

Interaction in Online Courses

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Abstract— There is an increased need within the engineering education sector to be more cognizant of the student learning process and effective ways of teaching them. To encourage greater student communication and interaction, engineering disciplines are becoming more focused in their use of the online learning environment by promoting the utilization of discussion boards, video gaming, and virtual worlds. The following article elucidates what engineering programs are doing around the U.S. to make online engineering programs more successful and engaging as well as educational techniques to getting students interacting at higher levels in online courses.

Index Terms— Communication, Interaction, Online courses, Student centered learning.

I. INTRODUCTION

Engineering is the only discipline area having the lowest online representation with a fall 2007 higher education institution penetration rate of 16 percent that offered a fully online engineering program compared to 24 percent for psychology offering a fully online psychology program and 33 percent for business offering a fully online business program [1]. According to the National Science Foundation (NSF), comparing data for the years 2006 and 2007, there was a 5.9 percent increase in graduate-level engineering programs. Civil engineers exhibited the largest percentage enrollment increase at 11.6 percent with 19,867 students, biomedical engineers at 6.2 percent with 6,904 students, and mechanical engineers at 2.5 percent increase with 18,347 students [2]. The employment outlook for 2006-2016 indicated that engineers will be among the fastest growing occupations with a projected 160,000 additional jobs [3].

A few years ago, many universities in India came to the realization that in order for their engineers to gain an equal footing in the global marketplace, the focus should be on the optimization of technical knowledge in the fields of management, marketing, finance, and organization. France also saw the need to revamp their engineering education system by emphasizing a pairing of formal technology training with the liberal arts and like India focusing on ways to stress a global perspective. Engineering departments in the United States chose to place particular emphasis on professional skills. For example, a University of California engineering school began offering online courses and degree programs that were personalized to accommodate the engineering

professional sector. The University of Wisconsin at Madison began offering an online master of engineering in professional practice that allowed students to complete a two year master's degree program without interrupting their career [4].

There is an increasing need within engineering education to be more aware of the student learning process and effective ways of teaching them [5]. According to Robinson and Hullinger (2008) an online learning environment is a perfect setting to encourage greater participation in mental capacities by integrating assignments that require higher level thinking skills. A convincing benefit of online learning is that students developed an assortment of computer skills. The autonomy of online learning is another benefit that has helped students to successfully learn on their own [6]. Asynchronous online discussion groups can contribute to student performance, self-worth, and satisfaction. A well designed discussion group can offer the chance to produce collaboration [7].

In a study of seven four-year colleges in the U.S., it was found that approximately 50 percent of all self-declared engineering majors dropped out during their first year because of the high degree of dislike towards the instructional experience received, citing the poor teaching skills of faculty as a primary reason, specifically the lecture format [8]. Present day students have a short attention span and favor the learning preference that involves exploration and discovery [9]. Mayo (2007) indicated a possible solution to reducing the dropout rate of engineering majors and increasing interaction could be found in video gaming. The use of video games in the educational system could be a means to improve learning outcomes through experimental learning with effective learning paradigms including:

- Experimental learning
- Inquiry-based learning
- Self-efficacy
- Goal setting
- Cooperation
- Continuous feedback

The use of video game teaching effectiveness when compared to that of a lecture showed positive improvements of 30 percent or more. Additional reasons for considering the use of video games in engineering courses include the mass appeal, availability to play at any time of day, designed to make learning more effective, and stimulates brain chemistry which in turn promotes learning [10].

A study conducted by Virginia Tech on the educational needs of engineers gleaned the following based on information gathered from employers, faculty, students, national consortium organizations, and competitors [11]:

- Four year colleges and universities were viewed by employers as being skilled in their delivery of distance education programs.
- Employers viewed distance education as very important to professional continuing education.
- Over 50 percent of the respondents were in agreement that distance education could be cost effective.
- When it came to employee training and professional development, more than 60 percent of the respondents indicated a lack of staffing to facilitate distance education.

The Virginia Tech study also asked company representatives and practicing engineers to list course topics that would enhance engineers' effectiveness in distance education courses. Leadership/soft skills, information technology, and project management software courses were identified as the top three topics. Participants indicated the top reasons for taking distance education courses were the convenience of studying at your own pace and flexible locations. They indicated that online courses should include multi-media instruction, chat rooms and other ways to communicate with faculty and students, and video conferencing. In addition, participants indicated that online course content should provide information that could be immediately utilized, use simulations of real-world situations, and provide a mix of group activities and on your own activities [11].

The key factor that has made an online course succeed or fail has been the element of interaction. Student interaction and teamwork plays a significant part in e-learning [12]. Students who have interacted in online courses have benefitted from the learning process and the achievement of positive results. When the interaction aspect has been absent, students exhibit dissatisfaction with the distance-learning course. Successful online instructors have been able to overcome communication and psychological breaches caused by operational distance associated with e-learning. Carefully structured online courses can lead to the element of closeness, thereby encouraging interaction [13].

There has been rapid growth of e-learning in recent years with an increasing number of universities offering online courses. E-learning technologies have seen a lack of support for group-oriented learning with a possible solution being the use of virtual worlds. This medium is something new and different for education. Students are able to create experiences in other roles, places, and times using virtual worlds. Results of a study involving the use of a virtual learning environment found that participation

in virtual group discussions and projects with individuals from varied cultures and locations throughout the world could be the same as being physically together [14].

Allen and Seaman [1] stated that online learning benefits learners when (a) learners wish to learn this way, (b) learners have access to and the skills to use the technology, (c) learners perceive that online learning is adding value to their lives, and (d) learners have access to support help when experiencing technology issues. In addition, Shank and Sitze [15] noted that many potential benefits to online learning include the following: everyone can contribute; the environment is learner controlled; the process can happen anytime, anywhere; and there is a permanent record of communication. Potential disadvantages to online learning include the lack of visual cues, technological and access hurdles, and a favoring of those who communicate well in writing.

A case study that involved five online graduate courses at two Midwestern higher education institutions, investigated asynchronous online discussions, evaluation procedures, and the meaning students achieved from their experiences. The online courses required the study participant to take part in gradable asynchronous discussions on a weekly or bi-weekly schedule. The study findings found that learner autonomy, learning community, structure, student writing skills, and self-regulatory cognitions were identified as essential features in online discussions and student experiences [16].

Kupczynski [17] conducted a study to examine various instructor behaviors and teaching methods utilized in Internet-based learning environments and to determine which approaches lead to student success in the online environment. Her study was a descriptive and comparative analysis of data collected from South Texas College. The college was located in a region with a high minority population and had a student population of over 17,000 students enrolled at five campuses covering two counties. The conclusions from her study indicated a relationship between student success and teaching method, instructor clarity, instructor accessibility, and instructor feedback. Kupczynski's study suggested that additional research was needed in this area. She recommended that her study be replicated at another 2-year or 4-year institution and that the new results be compared to the results of her study.

The main focus of a study conducted by Seung [18] was to analyze how the patterns of interaction contributed to the construction of shared knowledge in online learning environments by looking closely at one course in a teacher education program. The researcher took a case study approach, examined the characteristics of students who prefer web-based courses, the students' perceptions of online interaction, and the knowledge construction process through online interaction. The interaction referred to in the study equated to interactive learning activities among students and between students and the instructor through sending, reading, replying, posting,

questioning, answering, inquiring, discussing, and analyzing. The following major learning activities received the focus of this investigation:

1. Interactions via e-mail between the students and the instructor.
2. Interactions through asynchronous threaded discussions.
3. Interactions through synchronous text chat sessions.
4. Interactions between the students and materials.

The study concluded that students were very satisfied with their learning in a highly interactive learning environment through asynchronous communication such as threaded discussions, e-mail, and synchronous chat sessions. Instructors found that students were more engaged in online class discussions when it was personally relevant to them and when their learning was applied in classroom practice. In addition, the initial fears expressed by a few students and some students' frustration due to technical problems were positively changed through interactions among students and between the student and the instructor [18].

A study conducted by deBruyn [19] evaluated the nature and use of asynchronous computer mediated communication over a 2-year period, concentrating on those students learning off-campus, in the context of an interactive inquiry-based learning activity delivered online. The participants were mature-age and currently employed. The use of technology such as computer conferencing and the Internet to locate information and teaching materials available online was designed to enhance the learning experience of these students. This study sought to examine the ability of online communication to build an interactive learning environment that would support student-centered learning and student mastery in the context of an inquiry-based learning activity in which the initial student discussions of the online situation statements were able to occur only via asynchronous computer-mediated communications. Specifically, the study focused on the degree of convergent processes (i.e., degree of analysis, synthesis, and summarizing) and the level of social presence identified in the content of student postings as indicators of the development of an interactive learning environment. The data were gathered electronically and archived from online discussion postings.

The main findings on the evaluation of the level of social presence and degree of convergence in student threaded discussions of a learning situation were that student accessibility was limited, and student participation was unequal and of varying quality. The researcher noted that to improve the quality and quantity of student participation in online discussions, greater instructor immediacy and explicit linking of online discussions to student outcomes or learning objectives were necessary [19].

Based on research findings reported at the 2010 Texas Distance Learning Associations' state conference [20], some of the strategies to keep students plugged-in and engaged with their online coursework is to *modularize* the course content so that they are in chronological and bite-sized chambers allowing students better understanding and access to the material. *Engage students with groups* (discussions/group projects) to allow them the opportunity to interact and learn from one another. *Challenge them* and build *self-reflection and self-feedback* opportunities within the course. *Make assignments and readings as relevant and exciting as possible* to current events and current science; *promote feedback and encourage students*. *Get to know students* from the beginning of the course and communicate with them with *customized messages* instead of just template communication. Lastly, to be *more forgiving* with students as they are bound to hit snags with technology and or will miss assignments with time management. Studies have shown those students who are given more leniency in their online courses seem to respond much better to learning and become more engaged [20].

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