Web 2.0 in Education: the Impact of Discussion Board on Student Performance and Satisfaction

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ABSTRACT
Web.2 technologies allow people to be the producer of information and this will increase the information in a network. Discussion Boards (forums) are Web.2 technology that enable student to interact, collaborate and exchange knowledge in different online courses. The main objective of this research study is to investigate the impact of Discussion Boards on students' grades and satisfaction with the learning environment. The study compared two groups of similar students studying similar topic and compared the results after 6 weeks experiment. Results showed that there is a positive impact on students' grades and student's satisfaction. Moreover, additional investigations were made to deeply understand the other related impacts that arose during the research study.

INTRODUCTION
One of the main challenges of e-learning is providing methods and tools for interaction that take advantage of technology's unique features, rather than simply attempting to replicate interaction forms that are used in traditional learning (Zhu, 2012). One mode that technology offers is asynchronous interaction, a type of interaction that does not necessitate all students being online at the same point of time. Zhong (2013) points out that, in a traditional classroom, lecturers and students interact while being together in the class, and they study while they are alone outside of their classroom (i.e. home or library). Within a traditional mainstream classroom, asynchronous mingling can happen while individual study is occurring (Comeaux & McKenna-Byington, 2003). The Web 2.0 originated by O'Reilly (2005) to referring to the modern interactive generation of web-based application services that enable users to create their own content. They are also referred to as user-generated, read-write, social, and interactive web. There has been a recent explosion in Web 2.0 services, which continue to evolve rapidly to anticipate user demand. There are many services with similar functionality availability, which can confuse educators about which one they should use. In such a case, the teacher can use guides to find out which tools provide the best results (Chen *et al.*, 2012). With the continued growth and advancement of online courses, there should be an effort to understand more about students' experiences in the online environment.

Research studies that have been conducted into how students fare in online courses versus face-to-face courses; in addition, research has compared students' satisfaction with various course environments. Now, that discussion needs to move towards gaining a better and more holistic understanding of how students learn in courses and what online learning mechanisms help or hinder students' learning and satisfaction in these online courses. More in-depth knowledge in this area can influence the way instructors use online discussion and forums in their courses. Online discussions are often used in traditional and blended classes, so assessing the impact of student outcomes associated with discussion boards could benefit facilitators of traditional and hybrid courses as well. Following is how to utilize Web 2.0 in education.

THE STUDY BACKGROUND
WEB 2.0 IN EDUCATION
Based on the capabilities of Web 2.0, it increases student's motivation to learn. Specifically, through the practical advantages of using Web 2.0 technologies. In fact, they are user friendly and familiar to staff and students. Al-Oqily et al. (2013) claim that the present generation is composed of digital natives, those who can manage information much different than their predecessors. Although, Kurbalija et al. (2004) and many others

had different views previously. Regardless of the debate, it can be said undeniably that, now a days, most young people possess a basic understanding of Web 2.0 tools. Researchers have pointed out that the practice of teaching did not fit 21st century learners (Blackwell et al., 2014). The feeling was that there was too much dependence on imparting knowledge rather than encouraging certain processes of critical thinking. Therefore, Garrison and Anderson called for a rethinking of pedagogy, incorporating the opportunities offered by e-learning.

The capabilities of Web 2.0 platforms provide valuable opportunities for sense-making and processing as well as constructing knowledge and creatively collaborating (Abulibdeh & Syed Hassan, 2011). Mangold and Faulds (2009) have noted that the primary drive of technology adoption is the highly collaborative kind of work that student's desire. E-learning also provides greater independence learner in terms of distance and time at the cost of collaboration opportunities with others (Garrison and Anderson, 2003). However, e-learning now has the capability to support both collaborative and independent learning; inquiry communities can incorporate more discussion of individuals' experiences and ideas (Kietzmann et al., 2011).

There is also need for students to understand that the online profiles and activities are highly visible to potential employers; an individual's digital footprint can be a significant source of information about him or her. Moreover, Web 2.0 might call for new requirements to be met in digital literacy, including skills in presenting and producing multimedia content. This trend calls for renewed attention to creativity in presenting ideas, analyses, and arguments. It should be noted, however, that there is risk of the medium dominating the message (Bennett et al., 2012).

DISCUSSION BOARDS
In online education, threaded discussions or discussion boards are amongst the most frequently- and commonly-used tools. Discussion forums assist in producing asynchronous discussion over a certain time period (Blackmon, 2012). The ability to interact asynchronously is one of the main benefits of online learning. Students can reflect upon their perceptions and ideas before they decide to share them in the class, which leads to better reflective responses as well as deeper learning. A variety of other benefits to using discussion boards have been noted (Song & McNary, 2010):
- They build classroom dynamics by promoting discussion on different course topics.
- They allow students to reflect deeply on course concepts. Students have more time to research, reflect, and compose their thoughts prior to participating in discussions.
- They assist in learning by allowing students to look into and respond to the work of others.
- They allow the participation of guest experts who can post information and respond to questions.

On the other hand, meeting course objectives and aligning course content are other purposes of discussion boards (Xia et al., 2013). Well-designed activities with the discussion board can get used to encourage the following:
- Demonstrate knowledge of main concepts: Students can use the discussion board to discuss key concepts, enabling them to share ideas as well as learn within the group. When students submit assignments directly to the teacher, no idea sharing takes place (Balaji & Chakrabarti, 2010).
- Community building: One of the main reasons for using discussion boards is building a community of learners. This application helps the student in becoming a part of a vibrant learning community, rather than being an independent learner who completes and submits assignments without any peer interaction (Harris &Sandor, 2007).
- Reflection: Reflective activities require the students to share their learning experience, or to describe how an experience or situation has personal value. Such activities require the teacher to allow open and honest responses.
- Building consensus: Activities on consensus building require the students to work together to create a product or come to agreement on a certain topic (Cheng et al.,2011).
- Critical thinking: Using the questioning techniques of higher order and other activities, students can gain critical thinking skills through the use of the discussion board.
- Student leadership: When effectively used, discussion forums can help in encouraging student leadership, giving them more voice in the class (Dringus & Ellis, 2005).

Most experts on online learning and student centered classrooms say that discussion boards can enable important learning procedures. However, the facilitators and teachers have to look for ways to support the students, driving them towards the learning.

In one hand, online educators using the discussion board have estimated their interaction with students to be three times greater than face-to-face interaction; the same applies for student's interaction with their peers. The learning and collaborative thinking is much higher (Dixson et al., 2006). On the other hand, instructors who

facilitate a large discussion board, the activity's fervor could even be overwhelming experience. There are challenges like making the most of this new learning experience format and getting students to participate frequently and thoughtfully.

In managing online discussion, an important requirement is in striking a balance in the interaction with students to make certain that the focus of the board is on learning. It has to be interesting enough that learners are pulled into conversation, but of course, it is important to keep in mind that the discussion should not be so complicated and dense that learners get overwhelmed. It is important to manage participants' interaction time and ensure that board interactions are relevant and enriching (Biggs, 2012).

ONLINE COURSES
Lock (2001) asserts that there is continuous growth in online courses in higher academics. Student interaction remains an important factor affecting students' learning experiences with online learning. The depth and nature of student interactions in the online environment differs greatly from face-to-face classes. While in physical classrooms, students can interact physically inside or outside the class; in the case of online courses, students may merely communicate with classmates via computer-mediated communication (CMC) like chat rooms, discussion boards, or emails. Dringus and Ellis (2005) argued that asynchronous technology might allow participants to compare their progress with others, reflect more deeply, and explore topics. However, there is an absolute requirement for other students to share responses to reach the potential of online communication. Song and McNary (2011) seconded the argument of Wozniak and Silveira, (2004): the high level of interdependence in online education requires navigating displacements in space and time, making the task of maintaining online interaction quite challenging.

Understanding students' online interaction is of utmost importance. Interaction ultimately determines the quality of online learning. Shattuck (2014) reviewed some trends in distance education and found that students generally judge distance education's quality on the basis of perceptions regarding interaction. Moreover, interactions between students in online classes can increase motivation and commitment to learning.

MOODLE LEARNING MANAGEMENT SYSTEM
Moodle Learning Management System allows ongoing communication within a defined community of learners in an online course through a discussion board (DB). Unlike email, the DB supports threaded messages organized by topics. Through the DB, a user can commence a new topic, look for a given topic, share attachments and web links, and view, post and edit replies. Within a discussion, messages can be viewed in either chronological or threaded sequence. The discussion board application in Moodle Learning Management System may be viewed as an electronic portfolio belonging to a group of individuals (a defined learning group). This medium is capable of recording and supporting a variety of communications, including attachments and web links. Using the DB as a Web 2.0 technology, students in a course can be remotely and actively engaged in educational discussions facilitated and led by the instructor. Through the DB, students can share their work and request feedback from peers and the instructor. An added advantage of the DB environment is that commenting on one student's work may help several other students. In this way, the comment automatically becomes visible and shared with the whole class.

The purpose of online communication platforms like discussion boards is to provide a way for students to interact and discuss components of the course. Discussion groups allow students to participate actively and communicate with each other and faculty members. As such, they supplement content delivery; however, discussion not only supplements the content covered and delivered in courses, but it also enhances understanding of the ideas and issues discussed in conventional, blended, or fully online courses. According to researchers, a form of active learning, such as discussion boards, can help students practically apply the knowledge (theories, etc.) acquired in their courses. Through discussion boards, students have an opportunity to share their thoughts and learn from each other.

The present study investigates the impact of discussion boards on grades as well as student satisfaction in using Web 2.0 technologies. It shows how the use of Web 2.0 technologies has been useful for students in online learning. In particular, this study seeks to elucidate on the immense usefulness of one interactive medium, the discussion board. This tool has enabled better student learning, allowing students to actually discuss the issues that crop up during a study.

THE STUDY CONTEXT AND DESIGN

To achieve our objectives, an experiment has been conducted at a private university located in Riyadh. The subjects are students in two sections of the same course, a three credit hour course in the faculty of Business Administration. Students had to interact through Moodle learning management system during the semester.

PARTICIPANTS AND SAMPLING

Sampling involves selecting a small subset of a population that is representative of the whole population for a research study (Fowler, 2002). However, to obtain valid and reliable results for a study, it is critical to maintain the involvement of the appropriate participants. Moreover, students in both groups should have the same average scores/grades so that we can ensure that the increase/decrease in grades was because of the use of discussion boards. For this study, a total of sixty students were targeted (thirty students in each group).

The sampling process is comprised of several stages. The first stage is to define the population of concern. For the purpose of this study, this population is university students. Next, a sampling frame should be specified to provide a set of items or events that are possible to measure. In this case, the sampling frame is comprised of students within the two sections of the selected course. Students will be selected initially based on their grades so that both sections have the same average performance. The sampling methodology chosen for this study is one in which every element in the population is given the same probability of selection; this is known as an "equal probability of selection" (EPS) design. As there are two sections, there is an added focus on the equality between these sections.

SURVEY ADMINISTRATION

Surveys are considered an important research technique. There are many different methods for conducting surveys. Given the nature of the subject being studied and the sample population, the best way to conduct the survey for this phase of this research study is to develop an online survey. This method also offers a low cost for data collection, potential high speed return, and the ability to consistently present a series of similar questions (Fowler, 2002).

The instructor motivated all students to participate to ensure a high response rate. Following the objectives of this study, the questionnaire was divided into two main parts: general information and demographics and students' satisfaction. The students' grades were obtained from the professor after the students granted their permission. The respondents have been asked to rate the measures using a 5-point Likert scale (1-Not at all; to 5-Greatly), this approach is commonly employed in online education research (Roberts et al., 2005). Table 1 shows survey items which had been used on this study.

Table 1: Survey Items

Construct	Measurement Items
Part I	
Age	18-20
	21-23
	24-26
	More than 26
Major	Finance
	Marketing
	Accounting
	Human Resource
Experience with Internet	Home only
	University only
	Internet cafes
	Wireless
	All of the above
The rate of Internet use per day (in hours)	Less than 1 hour
	1-3 hour(s)
	3-6 hours
	6-10 hours
	More than 10 hours
Marital Status	Married
	Single
	Divorced

		Widowed
GPA		Acceptable
		Good
		Very Good
		Excellent
The use of Moodle		Course Material
		Course Announcements
		Grade Center
		Discussion Boards
		All Mentioned
		None Mentioned
Performance Expectations		Acceptable
		Good
		Very Good
		Excellent
Social Influence		I don't share my ideas and no one is influenced by them
		I share my ideas but no one is influenced by them
		I share my ideas and some are influenced by them
		Colleagues are always influenced by my ideas
Part II		
	ID	
Satisfaction	SAT1	The student's recommendation of this course to others
	SAT2	The perceived satisfaction of the learning experience
	SAT3	How satisfied are you with the online content?
	SAT4	Level of online interaction with the instructor.
	SAT5	Ability of instructor to engage you on using e-learning.
	SAT6	Level of online interaction with other students.
	SAT7	Availability of other sources of information.
Part III		
Reflections	ID	
	Grades	The grade of the student in the exam
	No. of Clicks	The amount of time the learner spends studying online

In addition, other data was gathered from the Moodle reporting system. For example, students' behavioral data was gathered, including the use of different features and technologies on Moodle as well as their access times.

EXPERINATAL DESIGN
The experiment was conducted using two groups of university students (n = 30/group), studying the same course with the same instructor and using the same materials and systems. The average grades of the students selected from both groups were also equal. The difference was that one of the groups used the discussion board on Moodle, and the other group did not. The experiment took two months, and students were given the same exam at the same time. Additionally, they filled in a questionnaire (listed in the Appendix) after the exam, which asked about the satisfaction of the educational process and gathered other important information.

In this study, the independent variable is the use of the Moodle discussion board on the learning management system by students studying in a blended learning environment. The use of this tool was available to one section, while the other section used the learning management system without the discussion board tool. The dependent variables are the students' satisfaction and the students' performance. Students' satisfaction was measured through the questionnaire submitted to them after a month of using the e-learning system. Student performance was measured by considering the grades of students in the exam given after one month of use. The access data of each student was taken from the online system and converted linearly to a 1–5 scale.

ANALYSIS AND RESULTS
In this study, the collected data had been analyzed to obtain descriptive statistics and an independent sample *t*-test procedure was used for the statistical comparison of the cohort's survey scores and grades. The analyzed data are presented as follow:

DESCRIPTIVE STATISTICS
Age: The course had participants spread widely over the 18–26 age groups, with four participants over age 26.

The majority (29 students) belonged to the 18–20 age group, while 18 students belonged to the 21-23 age group. The enrolled students are evenly distributed between the cohorts. Marital Status: All of the participants (60) were single in the two cohorts. **Attitudinal Attributes:** The students were asked how they would rate their social influence on the peer group; their responses are illustrated in the following graph. There was not much drift between populations, but the students in the group with access to the discussion board had slightly higher ratings.
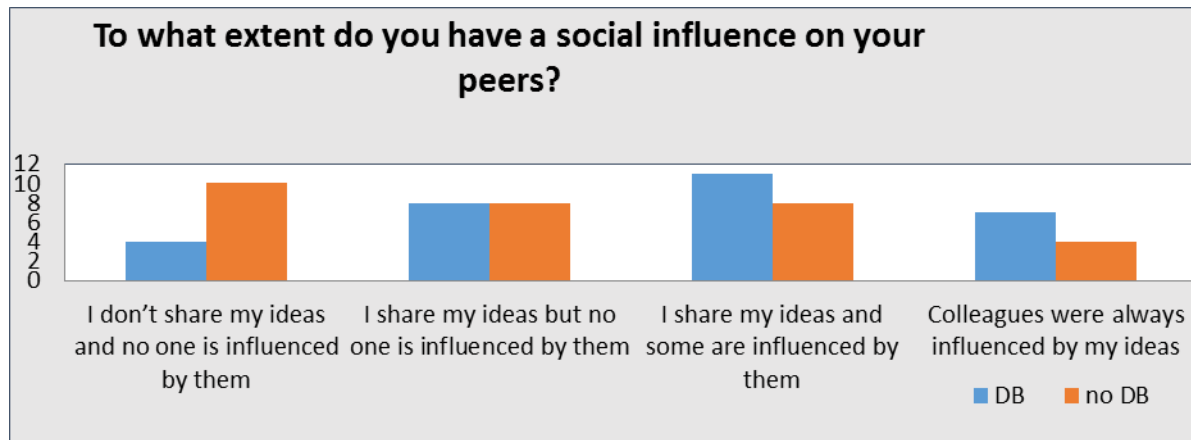

Figure 1: Attitudinal attributes

Academic Background: Students enrolled in the course were evenly distributed between the two cohorts by academic background. **Past Academic Performance:** Participants in both cohorts were evenly distributed with regard to past academic performance, which was identified as either "acceptable," "good," "very good," or "excellent grades". **Internet Access and Usage**: Participants were evenly spread between the two cohorts with various means of Internet access and usage, which varied from 1–3 hours per day to more than 10 hours per day. The majority of students access the Internet from their mobile phones. Percentages for other methods of access vary, but many students' responses are distributed among all options. Only a few students access the Internet from within the university.

The purpose of the first research question was to gather evidence to document the effectiveness of online discussion boards (a type of Web 2.0 technology) on student achievement. Student grades from the unit exam for the online course were collected to investigate the following hypothesis: "The use of online discussion boards (a type of Web 2.0 technology) in Moodle will enhance student performance."
Impact on Students' Grades and Satisfaction

Figure 2 represents the distribution of students' Likert scores of 1–5, separated by cohort. As can be seen below, 25 out of 30 students who used the discussion boards received either a 4 or 5 average grades, compared to only 15 out of 30 students who did not use discussion boards and received a 4 or 5 average grade. Twelve out of 30 students without access to discussion boards had an average grade of 3, compared to 3 out of 30 students who used discussion boards.
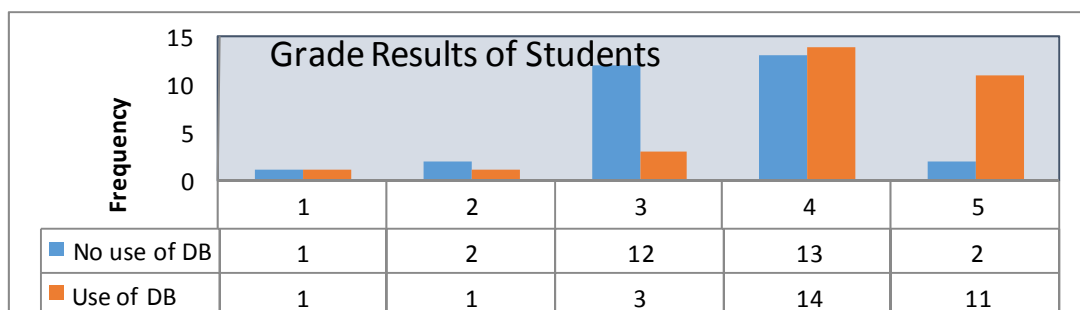

	1	2	3	4	5
No use of DB	1	2	12	13	2
Use of DB	1	1	3	14	11

Figure 2: Grade Results of Students

Table 2 below presents the means and standard deviations of the Likert scores of the exam grades across the two groups, with and without the use of discussion boards (DB). A t-test analysis was performed to compare the difference in mean between the two groups. The group with access to DBs scored significantly higher on the test than the group without access to DBs (t value = -2.84, p = .0063) as shown at **Table 3**.

The TTEST Procedure

Variable: PER1

Table 2: the means and standard deviations of the Likert scores of the exam grades

Group	Method	Mean	95% CI Mean		Std Dev	95% CI Std Dev	
No use of DB		3.4333	3.1128	3.7539	0.8584	0.6836	1.1539
Use of DB		4.1	3.7417	4.4583	0.9595	0.7642	1.2899
Diff (1-2)	Pooled	-0.6667	-1.1372	-0.1962	0.9103	0.7706	1.1124
Diff (1-2)	Satterthwaite	-0.6667	-1.1373	-0.196			

Table 3: Applying t-test for student grades

Method	Variances	DF	t Value	Pr > |t|
Pooled	Equal	58	-2.84	0.0063
Satterthwaite	Unequal	57.295	-2.84	0.0063

The students who had access to discussion boards were more confident about their performances. **Figure 3** depicts the distribution of students' expectations of their performance on the test. A greater percentage of the students who were provided access to the discussion boards rated their expectations as either "Very Good" or "Excellent."

Figure 3: Expected Performance In the test

STUDENTS' ATTITUDE TOWARDS THE LEARNING ENVIRONMENT
To obtain more in-depth information on the students' attitudes and levels of satisfaction towards this online course, seven assessment benchmarks were included in the survey conducted at the end of the unit test for the course. Each benchmark was rated using a 5-point Likert scale. Satisfaction was assessed using the following benchmarks:
SAT1: I would recommend this course to others.
SAT2: I am satisfied with the learning experience.
SAT3: I am satisfied with the online content.
SAT4: Level of online interaction with the instructor.
SAT5: Ability of instructor to engage you on using e-learning.
SAT6: Level of online interaction with other students.
SAT7: Availability of other sources of information.

Table 4 illustrates satisfaction scores of each of the above metrics. The means of the Likert scores are compared between the groups with and without access to discussion boards.

		1	2	3	4	5
SAT1: I would recommend this course to others.	No use of DB	0	3	17	10	0
	use of DB	0	0	2	12	16
SAT2: I am satisfied with the learning experience.	No use of DB	0	5	20	5	0
	use of DB	0	0	4	12	14
SAT3: I am satisfied with the online content.	No use of DB	0	6	19	5	0
	use of DB	0	2	15	13	0
SAT4: Level of online interaction with the instructor	No use of DB	7	12	11	0	0
	use of DB	0	0	8	20	2
SAT5: Ability of instructor to engage you on using e-learning	No use of DB	0	12	18	0	0
	use of DB	0	0	7	19	5
SAT6: Level of online interaction with other students.	No use of DB	5	19	6	0	0
	use of DB	0	0	2	12	16
SAT7: Availability of other sources of information	No use of DB	0	11	19	0	0
	use of DB	0	0	10	20	0

SAT1: I WOULD RECOMMEND THIS COURSE TO OTHERS

This benchmark assesses students' overall satisfaction with the online course in which they were enrolled. This besides the content and benefit of course to the student, is expected to influence and be influenced by all components of the online course surveyed in online questions and also the student's expectation of their performance on the course.

Table 4 illustrates the distribution of students in the two cohorts by their satisfaction scores of 1–5. As can be seen below, 28 out of 30 students who used the discussion boards gave either a 4 or 5 satisfaction rating, compared to 20 out of 30 students who did not use the discussion boards and who gave either an average or below average satisfaction rating. A t-test procedure statistically validates the significant differences between the satisfaction scores of the two groups (t value = -7.61, p = <.0001).

SAT2: I AM SATISFIED WITH THE LEARNING EXPERIENCE

This benchmark is an extension of the first benchmark and is aimed at understanding the perception and satisfaction of students with the content, layout, and experience with the online course. This is aimed at identifying the usefulness and perceived benefit of the course to a student.
Table 4 illustrates the distribution of students in the two cohorts by their satisfaction scores of 1–5. As can be seen below, 26 out of 30 students who used the discussion boards gave either a 4 or 5 learning experience satisfaction rating, compared to 25 out of 30 students who did not use the discussion boards and who gave either an average or below average learning experience satisfaction rating. A *t*-test procedure statistically validates the significant differences between the satisfaction scores of the two groups; t value = -7.92, p = <.0001.

SAT3: I AM SATISFIED WITH THE ONLINE CONTENT

Ideally, the inclusion or exclusion of discussion boards in the online course would not influence this benchmark. This is intended, rather, to obtain student feedback regarding their overall satisfaction with the online content presented in the course. According to the graph in Figure 6, DBs also help transcend the limitations of the content presented in online courses, and, thus, improve the overall experience.

Table 4 illustrates the distribution of student under two cohorts by their online content satisfaction scores of 1–5. As can be seen below, 15 out of 30 students who used the DBs gave a 3 online content satisfaction rating, which is very comparable to the average rating of the 19 out of 30 students who did not use the DBs. However, a 4 online content satisfaction rating (which implies a greater satisfaction with the online content) was given by 13 students who used the DBs compared to only 5 students who did not use the DBs. A *t*-test procedure statistically validates the significant differences in the satisfaction scores of the two groups (*t* value = -2.52, p = 0.0145).

SAT4: LEVEL OF ONLINE INTERACTION WITH THE INSTRUCTOR
The responses to this benchmark are expected to be influenced by students' use of DBs. As can be seen below, all the students who did not use the DBs gave either an average or below average rating for online interaction with their instructor. However, 22 out of 30 students who used the DBs rated this experience with a 4 or 5 rating. The differences in the mean scores of the two cohorts for this benchmark are evident and statistically validated by *t*-test result; *t* value = -9.59, p = <.0001s. The average satisfaction results for the 8 students who used the DBs indicate an opportunity for instructors to find more effective methods to promote meaningful discussions with and between students.

SAT5: ABILITY OF INSTRUCTOR TO ENGAGE YOU ON USING E-LEARNING
As with the fourth benchmark, this benchmark is also impacted by students' ability to access the discussion boards. The students who did not use the DBs rated this experience as average or below average. Among the student who did use the DBs, 7 students rated this experience as average. The *t*-test results validate the evident differences between the mean scores for this benchmark; *t*-value = -9.06, p = <.0001. The average satisfaction score for the 7 students with access to the DBs calls for an investigation into the methods instructors can use to manage and effectively engage all students in active e-learning.

SAT6: LEVEL OF ONLINE INTERACTION WITH OTHER STUDENTS
The students who did not use the DBs had little or no means to interact online with other students other than the discussions held during online class sessions and, thus, rated their level of online interaction with other students as average or below average. Students who had access to the DBs were more easily able to interact with other students, and, thus, only two students rated their level of online interaction with other students as average. The result of *t*-test of this item is *t* value = -15.15, p = <.0001.

SAT7: AVAILABILITY OF OTHER SOURCES OF INFORMATION
This benchmark hints at assessing students' experiences with regard to their ease of access to different sources of information outside the content available in the course. As with the last benchmark, SAT7 would be more relevant for students who had access to the DBs, as these students were able to share information online through different discussion board threads and by reviewing different discussions.
As can be seen below, the students with access to DBs gave fairly high scores for this benchmark. On the other hand, ten students with access to DBs rated this experience as only average; however, this could be a result of ineffective means of organizing and running discussion threads, which may impact students' ability to access required information. The result of *t*-test is *t* value = -8.25, p = <.0001

Supporting the first hypothesis of this study, students granted access to discussion boards showed a higher level of performance than students who did not have access. The use of discussion boards are believed to provide
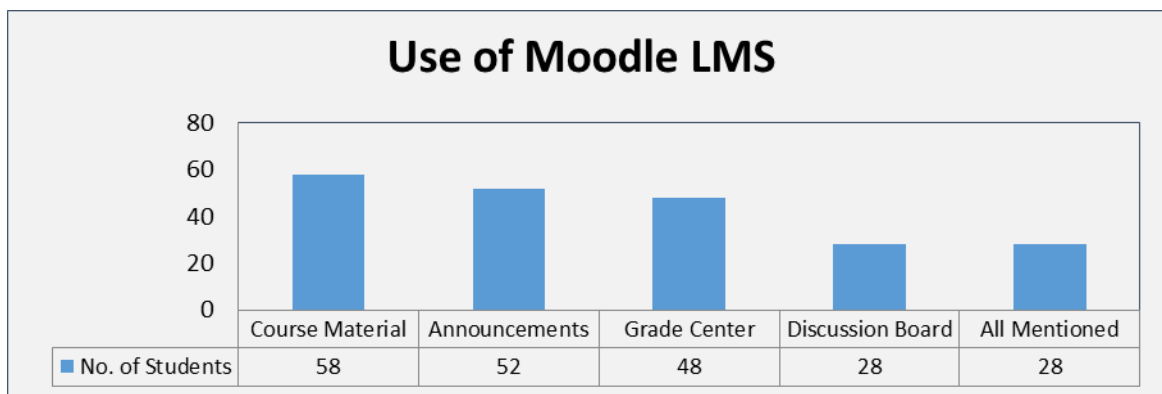

Figure 4: Use of the Moodle LMS by the two groups

many benefits. Moreover, the engagement of students within the Moodle and the consequent impact of the above-mentioned factors was also noted in students' responses to the survey, which allows us to understand the extent that LMS was used by students. The graph below indicates that the students with access to DBs other than discussion boards were also active and participative with these other tools of the system.

With regard to the second research question of the study, several themes became evident after students' survey responses regarding their overall satisfaction with the online course were studied. Students who participated in discussion boards were largely positive about the experience. Several of reflections from the survey indicate that discussion boards are effective learning tools that promote overall student satisfaction with the online experience and content of the course. It is evident from these results that the students in the experimental cohort felt the interaction and collaborative experience to be a positive one that helped increase their knowledge and understanding of the course material.

The following correlation table indicates a strong association between academic performance and overall satisfaction of the students with the online course. As validated in the study, online discussion boards are effective in influencing the performance of the enrolled students, due to several factors. Students with access to these discussion boards are also able to break the boundaries of space and time and interact freely with their peers and instructor; for example, they can make the best of their course by sharing information outside of the course's online content and by sharing and clearing any doubts to become more comfortable with and confident about their experience in the course. Confidence in academic performance and ease of interaction helps to explain why students who have access to discussion boards have elevated survey scores in comparison to those students without discussion board access, who, on average, struggle with the online content and the limited access to their instructor and peer assistance. Additionally, as indicated in the individual survey results, overall satisfaction scores (SAT1) are minimally associated with online content satisfaction scores (SAT3), while grades and overall satisfaction have a fairly strongly association with other measures.

It is important and interesting to consider the impact of the students' level of engagement with the LMS on the students' performance of engagement. The level of engagement is determined by the scores associated with the number of clicks students made while navigating the learning management system. As can be seen in the figure below, students enrolled in the course with access to the discussion boards had a higher score in terms of usage (or in other terms of engagement) with the LMS. The correlation table below depicts a significant association between the scores for number of clicks, grades, and satisfaction scores.
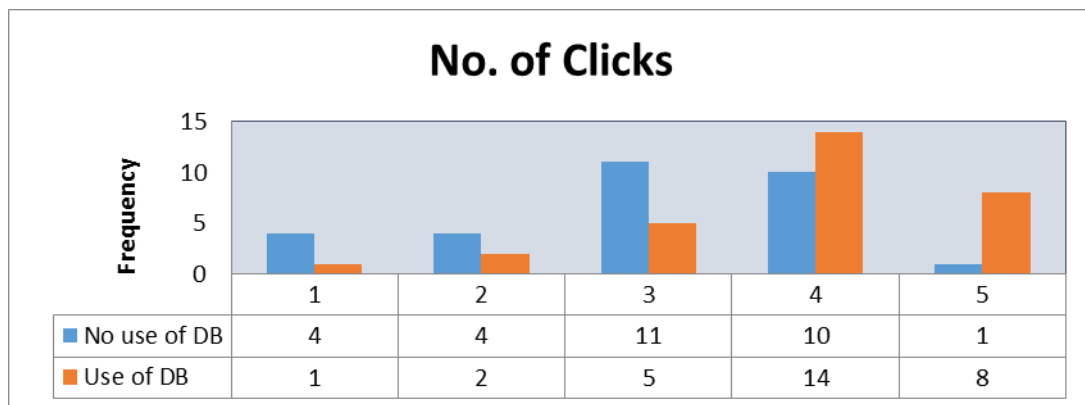

Figure 5: Number of clicks in the Moodle LMS by the two groups

Table 5: Applying Correlation coefficients between Grades and No. of clicks

Pearson Correlation Coefficients, N = 60 Prob > |r| under H0: Rho = 0	
	No. of Clicks
Grades	0.39193
	0.0020
SAT1	0.63176
	<.0001
SAT2	0.46283
	0.0002
SAT3	0.08598

	0.5136
SAT4	0.36303
	0.0044
SAT5	0.34299
	0.0073
SAT6	0.43320
	0.0005
SAT7	0.38451
	0.0024

CONCLUSIONS

Discussion boards are considered to be a powerful tool for the inclusion and development of pedagogical competencies, such as acute thinking, collaboration, and reflection. Because of their professed benefits, discussion boards should become progressively more utilized in online education. Discussion boards offer great pedagogical leverage, for example, by promoting reflection, analysis, and higher-order thinking. It is among one of the most effective tools for collaborative learning and can enrich students' learning experiences in several ways. A well-designed and executed online discussion board can encourage students' activity, collaboration, motivation, and other social constructivist attributes of the learning process. In this study, we analyzed and assessed the impact of discussion boards on student learning and satisfaction. We feel that this assessment will help increase online course developers' ability to design more effective learning experiences to enhance student performance, learning, and satisfaction. It will also encourage researchers to explore the various features and applications of discussion boards. According to our research, involvement in discussion boards can boost student performance and satisfaction. In some instances, more reflection and thought with regard to a particular agenda during the discussion portion of a course can produce better perceptive outcomes.

It should be noted, however, that online discussions, or more specifically, reading through threaded discussions, can be time consuming, and students are often discouraged when there are too many posts to read, particularly when posts are lengthy. After a close examination of such instances, discussion boards could be portrayed as being both effective and ineffective. For example, while some students in the online class may have felt better connected to other students by interacting via the discussion boards, other students may have felt that discussions moved too quickly and may have subsequently begun to feel more disconnected from other students. However, the disengaged students' feelings may have less to do with the discussion boards themselves and more to do with how the discussion boards were run. Just as participation in discussion boards can impact students' sense of community and connectedness, instructional uses of the discussion boards also affect the senses of either collaboration or alienation that students experience in online courses.

Keeping in mind the perceived benefits, there are potential challenges posed with the use—or more precisely, the inappropriate use—of discussion boards. For example:

1. A very common notion among users of discussion boards is the large amount of time that it takes to educate students to use them, especially when students are required to post several times within a discussion forum. Even though the instructor's presence may not be as apparent (as it is advised for instructors not to post too much within a discussion), instructors still have to address every post; when instructors do respond to a post, it is very important that their comments are thoughtfully worded so as not to stifle or shut down discussion, and thoughtful posts do take some time to develop. It is unfortunate but significant that almost all instructors who have been teaching online and using discussion forums as a major element of their courses report feeling worn out by the process. These same instructors, however, also acknowledge how valuable these discussions are to the quality and extent of student learning. Thus, they must balance the amount of work and time they invest in the discussion boards with ensuring the best quality of learning experience for their students.
2. Some instructors reported that using a blended class format in which students meet face-to-face once a month or even more frequently can undermine the quality and depth of online discussions, because some students tend to withhold sharing their thoughts and engaging effectively in online discussions, preferring to wait to share their ideas in person during the face-to-face class setting. Furthermore, sometimes by the time a class meets face-to-face, students' responses to an online discussion may no longer be relevant, especially if more than a week has gone by.
3. Student participation in online discussions may not be deliberate and proactive. Effective participation and indulgence requires forethought from the instructor and an ongoing engagement from the instructor and students to engage in the material. With regard to the instructor's role in the process, the nature and depth of discussion exercises should be determined in the preliminary design phase of an online course.

The implementation of an instructor's vision is very important and must be actively and attentively promoted for the phase of the course. Nonetheless, despite thought and oversight, discussion threads often lack depth, include repetitive comments, and involve minimal interaction. Therefore, many online instructors find it judicious to include measures that promote open discussion with rich and self-initiated dialogue, as opposed to an environment of obligatory discourse, hasty postings, and repetitive content. While the utilization of lively and timely subject matter in online discussion boards can be an effective way to promote and maintain students' attention throughout the course of an exercise, many students may procrastinate in getting involved in discussions and may discontinue completely once they have made their individual obligatory posts. Simply obligating students to post comments does not result in higher-order thinking, meaningful content, or continued interaction without the incorporation of reflection, blend, and application in the student posting process.

Given the above potential challenges, more research and experimentation should be done on these topics. If professors are going to continue to use online discussions boards in online courses, it is important that they be provided with knowledge about the effective use of these tools and their potential impact on students. Further examination of this topic could potentially lead to greater student satisfaction and achievement.

REFERENCES

Abulibdeh, E. & Syed Hassan, S. (2011). *E-learning interactions, information technology: Self-efficacy and student achievement at the University of Sharjah, UAE.* Australasian Journal of Educational Technology, 27(6), 1014-1025.

Al-Oqily, I., Alkhatib, G., Al-Khasawneh, A. & Alian, M. (2013). *Social networks impact: The case of Jordanian youth. International Journal of Continuing Engineering Education and Lifelong Learning*, 23(1), 100-114.

Balaji, M. & Chakrabarti, D. (2010). *Student interactions in online discussion forum: Empirical research from media richness theory perspective.* Journal of Interactive Online Learning, 9(1), 1-22.

Bennett, S., Bishop, A., Dalgarno, B., Waycott, J. & Kennedy, G. (2012). *Implementing Web 2.0 technologies in higher education: A collective case study.* Computers & Education, 59(2),524-534.

Biggs, J. (2012). *What the student does: Teaching for enhanced learning.* Higher Education Research & Development, 31(1), 39-55.

Blackmon, S. (2012). *Outcomes of chat and discussion board use in online learning: A research synthesis.* Journal of Educators Online, 9(2), 2.

Blackwell, C., Lauricella, A. & Wartella, E. (2014). *Factors influencing digital technology use in early childhood education.* Computers & Education, 77, 82-90.

Chen, Y., Hwang, R. & Wang, C. (2012). *Development and evaluation of a Web 2.0 annotation system as a learning tool in an e-learning environment.* Computers & Education, 58(4), 1094-1105.

Cheng, C., Par'e, D., Collimore, L. & Joordens, S. (2011). *Assessing the effectiveness of a voluntary online discussion forum on improving students in course performance.* Computers & Education, 56(1), 253-261.

Comeaux, P. & McKenna-Byington, E. (2003). *Computer-mediated communication in online and conventional classroom: Some implications for instructional design and professional development programmes.* Innovations in Education and Teaching International, 40(4), 348-355.

Dixson, M., Kuhlhorst, M. & Reiff, A. (2006). *Creating effective online discussions: Optimal instructor and student roles.* Journal of Asynchronous Learning Networks, 10(1), 3-5.

Dringus, L. & Ellis, T. (2005). *Using data mining as a strategy for assessing asynchronous discussion forums.* Computers & Education, 45(1), 141-160.

Fowler, F. (2002). *Survey Research Methods*. 3rd edition. Applied Social Research Methods Series, Volume 1.

Garrison, D.R., & Anderson, T. (2003). *e-learning in the 21st century: A framework for research and practice.* New York, Routledge.

Harris, A. & Rea, A. (2009). *Web 2.0 and virtual world technologies: A growing impact on IS education.* Journal of Information Systems Education, 20(2), 137.

Harris, N. & Sandor, M. (2007). *Developing online discussion forums as student centred peer e-learning environments. In: ICT: Providing Choices for Learners and Learning.* Proceedings Ascilite Singapore 2007, pp. 383-387.

Kietzmann, J., Hermkens, K., McCarthy, I. & Silvestre, B. (2011). *Social media? Get serious! Understanding the functional building blocks of social media.* Business Horizons, 54(3), 241-251.

Kurbalija, J., Dincic, D. & Slavik, H. (2004). *Interactive hypertext in e-learning: A case study asynchronous learning in the online classroom.* Proceedings of the Fifth International Conference on Information Technology Based Higher Education and Training.

Lock, J. (2001). *Review essay: Lessons from the cyberspace classroom: The realities of online teaching by Palloff and Pratt.* IEJLL: International Electronic Journal for Leadership in Learning, 5(14), 5.

Mangold, W. & Faulds, D. (2009). *Social media: The new hybrid element of the promotion mix.* Business Horizons, 52(4), 357-365.

McNary, S. & Song, L. (2010). *Understanding students. Collaborative online interaction: Analysis of discussion board postings*, 1, 716-721.

Roberts, T. G., Irani, T. A., Telg, W., & Lundy, L. K. (2005). *The development of an instrument to evaluate distance education courses using student attitudes*. The American Journal of Distance Education 19(1), 51–64.

Shattuck, K. (2014). A*ssuring quality in online education: Practices and processes at the teaching, resource, and program levels*. 318 pp. Stylus Publishing.

Song, L. & McNary, S. (2011). *Understanding students' online interaction: Analysis of discussion board postings*. Journal of Interactive Online Learning, 10(1), 1-14. http://www.ncolr.org/jiol/issues/pdf/10.1.1.pdf

Wozniak, H. & Silveira, S. (2004). *Online discussions: Promoting effective student to student interaction*, Proceedings of the 21st ASCILITE Conference (pp. *956-960*)

Xia, C., Fielder, J. and Siragusa, L. (2013). *Achieving better peer interaction in online discussion forums: A reflective practitioner case study.* Issues in Educational Research, 23(1), 97-113.

Zhong, S. (2013). Proceedings of the 2012 international conference on cybernetics and informatics. (1st ed.). New York, NY: Springer.

Zhu, C. (2012). *Student satisfaction, performance, and knowledge construction in online collaborative learning*. Journal of Educational Technology & Society, 15(1), 127-136.