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The Quality of Online Learning Using Blackboard in a Physics Course at King Saud University During the COVID-19 Pandemic: Students' Perceptions

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Abstract

The wide use of online learning platforms needs to be evaluated, especially in terms of students' perceptions. The present study aimed to investigate students' perceptions of online learning quality in a physics course at King Saud University (KSU) during the COVID-19 pandemic, 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 334 Health Colleges students in the first year of a five-year undergraduate degree, who were enrolled in a physics course at KSU. The results revealed that the online learning in the physics course 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 online learning in this course that could be attributed to gender. Further, the results revealed that there were statistically significant differences in those perceptions that could be attributed to students' computer skill level (in favor of students with a higher level of computer skills).

Keywords: online learning, Web-based learning, virtual learning, blackboard (Bb), information and communication technologies (ICT), science teaching.

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جودة التعلم عن بُعد باستخدام بلاكبورد في مقرر للفيزياء خلال جائحة كورونا (COVID-19) من وجهة نظر الطلبة بجامعة الملك سعود

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الملخص

إن الانتشار الواسع لمنصات التعلم عن بُعد يحتاج إلى تقويم، وخاصة من وجهة نظر الطلبة أنفسهم. هدفت الدراسة الحالية إلى استقصاء آراء الطلبة حول جودة التعلم عن بُعد باستخدام نظام بلاكبورد في مقرر للفيزياء بجامعة الملك سعود خلال جائحة كورونا (COVID-19)، ومعرفة ما إذا كانت آراؤهم تختلف باختلاف الجنس ومستوى الطالب في مهارات الحاسب. استخدمت الدراسة استبانة جينيس وإيليس (Ginns & Ellis, 2007) لاستقصاء آراء 334 طالباً وطالبةً من مسار الكليات الصحية المسجلين لمقرر في الفيزياء في سنتهم الدراسية الأولى. أشارت نتائج الدراسة إلى أن التعلم عن بُعد باستخدام نظام بلاكبورد في مقرر الفيزياء بشكل عام ذي جودة عالية، وإلى عدم وجود فروق دالة إحصائياً في آراء الطلبة تعود إلى الجنس. كما أشارت النتائج إلى وجود فروق دالة إحصائياً في آراء الطلبة حول جودة التعلم عن بُعد باستخدام نظام بلاكبورد في هذا المقرر تعود إلى مستوى الطالب في مهارات الحاسب، وكانت هذه الفروق لصالح الطلبة ذوي المستوى الأعلى في مهارات الحاسب.

الكلمات المفتاحية: التعلم عن بُعد، التعلم القائم على الشبكة العنكبوتية، التعلم الافتراضي، بلاكبورد، تكنولوجيا المعلومات والاتصالات، تدريس العلوم..

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Introduction

Due to the emergence of the COVID-19 pandemic in China in December 2019 and its subsequent spread all over the world, most countries have applied the closure of all educational institutions to protect their students from viral exposures. Although lockdowns and social distancing are considered the most important protection methods to slow down the spread of COVID-19 by breaking the chain of transmission, the closure of educational institutions has affected a large number of students. The educational institutions in affected countries have been seeking solutions to continue the educational process. Most educational institutions have shifted from traditional classroom instruction (CI) to online learning platforms, such as Learning Management System (LMS), Microsoft Teams, Zoom, among others.

Research literature has shown that students are accepting using online learning during COVID-19, and this literature supports the notion that online learning is as effective as traditional classroom learning if designed appropriately (Muthuprasad, Aiswarya, Aditya, & Jha, 2021; Nguyen, 2015). These findings promote the implementation of online learning model instead of traditional classroom instruction. For example, the study of Muthuprasad et al. (2021), which was applied to agriculture students in India, indicated that the majority of respondents (70%) were ready to choose online classes to manage the curriculum during COVID-19 pandemic. The students believed that the flexibility and convenience of online classes made it an attractive option. Also, the findings of Gismalla, Mohamed,

Ibrahim, Elhassan, and Mohamed (2021) indicated that approximately (64 %) of medical students in Sudan perceived that online learning is the best solution during COVID-19 lockdown. Similarly, the findings of Almahasees, Mohsen, and Amin (2021) suggested that both faculty and students in Jordan agreed that online learning is useful during COVID-19 pandemic. Further, the findings of Driscoll, Jicha, Hunt, Tichavsky, and Thompson (2012) indicated that there is no significant difference in students' satisfaction between online learning and face-to-face class, and both modes provide the same effective learning environment when online courses are designed using pedagogically sound practices.

In Saudi Arabia, all educational institutions were closed in the middle of the second semester of the academic year 2019-2020 (March 8th, 2020). To continue the educational process, King Saud University (KSU) began using online learning through Learning Management System (LMS), Blackboard (Bb). The physics course (Phys 109) was one of the courses that was taught online. Since evaluating the effectiveness of online learning requires understanding the perceptions of users (Muthuprasad et al., 2021), it was vital to investigate students' perceptions of the quality of online learning in the physics course (Phys 109), which is the aim of this research.

Literature Review

Online learning or web-based learning (WBL) is delivered via a computer using the Internet, enabling instant updating, distribution, and sharing of information (Rosenberg, 2001). Online learning can be defined as an instructional delivery system that allows students to participate synchronously or asynchronously in an educational opportunity through the Web browser without being physically present in the same location as the instructor.

Online learning has been widely used because of the increased popularity of computer-based programs as well as significant advantages of online learning, including better visualization, more personalization, easier access to additional sources, wider interaction, less of a language barrier, more creativity, and lower cost (Adams, 2007; Thrope & Godwin, 2006).

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Another cause for much of the growth in online learning programs in recent years is the development of the Internet and improvement of technologies that support online learning environments (Johnson & Aragon, 2003).

The resources and materials of online learning 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). Therefore, the use of online learning improves pedagogy, increases the amount of student access to knowledge, fosters social interaction, and enhances the ease of revision (Osguthorpe & Graham, 2003). In addition, online learning allows and encourages more students to benefit from further educational opportunities, and the incorporation of a range of information technology resources in this mode can help to facilitate pedagogy and learning as learners can use the resources in a variety of configurations (Duhaney & Duhaney, 2006).

Furthermore, the literature suggests many advantages of online learning that may promote effective teaching and learning of science and help students to acquire scientific knowledge in a meaningful way. Online learning offers learners flexibility and the convenience to choose both when and where to learn (Voci & Young, 2001); these are considered important characteristics for working adults (Rovai & Jordan, 2004). Online learning also offers an opportunity to use various technologies to facilitate teaching and learning outside the formal classroom (Duhaney & Duhaney, 2006). Having many types of interaction due to the use of online learning, whether this occurs synchronously in the virtual classrooms or asynchronously across a social network, has proven to be a factor that raises the level of communication and exchange of experiences among students and with their instructor (Voci & Young, 2001), increases students' motivation, and creates positive attitudes towards learning (Donnelly, 2010; Woltering, Herrler, Spitzer, & Spreckelsen, 2009), which, consequently, enables students to become more involved in the learning process (Wang, Shen, Novak, & Pan, 2009).

Online learning provides a high quality of interaction to students, between students themselves and with their course instructor (Shea, Fredericksen, Pickett, Pelz, & Swan, 2001; Swan, Shea, Fredericksen, Pickett, Pelz, & Maher, 2000; Kashy, Thoennessen, Albertelli, & Tsai, 2000; Hartman, Dzuiban, & Moskal, 2000). Research literature indicates that interaction is an important element in the learning process, especially in the online learning (Picciano, 2002; Picciano, 2001). For example, findings of Picciano (2002) indicated that there is a strong positive relationship between students' perceptions of their interaction in an online course and their perceptions of the quality and quantity of their learning. Many other studies have reported similar findings (e.g., Beaudoin, 2002; Shea et al., 2001; Dziuban & Moskal, 2001).

Other benefits which online learning opportunities offer have been cited by faculty. Online learning increases convenience and flexibility for faculty teaching and students learning (Hartman & Truman-Davis, 2001; Arbaugh, 2000), increases access for students to higher education (Grenzky & Maitland, 2001), enhances knowledge of educational technology (Thompson, 2001; Fredericksen, Pickett, Shea, Pelz, & Swan, 2000), increases opportunities for professional recognition and research (Hartman & Truman-Davis, 2001; Smith, 2001; Hislop & Atwood, 2000), offers high levels of student learning (Shea et. al., 2001; Hartman, Dzuiban, & Moskal 2000), and provides greater opportunity for more systematic design of online instruction and a corollary positive impact on student learning (Shea, Pelz, Fredericksen, & Pickett, 2002).

Furthermore, a number of prior studies have shown positive results arising from the use of online learning in higher education. The findings of Whittaker, Howarth and Lymn (2014) indicated that Facebook application is a promising tool to establish an online educational community amongst a group of undergraduate science students. The findings of Sitzmann, Kraiger, Stewart and Wisher (2006) indicated that Web-based learning (WBL) was 6% more effective than classroom instruction (CI) for teaching declarative knowledge. The study of Lim and Honey (2003) aimed to assess the quality of online learning in a pharmacology course for postgraduate nursing students. The findings suggested that students

achieved the learning outcomes for the course. Further, the students benefited from online mode in their development as independent learners, which will put them in a good position for lifelong learning as postgraduate nurses. Similarly, Maki, Maki, Patterson, and Whittaker (2000), in a two-year quasi-experimental study of undergraduate students, found more learning and better performance on examinations among students in the online sections of an introductory psychology course.

Learning Management System (LMS)

Across all sectors of education, the emphasis on online learning has been increasing (Head, Lockee, & Oliver, 2002) in an effort to solve educational problems such as the current knowledge explosion, the increase in student numbers, and the spread of the COVID-19 pandemic. The best way to manage this type of learning is to install and configure a learning management system (Codone, 2001). An LMS is a web-based software that enables instructors to manage course material and communicate quickly, easily, and effectively with learners. It 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 reported advantages of LMSs and their effectiveness for science teaching in higher education (e.g., Sawaftah & Aljeraiwi, 2018; Sawaftah & Aljeraiwi, 2016; Abdalla, 2007; Pereira et al. 2007; DeNeui & Dodge, 2006; Johnson et al., 2004). Web-based learning has benefited tremendously from the development of easy-to-use courseware management systems, such as TopClass, WebMentor, WebCT, Moodle, and Blackboard, all of which offer very similar basic features as instructional platforms (Abdalla, 2007). For the purpose of the present study, Blackboard (Bb), which is the platform for online learning at King Saud University (KSU), was used.

A review of the research literature found that prior related studies have surveyed students in higher education and used their perceptions of their own learning as an effective method of evaluating online learning. Suharsih and Wijayanti (2021) explored perceptions of online learning among graduate program students who were using the online learning system SPADA during COVID-19. The findings indicated that the students felt positive about the usefulness and the user friendliness of online learning. The students gave positive feedback regarding online learning in terms of learning autonomy, discipline, technological skills, flexibility, accessibility, and their readiness to deal with technical issues. Salam and Mudinillah (2021) used students' perceptions to evaluate the effectiveness and practicality of the Canva application in online learning during COVID-19. Content verification on the audiovisual learning media in online learning using the Canva application showed excellent results (with an average 4.66 out of 5.00). Meanwhile, the field test score on students' responses to learning media in online learning using the Canva application was in a good category (with an average 3.78 out of 5.00). The findings of Jusuf, Ibrahim, and Suparman (2021) indicated that the electrical engineering students were satisfied with online learning using the Canvas application. Also, the results of the pre-test and post-test questions which were used to determine the effectiveness of the virtual learning environment (VLE) and the learning materials indicated an increase in learning outcomes by 20.40%. A study by Maphosa (2021) evaluated undergraduate students' perceptions of online learning using the Moodle interface during COVID-19. The results showed that the students had positive perceptions of online learning, and agreed that online learning represents the future of teaching and learning. Students' perception explored by Sawaftah and Aljeraiwi (2018) revealed that the online component in blended learning using the Blackboard interface was generally perceived to be of high quality. The findings of Shea et al. (2001) reported that 78% of students enrolled in SUNY Learning Network's online classes felt that their level of learning was very high in the online environment.

At the same time, a review of the research literature also found three prior related studies involving higher education students that have reported

negative results for online learning. The study conducted by Almahasees et al. (2021), which aimed to identify perceptions of online learning among both faculty and students, suggested that both groups found online learning to be useful during COVID-19 pandemic, but at the same time they found its efficacy less effective than classroom instruction. Likewise, a study by Sarkar, Das, Rahman, and Zobaer (2021) explored public university students' perceptions towards online classes during the COVID-19 pandemic. The results showed that most students faced difficulty participating in virtual classes and could not communicate with each other correctly during online classes. Besides this, the findings indicated that female students showed a better view than male students regarding online classes. The third study demonstrating the perceptions of online learning among undergraduate medical students during COVID-19 was conducted by Gismalla et al. (2021). Although most of the medical students perceived online learning to be the best solution during COVID-19 lockdown, they reported to be against online learning implementation due to many challenges, such as the lake of interaction with each other and with their instructor.

Research Problem

Due to the spread of the COVID-19 pandemic across the globe, KSU began using online learning through LMS, Blackboard (Bb). The author contacted first-year undergraduate Health Colleges students at KSU who were enrolled in a general physics course (Phys 109) that was using the Blackboard as their platform for online learning. Some students complained about the effectiveness of the educational resources and learning materials on the Bb interface. This complaint, together with the findings of research literature regarding the advantages of online learning and its effectiveness as a teaching-learning model (e.g., Suharsih & Wijayanti, 2021; Salam & Mudinillah, 2021; Jusuf et al., 2021; Maphosa, 2021; Shea et al., 2001; Kashy et al., 2000), as well as the need for an evaluation of the online learning (Muthuprasad et al., 2021; Ginns & Ellis, 2009; Khan, 1997), led the researcher to examine the quality of online learning in the physics course (Phys 109) at KSU. The present study was designed to achieve

this aim through exploring Health Colleges students' perceptions of the quality of online learning in the physics course (Phys 109), 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 online learning in the physics course (Phys 109) using Blackboard?
2. Are there statistically significant differences (at a level of 0.05) in KSU students' perceptions of the quality of online learning in the physics course (Phys 109) using Blackboard that can be attributed to gender?
3. Are there statistically significant differences (at a level of 0.05) in KSU students' perceptions of the quality of online learning in the physics course (Phys 109) using Blackboard that can be attributed to the students' computer skill level (high, average, or low)?

Purpose of the Study

The present study aimed to investigate KSU students' perceptions of the quality of online learning in the physics course (Phys 109) using Blackboard, and to determine whether those perceptions vary significantly (at a level of 0.05) according to participants' gender or computer skill level.

Significance of the Study

The emergence of the COVID-19 pandemic in December 2019, and its subsequent spread across the world led to the closure of all educational institutions in an attempt to limit the number of hospitalizations and deaths caused by the pandemic as much as possible. As a result, there was an urgent need to use online learning platforms instead of classroom instruction. To continue the educational process, KSU began using online learning through LMS, Blackboard (Bb), which had already been in use for blended learning (BL).

The literature confirmed the need for an evaluation of online learning. Muthuprasad et al. (2021) reported that any efforts to strengthen the

effectiveness of online learning needs to take into account the perceptions of the users. Additionally, Ginns and Ellis (2009) suggested that any use of information and communication technologies (ICT) in higher education requires an evaluation of the contribution of these tools to students' learning.

This shows the urgent need to evaluate the implementation of online learning at King Saud University to enhance the strengths and to tackle the weaknesses, especially because this educational setup may continue until the end of the COVID-19 pandemic. In this research, the quality of online learning using Learning Management System (Blackboard) has been evaluated in terms of students' perceptions in the context of physics classes for Health Colleges track students at KSU. Accordingly, the results of the study may help to enhance the strengths and to tackle the weaknesses of teaching physics online at KSU. It may also help the administration of the Physics Department at KSU to decide whether they will continue to apply online learning in the physics course (Phys 109) or to address any shortcomings that become apparent.

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 109) in the second semester of the 2020–2021 academic year, 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.

Methodology

Participants

The population for this study consisted of 1453 (871 males and 582 females) Health Colleges students 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 109) in the second semester of the 2020-2021 academic year. All of these students studied the physics course via online learning using Bb platform. The study sample consisted of 334 students (183 males and 151 females; 22.99% 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 2020-2021 academic year.

Implementation of online learning in the Physics Course

The physics course (Phys 109) is a three-credit-hours required course at KSU: two hours for the theoretical component and one hour for the experimental component. The online learning mode was applied to the theoretical component only. In the second semester of the 2020–2021 academic year, and running for 14 weeks, the instructors taught the theoretical component of the course to the students using online learning through the Bb platform as follows:

- The Preparatory Year Deanship provided a video tutorial for all students on how to use the Bb interface to study their courses online (the physics course one of these courses).
- For two hours a week, the instructors taught the physics course to students online via the Bb platform. In addition, the instructors presented the content using interactive multimedia technologies in the form of a SCORM file that was loaded through the Bb 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 Bb, using their Usernames and Passwords, in order to access the course online and use the interactive

multimedia according to their own abilities and preferred speeds.
- Through their personalized accounts on the Bb 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), Bb allowed the students to contact each other and their teachers in synchronous and asynchronous exchanges. This also allowed them to ask questions, participate in discussions, and exchange views.
- Bb allowed the instructors to contact their students asynchronously, track their completion of homework and other tasks, and send them 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 scaling was adapted to a five-point Likert scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree), and the instrument was translated to Arabic. 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 online learning)	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

Table (1)

Subscale no.	Subscale title	No. of items	Subscale definition
4	Students' 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 on 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 101). 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 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 internal consistency of the CEQ, it was distributed to a pilot sample of 65 students from within the study population (but outside the sample), and Pearson's correlation coefficients were calculated. The Pearson's correlation coefficients between items and their subscales ranged from 0.45 to 0.91, and all of these coefficients were statistically significant at a level of 0.01. The Pearson's correlation coefficients between items and the whole scale ranged from 0.32 to 0.86, and all of these coefficients were also statistically significant at a level of 0.01.

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Furthermore, the internal consistency was tested by calculating the correlation coefficients of the instrument's subscales with each other and with the scale as a whole. The Pearson's correlation coefficients between subscales ranged from 0.53 to 0.72, and all of these coefficients were statistically significant at a level of 0.01. The Pearson's correlation coefficients between the subscales and the whole scale ranged from 0.76 to 0.92, and all of these coefficients were also statistically significant at a level of 0.01.

Reliability of the CEQ

To determine the reliability of the CEQ, the pilot sample data were used. The 65 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 0.91, and the reliability coefficients of the subscales were 0.77, 0.73, 0.63, and 0.81 respectively. These coefficients showed that the CEQ was satisfactory and reliable.

Data Collection

Participants' Perceptions of the Quality of Online Learning in the Physics Course

At the end of the second semester of the 2020–2021 academic year, after the participants had completed the physics course over a 14-week period, a link to the CEQ was distributed via e-mail to the whole study population. Only 334 students responded to the CEQ.

Participants' Computer Skill Levels

All participants had completed studying a computer skills course (IT 101) in the first semester of the 2020–2021 academic year (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 (Sherideh, 2015; Al-Jarrah & Obeidat, 2011):

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

Table 2 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 (2)
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
3	Appropriate Workload	3	4.04	0.34	1
4	Student Interaction	3	3.99	0.27	2
2	Good E-resources (Quality of Online Resources)	5	3.86	0.28	3

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Table (2)

Subscale no.	Scale/subscale	No. of items	M (out of 5)	SD	Subscale rank
1	Good E-teaching (Quality of Teaching in online learning)	7	3.81	0.38	4
	Total	18	3.89	0.32	

As shown in Table 2, the mean for the participants' responses to the CEQ as a whole was greater than 3.67. This indicates that, overall, the online learning via Bb in the physics course at KSU is of high quality. 3.81

Similar results can be seen for each of the four subscales of the CEQ. As shown in Table 2, the means for the four subscales are all greater than 3.67. This suggests that: the volume of work was highly appropriate to cope with online learning of the physics course, 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 online materials and activities supported learning to a high extent, and the teachers of the physics course (Phys 109) were highly effective in facilitating learning in the online context.

To further explore KSU students' perceptions of the quality of teaching in the online setup, the means and standard deviations for the participants' responses to the seven items of the first subscale were calculated. Table 3 shows these statistics; the subscale items have been arranged in descending order according to their means.

Table (3)
Descriptive statistics for participants' responses to the items of the "Good E-teaching" subscale

Item no.	Item	M (out of 5)	SD
5	The teacher's online responses motivated me to learn more deeply	4.29	0.98
13	The teacher's online interaction with me encouraged me to get the most out of my learning	4.08	0.58

Table (3)

Item no.	Item	M (out of 5)	SD
2	The teacher helped to focus the online discussions between students	4.03	0.64
11	The teacher helped to guide the online discussions between students	3.86	0.66
9	I didn't receive enough helpful online feedback from my teacher	3.79	0.86
18	The teacher used the Blackboard environment to regularly update students about information relevant to the physics course	3.32	0.98
15	The teacher used the Blackboard environment when appropriate to keep students informed about results	3.30	0.71
Whole subscale		3.81	0.38

As shown in Table 3, the mean for the participants' responses to the first subscale, good e-teaching, was greater than 3.67. This indicates that, in general, the instructors were highly effective in facilitating learning in the online context of the physics course.

Similar results can be seen for items 2, 5, 9, 11 and 13. As shown in Table 3, the means for participants' responses to these items were all greater than 3.67. This suggests that, to a high degree, the teachers' online responses motivated students to learn in greater depth, the teachers' online interaction encouraged students to get the most out of their learning, the teachers helped to focus online discussions between students, the teachers helped to guide the online discussions between students, and students received enough helpful online feedback from their teachers.

Exceptions to this trend can be seen in items 15 and 18. As shown in Table 3, the means for participants' responses to both these items are greater than 2.33 but less than 3.67. This indicates that, to an average degree, the teachers used the Blackboard environment to regularly update students about information relevant to the physics course, and the teachers used the Blackboard environment to keep students informed about their results.

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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 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-resources" subscale

Item no.	Item	M (out of 5)	SD
14	The online learning materials are designed to make the content really interesting to students	4.24	0.89
4	The online learning materials helped me to learn the required content in the physics course	4.02	0.57
12	The online learning activities helped me to understand the required activities in the physics course	3.87	0.84
8	The online learning activities in the physics course are designed to get the best out of students	3.60	0.82
1	The online learning materials in the physics course are extremely good at explaining things	3.59	0.80
Whole subscale		3.86	0.28

As shown in Table 4, 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 learning materials and activities assisted learning in the physics course to a high degree.

Similar results can be seen for items 4, 12, and 14. As shown in Table 4, the means for students' responses to these items were all greater than 3.67. This reveals that, to a high degree, the online learning materials were designed to make the content interesting, the online learning materials helped students to learn the required content in the physics course, and the online learning activities helped students to understand the required activities in the physics course.

Exceptions to this trend can be seen in items 1 and 8. As shown in Table 4, the means for participants' responses to both these items were greater than 2.33 but less than 3.67. This indicates that, to an average degree, the online learning activities in the physics course were designed to get the best out of students, and the online learning materials in the physics course were suitable for explaining things.

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 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 "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	4.25	0.65
6	The sheer volume of work for the online learning of the physics course means that it cannot all be thoroughly comprehended	4.22	0.99
17	The workload for the online learning of the physics course is too heavy	3.65	0.76
Whole subscale		4.04	0.34

As shown in Table 5, 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 online learning of the physics course.

Similar results can be seen for items 6 and 10. As shown in Table 5, 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 in the physics course, and the sheer volume of work for the online learning of the physics course meant that the work could all be thoroughly comprehended.

An exception to this trend can be seen in item 17. As shown in Table 5, the mean for participants' responses to this item was greater than 2.33 but less than 3.67. This indicates that, to an average extent, the workload for the online learning of the physics course was appropriate.

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 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 "Student Interaction" subscale

Item no.	Item	M (out of 5)	SD
7	Other students' online submissions encouraged me to investigate further sources of knowledge	4.19	0.65
3	I interacted with students' online postings/ submissions even if they weren't assessed	4.11	0.99
16	Other students' online submissions helped me to understand my ideas from a new perspective	3.69	0.93
Whole subscale		3.99	0.27

As shown in Table 6, the mean for participants' responses to the fourth subscale, student interaction, was greater than 3.67. This indicates 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 6, the means for the participants' responses to these items were all greater than 3.67. This indicates that, to a high degree, other students' online submissions encouraged them to investigate further sources of knowledge, students interacted with each other's online postings/submissions even if they weren't assessed, and students' online submissions helped them to understand their ideas from a new perspective.

The results reveal that, overall, online learning using Blackboard (Bb) in

the physics course (Phys 109) 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 2). Because the online learning mode consists of both synchronous and asynchronous learning via blackboard, this finding may be attributed to the advantages of both modalities.

Furthermore, this positive result may also be partly attributed to the use of ICT technical tools that supported effective and meaningful learning by being centered on learners, their interests and abilities, and their active participation in the teaching-learning process (Sawaftah & Aljeraiwi, 2018). Indeed, online learning can offer a high quality interaction to students among themselves and with their instructors (Shea et al., 2001; Kashy et al., 2000; Hartman et al., 2000; Swan et al., 2000), which is an important element in learning process, since many studies have reported that there is a strong positive relationship between students' interaction during online learning and the quality of their learning (Picciano, 2002; Shea et al., 2001; Dziuban & Moskal, 2001). Therefore, online learning may have fostered students' much-needed social interaction among each other and with their instructors, whether this occurred through synchronous interaction in the virtual classrooms or through asynchronous interaction across a social network. This possibility of having multiple types of interaction contributed to raising the level of communication and exchange of experiences among students and with their teachers (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).

Moreover, the asynchronous component of online learning allowed greater flexibility and convenience for learners to choose when and where to learn (Voci & Young, 2001), which is an important factor for working adults (Rovai & Jordan, 2004). Therefore, online learning offered an opportunity for an interesting use of different technologies to facilitate teaching and learning outside the formal classroom (Duhaney & Duhaney, 2006), increased students' access to knowledge, enhanced ease of revision (Osguthorpe & Graham, 2003), and encouraged and allowed more

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students to benefit from further educational opportunities. Moreover, by providing many information technology resources, online learning helped to facilitate pedagogy and learning in a variety of configurations (Duhaney & Duhaney, 2006).

Further, the resources and materials used in online learning 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; Singh, 2010; Osguthorpe & Graham, 2003), and produced changes in learning patterns and practices (Huon et al., 2007).

This result is consistent with those reported in the following studies, all of which suggested either that students were satisfied and engaged with online learning, or that the online learning experience was perceived as positive by the students: Suharsih and Wijayanti (2021), Salam and Mudinillah (2021), Jusuf et al. (2021), Gismalla et al. (2021), Maphosa (2021), Sawaftah and Aljeraiwi (2018), and Shea et al. (2001).

On the other hand, this result contradicts those of three prior related studies that reported negative results for the use of online learning: Almahasees et al. (2021), Sarkar et al. (2021), and Gismalla et al. (2021).

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 was used; the results of which are presented in Table 7.

Table (7)
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	183	70.58	6.52	332	1.55	0.121
Female	151	69.50	6.03			

Table 7 shows that there was no statistically significant difference between the two means (t=1.55, p=0.121). This indicates that there were no statistically significant differences (at a level of 0.05) in the participants' perceptions of the quality of online learning in the physics course at KSU that can be attributed to gender. Both male and female students agreed that the online learning environment via 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 online learning is low, especially for Saudi students who are relatively comfortable financially. This makes student access to technical tools feasible.

This result contradicts what has been reported by Sarkar et al. (2021), whose research indicates that female students have better perceptions of online classes than male 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 8 presents these statistics.

Table (8)
Descriptive statistics for participants' scores on the CEQ according to their computer skill levels

Computer skill level	N	M (out of 90)	SD
High	193	72.80	4.46
Average	83	68.58	5.71
Low	58	63.24	6.57
All participants	334	70.09	6.31

Table 8 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) was conducted; the results of which are presented in Table 9.

Table (9)
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	4330.74	2	2165.37	80.14	0.000
Within groups (error)	8943.38	331	27.02		
Total	13274.12	333			

Table 9 indicates that there were statistically significant differences among the CEQ scores of participants with different computer skill levels (F=80.14, p=0.000). To determine which of these differences were statistically significant (at a level of 0.05), the Scheffe test for comparing means was used; the results of which are summarized in Table 10.

Table (10)
Results of Scheffe 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)		72.80	68.58	63.24
High	72.80	-	4.22*	9.56*
Average	68.58	4.22*	-	5.34*
Low	63.24	9.56*	5.34*	-

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

Table 10 indicates that all differences between the means of the three groups (students with high, average, or low computer skill levels) were statistically significant (at a 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 online learning 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 online learning with greater ease. This encouraged them to engage with online learning more often in order to interact with others 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 online learning 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 online learning via Bb in physics classes at KSU, and investigated whether those perceptions varied significantly according to participants' gender or computer skill levels. Regarding students' overall perceptions, the results of the study revealed that the online learning experience in physics classes using Bb 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 volume 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 content 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 online learning in physics classes at KSU; and b) there were statistically significant differences in the perceptions of students with different computer skill levels toward the quality of online learning in physics classes 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 online learning in physics classes, it is important to investigate students' perceptions of the quality of this mode of learning in other courses as well. It is also essential to assess and evaluate the effectiveness of this mode of learning 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 like critical thinking. Furthermore, online learning is recommended for physics classes, 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 administration of the Physics Department at KSU to address any shortcomings of online learning that were revealed through this study.

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