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The Quality of Blended Learning Based on the Use of Blackboard in Teaching Physics at King Saud University: Students' Perceptions

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Abstract

The present study aimed to investigate students' perceptions of the quality of blended learning (based on the use of Blackboard) in teaching physics at King Saud University (KSU), and whether these perceptions vary according to gender and computer skills level. The Course Experience Questionnaire (CEQ), developed by Ginns & Ellis (2007), was used to examine the perceptions of 341 Health Colleges students in the first year of a five-year undergraduate degree, who were enrolled in a general physics course at KSU. The results revealed that the blended learning in teaching physics at KSU was generally perceived to be of high quality. The results also revealed that there were no statistically significant differences in students' perceptions of the quality of blended learning in teaching physics at KSU that could be attributed to gender. However, the results revealed that there were statistically significant differences in those perceptions that could be attributed to students' computer skill levels in favor of students with a higher level of computer skills.

Keywords: blended learning, web-based learning, learning management systems, information and communication technologies, science teaching strategies.

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جودة التعلم المدمج القائم على نظام بلاكبورد في تدريس الفيزياء بجامعة الملك سعود من وجهة نظر الطلبة

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الملخص

هدفت الدراسة الحالية إلى استقصاء آراء الطلبة حول جودة التعلم المدمج القائم على نظام بلاكبورد في تدريس الفيزياء بجامعة الملك سعود، ومعرفة ما إذا كانت آراءهم تختلف باختلاف الجنس ومستوى الطالب في مهارات الحاسب الآلي. استخدمت الدراسة استبانة جينيس وإيليس (Ginns & Ellis, 2007) لاستقصاء آراء ٣٤١ طالباً وطالبةً من مسار الكليات الصحية المسجلين لمقرر الفيزياء في سنتهم الدراسية الأولى. أشارت نتائج الدراسة إلى أن التعلم المدمج القائم على نظام بلاكبورد بشكلٍ عام ذي جودة عالية في تدريس الفيزياء، وإلى عدم وجود فروق دالة إحصائياً في آراء الطلبة تعوّد إلى الجنس. كما أشارت النتائج إلى وجود فروق دالة إحصائياً في آراء الطلبة حول جودة التعلم المدمج القائم على نظام بلاكبورد في تدريس الفيزياء تعود إلى مستوى مهارات الحاسب الآلي، وكانت هذه الفروق لصالح الطلبة ذوي المستوى الأعلى في مهارات الحاسب الآلي.

الكلمات المفتاحية: التعلم المدمج، التعلم القائم على الشبكة العنكبوتية، نظام إدارة التعلم، تكنولوجيا المعلومات والاتصالات، استراتيجيات تدريس العلوم.

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Introduction

Experts in science education face new challenges including the need for instructional strategies that can help students to continue their learning outside the classroom, and will offer tools and expertise that can help them to access, by themselves, the knowledge they need. At the same time, science teachers in tertiary institutions and schools are advised to concentrate on learner-centered strategies that are effective for helping students to acquire scientific knowledge in a meaningful way. The US National Science Education Standards recommend that science teachers should select teaching strategies that support the development of student understanding (NRC, 1996). Moreover, Trowbridge, Bybee, and Powell (2000) identified students' learning and acquisition of scientific knowledge in meaningful ways as one of the principal goals of science teaching. Similarly, Yager (2000) considered that giving students opportunities to build their own knowledge and understanding had become one of the most widely-accepted principles in the teaching and learning of science.

Effective and meaningful learning in science can be supported through the use of information and communication technologies (ICT) that include technical tools and learning approaches, centered on learners and their active participation in the teaching-learning process, that meet their interests, and suit their abilities. Consequently, the US National Science Education Standards further noted that new technologies often extend the current levels of scientific understanding and introduce new areas of research (NRC, 1996). López-Pérez, Pérez-López, and Rodríguez-Ariza

(2011) noted that ICT use can provide educators and learners with an innovative learning environment to stimulate and enhance the teaching and learning process. Furthermore, McDonald, McPhail, Maguire, and Millett (2004) observed that the increasing application of ICT provides rich learning environments.

E-learning is considered to be one of the most important technological contributions to the field of education (Sawaftah & Aljeraiwi, 2016). E-learning is a kind of instruction delivered electronically either through a web browser (using an intranet or the Internet), or through the use of CD-ROMs or DVD multimedia platforms (Hall, 1997). When content is delivered via CD-ROMs or DVD, it is typically a form of computer based instruction (CBI), while content delivered via a web browser is usually identified as web-based, self-paced, distance, or online learning (Codone, 2001; Voci & Young, 2001). Much research focuses on ways to achieve the goals of science teaching through applying and employing the available technological tools and software programs, which create an interactive learner-centered environment and provide opportunities for learners to learn according to their individual abilities and speeds, especially when classrooms are congested. Consequently, Codone (2001) considered that e-learning provides opportunities to meet the individual needs of learners, as they can all learn according to their abilities and speed (that is, self-paced learning), and can develop ways to collaborate and interact with each other. Many prior studies have shown positive results from the use of e-learning in science teaching at high school and college levels (e.g., Bakas & Mikropoulos, 2003; Cameron, 2003; Kearney, Treagust, Yeo, & Zadnik, 2001).

Due to the physical distance between students and their instructors in web-based instruction, however, there are some disadvantages and risks associated with the use of this style of instruction (Codone, 2001; Mabrito, 2006). Although the instructional material is available online in web-based instruction, students have no face-to-face interaction with their instructor and they are not exposed to body language or other social indicators that assist with the learning process (Mabrito, 2006). This absence of live human interaction may also be disconcerting to students (Codone, 2001)

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and may have a negative effect on students' acquisition of communication skills. Additionally, not all content is suitable for online delivery (Codone, 2001). These disadvantages lead to the need to complement web-based instruction with face-to-face instruction, resulting in a style of learning, which is known as blended learning (BL; Garrison & Kanuka, 2004).

Blended Learning (BL)

In its simplest form, BL can be defined as the thoughtful integration of online instruction with classroom-based instruction (Garrison & Kanuka, 2004). Classroom-based instruction, which is the most traditional of all instruction modalities (Hwang & Arbaugh, 2009; Voci & Young, 2001), occurs when students and their instructor are face-to-face (FTF) in a classroom-based setting (Head, Lockee, & Oliver, 2002). Online instruction, which involves web-based or self-based learning, occurs outside the classroom and relies on the delivery of content via a web browser, through either the Internet or an intranet (Codone, 2001; Voci & Young, 2001).

Because BL integrates FTF classes with online learning, it is possible for this approach to capture the advantages of both modalities (Graham, 2004). Thus, BL offers learners the flexibility and convenience to choose both when and where to learn (Voci & Young, 2001); these are considered important characteristics for working adults who decide to pursue post-secondary degrees (Rovai & Jordan, 2004). For the same reason, the literature describes BL as balanced learning. This balance is achieved by combining the advantages of two learning modalities, classroom-based and web-based instruction (Voci & Young, 2001). Further, the literature suggests many advantages of BL that may promote effective teaching and learning of science and help students to acquire scientific knowledge in a meaningful way. BL offers an interesting combination of the traditional classroom experience and the use of different technologies to facilitate teaching and learning outside the formal classroom (Duhaney, 2006). Having many types of interaction, as is made possible by the use of BL, has proved to be a factor that increases motivation and creates positive attitudes towards learning (Donnelly, 2010; Woltering, Herrler, Spitzer, &

Spreckelsen, 2009), which, consequently, enable students to become more involved in the learning process (Wang, Shen, Novak, & Pan, 2009).

In situations where student numbers are high, such as in the first year of many undergraduate study courses (which represents an important year in determining the student's commitment to university learning; see Huon, Spehar, Adam, & Rifkin, 2007), the resources and materials of BL provide opportunities for students to comprehend and extend the knowledge presented, which may motivate students to learn, improve and support the learning process (Lei, 2010; Osguthorpe & Graham, 2003; Singh, 2010), and produce changes in learning patterns and practices (Huon et al., 2007). Moreover, Osguthorpe and Graham (2003) reported that the use of BL improves pedagogy, increases the amount of student access to knowledge, fosters social interaction, increases the amount of teacher presence during learning, and enhances the ease of revision. According to Duhaney (2006), the BL approach encourages and allows more students to benefit from further educational opportunities, and the incorporation of a range of information technology resources in this approach can help to facilitate pedagogy and learning as learners can use the resources in a variety of configurations.

Furthermore, a number of prior studies have shown positive results arising from the use of BL for science teaching in higher education (e.g., Garrison & Kanuka, 2004; Kupetz & Ziegenmeyer, 2005; Lim & Morris, 2009; Lopez-Perez et al., 2011; Makhdoom, Khoshhal, Algaidi, Heissam, & Zolaly, 2013; Motteram, 2006; O'Toole & Absalom, 2003; Rovai & Jordan, 2004; Uzun & Senturk, 2010; Wang et al., 2009).

Learning Management System (LMS)

Across all sectors of education, the emphasis on online learning has been increasing (Head et al., 2002) in an effort to solve educational problems such as the current knowledge explosion and increases in student numbers. The best way of managing this type of learning is to install and configure a learning management system (LMS; Codone, 2001). An LMS is a web-based software that enables instructors to manage course material and communicate quickly, easily, and effectively with learners. The LMS

provides instructors with a variety of software tools so that they can focus on teaching and learning instead of exclusively on the technology (Johnson et al., 2004). Within an LMS, students can securely log in to a home page customized for their particular course of study, select sections of the course material that they want to study, launch the content, communicate online with each other and with their instructor, and participate through collaborative features (Codone, 2001). A number of studies have noted the advantages of LMSs and their effectiveness for science teaching in higher education. For example, Abdalla (2007), Pereira et al. (2007), De Neui and Dodge (2006), and Johnson et al. (2004) all found that complementing traditional classes with online materials using an LMS had positive effects on learning outcomes. Web-based learning has benefited tremendously from the development of easy-to-use courseware management systems, such as TopClass, WebMentor, WebCT, and Blackboard, all of which offer very similar basic features as instructional platforms (Abdalla, 2007). For the purpose of this study, BL consisted of a combination of FTF and online learning, which uses Blackboard as an LMS at King Saud University.

A review of the literature found prior related studies that aimed to investigate students' perceptions of the quality of the BL approach. Participants in a study conducted by Motteram (2006) reported that they had engaged with the ideas and processes of BL and that this approach had enhanced their learning experiences because the course structure allowed them to deal with topics in their own time. Another study relating to students' perspectives of the quality of BL experiences was provided by Khine and Lourdusamy (2003), who concluded that, overall, the BL experience was perceived to be positive by the participants. The findings of Lopez-Perez et al. (2011), similarly, suggested that students were satisfied with BL and that they considered this approach to be useful for helping them to understand and learn the subject content. Abou Naaj, Nachouki, and Ankit (2012) found that students were satisfied with all components of BL, although the level of satisfaction did vary according to gender. The results obtained by Morris (2010) provided support for the use of BL approaches to improve students' academic performance in

higher education courses, as well as to enhance student satisfaction with their learning experiences. Mackey and Ho's (2008) research suggested that web-based multimedia instruction was an effective approach for teaching web design in an information science course that used BL. The findings of Tang and Byrne (2007) indicated that students appeared to be more satisfied with the blended mode of delivery than with either strictly online or regular classroom formats. Finally, an evaluation of students' use of the BL environment by Boyle, Bradley, Chalk, Jones, and Pickard (2003) indicated that students made a generally positive assessment of the main elements of BL and that there was widespread use of the new online features.

Research Problem

The authors contacted first-year undergraduate students from the Health Colleges at KSU who were studying a general physics course (Phys 145) that used a BL approach based on the Blackboard instructional platform. Some students complained about the effectiveness of the educational resources and teaching materials on the Blackboard interface. This complaint, together with the advantages of BL and its effectiveness as a teaching strategy (e.g., Donnelly, 2010; Duhaney, 2006; Holley & Dobson, 2008; Lei, 2010; Lopez-Perez et al., 2011; Makhdoom et al., 2013; Milheim, 2006; Pereira et al., 2007; Singh, 2010; Uzun & Senturk, 2010; Woltering et al., 2009), as well as the need for an evaluation of the BL approach for teaching college physics for health students (Ginns & Ellis, 2009), led to an examination of the quality of BL in physics teaching at KSU. The present study was designed to achieve this aim through exploring the Health Colleges students' perceptions of the quality of BL within the teaching of the physics course (Phys 145), and examining whether those perceptions varied according to gender or computer skill level.

Research Questions

This study addresses the following research questions:

1. What are KSU students' perceptions of the quality of BL based on the use of Blackboard in teaching Phys 145?

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2. Are there statistically significant differences (at a level of 0.05) in students' perceptions of the quality of BL based on the use of Blackboard in teaching Phys 145 at KSU that can be attributed to gender?
3. Are there statistically significant differences (at a level of 0.05) in students' perceptions of the quality of BL based on the use of Blackboard in teaching Phys 145 at KSU that can be attributed to the students' computer skill level (high, average, or low)?

Purpose of the Study

The present study aimed to investigate students' perceptions of the quality of blended learning based on the use of Blackboard in physics teaching at KSU and to determine whether those perceptions varied significantly according to participants' gender or computer skill level.

Significance of the Study

In an attempt to combine e-learning with FTF classroom instruction, KSU initiated a project called "Developing the Digital Content of KSU Courses". Faculty members were required to transform their course material into digital content and submit it to the Blackboard LMS to allow students to continue their learning outside the classroom. KSU held training sessions for faculty members to support the implementation of this project. Any use of information and communication technologies (ICT) in higher education requires an evaluation of the contribution of these tools to students' learning, especially when they are used as a complement to FTF methods (Ginns & Ellis, 2009). Thus, after implementing the BL approach in the course "General Physics for Medical Colleges Students (Phys 145)," an evaluation was required. The results of the present study may help the directors of the Physics Department at KSU to decide whether they will continue to apply BL in the physics course (Phys 145) or to address any shortcomings that become apparent. It may also help the directors in deciding whether to extend this approach to other physics courses.

Limitations of the Study

The study has the following limitations:

- The study involved a group of Health Colleges students in the first year

(Preparatory Year) of a five-year undergraduate degree at KSU in Saudi Arabia, which limits the generalizability of results beyond this population.

- The study involved students who were enrolled for a general physics course (Phys 145) in the second semester of the academic year 2014–2015, which limits the generalizability of results beyond this course and this semester.
- The Course Experience Questionnaire (CEQ), which was used in the study, was translated and modified, and its psychometric characteristics were verified. Therefore, the interpretation of results depends on the validity and reliability of the instrument.

Procedural Definitions

Blackboard (Bb)

Bb is a particular learning management system (LMS) which is used at KSU. It is web-based software that provides the instructor with a variety of electronic tools for managing course material, communicating quickly with learners, tracking learners' completion of homework and other tasks, and sending learners feedback. Within Bb, students can securely log in to digital courses, select courses they want to study, complete their homework and other tasks, see feedback from their instructor, and communicate online with each other and with their instructor (through email, chat rooms, and the Bb platform).

Blended Learning (BL) Based on Blackboard (Bb)

BL based on Bb is the teaching strategy that KSU instructors (including the instructors for the physics course, Phys 145) used with their students. In implementing this strategy, the instructors integrated face-to-face instruction with online learning as follows:

- For the face-to-face instruction component, the instructors taught the physics course (Phys 145) to students face to face in the classroom using traditional methods (lecture, explanation, and discussion). In addition, the instructors presented the content using interactive multimedia techniques in the form of a SCORM file that was loaded through the

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Bb interface.

- For the online learning component, students revised the physics course online while outside the classroom. This involved students using the interactive multimedia according to their own abilities and preferred speeds, completing homework and other tasks, receiving feedback from their teacher, and contacting each other and their teacher in asynchronous dialogue through the available social communication networks (email, chat rooms, and the Bb platform).
- The Bb interface allowed the instructors to contact their students in asynchronous dialogue, track students' completion of homework and other tasks, and send students feedback.

Methodology

Participants

The population for this study consisted of 992 students from the Health Colleges in the first year (Preparatory Year) of a five-year undergraduate degree at KSU in Saudi Arabia who were enrolled in the physics course Phys 145 in the second semester of the academic year 2014–2015. All of these students studied this physics course using BL based on the use of Blackboard. The study sample consisted of 341 students (187 males and 154 females; 34.4% of the whole population) who responded to the study instrument, the Course Experience Questionnaire (CEQ), which was distributed electronically. The link for the CEQ was sent by e-mail to the whole study population at the end of the second semester of the academic year 2014–2015.

Implementation of BL in the Physics Course

The physics course (Phys 145) is a required course worth three credit hours at KSU: two hours for the theoretical component and one hour for the experimental component. The BL approach was applied to the theoretical component only. In the 14-week second semester of the academic year 2014–2015, the instructors taught the theoretical component of the course to the students using BL (based on the use of Blackboard interface) as follows:

- The instructors trained students on how to use the Blackboard interface to complete the physics course activities online.
- For two hours each week, the instructors taught the physics course to students face to face in the classroom using traditional methods (lecture, explanation, and discussion). In addition, the instructors presented the content using interactive multimedia technologies in the form of a SCORM file that was loaded through the Blackboard interface. The multimedia file consisted of outlines of information, training, assessment questions, fixed and moving photos and drawings, and links to videos and enrichment materials available on the Internet.
- Students could log into their accounts on Blackboard, using their usernames and passwords, in order to access the course online (outside the classroom) and use the interactive multimedia according to their own abilities and preferred speeds.
- Through their personalized accounts on the Blackboard interface, students could complete their homework and other tasks and see feedback from their teachers.
- Through the available social communication networks (email, chat rooms, and the Bb platform), Blackboard allowed the students to contact each other and their teachers in asynchronous dialogue. This also allowed them to ask questions, participate in discussions, and exchange views.
- The Bb interface allowed the instructors to contact their students in asynchronous dialogue, track students' completion of homework and other tasks, and send students feedback.

Instrument

Choosing the Instrument

For the present study, the 18-item version of the Course Experience Questionnaire (CEQ), developed by Ginns and Ellis (2007), was used. This instrument originally used a three-point Likert scale, but the rating criteria were adapted to a five-point Likert scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) for the present study. The CEQ consisted of four subscales, which were labelled Good E-teaching, Good E-resources,

Appropriate Workload, and Student Interaction. The definitions of these subscales are shown in Table 1.

Table 1
Subscales of the CEQ and their definitions

Subscale no.	Subscale title	No. of items	Subscale definition
1	Good E-teaching (quality of teaching in BL)	7	Measures the extent to which the teacher was effective in facilitating learning in an online context
2	Good E-resources (quality of online resources)	5	Measures the extent to which the online materials and activities assisted learning
3	Appropriate Workload	3	Measures the volume of work needed to cope with the online components of the course
4	Student Interaction	3	Measures the degree to which other students' online postings to a discussion board were perceived as useful and provoked engagement with the topics

The version of the CEQ used in the present study had three sections. The first section contained general information such as the purpose of the instrument and instructions as to how students should respond to its items. The second section collected demographic data and personal information from students: their gender and their average grade in the computer skills course (IT 140). The third section contained the items of the CEQ.

Scoring for the CEQ

The scoring for each positive item of the CEQ was as follows: 5 points for the response "Strongly Agree," 4 for "Agree," 3 for "Neutral," 2 for "Disagree," and 1 for "Strongly Disagree." For negative items, scoring used the reverse of this distribution.

Validity of the CEQ

The content validity of the CEQ was ensured by consulting a group of

referees. The referees were asked to validate the content of the CEQ in terms of the classification of student computer skill levels as well as the clarity and translation of each item. The referees' notes and suggestions were studied carefully and taken into consideration.

To test the construct validity of the CEQ, it was distributed to a pilot sample of 63 students from within the study population (but outside the sample), and Pearson's correlation coefficients were calculated for each subscale and the whole instrument. The correlation coefficients between items and their subscales ranged from 0.45 to 0.90, and all of these coefficients were statistically significant at a level of 0.05. Furthermore, the correlation coefficients between items and the whole scale ranged from 0.33 to 0.86, and all of these coefficients were also statistically significant at a level of 0.05.

Furthermore, the internal construction validity was tested by calculating the correlations of the instrument's subscales with each other and with the scale as a whole. The correlation coefficients are presented in Table 2.

Table 2
Pearson's correlation coefficients of subscales with each other and with the scale as a whole

Correlation	Good E-teaching	Good E-resources	Appropriate Workload	Student Interaction	Over All the Scale
Good E-teaching		0.70**	0.59**	0.70**	0.92**
Good E-resources	0.70**		0.53**	0.70**	0.87**
Appropriate Workload	0.59**	0.53**		0.65**	0.75**
Student Interaction	0.70**	0.70**	0.65**		0.87**
Over All the Scale	0.92**	0.87**	0.75**	0.87**	

Note. ** Correlation is significant at the 0.01 level (2-tailed)

As shown in Table 2, the Pearson's correlation coefficients among subscales ranged from 0.53 to 0.70, and all of these coefficients are statistically significant at the 0.01 level. Also, the Pearson's correlation coefficients between subscales and the whole scale ranged from 0.75 to 0.92, and all of these coefficients are statistically significant at the 0.01 level.

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Reliability of the CEQ

To determine the reliability of the CEQ, the pilot sample data were used. The 63 students' responses were analyzed to determine the Cronbach's alpha coefficient (α) for the reliability of the whole CEQ and each of its subscales. The alpha reliability coefficient of the whole CEQ was 0.90, and the reliability coefficients of the subscales were 0.76, 0.73, 0.64, and 0.81 respectively. These coefficients showed that the CEQ was satisfactory and reliable.

Data Collect Collection

Participants' Perceptions of the Quality of BL in the Physics Course

At the end of the second semester of the 2014–2015 academic year, after the participants had completed the whole physics course over a 14-week period, a link to the CEQ was distributed via e-mail to the whole study population. Only 341 students responded to the CEQ.

Participants' Computer Skill Levels

All participants had completed a computer skills course (IT 140) in the first semester before studying the physics course. Students' average grades for this course were used to represent their computer skill level. In the study instrument, students were asked to identify the range (from three given ranges) that included their average grade for the IT course. Based on this data, the students' computer skill levels were classified as follows:

- High computer skill level: This category represents an average grade for the IT course that was greater than or equal to 85%.
- Average computer skill level: This category represents an average grade for the IT course that was greater than or equal to 70% but less than 85%.
- Low computer skill level: This category represents an average grade for the IT course that was less than 70%.

Results and Discussion

Results Related to the First Research Question

To address the first research question of this study, the means and standard deviations of participants' responses to the CEQ as a whole, to

each of its subscales, and to each of its items were calculated and classified into three quality levels as follows (Al-Jarrah & Obeidat, 2011):

- High quality: If the mean for the participants' scores was greater than or equal to 3.67 out of 5.
- Average quality: If the mean for the participants' scores was greater than or equal to 2.33 but less than 3.67 out of 5.
- Low quality: If the mean for the participants' scores was less than 2.33 out of 5.

Table 3 shows the means and standard deviations for the participants' responses to the subscales of the CEQ; the subscales have been arranged in descending order according to their means.

Table 3
Descriptive statistics for participants' responses to the subscales of the CEQ

Subscale no.	Scale/subscale	No. of items	M (out of 5)	SD	Subscale rank
4	Student Interaction	3	4.19	0.52	1
3	Appropriate Workload	3	4.03	0.55	2
1	Good E-teaching (Quality of Teaching in BL)	7	3.87	0.38	3
2	Good E-resources (Quality of Online Resources)	5	3.83	0.41	4
	Total	18	3.94	0.36	

As shown in Table 3, the mean for the participants' responses to the CEQ as a whole was greater than 3.67. This suggests that, overall, the BL (based on Blackboard) used in teaching physics at KSU is of high quality.

Similar results can be seen for each of the four subscales of the CEQ. As shown in Table 3, the means for the four subscales are all greater than 3.67. This indicates that: the teachers of the physics course (Phys 145) were highly effective in facilitating learning in the online context; the online materials and activities supported learning to a high extent; the volume of work was highly appropriate to cope with the online components of the physics course; and the students' online postings to a discussion board were perceived as highly useful and provoked a high level of engagement with the topics of the physics course.

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To further explore KSU students' perceptions of the quality of teaching within the BL, the means and standard deviations for the participants' responses to the seven items of the first subscale were calculated. Table 4 shows these statistics; the subscale items have been arranged in descending order according to their means.

Table 4
Descriptive statistics for participants' responses to the items of the "Good E-teaching" subscale

Item no.	Item	M (out of 5)	SD
9	I didn't receive enough helpful online feedback from my teacher	4.36	0.93
2	The teacher helped to focus online discussions between students	4.07	0.61
13	The teacher's online interaction with me encouraged me to get the most out of my learning	4.04	0.60
5	The teacher's online responses motivated me to learn more deeply	3.85	0.83
11	The teacher helped to guide the online discussions between students	3.82	0.68
15	The teacher used the Blackboard environment when appropriate to keep students informed about results	3.52	0.71
18	The teacher used the Blackboard environment to regularly update students about information relevant to the physics course	3.42	1.10
Whole subscale		3.87	0.33

As shown in Table 4, the mean for the participants' responses to the first subscale, good e-teaching, was greater than 3.67. This suggests that, in general, the instructors were highly effective in facilitating learning within the online context of the physics course.

Similar results can be seen for items 9, 2, 13, 5, and 11. As shown in Table 4, the means for participants' responses to these items were all greater than 3.67. This indicates that, to a high degree: students received enough helpful online feedback from their teachers; the teachers helped to focus online discussions between students; the teachers' online interaction encouraged students to get the most out of their learning; the teachers'

online responses motivated students to learn in greater depth; and the teachers helped to guide the online discussions between students.

Exceptions to this trend can be seen in items 15 and 18. As shown in Table 4, the means for participants' responses to both these items are greater than 2.33 but less than 3.67. This suggests that, to only an average degree, the teachers used the Blackboard environment to keep students informed about their results; and the teachers used the Blackboard environment to regularly update students about information relevant to the physics course.

To further explore KSU students' perceptions of the quality of the online resources provided, the means and standard deviations for the participants' responses to the five items of the second subscale were calculated. Table 5 shows these statistics; the subscale items have been arranged in descending order according to their means.

Table 5
Descriptive statistics for participants' responses to the items of the "Good E-resources" subscale

Item no.	Item	M (out of 5)	SD
4	The online learning materials helped me to learn during the face-to-face situations in the physics course	4.22	0.90
8	The online activities in the physics course are designed to get the best out of students	4.05	0.77
14	The online teaching materials are designed to make topics really interesting to students	3.81	0.57
1	The online teaching materials in the physics course are extremely good at explaining things	3.63	0.77
12	The online activities helped me to understand the face-to-face activities in the physics course	3.45	0.78
Whole subscale		3.83	0.31

As shown in Table 5, the mean for the participants' responses to the second subscale, good e-resources, was greater than 3.67. This suggests that, in general, the online materials and activities assisted learning within the physics course to a high degree.

Similar results can be seen for items 4, 8, and 14. As shown in Table 5,

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the means for students' responses to these items were all greater than 3.67. This indicates that, to a high degree, the online learning materials helped students to learn during the face-to-face components of the physics course; the online activities in the physics course were designed to get the best out of students; and the online teaching materials were designed to make topics interesting.

Exceptions to this trend can be seen in items 1 and 12. As shown in Table 5, the means for participants' responses to both these items were greater than 2.33 but less than 3.67. This suggests that, to an average degree, the online teaching materials in the physics course were suitable for explaining things; and the online activities helped the students to understand the face-to-face activities.

To further examine KSU students' perceptions of the course workload, the means and standard deviations for the participants' responses to the three items of the third subscale were calculated. Table 6 shows these statistics; the subscale items have been arranged in descending order according to their means.

Table 6
Descriptive statistics for participants' responses to the items of the "Appropriate Workload" subscale

Item no.	Item	M (out of 5)	SD
10	In general, I had enough time to understand the things that I had to learn online in the physics course	4.36	0.88
17	The workload for the online component of the physics course is too heavy	4.11	0.66
6	The sheer volume of work for the online component of the physics course means that it cannot all be thoroughly comprehended	3.63	0.77
Whole subscale		4.03	0.37

As shown in Table 6, the mean for the participants' responses to the third subscale, appropriate workload, was greater than 3.67. This suggests that, in general, the volume of work was highly appropriate to cope with the online components of the physics course.

Similar results can be seen for items 10 and 17. As shown in Table 6, the means for the participants' responses to both these items were greater than 3.67. This indicates that, to a high degree, students had enough time to understand the things that they had to learn online within the physics course; and the workload for the online component of the physics course was appropriate.

An exception to this trend can be seen in item 5. As shown in Table 6, the mean for participants' responses to this item was greater than 2.33 but less than 3.67. This reveals that, to an average extent, the sheer volume of work for the online component of the physics course meant that the work could not all be thoroughly comprehended.

To further examine KSU students' perceptions of student interaction, the means and standard deviations for the participants' responses to the three items of the fourth subscale were calculated. Table 7 shows these statistics; the subscale items have been arranged in descending order according to their means.

Table 7
Descriptive statistics for participants' responses to the items of the "Student Interaction" subscale

Item no.	Item	M (out of 5)	SD
3	I interacted with students' online postings/ submissions even if they weren't assessed	4.46	0.68
7	Other students' online submissions encouraged me to investigate further sources of knowledge	4.21	0.66
16	Other students' online submissions helped me to understand my ideas from a new perspective	3.91	0.75
Whole subscale		4.19	0.27

As shown in Table 7, the mean for participants' responses to the fourth subscale, student interaction, was greater than 3.67. This suggests that, in general, the students' online postings to a discussion board were perceived as highly useful and provoked a high level of engagement with the topics of the physics course.

Similar results can be seen for items 3, 7, and 16. As shown in Table 7, the means for the participants' responses to these items were all greater

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than 3.67. This indicates that, to a high degree, students interacted with each other's online postings/submissions even if they weren't assessed; other students' online submissions encouraged them to investigate further sources of knowledge; and students' online submissions helped them to understand their ideas from a new perspective.

The results reveal that, overall, the BL based on the use of Blackboard in teaching physics at KSU was perceived to be of high quality, since the mean score for the participants' responses to the CEQ as a whole was 3.94 (see Table 3). Because the BL approach combines face-to-face classes with web-based learning, and both methodologies can be very effective (Milheim, 2006), this finding may be attributed to the way the BL approach benefits from the advantages of both modalities.

Moreover, this positive result may also be partly attributed to the unique advantages of BL that are caused by the combination of FTF and online instruction. This combination may have fostered students' much-needed social interaction with each other and with their instructor, whether this occurred through FTF interaction in the classroom or through asynchronous interaction across a social network. This possibility of having more types of interaction meant that the BL contributed to raising the level of communication and exchange of experiences among students and with their teacher (Fassinger, 1995; Voci & Young, 2001), increased students' motivation, and created positive attitudes towards learning (Donnelly, 2010; Woltering et al., 2009), which enabled them to become more involved in the learning process (Wang et al., 2009). The BL approach also allowed greater flexibility and convenience for learners to choose when and where to learn (Voci & Young, 2001); these are considered important characteristics for working adults (Rovai & Jordan, 2004). Additionally, the BL approach offered an opportunity for an interesting combination of the traditional classroom experience and the use of different technologies to facilitate teaching and learning outside the formal classroom (Duhaney, 2006). Moreover, the use of BL increased students' access to knowledge, increased teacher presence during learning, and enhanced ease of revision (Osguthorpe & Graham, 2003). BL also encouraged and allowed more students to benefit from further educational

opportunities, and the availability of many information technology resources within this approach helped to facilitate pedagogy and learning in a variety of configurations (Duhaney, 2006). Further, the resources and materials for the BL provided greater opportunities and reinforcement for students to comprehend and extend the knowledge presented, motivated students to learn, improved and supported their learning process (Lei, 2010; Osguthorpe & Graham, 2003; Singh, 2010), and produced changes in learning patterns and practices (Huon et al., 2007). Therefore, the BL approach itself had a positive effect on students' perceptions of the quality of BL in the physics course.

These results are consistent with those reported in the following studies, all of which suggested either that students were satisfied and engaged with all components of a BL approach, or that the BL experience was perceived as positive by the students: Abou Naaj et al. (2012), Boyle et al. (2003), Khine & Lourdusamy (2003), Lopez-Perez et al. (2011), Mackey & Ho (2008), Morris (2010), Motteram (2006), Tang & Byrne (2007).

Results Related to the Second Research Question

To address the second research question of this study, the means and standard deviations for each gender's responses to the CEQ were calculated. To test the statistical significance of the difference between male and female students, an independent samples t-test technique (at a significance level of 0.05) was used; the results are presented in Table 8.

Table 8
Results of t-test for the difference according to gender between participants' scores on the CEQ

Gender	N	M (out of 90)	SD	df	t	Significane (p-value)
Male	187	71.44	6.66	339	1.50	0.133
Female	154	70.38	6.24			

Table 8 shows that there was no statistically significant difference between the two means (t=1.50, p=0.133). This indicates that there were no statistically significant differences (at the level of 0.05) in the participants' perceptions of the quality of BL in physics teaching at KSU

that can be attributed to gender. Both male and female students agreed that the BL environment based on the use of Blackboard was of high quality in teaching the physics course.

This result may be attributed to the fact that the utilization of technology is no longer restricted to any special class of people. Technology has become accessible to a greater proportion of students, both male and female. In addition, the cost of using the technology needed for engaging in BL is low, especially for Saudi students who are relatively financially comfortable; this makes student access to technical tools feasible.

This result is inconsistent with that reported by Abou Naaj et al. (2012), whose research suggested that male students were more satisfied with BL than female students.

Results Related to the Third Research Question

To address the third research question of this study, the means and standard deviations for participants' responses to the CEQ were calculated according to the participants' computer skill levels. Table 9 presents these statistics.

Table 9
Descriptive statistics for participants' scores on the CEQ according to their computer skill levels

Computer skill level	N	M (out of 90)	SD
High	197	73.23	4.61
Average	85	69.99	6.20
Low	59	64.80	7.86
All participants	341	70.96	6.49

Table 9 suggests that there were differences between the mean scores on the CEQ for participants with different computer skill levels. To examine the statistical significance of these differences, a one-way analysis of variance (ANOVA; at a significance level of 0.05) was conducted; the results are presented in Table 10.

Table 10
ANOVA results for scores on the CEQ according to participants' computer skill levels

Source	Sum of squares	df	Mean square	F	Significane (p-value)
Between groups	3339.77	2	1669.89	51.46	0.000
Within groups (error)	10967.81	338	32.45		
Total	14307.58	340			

Table 10 indicates that there were statistically significant differences among the CEQ scores of participants with different computer skill levels (F=51.46, p=0.000). To determine which of these differences were statistically significant (at the 0.05 level), the Scheffé test for comparing means was used; the results are summarized in Table 11.

Table 11
Results of Scheffé comparisons of CEQ score means according to participants' computer skill levels

Computer skill level	M (out of 90)	High	Average	Low
M (out of 90)		73.23	69.99	64.80
High	73.23	-	3.24*	8.43*
Average	69.99		-	5.19*
Low	64.80			-

Note. * The mean difference is statistically significant at the 0.05 level.

Table 11 indicates that all differences between the means of the three groups (students with high, average, or low computer skill levels) were statistically significant (at the significance level of 0.05). The difference between the mean scores of students with high and average computer skill levels was 3.24 in favor of the students with a high computer skill level. The difference between the mean scores of students with average and low computer skill levels was 5.19 in favor of the students with an average computer skill level. The difference between the mean scores of students with high and low computer skill levels was 8.43 in favor of the students with a high computer skill level.

These results reveal that there were statistically significant differences in participants' perceptions of the quality of BL in physics teaching at KSU that could be attributed to the participants' computer skill levels and that consistently appeared in favor of students with higher computer skill levels.

This result may be attributed to different levels of computer skills demonstrated by the students. Students with higher computer skill levels and greater access to technology tools used BL with greater ease. This encouraged them to engage with Bb more often in order to interact with the online physics course outside the classroom, meaning that these students completed homework and other tasks, and used social communication networks associated with the course, more frequently than other students who had lower computer skill levels. Therefore, these students' perceptions of the quality of BL in the physics course were more positive than those of their peers who had lower computer skill levels.

Conclusions

The present study examined students' perceptions of the quality of BL (based on the use of Bb) in teaching physics at KSU, and investigated whether those perceptions varied significantly according to participants' gender, computer skill levels, or overall academic achievement level. Relating to students' overall perceptions, the results of the study revealed that the use of BL (based on the use of Bb) in physics teaching at KSU was generally perceived to be of high quality. When each domain of the CEQ was considered individually, the results revealed that: a) the teachers were highly effective in facilitating learning within the online context of the physics course; b) the online materials and activities supported learning within the physics course to a high degree; c) the load of work was highly appropriate to cope with the online components of the physics course; and d) the students' online postings to a discussion board were perceived as highly useful and provoked a high level of engagement with the topics of the physics course.

The results of the study also revealed that: a) there was no statistically significant difference between male and female students' perceptions of

the quality of BL in teaching physics at KSU; and b) there were statistically significant differences in the perceptions of students with different computer skill levels toward the quality of BL in physics teaching at KSU and these consistently appeared in favor of the students with higher computer skill levels.

Recommendations

In closing, just as this study investigated students' perceptions of the quality of the use of a BL approach in physics teaching, it is also important to investigate students' perceptions of the quality of this approach in the teaching of other courses as well. It is also essential to assess and evaluate the effectiveness of this approach through probing learning outcomes such as student achievement, retention, and learning processes in terms of higher levels of learning (e.g., critical and creative thinking), particularly since Gardiner (1998) noted the need for classroom change in order to allow students to acquire more significant cognitive skills such as critical thinking skills. Furthermore, using a BL approach is recommended for teaching physics, especially in situations where student numbers are high (such as the first year of undergraduate study). Finally, the results of this study may also help the directors of the Physics Department at KSU to address any shortcomings of the approach that were revealed through this study.

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