Performance on Collaborative Tasks in Blackboard Chat Rooms and Immersion in Internet-Based Social Networks

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Abstract *— According to the report "Online Education in the United States, 2009" [1] released in January 2010, over 4.6 million students were taking at least one online course during the fall 2008 term; the new online enrollment figure represents a 17 percent increase over the number reported the previous year. Universities offer online courses in a wide range of disciplines. Currently about 16% of institutions are offering programs in engineering. However, online courses for credit towards a degree in some particular disciplines are only available in limited selection. It is often believed that while many courses are enriched by online tools and courseware that include lectures, quizzes, and laboratory experiments, in engineering many types of instruction and student exercises do not lend themselves to effective learning through virtual experiences. In some disciplines, particularly in engineering, group projects constitute a significant factor in the educational experience, and those have shown to be a challenge in the effective implementation of online courses. It is expected that distance education will continue to grow and with it the number and span of engineering courses being offered online will most likely increase. Cooperative and collaborative learning implemented through group projects will continue to play a significant role in online engineering education. The group projects will continue to facilitate deep learning in the subject area and they will allow students to develop team skills that include those needed in effective decision making, communication, and conflict management. This paper describes collaborative learning activities in on-line sections of a freshman level course required by all freshmen at this university, including engineering and computer science majors. The course requirements included well defined and structured group projects to be completed and recorded on Blackboard using the Chat Room communication tool. The paper examines Chat Room records of activities related to group projects from three consecutive semesters. The paper also examines students' self-reported immersion in Internet based social networks during the same three semesters. Results of the analyses of the Blackboard-based group project oriented activities and of the level of students' immersion in Internet based social networks suggest a relationship between student performance on structured cooperative and collaborative tasks in an online course and their level of engagement in Internet based social networks.*

Index Terms — *collaboration, group work, online education, social networking*

SEARCH FOR EFFECTIVE PEDAGOGIES IN ENGINEERING EDUCATION

Armed with knowledge and understanding of the transformations occurring in the world caused by continuously developing technology, particularly digital technology and its information component, there is a general recognition that engineering education must not only follow but also anticipate these changes. Engineering educators examine evolving meanings of knowledge construction, learning, professional competence, and expertise, and try to define knowledge and skills – traditional and specific as well as new - that engineering graduates must possess in order to make a meaningful contribution in their professional life. Engineering educators follow current developments in educational philosophy and pedagogy, and try to devise and apply teaching and learning methods that would be the most fruitful and effective in engineering education.

One of the promising approaches to engineering education is to formulate it within the framework of the Problem and Project Based Learning pedagogy. This pedagogy is based on the Problem Based Learning (PBL) educational philosophy and methods, and it is believed to be most effective in developing engineering skills and acquisition of domain-specific knowledge [2]. PBL is a student-centered instructional strategy in which students generally work in collaborative groups. The PBL approach to engineering education allows knowledge acquisition and the development of the core of domain-specific engineering skills, as well as skills that are interdisciplinary, sustainable, and transferable. The PBL approach focuses on engaging in goal-oriented activities, complex problem solving, life-long learning, and adapting to the demands of digital technology and changing society.

A number of universities have adopted the PBL pedagogy. UNESCO Chair in Problem Based Learning in Engineering Education at Aalborg University in the Netherlands adopted PBL as a sustainable innovation in engineering education to be promoted globally. But in spite of numerous reports of the high effectiveness of the PBL pedagogy, adoption of the student-centered educational philosophy has been slow. This is mostly due to the resources required, the demands imposed on faculty, and challenges which are often associated with the collaborative group component in student-centered learning [3].

21ST CENTURY SKILLS

Critical thinking, problem solving, self-directed learning, and collaboration skills are identified as the key skills defined in the "21st –Century Skills" framework, on which, it is believed, future individual and societal success will depend [4]. Thinking and problem solving, critical thinking, collaboration, and other "21st- Century Skills" have constituted essential objectives in education from the beginning of time, but it has been postulated that the future demands that those skills be common, pervasive, and at a high level. Researchers in education argue that those skills should be effectively taught throughout all educational stages, starting early at schools. When students enter higher education institutions they should be ready to acquire a new domain knowledge and domain specific skills that will allow them to solve complex tasks in particular areas of studies [5].

Research in education suggests that collaboration, considered one of the essential 21st century skills, is not well understood and thus it is not clear as yet how it can be taught effectively. It is generally assumed that the collaboration skill is acquired through working in groups on problems and projects. True collaboration on a project involves more than group work where individual efforts are mere conglomerates and where the quality of one part does not affect the function of the whole project. Collaboration requires knowledge of the domain within which the project is defined, effective application of a specific set of skills, and an understanding of the functional complexity of the project itself. Among other things, collaboration requires interaction by group members, and the use of feedback in terms of providing it as well as receiving it. It should also provide opportunities to modify individual work so that each project component performs as intended and effectively integrates with other parts of the project. For many years, researchers in education and university teachers have studied and discussed the nature of cooperation and collaboration in university learning environments, and have developed sets of guidelines for effective group work through which collaboration skills are to be acquired [6]- [8].

COLLABORATING ON GROUP PROJECTS

Student-centered instructional methods such as Project and Problem Based Learning have proven to be challenging for teachers in a brick-and-mortar environment but they have shown to be particularly difficult to implement and assess effectively in on-line courses. While individual learning within Project and Problem Based Learning pedagogy applied in on-line courses may be very successful, achieving effective student collaboration on group projects on-line poses challenges.

Social studies and educational research show that an important factor in collaborative work is face-to-face interaction with group members, exchanging information, giving and receiving feedback, and discussion of alternative solutions. In over 80 percent of on-line courses all of the content and assessment is delivered and processed on-line and the courses have no face-to-face meetings. Often the students reside in different places, sometimes in different parts of the world. Many students who take on-line courses have different obligations and different work and study schedules. For many students, committing to a particular time for meeting on-line proves to be difficult. Many students, while able to deliver high performance on individual assignments, default on group assignments. On-line courses seem to have proven themselves to be what they were intended to be: efficient conduits for delivery of education anywhere and anytime to individual students.

In order to teach collaborative skills through group projects in on-line courses, an instructor must show a considerable degree of ingenuity in course design and the choice of group projects. The educators who design on-line courses must also recognize changes in the population of the new generation of students who have grown up with the intense use of information technology and computers. Instructors must be able to incorporate the implication of those changes as they relate to teaching and learning.

DIGITAL IMMERSION

Information technology has made on-line education possible and has changed the educational system profoundly. The pervasive and ubiquitous use of the Internet, engagement in web searches, and in particular participation in social networks, also has shown a significant effect on student behavior and learning. The repetitive and deeply engaging use of information technology has influenced the way students think, behave, interact with people, engage in tasks, and learn. Research shows that intense interaction with computers and the Internet changes the way in which the high-technology users' brains function, and that it causes changes in the neural circuitry of the users' brains.

The current generation of university students has been using the Internet for many years now. In recent years a large percentage of students has engaged in social networking on a large scale. Social networks allow the users to communicate and interact with large numbers of other users. But although the students tend to be connected with other students and friends all the time, the nature of their interaction is not the type that fosters the kind of cooperation required, say, in an engineering group project, either in face-to-face collaboration or in an on-line meeting.

In recent years there have been numerous studies on the effects of social networking on their users. However, it appears that there is a dearth of research related to the effect of the use of social networking on the performance in work groups that comprise goal-oriented activities and dedicated collaboration, and which require effective outcomes from the group members working either in face-to-face environments or on-line.

Research on social relationships and social networking shows that the latter has a positive impact on the former when the users are friends in real life, or simply when on-line social contacts are also off-line contacts [9]. Those findings have implications on the design of group projects and understanding student behavior and preferences in learning environments. Based on the research on social networking, it may be postulated that building a learning community that allows fellow students and group members to know each other should have a positive effect on group work and on learning how to collaborate in both face-to-face and on-line educational environments. Studies show that face-to-face interaction is highly significant in social networking. This would suggest that in on-line courses, on-line group meetings should benefit from the use of web-cameras that would allow group members to see each other's faces and their facial expressions.

Furthermore, research in neuroscience shows that repetitive use of the Internet alters the function and wiring of users' brains. For example, web searches and on-line activities have shown to change the neural circuitry of the left front part of a user's brain. That particular part of the brain controls the human ability to make decisions and integrates complex information. Among its other functions, this part of the brain controls working memory. Searching the web improves some cognitive abilities, particularly those related to rapid information processing. However, scientists are concerned that while an Internet user's brain adapts for rapid web searches, the neural circuits that control traditional learning functions are used less and as a result may gradually decrease. Research shows that intense Internet users encode information differently from less frequent users [10].

Research on the impact of digital technology on behavior shows that the intense use of Internet-based information technology affects users' attention. While frequent Internet users show improvements in many forms of attention related to sifting through large amounts of information, they also show shorter attention spans which are particularly detrimental in the context of traditional forms of learning. Being continuously surrounded by, and interacting with, high-tech information puts the users in a state of "continuous partial attention", This state makes them ready to accept a new piece of information in an instant, but at the same time hinders the users' ability to think at deeper levels and make thoughtful decisions.

Living immersed in digital technology, scientists say, wires the brain to crave instant gratification which is related to short-term and long-term rewards. This has implications on developing and maintaining skills such as planning for the future, learning, collaboration, and social interaction. In an academic setting, it affects students' behavior and preferences in classroom and on-line learning, working on projects, and collaborative work. Heavy users of digital technology tend to postpone long-term goals, show a preference for superficial processing of information rather than in-depth understanding and pursuit of knowledge, prefer disconnected pieces of information to complex information within its full context, and show lack of understanding of the big picture. In intense digital technology users the areas of the brain that are active in traditional learning methods as well as in face-to-face interaction become less developed and may even atrophy, researchers say.

The work being done defining skills for the 21st century as well as adapting education methods and philosophies will have to take under consideration the new characteristics of generations of students who have grown up surrounded by ubiquitous and pervasive digital information technology, and have been its consummate users throughout their lives. Constructivist learning theory-based methods as well as the Project and Problem Based Learning approach to teaching and learning need to be evaluated and adapted to new generations of students. These students, who have been changed by their interaction with digital technology, find the traditional approach to learning as well as skills and knowledge acquisition not attractive and not compatible with the skills they have developed through their life-long use of cyber tools and the Internet.

COURSE WORK: EXAMS, HOMEWORK, AND GROUP PROJECTS

This study was inspired by an observation that there existed a peculiar inconsistency in performance on various tools of summative assessment in a freshman level on-line course. More specifically, students performed very well and with apparent diligence and enthusiasm on individual assignments and exams. However, they performed very poorly on group assignments that required recorded sessions in Blackboard Group Chat Rooms. The observation and subsequently examined data come from an Analytical Reasoning (AR) course, a first year level course that had to be taken by all students at the university including those enrolled in engineering. The study examined student performance data from three consecutive semesters of the course, as well as student responses to a questionnaire that was administered through the Blackboard course management system.

On-line sections of Analytical Reasoning used the same textbook and syllabus as the regular sections of the course. The material covered, the schedule of coverage, the course content, and the exam dates were the same. The number of homework assignments was at least twice as high as the number of assignments for the on-campus sections. To

compensate for the lack of face-to-face interaction and the opportunity to develop collaborative skills afforded to students in on-campus classes, the on-line course required completion of two group projects.

The projects required on-line group meetings and recorded sessions in group Chat Rooms on Blackboard. The subjects of the group projects were related to current world issues and affairs. The projects were designed for students to apply skills and knowledge learned in the course, as well as learn about responsibility with regard to individual contribution, cooperation, collaboration, feedback, and goal oriented endeavors. The instructor provided support and directions. Initially, 3-person groups were formed by the instructor. Throughout the semester, the students could change the group membership, or even meet impromptu in a Chat Rom to which all students enrolled in the class had access.

Summative assessment in the course comprised 4 exams (75%), 32 homework assignments (20%), and 2 group projects (5%). The on-line Analytical Reasoning course had no face-to-face activities. The exams and homework assignments were delivered and scored through the Blackboard course assessment system. The exams had constraints in terms of time and number of attempts. The homework assignments had constraints in the number of attempts allowed but no time constraints. Homework assignments had strictly enforced due dates; and the exams had specified periods of time during which they could be taken. The exams and homework assignments had the format of on-line tests. Immediately after a student submitted a test, the Blackboard system assessed his or her performance and showed the grade as a percentage of correct answers as well as a score, i.e., the number of correct answers. The grade received on the test was used by the course management system to modify a weighted total grade and made that grade available to the student practically instantly. The weighted total grade showed in percentages the total earned so-far towards the final grade.

Group assignments had due dates and each assignment required at least two meetings in group Chat Rooms. The Chat Room sessions had to be recorded – the text records had to show the processes and steps through which the solutions were obtained; comments, statements, and explanations indicated individual engagement and contribution to the projects. The sessions were examined by the instructor and were graded manually. Students could receive credit for the group assignments only from the Chat Room records and only if at least two students attended the recorded sessions.

Homework assignment had between 10 to 20 questions. The work on homework assignment was considered to be an individual effort for the purpose of grading but cooperation between students while studying and working on assignments was encouraged. The number and the nature of questions received by the instructor suggested that students indeed put individual effort into completion of the assignments. However, there was not much evidence that students interacted with classmates and engaged in studying together.

All students enrolled in the course completed homework assignment at a rate higher than 90%. Most of the students completed homework assignments soon after they were posted and submitted them well before the due dates. Most of the scores on the homework assignments were between 80% and 100%. Exams were taken by all students enrolled in the course and the exam scores showed to be well distributed with a satisfactory average and standard deviation.

Group projects required the group members to get in contact with fellow students, allocate responsibilities, and set a meeting time in the Chat Room. In each semester, the students had difficulties with establishing contact with group members, establishing a mutually acceptable time for the meetings, and with attending the meetings. Many students concerned about their grades completed all parts of the projects on their own and submitted recorded Chat Room sessions of their work. Some students who presented recorded sessions of their own work on all parts of the completed project requested that their group members' names be added to the authors list so all of them would receive credit for the project – requests rejected by the instructor. The instructor insisted on adhering to the specified rules for the group projects. Each semester, although many students completed the projects, only those who provided records of Chat Room sessions with at least two persons present received credits for the projects.

END-OF-SEMESTER QUESTIONNAIRE

At the end of each of the three semesters, the students were asked to complete a questionnaire in which they were asked about their experience in the on-line course. The questionnaire also included questions about the students' involvement in non-course related activities in the digital world.

Spring, Summer, and Fall enrollments in the course on-line sections were 38, 42, and 45 students respectively. In the Spring, Summer, and Fall semester sections the number of students who completed the on-line questionnaire were 24 (63%), 30 (71%), and 30 (67%).

In one of the questions the students were asked about their participation in the Chat Room meetings. Responses for "always", "practically always", and "sometimes" were combined. They show the number of students who participated in some ways in Chat Room meetings among the students who responded to the questionnaire during Spring, Summer, and Fall semester was 20 (83%), 17 (57%), and 15 (50%) respectively. When the whole class records were considered, the number of students who completed the projects as group collaborative assignments and received grade point credits during the Spring, Summer, and Fall semesters was 16 (42%), 10 (23%), and 2 (4%) respectively. Figure 1 shows that as enrollment in the on-line sections increased over the three semesters, the number and the percentage of students who received credit for collaborative group work decreased quite dramatically.

Another question in the questionnaire asked the students whether they were users of Internet-based social networks. Figure 2 shows student membership in different social networks in the three course sections. The graph shows that over the course of the three semesters the number of students who were social-network users grew rapidly.

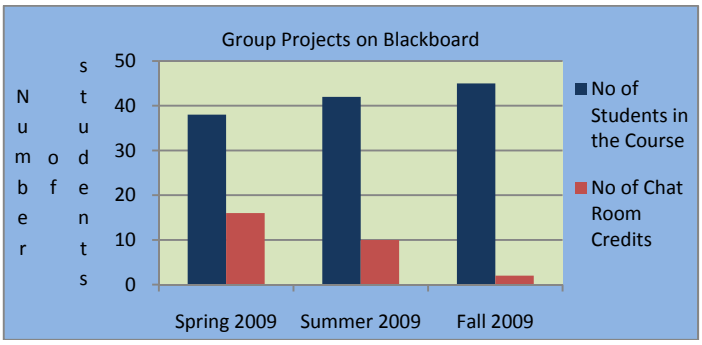

FIGURE 1
ENROLLMENT IN THE COURSE AND NUMBER OF STUDENTS WHO RECEIVED CREDIT FOR GROUP WORK

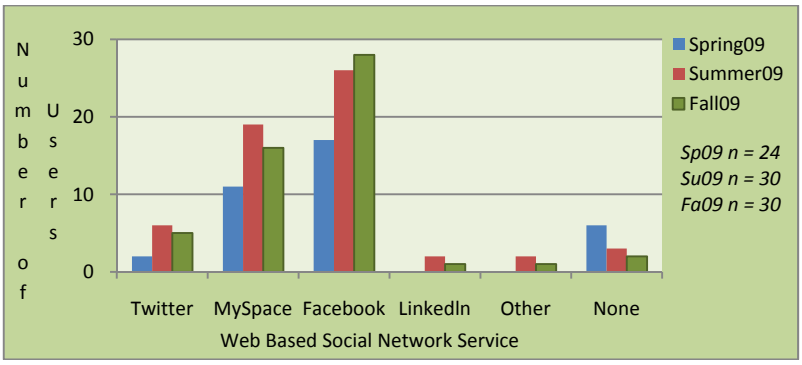

FIGURE 2
STUDENTS WHO WERE USERS OF INTERNET BASED SOCIAL NETWORKS

For communicating over the Internet, young people use e-mail less and less frequently and use instant messaging (IM) instead. IM in its basic form is an Internet based real-time direct text-based communication between two or more people. It should be noted that the use of Twitter, a social networking service in which users use short messages, is growing rapidly and it may affect the use of IM. In one of the questions in the questionnaire the students were asked to estimate the number of hours that they spent daily on e-mail and IM. Figure 3, Figure 4, and Figure 5 show the changing pattern of use of those two communication media over the three semesters – in the Fall semester the patterns of use of IM and e-mail became similar.

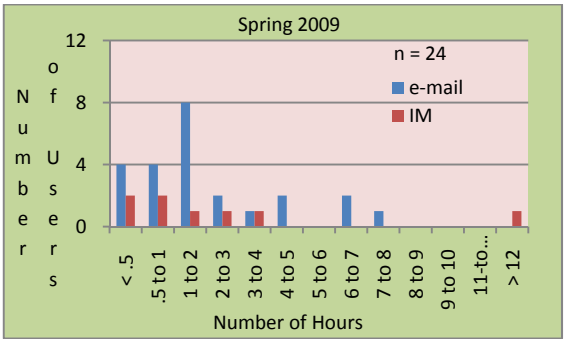

FIGURE 3
SPRING 2009: NUMBER OF HOURS SPENT ON E-MAIL AND INSTANT MESSAGING DAILY

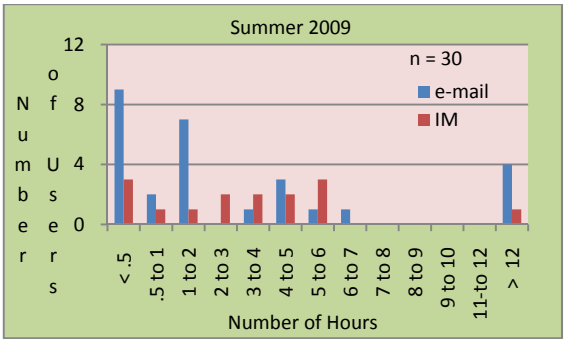

FIGURE 4
SUMMER 2009: NUMBER OF HOURS SPENT ON E-MAIL AND INSTANT MESSAGING DAILY

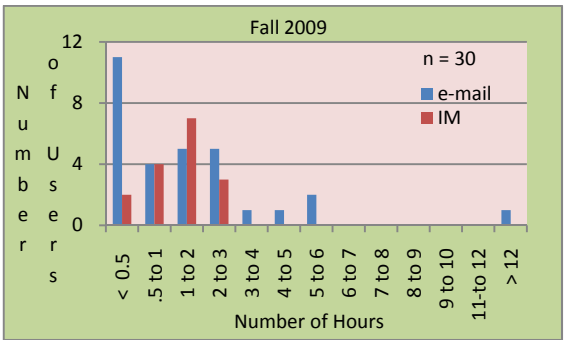

FIGURE 5
FALL 2009: NUMBER OF HOURS SPENT ON E-MAIL AND INSTANT MESSAGING DAILY

SUMMARY AND DISCUSSION

The data from summative assessment instruments, that is, performance on exams, homework assignments, and group collaborative projects in an on-line course were examined in search of explanations for the apparent differences between the scores obtained on individual work assignments and those obtained on collaborative work assignments. Students in three consecutive semesters consistently performed well on exams and homework assignments which had the format of on-line tests. After completing and submitting a test, a student immediately received a score on the submitted test, that is, feedback on his or her performance was available instantly. In addition to receiving instant information on their test performance, students also could get information on their weighted total score, that is, their percentage points earned towards the final score. The assignments were numerous but relatively short and allowed flexible scheduling for completing and submitting them. The flexibility in the course work, allowing students to study and complete the tests at any time from anywhere, as well as instant feedback on the completed work, most probably contributed to the high rate of completed assignments. Frequent tests on smaller consecutive parts of the course material allowed students to acquire the content of the course and build their skills gradually, and provided them access to frequent feedback on the level of accomplished learning over the course length. That particular course structure probably contributed to the high performance on submitted tests.

Group assignments required planning, social interaction with unknown persons, adjustment to the needs and requests of other group members, interdependence, collaboration, cooperation, and loss of flexibility in terms of when and where to work, alone or not. Also, instant feedback on performance was not available and no instant rewards in any form were given at different stages of the projects; the projects took time to complete and the instructor had to take time to grade them manually. For students immersed in digital technology who had developed new ways and habits of interacting with their environment, group projects, particularly group projects in on-line courses, most probably do not present attractive learning activities, and students, apparently, are willing to pay a price for their preferences. In the case of this course, that price was 5% of the total grade. Designing group assignments for students who are consummate and dedicated digital technology users will require considerable innovations in educational approaches. In order to develop 21st century skills and knowledge, educators have to understand the ways in which new technology imposes changes and demands on individuals and society.

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