Original Article

Effect of the Sudden Shift to E-Learning during COVID 19 Pandemic on Student Engagement

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ABSTRACT

During the novel COVID-19 pandemic, many universities globally shifted from on-campus-based teaching to online education. During this emergency educational situation, modifications are done abruptly. Important elements of education that contribute to student success need to be carefully monitored. This study analyzed the effect of sudden shift to e-learning during the COVID-19 pandemic on student engagement. The study involved the same group of students who used to learn in the traditional classroom before the pandemic and shifted to online education during the pandemic. A 5-point Likert scale online survey was created using Google form and the link was sent to students Emails. Two validated questionnaires were used, one for measurement of student engagement in e-learning and the other for measurement of engagement in the traditional classroom.
Factor analysis of the two questionnaires showed good results. Values of Alfa Cronbach were greater than 0.85. Values of validity were higher than 0.9. Both values indicated the high reliability and validity of the questionnaires. The Wilcoxon signed test showed that students were significantly less engaged in the e-learning (p-value 0.006). Emotional, behavioral, and social engagement were lower in e-learning (p-values 0.001, 0.001, 0.024, respectively). However, cognitive engagement was higher in e-learning (p-value 0.001). The sudden shift to online education during COVID 19 pandemic was associated with decreased but differential effects on student engagement. Institutions should carefully monitor student engagement and implement practices that improve it during this contingency situation.

Key words: *Student engagement, E-learning, Learning in traditional classroom, Sudden shift to e-learning, COVID 19 pandemic*

INTRODUCTION

The novel COVID-19 pandemic disrupted life in all aspects including education throughout the world in 2020 [1-3]. Many countries suspended campus-based teaching and shifted to online education [2, 4]. Various e-learning platforms were used as an educational tool replacing the teaching on campus or supplementing it [5].

The sudden shift to online education represents a great challenge to the education system [6]. A shift to online education needs adjustments to the teaching and learning practices associated with on-campus teaching and learning environment [7]. Using e-learning tools requires modification of the contents that were previously taught face-to-face to suit the online format [8]. Online environments are characterized by different traditions and expertise, which may represent great challenges for students and staff [7-9]. There is a need to train and familiarize students and teachers with the utilization of these e-learning tools [10-12]. During the sudden shift to online education in the era of COVID pandemic, teachers reported that they are unprepared to use online teaching platforms and they struggled to adapt their pedagogy to the new learning environment. Teachers reported their

need for support with shifting their practice [13]. Students also reported many challenges to online education including concerns related to COVID-19 pandemic, use of technology tools, online experience, student assessment, communication, and technology-related phobia [14]. A great concern to the universities during this pandemic is to maintain vital elements of education that are important for student's success. One of the most important elements is student engagement, which is a known measure of the quality of learning.

Australian Council of Educational Research defines student engagement as student participation in activities and conditions to create high-quality learning [15]. Student engagement is usually categorized into emotional engagement, behavioral engagement, social engagement, and cognitive engagement. [16-18]. Student engagement correlates positively with favorable learning outcomes and is frequently reported to improve student general abilities and critical thinking, promote cognitive, psychosocial, and ethical development, as well as many other favorable outcomes [19, 20]. In contrast, disengagement has been linked to dropout, school failure, and serious behavioral problems [21, 22].

However, engagement as a student in a virtual classroom is different from engagement as an on-campus student [23]. Literature shows students are different in their preference of learning strategy online or on campus-based [9]. Even an online adaptive education system has been developed to account for the individual differences among students in learning abilities [24]. The present study aimed to identify the effect of the sudden shift to e-learning during COVID-19 pandemic on student engagement. The study has two questions; 1: Is there any significant effect of the sudden shift to e-learning on student engagement? 2: Is there any significant difference in student engagement between e-learning and on-campus learning?

The study results are expected to provide recommendations that may help to improve the quality of learning and increase student's success in e-learning during COVID-19 pandemic.

MATERIALS AND METHODS

Study design and setting

The study is a comparative, quasi-experimental, ex-post facto study that involved the same group of students who used to learn in traditional classrooms before COVID-10 pandemic and shifted to online education during the pandemic. Study participants were students of Almaarefa University, Riyadh, the capital of Saudi Arabia. Almaarefa University is a private establishment of higher education, it encompasses three colleges: Medicine, Pharmacy, and Applied Sciences. The college of Applied Sciences contains several programs: Nursing, Respiratory Care, Emergency Medical Services, Anesthesia Technology, Health Information System, Computer Science, Information Systems, and Industrial Engineering.

At the start of the shift to online education officially by the ministry of higher education, the education center of Almaarefa University delivered multiple staff training workshops on e-learning. Teaching and assessment processes at Almaarefa University were changed dramatically and continuous modifications in teaching and assessment were applied as new issues. Synchronous online courses were adopted. Life lectures were conducted using many electronic platforms. Teachers during the lectures were assumed to provide opportunities for students to thoughtfully engage with the subject and allow them to interact with each other virtually. Video recorded lectures, scientific forums, assignments, and formative quizzes were uploaded into MOODLE. Staff What Sapp groups with students were encouraged. All aimed to provide students with different learning opportunities and increase their motivation, participation, and interaction with students and with the teachers.

The study participants were students of health professions programs which are: College of Medicine, College of Pharmacy, Nursing program, and Allied health program (Respiratory Care, Emergency Medical Services, Anesthesia Technology, and Health Information System). Only students who were in their formal study is in traditional classrooms and shifted to e-learning during the pandemic were included. Students in internships were excluded because they did not take online courses. The total number of the participants was 908 students and taking the margin of error as 5% and applying the down mentioned formula yielded a sample size of 270 students.

$$n = \frac{Nz^2pq}{d^2(N-1) + Z^2Pq}$$
(1)

Where:

n= sample size

N = Total population.

z = critical value to achieve (1-α)% confidence level, here we used z = 1.96.
p = anticipated population proportion
q = 1-p
d = the desired margin of error.

To ensure that the sample is representative of the population under study as well as to help generalize study results, simple random sampling was involved in the selection of the sample. To account for non-response and incomplete responses, the questionnaire was sent to 500 students. About 339 students responded to the questionnaire which is a good response rate. The 339 students' responses were included in data analysis in an effort to reduce the marginal error.

Instruments and data collection
Two previously developed and validated questionnaires were used, the online student engagement scale was used for the measurement of student engagement in e-learning [25]. The student course engagement questionnaire was used for the measurement of engagement in the traditional classroom [26]. Then a 5point Likert scale online survey was created using Google form and the link was sent to students Emails at mcst@edu.sa. The link was also provided at Almaarefa Moodle website where students usually get access to learning resources and academic announcements. The first part of the questionnaire included the individual characteristics followed by measures of student engagement. Informed consent was obtained from each student, and confidentiality and anonymity were assured.

Data Entry and analysis
Data analysis was performed using SPSS v.20 (SPSS Inc. Chicago, IL, USA). The construct validity of the questionnaire was tested with factor analysis. Sampling adequacy was tested by the Kaiser-Meyer-Olkin measure of the adequacy of sample size. The reliability of the questionnaire was measured by Alfa Cronbach, while validity was calculated by taking the square root of the Alfa Cronbach.
Descriptive statistics were calculated for all variables. Comparison of student engagement in e-learning vs. traditional classrooms was done by Wilcoxon signed test as the data distribution was not normal. Shapiro Wilk test was used to evaluate normal distribution.

RESULTS AND DISCUSSION

Factor Analysis results of student engagement questionnaire
The Kaiser-Meyer-Olkin measure of sampling adequacy for all domains showed significant results indicating that sample size was adequate for factor analysis. Factor analysis of the two sections (online and classroom) along with respective domains showed good results in terms of explanation and factor loadings, so there was no need to modify, add or remove any variable **(Tables 1 and 2)**.

Table 1. Factor Analysis results of the questionnaire of student engagement in e-learning

Domains/variables	Loadings	Total variance explained
Behavioral engagement		
Making sure to study regularly	0.785	
Staying up on readings	0.796	
Looking over class notes between getting online to make sure I understand the material	0.861	
Being organized	0.824	67.5%
Taking good notes over readings, PowerPoint, or video lectures	0.837	
Listening/reading carefully	0.823	
Making sure to study on a regular basis	0.785	
Emotional engagement		
Putting forth effort	0.655	65.0%
Finding ways to make the course material relevant to my life	0.887	

Domains/variables	Loadings	Total variance explained
Applying course material to my life	0.864	
Finding ways to make the course interesting to me	0.89	
Really desiring to learn the material	0.836	
Having fun in online chats, discussions, or via email with the instructor or other students	0.668	
Social engagement		
Participating actively in small-group discussion forums	0.829	
Helping fellow students	0.769	
Engaging in conversations online (chat, discussions, email)	0.847	63.3%
Posting in the discussion forum regularly	0.762	
Getting to know other students in the class	0.767	
Cognitive engagement		
Getting a good grade	0.966	93.2%
Doing well on the tests/quizzes	0.966	

Table 2. Factor Analysis results of the questionnaire of student engagement in traditional classroom

Domains/variables	Loadings	Total variance explained
Behavioral engagement		
Doing all the homework problems	0.831	
Coming to class every day	0.842	
Taking good notes in class	0.855	
Looking over class notes between classes to make sure I understand the material	0.843	
Putting forth effort	0.875	73.1%
Being organized	0.863	
Staying up on the readings	0.842	
Making sure to study on a regular basis	0.854	
Listening carefully in class	0.889	
Emotional engagement		
Thinking about the course between class meetings	0.772	
Finding ways to make the course interesting to me	0.886	
Really desiring to learn the material	0.877	
Finding ways to make the course material relevant to my life	0.905	75.0%
Applying course material to my life	0.885	
Social engagement		
Participating actively in small-group discussion forums	0.829	
Helping fellow students	0.769	
Engaging in conversations online (chat, discussions, email)	0.847	
Posting in the discussion forum regularly	0.762	63.3%
Getting to know other students in the class	0.767	
Cognitive engagement		
Going to the teachers' office hours to review assignments or tests, or to ask questions	0.581	
Being confident that I can learn and do well in the class	0.873	68.6%

Reliability and validity of the questionnaire

All values of Alfa Cronbach were greater than 0.85 indicating high reliability of the scales of the questionnaire. All values of validity were higher than 0.9 indicating the high validity of the questionnaire **(Table 3)**.

Table 3. Reliability and validity for student engagement questionnaires in e-learning and learning in traditional classroom.

Domain	Alfa Cronbach	Validity
Online student engagement		
Behavioral engagement	0.903	0.950
Emotional engagement	0.887	0.942
Social engagement	0.854	0.924
Cognitive engagement	0.927	0.963
In traditional classroom engagement		
Behavioral engagement	0.954	0.977
Emotional engagement	0.916	0.957
Social engagement	0.850	0.922
Cognitive engagement	0.876	0.936

Sample socio-demographic characteristics

The total number of students included in the study was 339 with a mean age of 22.5 ± 3.5 years **(Figure 1)**. Male students represent 136 (39.2%) while Female students represent 211 (60.8%)
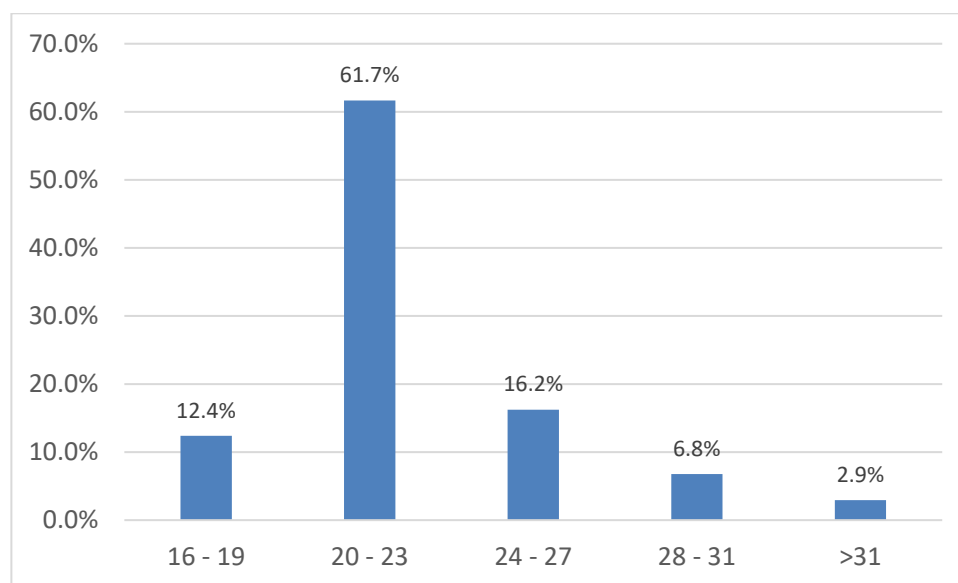

Figure 1. Age distribution of the study sample

Measurement and comparison of student engagement in e-learning and traditional classrooms

The score of student engagement in e-learning was 3.43 ± 1 while the score of student engagement in the traditional classroom was 3.54 ± 1.07. Since all variables did not show normal distribution using the Shapiro Wilk test (p-value<0.001), Wilcoxon signed, a non-parametric test was used. There was a significant difference, between student engagement in online and traditional classroom (p-value 0.006) **(Table 4)**.

Table 4. Comparison of student engagement in e-learning and traditional classroom

Variables	Mean	SD	Median	p-value
Behavioral engagement in e-learning	3.46	1.09	3.67	<0.001
Behavioral engagement in traditional classroom	3.69	1.18	4.00	
Emotional engagement in e-learning	3.39	1.07	3.50	<0.001

Emotional engagement in traditional classroom	3.53	1.12	3.80	
Social engagement in e-learning	3.18	1.08	3.20	0.024
Social engagement in traditional classroom	3.33	1.18	3.50	
Cognitive engagement in e-learning	3.69	1.27	4.00	0.001
Cognitive engagement in traditional classroom	3.59	1.10	3.80	
The overall score of student engagement in e-learning	3.43	1.00	3.63	0.006
The overall score of student engagement in traditional classroom	3.54	1.07	3.85	

COVID-19 pandemic has forced higher education in most of the countries to be conducted online for approximately a year till now [2]. This sudden shift to e-learning has put the higher education system through an extraordinary experience that may impact its future [27]. Important elements of education that contribute to student success and performance need to be carefully investigated. This study investigated the effect of a sudden shift to e-learning during the pandemic on student engagement. The overall score of student engagement was found significantly lower in e-learning in comparison to their engagement level in the traditional classroom.

Teachers and students during the pandemic reported that online education is challenging for both of them. Both teachers and students reported a lack of interaction between student-student and student-teacher in online education. Students are unsatisfied with online education. Students are, concerned by the lack of guidance and the unfamiliar methods of assessments. However, they reported that students' overall skills are improved [28]. Students were reported to prefer face-to-face to online education and they related this preference to the effectiveness and clarity of presentations [29]. In another study, students showed a strong desire for face-to-face class discussions and reported feeling more engaged, and receiving more immediate feedback compared to online discussions [30].

Interestingly, this study found student's cognitive engagement is significantly higher in e-learning when compared with their engagement in the traditional classroom. Cognitive engagement is students' psychological motivation and investment to learn that ranges from memorization to the use of self-regulatory strategies to facilitate a deeper understanding of the discipline [31]. Cognitive engagement has been shown to predict students' performance and goal orientation [32]. The shift to online education during the pandemic is associated with improved students' overall skills, skills of discussion as well as improvement in their performance [28, 33, 34]. The new e-learning environment students had faced during the shift to online education may challenge the students and led them to be more goal-oriented [34, 35]. Also, the modifications made in the teaching and assessment process during the shift to online education may act as motivators for students' active learning. Students' learning strategies were reported to change to a more continuous habit during their adaptation to the educational changes made during the pandemic. Thus, higher cognitive engagement in e-learning during the pandemic may be a result of improved students' goal orientation, motivation, and self-regulation. At Almaarefa University, the role of the teacher was maintained in online education as life lectures were conducted using many electronic platforms. This may possibly add to the better students' cognitive engagement in e-learning. Maintaining the teacher role in online discussions is associated with high cognitive engagement [36].

This study revealed that other types of student engagement are less in e-learning compared to the respective types in the traditional classroom. Student emotional engagement in an e-learning environment is less than their learning in the traditional classroom. Emotional engagement refers to students' effective reactions in the classroom, including anxiety, sadness, happiness, boredom, and interest [31]. Promoting Student's emotional engagement is important like other types of engagement as it is linked to student's success and performance [37, 38]. It is thus necessary to promote this type of engagement in the e-learning environment. To promote the emotional engagement of students, Yang *et al*. (2016) confirmed that teachers and course designers in online education shall create a learning environment that is supportive and builds confidence [39]. Rodríguez-Ardura and Meseguer-Artola (2016) reported that successful e-learning environments are that one in which students feel as they are in the traditional classrooms with the same teaching-learning process and the same interaction with their lecturers and peer students [40]. In e-learning during the pandemic, both teachers and students reported a lack of interaction between student-student and student-teacher. It is thus necessary to build an e-learning environment that mimics the traditional classroom learning environment, in which students easily reach teachers, find answers to their worries and questions, and find help and guidance. Courses structure and delivery, assessment methods, various communication channels with teachers, academic and nonacademic administrators should be announced early at the start of the semester. Hewson (2018) showed that the concerns that distance learners expressed are around the

uncertainty: about the course structure and delivery; about their weekly study commitment, about the assessment criteria and access to course information, and about communication and relationships with their teachers. He reported that the teacher-student relationship was a critical concern for students in e-learning [41].

Another finding in this study is the less student behavioral engagement in an e-learning environment in comparison to traditional classroom. Behavioral engagement refers to student positive conduct, the absence of disruptive behaviors, and involvement in academic and non-academic tasks [31]. Studies demonstrated that behavioral engagement is an important condition that supports academic achievement [37, 42]. Cognitive and emotional engagement are potential mediators of a behavioral engagement or prerequisites to behavioral engagement [37, 43]. In our study, students are cognitively engaged, however, they are emotionally disengaged which may account for their decreased behavioral engagement. Certain specific teaching practices have been shown to increase student behavioral engagement if implemented appropriately in classrooms. These are teacher modeling, opportunities to respond, and feedback [44]. Teacher modeling is about teacher demonstrates to students a desired behavior or skill while describes simultaneously the decisions and actions made during the process [45, 46]. Modeling increased student achievement and engagement [45, 46]. Opportunities to respond are about the provision of an academic prompt, question, or task presented by a teacher and elicits the active response of students [47]. Opportunities to respond are correlated with students' positive behavioral and academic outcomes [48]. Teacher feedback is about teacher provision of students with information regarding their behavioral or academic performance [49]. When teachers use higher rates of effective feedback, students show fewer disruptive behaviors, improved performance, and increased time-on-task [50]. Our study recommends the implementation of such effective teaching practices upon conduction of online education during the pandemic to increase student performance and engagement.

This study also found that student social engagement is less in the e-learning environment. Several studies pointed that engagement has an interpersonal component; interactions with other students and the teachers, which are an important part of the classroom experiences [51, 52]. Research show the importance of online social interaction, and online contact with staff for student engagement in e-learning environment [53-55].

It is evident that the extraordinary experience which faced the education system during the pandemic is not without benefits or lessons. Student cognitive engagement, skills, and performance were improved in the e-learning. Despite the challenges, most students believe that the pandemic has increased their confidence in the effectiveness of online medical education, and most of them intended to integrate the online expertise gained into their practice during the pandemic. Many studies which explored the advantages and limitations of e-learning during the pandemic supports the use of e-learning in dental and medical institutes, considering its numerous advantages [56]. A national study in the UK suggests medical schools incorporate online teaching methods within traditional medical education in form of online problem-based/team-based learning activities as these teaching activities allow students to pace learning in their time and interact with peers [57]. This allows to get benefits of online education and account for some of its drawbacks. Now many educators expect more incorporation of online teaching methods within traditional medical education after the pandemic.

Study limitations

The study involved Likert scale, a self-reported measure as the participants were asked to report directly on their own behaviors, attitudes, or intentions. Despite the limitations associated with it, self-reports are the most common type used to assess student engagement. Self-report methods are useful for the assessment of cognitive and emotional engagement [58]. Despite this limitation, the study provides valuable insights into the student engagement in e-learning during the pandemic.

Implication for practice

Institutions urgently need to revise their current online education to objectively implement practices that improve their student engagement during this contingency situation. From the study findings, it is recommended that instructors of online courses and even in traditional classrooms provide appropriate technology and instructional strategies that improve the self-regulation, self-efficacy, and strategies of students and provide opportunities for them to experience successful learning.

It deems that institutions in near future should develop contingency, well-planned ready online educational plans to face such challenges as those faced during COVID 19 pandemic. Institutions should scale up teachers' and students' training for online education, should prepare online courses that align with the graduate's outcomes, should plan an e-learning environment that promotes student engagement emotionally, socially, behaviorally, and

strengthen cognitive engagement. It is also recommended that institutions should integrate online courses in their curricula to promote student active learning, goal orientation, and self-regulation as indicated by the improved student cognitive engagement and performance in e-learning. Another benefit of integrating online courses within the curricula is to boost the readiness to shift to online education in crisis.

It is also recommended in the building of online courses, instructors should build an e-learning environment that mimics the traditional classroom learning environment, in which students easily reach teachers as well as administrators, social workers, etc. Instructors should provide opportunities for collaboration and encourage knowledge sharing and support among students. The reported challenges and barriers met by staff and students during the sudden shift should be also taken into consideration.

CONCLUSION

During the pandemic, the sudden shift to online education is associated with differential effects on student engagement. Online education improves student cognitive engagement, in other words, online education increased student's motivation to learn, self-regulation, and goal orientation. Other types of student engagement are found lower in online education,

Putting in mind that technology is highly likely to be essential components of future of medical education after COVID 19 pandemic, the current study gives insights into the current e-learning environment and provide recommendations for improvement.

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