skype	0%	0%
Adobe Connect	0%	0%

The frequency of communication among students in the course:

Table 6. Student-to-Student Communication Frequency

Communication Frequency	Student Responses
Two or more times per week	2%
Weekly	84%
Monthly	9%
Never	5%

86% of the students expressed that they either "agreed" or "strongly agreed" that this amount of communication was adequate enough to engage them in the course, while just 9% was "undecided" and 5% "disagreed." There were no students that answered with "strongly disagree" to this particular question on the Likert scale.

Next, students were asked to comment on how often their instructors communicated with them using the various methods outlined in Table 5 during the course, and likewise, the instructors were then asked on their survey how often they communicated with their students. Table 7 is a reflection of these results:

Table 7. Instructor-to-Student Communication Frequency

Communication Frequency	Student Responses	Instructor Responses
Two or more times per week	20%	50%
Weekly	73%	50%
Monthly	7%	0%
Never	0%	0%

93% of students conveyed that they either "agreed" or "strongly agreed" that this amount of communication was adequate enough to engage them in the course, while just a mere 7% replied they were "undecided". There were no students that answered with "disagree" or strongly disagree" to this particular question on the Likert scale.

Instructor Engagement Initiatives

Both instructors held bi-weekly synchronous chat sessions online with their class sections as an instructionally designed engagement effort within the course. All students confirmed the fact that the chats were held within the LMS environment and were either led by the instructor (50%) or by a rotating student leader (50%). 100% of the students in the first section commented that they were happy that the instructor led the chats and 100% also did not prefer to have a rotating student leader for the chats instead. But in the second section, 95% agreed they were happy with using a rotating student leader and just 5% unhappy. The greatest disparity was with the fact that 33% of this second section did feel that they would have preferred to have the instructor lead the chats vs. the rotating student leader.

Overall 48% of students in both sections "strongly agreed" and 41% "agreed" that they liked these type of live discussions, while just 9% were "undecided" and only 2% "disagreed". None of the students selected the category of "strongly disagree" on the Likert scale to the question of liking the live chats during the course. Both instructors also liked holding the chats even though each held them differently with one of them leading the chats, and the other letting a rotating student leader hold the chats. Each instructor also commented that they would not change their method and switch to instructor led chats or student led chats or vice versa.

Student responses on the question of whether or not the synchronous or live chats helped to engage students in the course more resulted in identical numbers to the previous question with 48% students answering "strongly agreed" and 41% "agreed", 9% "undecided" and 2% "disagree". Once again, there were no students that selected the category of "strongly disagree" on the Likert scale. Both instructors felt that these synchronous chats did indeed engage their students in the course according to their survey answers.

Finally, students were asked how "connected" they felt to their fellow classmates and their instructor compared to that of a traditional face-to-face course given the online course contained the synchronous chats. Table 8 reflects both student sections answers:

Table 8. Student "Connectedness"

Rate	To Classmates	To Instructor
Less	32%	20%
More	20%	20%
The Same	48%	59%

Likewise, the instructors were asked how connected they felt their students were to each other and how connected they were to their students by the end of the course considering the various instructional elements including the synchronous chats. The answers were equally divided with one instructor answering they were connected to their students "less" while the other instructor replied "the same". By the same token, when asked how connected their students were to each other one instructor replied "less" than a traditional classroom while the other answered with "the same" again.

*Final Grades vs. Chat, Message and Total LMS Activity*

Outside of the survey, students' final grades were collected along with total site usage, total chat activity, and total message activity within the learning management system. Researchers were curious to discover:

1. If there was any relationship between students' final grades and the amount of site activity, chat activity, or message activity within the learning management system.
2. If increased site, chat or message activity impacted students' final grades in any manner.

In order to answer these questions about the relationship between the different variables, a Pearson Correlation was first performed on each set.

To start, final course grades were examined with total site usage of the learning management system. This produced a significant correlation (p=.000) of .479 as Figure 1 demonstrates below:

Figure 1. Total Site Activity
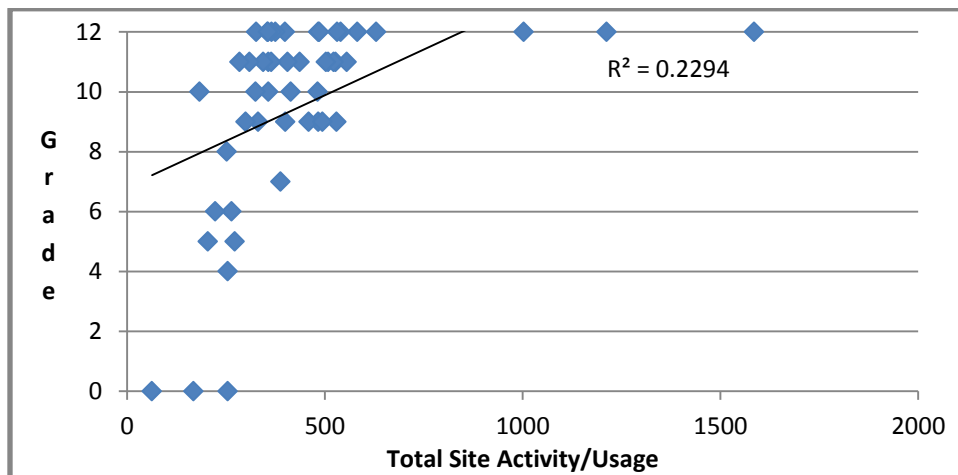
Next, final course grades were analyzed against chat room activity in the learning management system. This also produced a significant relationship (p=.001) result of .450 as Figure 2 displays:

Figure 2. Chat Activity
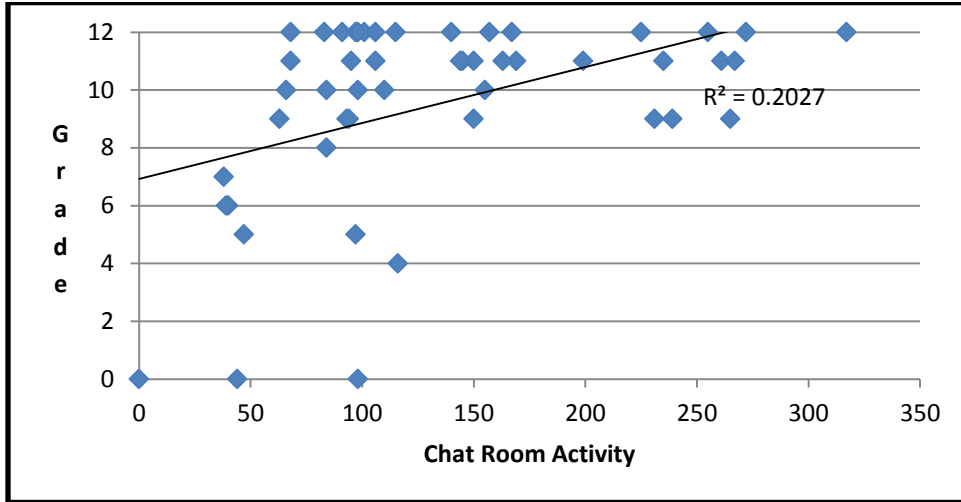
Finally, final course grades were evaluated alongside message activity in the learning management system. This time, however, the relationship was extremely low at .125 and not statistically significant (p=.391) then as Figure 3 reveals:

Figure 3. Message Activity
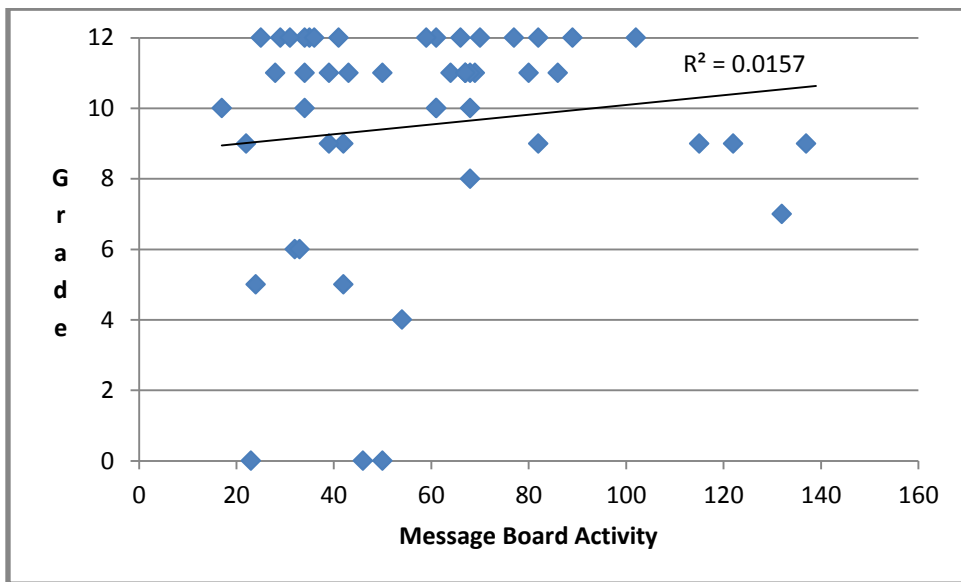
To answer the second question of if increased site, chat or message activity impacted students' final grades in any manner, a regression analysis was performed on all sets of the data as previously matched. In order to perform this final course grades were converted to a 12 point scale, so an A+ = 12, an A = 11, an A- = 10, and so forth. Table 9 demonstrates the ANOVA results and Table 10 displays the final results for all sets of the data:

Table 9: ANOVA Results

ANOVA[ab]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	153.493	3	51.164	6.678	.001[b]
	Residual	344.752	45	7.661		
	Total	498.245	48			

a. Dependent Variable: Course Grade
b. Predictors: (Constant), Message Activity, Chat Room Activity, Total Site Activity/Usage

Table 10. Final Regression Results

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.950	1.094		5.438	.000
	Total Site Activity/Usage	.005	.002	.362	2.602	.013
	Chat Room Activity	.013	.006	.309	2.261	.029
	Message Activity	-.004	.014	-.037	-.283	.779

a. Dependent Variable: Course Grade

Final results demonstrate that as the student's total site activity increased by 1, it increased the final course grade by .005 based on the 12 point grading scale. Likewise, an increase of 1 in chat room activity increased the final course grade by .013. Message activity had a small negative impact associated with the final course grade but this relationship was not statistically significant. The results for the beta coefficient suggest that the overall change in total site activity had the greatest impact on final course grade for students compared to the other two variables examined.

Conclusion and Future Considerations

The results of this pilot study suggest several implications on student usage, communication, synchronous chats and final grade impact in this online ethical decision-making engineering and technology course and have several suggestions for future study as well.

First, even though the instructors set up an interactive and involved environment utilizing various course tools available in the LMS such as the chat room, announcements, messages, etc. weekly and stayed connected to the LMS daily themselves, only 48% of the students accessed the environment daily, 39% at three or more times per week and 14% at once or twice per week. In addition, while both instructors took advantage of the LMS's capability to forward the internal messages to an outside email so that they could stay connected to course issues and students, only 50% of students enabled this feature to stay informed of course events and information even after the faculty reminded them of the advantages of doing so. This demonstrates an amount of distance that a number of the students choose to maintain throughout the course. Student comments in this area reflected this as well: "because a weekly periodic check was sufficient so mobile access was unnecessary" and "I log on to my computer (and the LMS) frequently enough to stay informed." Researchers plan to examine this area in close perspective in the larger study

in future semesters to determine if this is a continuing trend or if this data fluctuates at all with the increase in online sections examined.

Communication results suggest that both students and instructors felt that the amount of communication in this course was sufficient to engage students in the course. Less than 10% replied that they were "undecided" or "disagreed" with the feeling of engagement from the amount of communication from between both student-to-student and instructor-to-student associations. Researchers will be interested to understand if this changes as additional online sections with other instructors are added to the study in future semesters.

Next when exploring one of the largest engagement initiatives within the course, the synchronous chats, both instructors and the majority of students agreed that they liked this type of discussion added to the course. Likewise, both instructors and the majority of students commented that the felt it also engaged the students in the course more as well. Student comments in this area indicated this also: "helped us get more in touch with ethics, other students' opinions, and thoughts"; "it is the only way to engage in an online class"; and "allowed us all to get involved with each other and get other points of view." Even with this positive feedback when students were asked how "connected" they felt to their fellow students and the instructor, 32% still answered less to their fellow students and 20% answered less to their instructor. Another positive in these results was that 20% also felt more and 48% felt the same connection to their fellow students, while 20% felt more and 59% felt the same for the instructor which indicates the greatest majority in the course had the same, if not more of a connection with both their fellow students and instructor. There are several future considerations with synchronous chats, the first being the discrepancy between the two piloted sections as one section had the instructor lead the bi-weekly chats and the second section had a rotating student leader. As the results demonstrated in this study, students with the instructor led section were 100% happy with their chats and 100% did not prefer to change, while 95% were happy in the rotating student leader section and 33% did prefer to have the instructor lead the chats instead. In future semesters, the additional sections and instructors will have an impact on these results depending on how they elect to conduct their chats (instructor vs. rotating student leader.) It is the hope of researchers that at the end of the two-year study the true student preference can be determined with enough evidence to validate the results. Other respects with the synchronous chats that may alter results in the future include both how often the chats are held (these were held bi-weekly) and for how long each session lasts (these were held for 60 minutes each.) These variables may provide even more interesting findings if they become more inconsistent between the multiple online sections. Researchers plan to examine this area closely and perhaps in more depth as required in future semesters.

Finally after running the Pearson Correlation between students' final course grades and several of the learning management system variables such as total site activity, chat and message activity, researchers are better able to understand specific activities that impact a student's final course grade. Overall, total site activity proved to have the greatest impact on final course grade at .005 to every 1 point of increased site activity. As mentioned above, both instructors and students liked and felt the synchronous chats engaged students more in the course. Similarly, the mathematical results demonstrated that the chat activity had an impact of .013 on a student's grade to every 1 point of increased chat activity validating those instructor and student opinions.

For the future semesters of the study due to the pilot results, researchers plan to focus on only the total site and chat activity since the message activity had no significant impact with any of the findings. It should also be noted that researchers attempted to run the Chi-Square within certain questions against the two surveys, instructor vs. student, but almost all the results came back as not significant and this was largely due to the fact that this was the pilot study with only two sections and two instructors. Researchers anticipate being able to expand the use of this and other analysis tools in upcoming semesters depending on the number of online sections offered and instructors teaching.

Based on the results of this pilot study, researchers understand that the majority of students felt engaged in the ethical decision-making engineering and technology course due to their total site and chat activities. Planned next steps to this research include the continuation of this study for the two-year period with the expansion to the full online sections available each and every semester including summer sessions. This should provide researchers up to six or seven sections to investigate each semester and at least three sections in the summer months providing a large amount of data to be able to examine. Researchers are anxious to discover if those results will be similar to these in the end.

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