Investigating Impacts of Using Mobile Video Lectures on Student Satisfaction and Academic Achievement in Blended Learning

Ahmet Berk ÜSTÜN [1]

[1] abustun@bartin.edu.tr, orcid.org/0000-0002-1640-4291, Bartın University, Turkey

To Cite: Üstün, A. B. (2023). Investigating impacts of using mobile video lectures on student satisfaction and academic achievement in blended learning. *Malaysian Online Journal of Educational Technology, 11*(3), 199-210.
http://dx.doi.org/10.52380/mojet.2023.11.3.474

ABSTRACT

In this study, a mobile Blackboard blended learning (BL) environment was implemented to teach the introductory computer course by integrating a learning management system with supplementary video lectures into BL provided through mobile technologies. The purpose of the study was to explore the impact of the mobile Blackboard BL environment on student satisfaction and learning achievement. The quantitative collection method was employed through a quasi-experimental design with a pretest and posttest control group. For seven consecutive weeks, the experimental group of students was taught in the mobile Blackboard BL environment and the control group of students was taught in the traditional learning environment. The students were asked to complete the instructional materials motivation survey to gauge their satisfaction level and given an achievement test at the end of the learning process. The study's findings revealed that the satisfaction level was significantly higher in the experimental group of students than in the control group of students. However, there was no statistical difference between students in the experimental and control groups in terms of learning achievement although students in the experimental group obtained slightly better results from the achievement test.

Keywords: Mobile learning, blended learning, learning management system, video lecture, academic achievement

Article History:
Received: 20 October 2022
Received in revised form: 19 April 2023
Accepted: 7 July 2023
Article type: Research Article

INTRODUCTION

In our modern world, it is obvious that online learning is extensively used at all levels of education. Although online learning offers various benefits for students and educators, there are some drawbacks of learning and teaching online (Chou & Chou, 2011). One of the many benefits of online learning is to eliminate the constraints of conventional learning like time and location (Keskin & Yurdugül, 2020; McKeachie & Svinicki, 2014). On the other hand, it cannot be ignored that online learning has several weaknesses, in that the use of this medium can cause potential threats to the success of any online program, one example being a limitation of technology affecting the adaptability of an institution (Illinois Online Network, 2010). Blended learning (BL) is considered an alternative educational environment aimed to overcome the obstacles and

apprehensions associated with online learning environments (Chou & Chou, 2011).

Several researchers (Chou & Chou, 2011; Graham & Dziuban, 2008; Truitt & Ku, 2018; Ustun & Tracey, 2020) support the trend toward BL. BL seems to be the ultimate level of online learning (Usta & Mahiroglu, 2008). In other words, teaching in BL is a more effective choice than teaching in online learning to meet students' needs in educational settings. Generally, it can be defined as a fusion of the most effective elements from both face-to-face (F2F) learning and online learning (Osguthorpe & Graham, 2003). The commonly accepted and used definition is this definition in the literature. There are several benefits of using a BL approach. One of the noteworthy benefits of BL is that learners have the opportunity to ask questions and seek clarification on subjects that may have remained unclear during the F2F sessions (Ustun & Tracey, 2020). It is because of the power of BL that facilitates interaction between instructors and students as well as students and students. In addition, this benefit is significant because evidence reveals that an essential contribution to student learning performance is student interaction (Chou & Chou, 2011).

In this sense, the importance of using learning management systems (LMSs) should be stressed because LMSs are considered a part of a BL approach (Lust et al., 2012). These systems have features that deliver course materials online to enable students to access them at their convenience (Ustun & Tracey, 2021), allow cooperative learning (Seluakumaran et al., 2011) and facilitate communication between instructor and students (Karaoglan et al., 2022). LMSs can facilitate and increase interaction and communication among students (Ustun, Karaoglan Yilmaz, & Yilmaz, 2021). Also, synchronous or synchronous instructional videos can be delivered by LMSs. According to Papachristos et al. (2010)'s comprehensive study, several features of LMSs offering educational advantages are not fully utilized, particularly providing animation or video is almost unexploited to benefit from multimedia (as cited in Kabassi et al., 2016). Many studies highlight the affirmative effects of instructional videos on learning processes. For instance, Buch et al. (2014) explore the effectiveness of video-based e-learning in teaching clinical skills by comparing a video-based e-learning module and a text and picture based e-learning. Their findings demonstrate that students in video-based e-learning significantly obtain higher scores than students in text/picture-based e-learning from the practical examination.

BL requires designers to determine the most effective elements of F2F learning and online learning and mix them. However, although online learning has the potential to provide accessibility, flexibility, and reflective interaction for students, it might cause a sense of isolation because of the fact that it separates students and instructors in terms of space or time throughout the period of education. Specifically, the absence of visual conversational cues makes individual thoughts, feelings, and humor difficult to understand, which can negatively affect students learning in online learning (Borup et al., 2012). Video-based lectures might contribute to overcoming these challenges and promote students' learning experience. Donkor (2011) examines the effectiveness of video-based instructional materials in aiding distance learners to acquire practical skills and concludes that utilizing video-based instructional materials has highly positive effects on online students' acceptance and satisfaction with acquiring practical skills.

The integration of an LMS in BL can be designed with the principles of social constructivism so learning environments where students actively construct new knowledge and learn by doing as they interact with each other can be created (Tang, 2013). Furthermore, instructors can use LMSs to design a well-organized learning setting where students can effortlessly access learning materials and utilize tools easily (Ustun & Tracey, 2020). However, students are restricted from reaching learning environments by time or location such as traveling by bus, train or airplane, walking on the street or sitting in a cafe in these educational settings. Mobile technologies can be a remedy to make educational resources available and offer rich

multimedia experiences by breaking the barriers of time or location in any educational setting such as seamless learning (Milrad et al., 2013; Huang & Yu, 2019; Ustun, 2019). A mobile-enhanced, inquiry-based learning model is designed for students to watch tutorials to learn their lab work and record their own video footage regarding their lab work by using their smartphones at Abilene Christian University (Johnson et al., 2016). The findings of a similar approach show a significant increase in student expression of deeper learning at the California University of Pennsylvania and Del Mar College (Johnson et al., 2016). Mobile learning has reshaped how students access information, and resources, carry out learning and interact with content.

Purpose of Study

Although studies related to mobile learning show promising results in the literature, it is still developing and too early to determine its direct effects on educational outcomes (Genç et al., 2019; Eppard et al., 2019; Wagner et al., 2014). Particularly, research into delivering video lectures through LMS by using mobile technologies in a BL environment is an important issue to reveal the consequences of the practical application of mobile learning in this context. Having a main role in student academic achievement and satisfaction in a mobile Blackboard learning environment is worth investigating to uncover the educational value of the successful adoption of mobile Blackboard BL in higher education. This study developed mobile BL using the LMS (Coursesites) platform, specifically handling course contents, delivering video lectures and providing discussion space. This mobile Blackboard BL environment was designed for 62 students who were taking the introductory computer course and included several instructional videos as supportive material. Each video would serve as an advanced organizer in the form of a short online tutorial. Therefore, the aim of the study is to examine the impact of utilizing instructional video lectures in a mobile Blackboard BL environment on undergraduate students' satisfaction and learning achievement. The study aimed to address the following two primary objectives.

- To investigate the impact of using instructional video lectures on the learning achievement of students in a mobile Blackboard BL.
- To explore the effect of using instructional video lectures on students' satisfaction in a mobile Blackboard BL.

RESEARCH METHOD

Research Model

This study examined the impact of using Video Lectures in a mobile Blackboard learning environment on student satisfaction and measured the effectiveness of utilizing Video Lectures in a mobile Blackboard learning course in a public university. The research methodology employed a quasi-experimental research design. Because of using intact classrooms, students weren't randomly assigned to groups. The pre-test was developed to determine if there were baseline differences in student ability between the two groups. It was designed to assess the students' prior knowledge and consisted of 30 multiple-choice questions with a full score of 100 points. To compare the pretest scores of students in the F2F group and the mobile Blackboard BL group, an independent-samples t-test was performed. There was not a significant difference in the scores for the control (F2F) group $\overline{X}$= 34.34, SD=10.51) and the experimental (mobile Blackboard BL) group ($\overline{X}$= =32.31, SD=9.57); conditions; t(83)=0.84, p = 0.39. Based on these findings, it can be inferred that both groups of students possessed statistically similar abilities prior to engaging in the subject unit. Figure 1 displays the summary of the research process.

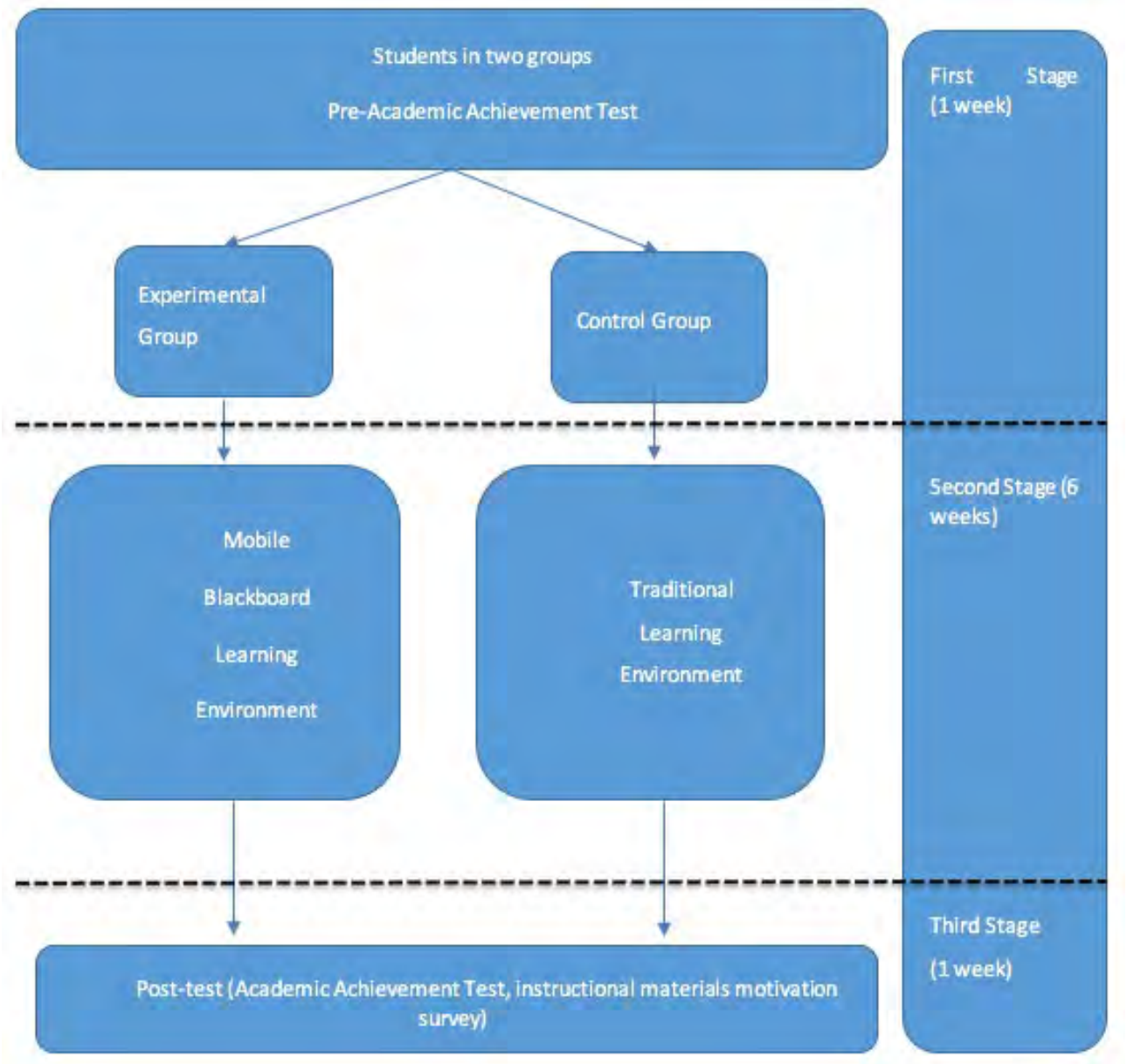

Figure 1. Research Process

Participants

A total of 85 undergraduate students were selected as participants consisting of 43,5% male (n=37) and 56,5% female (n=48) at a public university. The participants in the F2F lecture group were 23 students consisting of 52,2% male (n=12) and 47,8% female (n=11) and enrolled in the introductory computer course from the Economy program. The participants in the BL group were 62 students consisting of 40,3% male (n=25) and 59,7% female (n=37) and enrolled in the same course from the Political Science and Public Administration program. All participants were in their second semester of the 4-year program and finished seven courses in their program using a F2F approach and three courses using an online approach in their program at the time of the study. They didn't finish any courses using a BL approach.

Data Collection Tool

This study employed instructional materials motivation survey (IMMS) given to freshman who voluntarily participated in the study. Keller (1987) developed the scale to gauge students' motivational attitudes toward print-based self-directed learning, online instruction and computer-based instruction. The aim of employing IMMS was to assess the students' satisfaction regarding the instructional activities and

tools they utilized. Previous studies have validated and proven the scale (Keller, 2010). The scale consisted of 36 items in total and has only four factors including 9 items for confidence and relevance subscales, 12 items for attention subscale, and 6 items for satisfaction subscale. Upon recalculating the internal consistency estimates of the scale using Cronbach's alpha for this study, a Cronbach Alpha reliability coefficient of 0.94 was obtained. The scale utilized in this study is a 5-point Likert scale, ranging from (1) "I strongly disagree" to (5) "I strongly agree". A higher score on the scale indicates a greater level of student satisfaction with the course.

The post-test was developed based on what students learned after completion of the instructional program. It was designed for the determination of learning achievement and the effectiveness of the instructional process in this study. The post-test consisted of 30 multiple-choice items, with a maximum score of 100. To determine the reliability coefficient of the scale, the Kuder-Richardson 21 reliability was calculated, resulting in a coefficient of 0.83. This value was deemed sufficient for the achievement test, according to Nunnally (1967). The item difficulty indexes in this study ranged from 0.20 to 0.90, while the item discrimination indexes exceeded 0.25. It is worth noting that items with a difficulty index between 0.20 and 0.90 and a discrimination index above 0.20 are generally considered satisfactory in academic achievement tests (Agarwal, 1986 as cited in Boopathiraj & Chellamani, 2013).

Procedures

The study was conducted within the context of an introductory computer course covering teaching the Excel essentials from the basics such as creating workbooks, cell basics, modifying columns to the advanced topics such as simple and complex formulas and math, statistical, logical, date and time functions. The research process spanned a duration of 8 weeks in total. The control group (traditional F2F group) had four F2F class hours each week and the experimental group had three F2F class hours and online activities each week. Both groups dedicated an equal amount of time to lectures each week. On the one hand, the control group had a chance to practice for one more hour in the class session. On the other hand, the Coursesites Blackboard (LMS) was designed and implemented to create an online learning environment for the experimental group. The design of the LMS was intentionally kept simple and well-organized, allowing students to easily access and navigate the Coursesites platform, particularly through their mobile devices. After preparing the LMS, weekly announcements, instructional video lectures, course learning materials and a general discussion board were provided through the mobile Blackboard BL environment. Weekly announcements were one of the communication channels that enabled the instructor to send one way informative and motivational email messages to the students. Instructional video lectures covering weekly topics were provided each week. The course learning materials, typically delivered in F2F meetings, were made available to students in an online format. Even though the instructor created no required discussion assignments to ask leading questions about the topics, a general discussion board forum was created as another communicational channel between student-student and student-instructor. The forum was provided to enable students to ask questions about any topics that remained unclear to them during class or video lectures, as well as to address any technological problems or concerns they may have had.

After designing and implementing the mobile Blackboard BL environment, it was vital to give an orientation for the online learning environment. Preparing students to be ready to learn increases the probability of success in online learning (Guglielmino & Guglielmino, 2003; Yilmaz, 2017). After students were ready to learn in online learning, the implementation of online learning became an effective and efficient learning environment (Guglielmino & Guglielmino, 2003). In order to prepare students to be ready for online learning, the instructor gave an orientation session that focused on teaching how to use the LMS during the week. omprehensive instructions were provided on how to register for the online course through the LMS, to access all elements of the online resources (specifically online video lectures), to complete discussion posts, to communicate with the instructor and what to do if encountering any technical problems were explicitly given. The instructor also monitored the students closely and provided guidance and counseling if needed until the end of the learning process.

Data Analysis

Instead of using the chi-square test, The utilization of the Kolmogorov-Smirnov test was employed to assess whether the students' scores obtained from the IMMS exhibited a normal distribution or not. Lilliefors (1967) indicates that the Kolmogorov-Smirnov test has several advantages over the chi-squared test such as providing strong results for any sample size. Based on the outcome of the Kolmogorov-Smirnov test, it was determined that the data followed a normal distribution ($p > .05$). Consequently, a parametric test, specifically the independent samples t-test, was employed to compare the scores of the IMMS scale between the two groups. However, it was observed that the post-test scores did not exhibit a normal distribution ($p < .05$) so nonparametric tests were employed to conduct the analyses. Therefore, Wilcoxon signed-rank test was employed to compare pre-test and post-test and the post-test results of the two groups were compared to reveal whether the learning achievement of the two groups was different or not by using Mann–Whitney U test. As a ground, .05 significance level was taken for the significance tests in the study.

FINDINGS

Students' responses to IMMS were analyzed to find descriptive statistics of the control and experimental group. Table 1 displays the descriptive statistics.

Table 1. *Descriptive statistics of the groups*

Group	Number of Students	Number of Items	Standard Deviation	Median	Standard Error of Mean	Mean
Experimental Group	62	36	.58	3.87	.07	3.89
Control Group	23	36	.73	3.42	.15	3.30

Ciloglu and Ustun (2023) state that the findings obtained from a 5-point Likert scale can be interpreted as low, moderate and high levels according to the arithmetic mean score that is respectively between "1.00 – 2.33", "2.34 – 3.67" and "3.68 – 5.00" score range. Upon examining Table 1, the experimental group had an arithmetic mean score of 3.89, while the control group had an arithmetic mean score of 3.30 on the IMMS. Based on the interpretation, the experimental group score from IMMS was high while the control group score was moderate. The obtained score indicates that the experimental group exhibited a high level of satisfaction with the utilization of instructional activities and tools. To ascertain whether there was a significant difference between the control and experimental group, an independent-sample t-test was performed. As illustrated in Table 2, a significant difference was observed in the scores between the control (F2F) group ($M=3.30$, $SD=.73$) and the experimental (mobile Blackboard BL) group ($M=3.89$, $SD=.58$) conditions; $t(83)=3.84$, $p = 0.00$. These results suggested that the way of instructional approach deploying mobile technologies in BL had a statistically positive effect on student satisfaction.

Table 2. *T-test for learning satisfaction between two groups*

Group	Number of Students	Mean	Standard Deviation	*t*	*p*
Experimental Group	62	3.89	.58	3.84	.00
Control Group	23	3.30	.73		

To investigate the presence of a statistically significant gender-dependent difference that could influence the level of student satisfaction in the experimental group, an independent-sample t-test was conducted. As illustrated in Table 3, no significant difference was found in the scores for the level of student satisfaction between gender groups, females ($\overline{X}= 3.90$, $SD=.57$) and males ($\overline{X}= 3.89$, $SD=.61$) conditions; $t(60)=0.08$, $p = 0.78$. These results suggested that the way of instructional approach deploying mobile technologies in BL had no significant effect on student satisfaction based on gender.

Table 3. *T-test for learning satisfaction between gender*

Group	Number of Students	Mean	Standard Deviation	*t*	*p*
Female	37	3.90	.57	0.08	.77
Male	25	3.89	.61		

Wilcoxon signed-rank tests were carried out to examine whether there was a significant increase in students' learning outcomes. In the experimental group, a significant difference was observed between pre-test score of students ($\overline{X}$= 31.66) and post-test score of students ($\overline{X}$= 71,19) conditions; z=-6.84, p<.05, r=-0.86. In the control group, a significant difference was observed between pre-test score of students ($\overline{X}$=33.33) and post-test score of students ($\overline{X}$=69.55) conditions; z=-3,98, p<.05, r=-0.83. Regardless of the instructional intervention, a significant increase was observed in students' learning outcomes according to the findings. The Mann–Whitney U test was conducted to compare students' post-test scores in the F2Fgroup and the mobile Blackboard BL group. Table 4 demonstrates the summary of the analysis. The findings showed that there was no significant difference in the scores for the experimental (mobile Blackboard BL) group ($\overline{X}$=71.19) and the control (F2F) group ($\overline{X}$=69.55) conditions; U=670, z=-.42, r=-.04, p>.05. According to the findings, although the experimental group exhibited a slightly higher performance than the control group, the effect of the instructional approach providing video lectures through mobile Blackboard BL on students' learning achievement was not significantly better than the traditional instructional approach.

Table 4. *Mann–Whitney U test for learning achievement between two groups*

Group	Number of Students	Mean Rank	Sum of Ranks	*U*	*p*
Experimental Group	62	42.31	2623	670.0	.66
Control Group	23	44.87	1032		

Table 5. *Mann–Whitney U test for learning achievement between gender*

Group	Number of Students	Mean Rank	Sum of Ranks	*U*	*p*
Female	37	30,45	1126,50	423.50	.57
Male	25	33,06	826,50		

To investigate whether a statistically significant gender-dependent difference existed, the Mann-Whitney U test was performed to compare the post-test scores of male students with those of female students in the experimental group.

As it is illustrated in Table 5, no significant difference was found in the scores between the female students ($\overline{X}$=70.85) and the male students ($\overline{X}$= 71.70) conditions; U=423.50, z=-.56, r=-.07, p>.50. These findings suggested that the effect of the instructional approach providing video lectures through mobile Blackboard BL on students' learning achievement did not result in a significant difference based on gender difference.

DISCUSSION

It is important to discuss learning approaches including BL, mobile learning and the use of instructional video lectures and learning management systems in the context where these significant topics are addressed altogether. In this sense, a mobile Blackboard BL environment was created to attract student attention as a novel way of learning and instructional video lectures are delivered through the designed learning environment. The effectiveness of this learning environment was assessed relating to its effect on student

achievement and student satisfaction. The students who were taught in this environment were surveyed to reveal the level of student satisfaction and they were tested to find out if their academic success was significantly changed better than students in the traditional F2F learning environment.

First, the level of student satisfaction was high in the experimental group. Upon comparing it with the control group, the experimental group exhibited a significantly higher level of student satisfaction. This finding can be interpreted that the implementation of the mobile Blackboard BL environment and providing instructional video lectures satisfied students' learning preferences. Chen and Hu (2018) indicated that the mobile-supported platform has the potential to encourage students who display reluctance or shyness to participate in class activities to be active throughout the learning process and therefore, their attitudes towards learning are changed in a positive way according to the results of their experimental study. Donkor (2011) found that video-based instructional materials were perceived as interesting, enjoyable, effective, and relevant, which results in students' acceptance and satisfaction with using the materials according to his cross-sectional descriptive study. Yahya et al. (2018) explored the effectiveness of an online screencast video that was accessed by the Quick Response (QR) code as a learning tool for mobile learning in BL. They found that the level of students' attitude towards combining conventional paper-based learning materials and instructional screencast videos accessed through QR codes for mobile learning is very high so designing this type of learning environment can be an effective way of promoting learning and teaching. Another study carried out by Marçal et al.(2016) demonstrated that students who use mobile technologies in a BL environment are more prone to participate in the course than the students who are in traditional on-campus learning and they are highly satisfied and enjoy the use of mobile technologies by receiving text messages regardless of location and time as supplemental resources in their learning process. Chang et al.(2013) revealed that college students who found a mobile learning system as a convenient, playful, easy and useful way of learning English intended to continue learning English by utilizing this mobile system.

As revealed by the statistical results, although the students in the mobile Blackboard BL had slightly better results than the students in traditional F2F learning according to the final exam, providing instructional video lectures through the mobile Blackboard BL did not significantly contribute to student learning achievement comparing with the control group. This might be the reason that instructional video lectures can be very effective in helping students acquire practical skills. This is consistent with the study carried out by Donkor (2011) who revealed that providing instructional video materials considerably enhances students' practical knowledge acquisition because of the easiness and usefulness of utilizing these materials in developing practical skills. However, students took multiple-choice questions in a paper-based test at the end of the study, which is a useful technique to measure theoretical knowledge, but it might not have demonstrated their actual practical skill acquisition. Besides, although students conveniently and flexibly reached the instructional videos, received emails, asked and discussed questions in discussion boards through the mobile Blackboard BL environment, there were no weekly discussion assignments. This might result in limited interactivity and collaboration among students. Providing collaborative learning strategies and making students engaged in learning activities are important factors in creating efficient and effective BL for the improvement of students' critical thinking skills and learning achievement (Chen & Hu, 2018; Ustun & Tracey, 2020).

The result aligns with the previous studies (El-Sayed et al., 2013; Suana et al., 2019). For instance, Suana et al. (2019) conducted a study to assess the effectiveness of mobile learning in BL by comparing the learning outcomes of the students taught in a mobile-based BL environment with the students taught in an LMS-based BL environment. Their conclusion was that there was no statistically significant difference in the improvement of learning outcomes between the experimental and control groups. However, Zhou and Li (2019) created a mobile BL environment where students were able to continue to utilize several applications including a social media mobile application, a live polling system, video communication and conferencing software and a mind mapping tool as in-class and out-of-class learning activities for dance and drama lessons. The researchers demonstrated that this mobile BL is effective and efficient in promoting teaching and learning experiences even though some instructors and students are reluctant to employ mobile devices in learning processes because of their concerns about a lack of competence regarding using technology.

Limitations

This study is conducted on 85 students studying in the Economy program and Political Science and Public Administration program at a public university. The results may not be generalized because of the limited population size. If the experimental and control groups were of equal size, the findings of the study would have possibly provided more meaningful results. This study was conducted in higher education and the results may only address a lack of research evidence related to higher education. Expanding the sample to include students of different ages and levels of education may require different procedures and results.

Suggestions

Providing video-based lectures through mobile devices helps students learn the content at their convenient pace and time, which increases students' satisfaction. Instructors or designers might consider producing high-quality video-based teaching materials for students who are specifically in an online or BL environment. Also, these materials can be delivered through mobile LMS platforms to be reachable in a well-organized way. Therefore, learners can find the design of the learning environment useful, accessible and flexible. Keller (2010) indicates that students feel distracted and lose their motivation because of poorly designed instructional materials and learning environments. Finally, in this study, the platforms and tools used were free of charge so the power of open-source online learning environments should be considered while creating BL, specifically in bridging the gap between students at universities with fewer resources and students at other universities that offer paid LMSs to their students.

Further research is needed to investigate the impact of designing a similar learning environment on student practical knowledge instead of focusing on student theoretical knowledge. In parallel with this research direction, further studies could explore the effect of designing a similar learning environment on the retention of student practical knowledge over a longer period. This potentially shows whether acquired theoretical or practical skills have been transferred effectively in real-life practical situations. Besides, conducting interviews with students to collect in-depth information on students' opinions, experiences and feelings gives a chance to make a deeper analysis of students' satisfaction. Future research could examine students' satisfaction in learning a mobile LMS BL environment by collecting qualitative and quantitative data to determine reasons for students' satisfaction. Furthermore, the use of interactive platforms if selecting and being aware of what, why and how to use help create interactive and collaborative learning environments (Yilmaz & Keser, 2017). In this sense, LMSs are beneficial tools to help instructors design and implement interactive learning environments that offer various forms of interaction such as student-student and instructor-student so it is essential to investigate the impact of collaborative mobile LMS BL environment on students' learning achievement after planning and designing the learning environment in detail. Finally, similar research could be conducted in different public and private universities located in the same country or different countries to increase the generalizability of the study.

CONCLUSION

In the information age, BL to create promising learning environments, LMSs to deliver online learning, instructional video lectures to learn at their own pace and mobile technologies to reach educational content anytime and anywhere can be utilized to facilitate learning and improve performance. However, Zhou and Li (2019) state that it is still not enough instructional practices on how to employ mobile devices in BL to support student learning and scholarly findings to reveal the impact of using them on educational outcomes. In this study, the impacts of instructional video lectures provided by the mobile Blackboard BL environment on undergraduate students' satisfaction and learning achievement have been investigated. The study revealed that providing video lectures in the mobile Blackboard BL environment had a significant effect on student satisfaction in a positive way. The results also demonstrated that students' learning achievement was significantly increased by using video lectures in the mobile Blackboard BL environment. However, although the final grades of students in the mobile learning group were slightly higher than those in the control group, there was no statistically significant difference observed in comparison to students in traditional F2F learning.

REFERENCES

Agarwal. Y.P. (1986). *Statistical methods, concepts, applications and computations*. Sterling Publication.

Boopathiraj, C., & Chellamani, K. (2013). Analysis of test items on difficulty level and discrimination index in the test for research in education. *International Journal of Social Science & Interdisciplinary Research,* 2(2), 189-193.

Borup, J., West, R. E., & Graham, C. R. (2012). Improving online social presence through asynchronous video. *The Internet and Higher Education*, 15(3), 195-203.

Buch, S. V., Treschow, F. P., Svendsen, J. B., & Worm, B. S. (2014). Video- or text-based elearning when teaching clinical procedures? A randomized controlled trial. *Advances in Medical Education and Practice*, 5, 257–262.

Chang, C. C., Liang, C., Yan, C. F., & Tseng, J. S. (2013). The impact of college students' intrinsic and extrinsic motivation on continuance intention to use English mobile learning systems. *The Asia-Pacific Education Researcher,* 22(2), 181-192.

Chen, J., & Hu, J. (2018). Enhancing L2 learners' critical thinking skills through a connectivism-based intelligent learning system. *International Journal of English Linguistics,* 8(6), 12-21.

Chou, A. Y., & Chou, D. C. (2011). Course management systems and blended learning: An innovative learning approach. *Decision Sciences Journal of Innovative Education*, 9(3), 463–484.

Ciloglu, T., & Ustun, A. B. (2023). The effects of mobile AR-based biology learning experience on students' motivation, self-efficacy, and attitudes in online learning. *Journal of Science Education and Technology, 32*(3), 309-337.

Donkor, F. (2011). Assessment of learner acceptance and satisfaction with video-based instructional materials for teaching practical skills at a distance. *International Review of Research in Open and Distance Learning*, 12(5), 74-92.

El-Sayed, R. E. H., El-Hoseiny, S., & El-Sayed, E. (2013). Video-based lectures: An emerging paradigm for teaching human anatomy and physiology to student nurses. *Alexandria Journal of Medicine*, 49(1), 215-222.

Eppard, J., Hojeij, Z., Ozdemir-Ayber, P., Rodjan-Helder, M., & Baroudi, S. (2019). Using mobile learning tools in higher education: A UAE case. *International Journal of Interactive Mobile Technologies*, 13(11), 51-69.

Genç, Z., Masalimova, A. R., Platonova, R. I., Sizova, Z., & Popova, O. V. (2019). Analysis of documents published in scopus database on special education learning through mobile learning: A content analysis. *International Journal of Emerging Technologies in Learning*, 14(22), 192-203.

Graham, C., & Dziuban, C. (2008). Blended learning environments. In J. Spector, M. Merrill, J. Merrienboer, & M. Driscoll (Eds.), *Handbook of Research on Educational Communications and Technology* (3rd ed.) (pp. 269–274). Taylor & Francis Group

Guglielmino, L. M., & Guglielmino, P. J. (2003). Identifying learners who are ready for e-learning and supporting their success. In G. M. Piskurich (Ed.), *Preparing learners for e-learning* (pp. 19e33). John Wiley & Sons.

Huang, R. T., & Yu, C. L. (2019). Exploring the impact of self-management of learning and personal learning initiative on mobile language learning: A moderated mediation model. *Australasian Journal of Educational Technology*, 35(3), 118-131.

Illinois Online Network. (2010, April 1). Weaknesses of online learning. Retrieved from http://www.ion.uillinois.edu/resources/tutorials/overview/weaknesses.asp

Johnson, L., Becker, S. A., Cummins, M., Estrada, V., Freeman, A., & Hall, C. (2016). *NMC horizon report: 2016 higher education edition* (pp. 1-50). The New Media Consortium.

Kabassi, K., Dragonas, I., Ntouzevits, A., Pomonis, T., Papastathopoulos, G., & Vozaitis, Y. (2016). Evaluating a learning management system for blended learning in Greek higher education. *SpringerPlus*, 5(1), 101.

Karaoglan-Yilmaz, F. G., Zhang, K., Ustun, A. B., & Yilmaz, R. (2022). Transactional distance perceptions, student engagement, and course satisfaction in flipped learning: a correlational study. *Interactive Learning Environments,* 1-16.

Keller, J. M. (1987). Development and use of the ARCS model of instructional design. *Journal of Instructional Development*, 10(3), 2-10.

Keller, J. M. (2010). *Motivational design for learning and performance: The ARCS model approach*. Springer Science & Business Media.

Keskin, S., & Yurdugül, H. (2020). Factors affecting students' preferences for online and blended learning: motivational vs. cognitive. *European Journal of Open, Distance and E-learning*, 22(2), 72-86.

Lilliefors, H. W. (1967). On the Kolmogorov-Smirnov test for normality with mean and variance unknown. Journal of the American Statistical Association, 62(318), 399-402.

Lust, G., Collazo, N. A., Elen, J., & Clarebout, G. (2012). Content management systems: Enriched learning opportunities for all? *Computers in Human Behavior,* 28(3), 795–808.

Marçal, E., Andrade, R., Viana, W., Junqueira, E., & Melo, R. (2016, April). Mobile phone text messaging to increase student participation: an experience in a blended course. *In Proceedings of the 31st Annual ACM Symposium on Applied Computing*, 239-245. ACM.

McKeachie, W. J., & Svinicki, M. (2014). *McKeachie's teaching tips: Strategies, research, and theory for college and university teachers* (14th ed.). Wadsworth, Cengage Learning.

Milrad, M., Wong, L.-H., Sharples, M., Hwang, G.-J., Looi, C.-K., Ogata, H. (2013). Seamless learning: An international perspective on next-generation technology-enhanced learning. In Z. L. Berge & L. Y. Muilenburg (Eds.), *Handbook of mobile learning* (pp. 95–108). Routledge.

Nunnally, J. C. (1967). *Psychometric theory*. McGraw Hill.

Osguthorpe, R. T., & Graham, C. R. (2003). Blended learning environments: definitions and directions. *Quarterly Review of Distance Education*, 4(3), 227-233.

Papachristos D, Alafodimos C, Kalogiannakis M, Zafiri E, Kikilias P (2010) Comparative evaluation of internet bared distance education in the Greek higher technological education (2007–2010 period). *In: Proceedings the international conference on e-learning in the workplace 2010*. Columbia University, NYC, USA.

Seluakumaran, K., Jusof, F. F., Ismail, R., & Husain, R. (2011). Integrating an open-source course management system (Moodle) into the teaching of a first-year medical physiology course: a case study. *Advances in Physiology Education,* 35, 369–377.

Suana, W., Distrik, I.W., Herlina, K., Maharta, N., & Putri, N.M.A.A. (2019). Supporting blended learning using mobile instant messaging application: Its effectiveness and limitations. *International Journal of Instruction*, 12(1), 1011-1024.

Tang, J. (2013). The research on blended learning of ESL based on moodle platform. *Studies in Literature and Language,* 6(2), 30-34.

Usta, E., & Mahiroglu, A. (2008). Harmanlanmıs ogrenme ve cevrimici ogrenme ortamlarinin akademik basari ve doyuma etkisi. *Ahi Evran Universitesi Kırsehir Egitim Fakultesi Dergisi*, 9(2), 1-15.

Truitt, A. A., & Ku, H.-Y. (2018). A case study of third grade students' perceptions of the station rotation blended learning model in the United States. *Educational Media International*, 55(2), 153–169.

Ustun, A. B. (2019). Effects of mobile learning in blended learning environments. *Bilgi ve İletişim Teknolojileri Dergisi*, 1(1), 1-14.

Ustun, A.B., Karaoglan Yilmaz, F.G. & Yilmaz, R. (2021). Investigating the role of accepting learning management system on students' engagement and sense of community in blended learning. *Education and Information Technologies, 26,* 4751–4769.

Ustun, A. B., & Tracey, M. W. (2020). An effective way of designing blended learning: A three phase design-based research approach. *Education and Information Technologies*, *25,* 1529–1552.

Ustun, A. B., & Tracey, M. W. (2021). An innovative way of designing blended learning through design-based research in higher education. Turkish Online Journal of Distance Education, 22(2), 126-146.

Wagner, D. A., Castillo, N. M., Murphy, K. M., Crofton, M., & Zahra, F. T. (2014). Mobiles for literacy in developing countries: *An effectiveness framework. Prospects*, 44(1), 119-132.

Yahya, F. H., Abas, H. & Yussof, R. L. (2018). Integration of screencast video through QR Code: An effective learning material for m-Learning. *Journal of Engineering Science and Technology*, 1-13.

Yilmaz, R. (2017). Exploring the role of e-learning readiness on student satisfaction and motivation in flipped classroom. *Computers in Human Behavior,* 70, 251-260.

Yilmaz, R., & Keser, H. (2017). The impact of interactive environment and metacognitive support on academic achievement and transactional distance in online learning. *Journal of Educational Computing Research,* 55(1), 95-122.

Yurdakul, I. K. (2011). Examining technopedagogical knowledge competencies of preservice teachers based on ICT usage. *Hacettepe University Journal of Education*, 40, 397–408.

Zhou, M., & Li, Z. (2019). Blended mobile learning in theatre arts classrooms in higher education. *Innovations in Education and Teaching International*, 56(3), 307-317.