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Exploring the Factors Influencing the College Students' Engagement in Mobile Learning in Palestine

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ABSTRACT

This study aims to explore the factors influencing students' engagement in mobile learning at Palestine Technical University Kadoorie. It utilizes a mixed research approach that combines both quantitative and qualitative designs. The study sample consists of 37 college students from two different faculties: Arts and Educational Sciences, and Applied Sciences. Data were collected using a pre-existing scale for engagement and its factors. Semi-structured interviews were conducted with 12 students who completed the scales. The findings showed a statistically significant difference in the total engagement scores, specifically in the emotional engagement dimension. However, there was no statistical significance found in the social, cognitive, or behavioral domains. Factors related to instructors are influential factors in student engagement and have been found to be statistically significant. Qualitative findings supported the quantitative results for this question, which showed subthemes of instructor-related factors such as instructor presence, motivation, teaching strategies, and technical environment. Researchers recommend that policymakers and educators prioritize the engagement factors of students in mobile learning. One of the limitations is the generalizability of this study. The participants who were surveyed were exclusively sourced from two departments within one university. To broaden the scope, we suggest that future research include individuals from various disciplines, universities, academic institutions, and students.

KEYWORDS

influencing factor, digital education, digital teaching, and higher education, mobile learning, mobile technologies, engagement

1   INTRODUCTION

With rapidly evolving mobile technologies, the way people interact, communicate, and live has changed. Even though there has been a substantial investment in mobile devices in educational settings, there is still a need for development in pedagogy and practices in this field [1], [2]. For example, higher education institutions need to adapt to changing paradigms by utilizing mobile technologies to provide educational services

and communicate effectively with students. Engagement of students is a crucial pillar for their learning; it reduces the dropout rate and improves student retention rates [3]. Mobile technologies have reshaped students' engagement and revolutionized the way they participate in the learning process. As an example, it has provided new features that enable communication between students and teachers through different educational applications [4]. As student engagement in general refers to active involvement and sustained effort by students in their learning process, it encompasses more than just accessing course content on mobile devices [3]. For example, learning engagement has been found to be a significant predictor of students' academic performance and plays a crucial role in assessing the quality of teaching and learning processes. Numerous studies have shown that active engagement in learning positively impacts the lifelong learning skills of university students [3], [4]. It improves their critical thinking abilities, behavior, and problem-solving skills and enhances their overall academic success [5]. On one hand, a high level of learning engagement motivates students to develop self-regulation and self-management, and ultimately boosts their self-confidence. On the other hand, such engagement also improves their higher-order thinking skills and effectively applies what they've learned [6].

Engagement is influenced by factors that are linked to students' motivation, interest, and commitment to learning.

Factors that influence student engagement in mobile learning are extremely crucial for educators in higher education institutions. There are many factors that have been found to influence student engagement while using mobile learning, such as experience in using mobile learning applications [5]. The availability of relevant materials and the inclusion of a diverse range of multimedia options and resources have been found to enhance student engagement in mobile learning [6]. Additionally, the interactive and cooperative aspects of mobile learning can promote student engagement [7]. Nevertheless, these social and collaborative aspects must be tailored to suit the specific requirements and preferences of individual learners [8].

Consequently, researchers should explore the factors that impact student engagement. This will enable them to create mobile learning experiences that effectively captivate students, inspire greater dedication to their studies, and boost motivation to attain desired learning objectives.

This study aims to examine the findings of relevant previous studies and investigate the factors that influence mobile learning. Identifying the factors that affect student engagement during mobile learning contributes to the improvement of mobile learning processes. Quantitative tools, such as surveys, and qualitative methods, represented by semi-structured interviews, were designed and converted into electronic formats to facilitate easy collection of sample responses. Statistical analysis was used for quantitative data, while qualitative data were coded and analyzed using content analysis. This process led to the results, which were discussed and compared with previous studies.

Mobile learning provides students with the opportunity to access learning materials and engage in instructional activities anytime and anywhere using mobile devices. However, research shows that student engagement is a crucial factor that affects the effectiveness of mobile learning. This study aims to identify the factors that influence student engagement in mobile learning environments in higher education settings.

The study addresses a gap in the existing literature regarding the factors that influence students' use of mobile devices for meaningful engagement in learning. While some research has investigated the use of mobile technology for learning in specific contexts, few studies have examined the factors that influence effective engagement in mobile learning. This study contributes to knowledge by uncovering factors that influence engagement in mobile learning in higher education.

The study holds both theoretical and practical significance. It explores student engagement levels and the factors that influence them, addressing research questions about differences in engagement with mobile learning and the factors that affect it [8], [9]. Objectives include identifying how students engage in mobile learning, factors that influence this engagement, and solutions to improve engagement. The focus on engagement in mobile learning in higher education addresses a need identified in prior studies. The findings will help improve the effectiveness of mobile learning [10], [11].

2 LITERATURE REVIEW

Smart mobile devices and tablets' usage is on the rise [12]. It affects how we interact with PC applications, such as touch, slide, drag, and drop nonphysical items on a screen, which has become a regular activity in our daily lives. In this context, certain universities and other educational institutions are utilizing mobile wireless technology to offer educational services, enabling students to access information from any location [13].

Mobile learning is a great option available to students for creating and maintaining effective learning, which overcomes the time and space limitations of traditional formal learning [14], [15]. It enables learners to have mobility by allowing them to learn everywhere and anywhere. This offers opportunities to design teaching and learning in a different way. For example, harnessing mobile devices for seamless learning opportunities outside of the classroom is an advantage of mobile learning [15]. This will result in a new era of learning that moves away from the traditional classroom structure of "chalk and talk" and textbooks and towards more dynamic, learner-centric environments that enable personalized and contextualized learning [16]. The positive effects of mobile learning have been identified in many disciplines [17], [18].

Nowadays, students are mobile and regularly use mobile devices to study while on the go [19], [20]. Mobile learning offers learning environments that enable the mobility of learners by promoting access to various apps, which provide an ideal platform for informal and formal learning in many disciplines [21], [22], [23]. It minimizes the reliance on fixed study locations, allowing for mobility that facilitates both formal and informal learning environments. Instructors have long been interested in students' engagement because it is closely related to desired learning outcomes. Thus, many researchers have linked students' engagement to their willingness to participate in class and their level of involvement [24].

Cole and Chan (1994) defined learner engagement as "the extent of students' involvement and active participation in learning activities," as cited in [25, *p*. 259]. Engagement focuses on the correlation between the time and effort invested by students and educational institutions to maximize their learning experience and improve overall academic outcomes [25], [27]. Furthermore, it is an important concept that is associated with positive motivation, good learning outcomes, and persistence [27], [28]. There are three components of engagement: affective, cognitive, and behavioral engagement [29]. Some researchers identify four types of engagement: behavioral, social, emotional, and cognitive [28]. Behavioral engagement is defined as actions and activities that can be observed, discussions, commitment to class rules, and adherence to a code of ethics [29]. The social dimension of engagement includes a sense of belonging, socialization, and relationships between learners [30]. The emotional engagement reflects the levels and types of emotions and feelings expressed by students, such as passion, joy, happiness, motivation, and optimism [28]. Cognitive engagement relates to the cognitive and mental processes, attention, and cognitive curiosity of learners [31].

Laptops and other types of portable personal computers are widely recognized as the most commonly used mobile devices for education. However, in the past decade, the rise of smartphones has brought about a new transformation by greatly amplifying the future significance of "m-learning" [12], [31]. Several studies were conducted [32], [33], [35] to explore the engagement of students who use mobile learning. Salhab and Daher [34] investigated mobile learning engagement for college students and reported that students were socially, cognitively, emotionally, and behaviorally engaged after the implementation of a Moodle mobile application. Students were found to be socially engaged through social-mobile interaction, community building, and relationships with their peers, and competition. Meanwhile, they were emotionally engaged by paying more attention and implementing cognitive and metacognitive strategies. On the other hand, Tang and Hew [36] investigated how m-learning enhances learning engagement. They found that m-learning affects both behavioral and cognitive engagement, particularly in various learning contexts, by providing immediate access to information. Cho and Castenda [37] investigated the impact of incorporating game-like activities through a mobile application on the motivational and emotional engagement of students in a grammar course. Results revealed significant improvements in internal goal orientation, beliefs regarding learning control, and self-efficacy for learning among 82 students from the United States. Additionally, the students' enjoyment of learning in Spanish courses increased. Additionally, a previous study by Daher [38] concluded that mobile phones provide new opportunities for learners to personalize their own learning and amplify their voices in innovative ways. This positively impacts their learning by encouraging students' motivation, autonomy, confidence, enjoyment, empowerment, and understanding of the content. Since engagement is a state, many factors have been investigated that are reported to influence engagement, such as social interaction, context, and teaching practices [39]. Understanding the factors that affect student engagement in a mobile learning environment is critical for educators and policymakers to create effective mobile learning interventions and promote meaningful learning. Several studies were conducted to identify the key factors influencing student engagement in a mobile learning environment [40], [41].

For example, Elammari and Cavus [42] found that factors such as students' expertise with mobile applications can increase their motivation, which in turn may affect their learning and academic achievement when using mobile learning. Student-related factors were widely discussed in the mobile learning research literature as significant influences on mobile learning engagement. These factors encompass motivation, self-efficacy, learning styles, technical skills, and effective time management. Prior knowledge levels should be considered, and peer interaction can enhance engagement through collaboration. Regular feedback, clear assessment criteria, a sense of relevance, and perceived control over the learning environment also influence levels of engagement.

Moreover, students' motivation also influences student engagement. A supporting study confirmed the role of motivational factors, such as intrinsic and external factors, in mobile learning as catalysts to increase students' levels of learning engagement [43], [44]. They explained how intrinsic motivational factors, such as a desire to learn, interest in learning platforms, and self-regulation, encourage students to be engaged. External motivational factors, such as the instructor and classmates, influence their engagement as well.

Additionally, Barua et al. [45] showed the importance of both direct and indirect factors. Direct factors refer to elements that contribute to learning through active engagement, such as the subject matter, academic skills, or approaches that support students' learning styles. Indirect factors include the learning platform, availability of

instructional content, socialization, learning methods employed, selection of appropriate materials, students' interest, and instructors' readiness. A study by Chang et al. [46] analyzed 65 empirical studies published between 2007 and 2016 to identify key contextual factors and their impact on student engagement. Results showed that several contextual factors significantly influenced student engagement in mobile learning. These factors included the availability of resources and learning materials, technical support, integration of mobile learning into the curriculum, alignment with educational goals, flexibility in accessing learning materials, and cultural considerations. Meanwhile, Allen and Seaman, [47] reported that motivational factors are crucial and should be considered as they influence students' engagement and interest in acquiring and generating knowledge in the context of mobile learning. The literature review highlights the critical importance of teachers as certain factors in the context of mobile learning. This presence not only fosters a sense of guidance but also encourages students to actively engage in the learning process. Additionally, efficient teaching strategies, teaching styles, and innovative strategies facilitated by digital tools on mobile devices significantly impact student engagement. These approaches align with students' preferences and learning characteristics. These approaches, such as the use of interactive applications, stimulate critical thinking through collaborative and brainstorming techniques. They have been found to be particularly effective in enhancing student engagement within mobile learning environments.

After reviewing the literature, a list of factors that influence student engagement in mobile learning has been identified and classified as follows: technical factors that include device usability and functionality, connectivity and network reliability, availability of user-friendly interfaces and intuitive design, compatibility with various mobile devices and operating systems, and access to relevant mobile applications and tools [48]. Literature reviews emphasize that the technical features of mobile devices have a significant impact on mobile learning engagement. Larger screens with high-resolution displays and touchscreen functionality provide a comfortable and interactive learning experience. Faster processors enable the smooth handling of multimedia content, while longer battery life ensures uninterrupted learning sessions. Reliable internet connectivity is essential for accessing online materials, and ample storage capacity allows for the downloading of resources. High-quality audio and video capabilities enhance multimedia content. Sensors enable location-based and interactive learning, connecting education to the real world. Accessibility features cater to learners with disabilities. Security and privacy features create a safe learning environment, fostering trust and engagement.

Moreover, pedagogical factors were also identified. These factors include interactive and multimedia-rich content, personalized learning experiences, gamification elements, interactive exercises, collaborative learning activities, peer interaction, opportunities for reflection and metacognition, and real-world application and problem-solving tasks [49]. These pedagogical factors were found to influence engagement by offering an attractive experience for students that stimulates their thinking skills and engages them cognitively.

Motivational factors were identified by Gumbeer et al. [9], who conducted a systematic review in this context. They reported the following factors: intrinsic motivation, perceived usefulness of mobile learning, relevance of content, and the presence of rewards or incentives. These factors empower students with a sense of independence and influence over their choices, leading to higher levels of engagement. Proficiency: When people possess intrinsic motivation, they tend to participate in endeavors that foster personal advancement and the enhancement of skills. Zhang et al. [50] identified additional factors such as motivation and enjoyment of learning,

perceived usefulness and relevance of mobile learning, autonomy and control over learning processes, the presence of rewards, and clear goals and feedback mechanisms.

According to Joo et al. [51], the social factors were also identified among these factors. These include collaboration and interaction with peers and instructors, opportunities for discussion and knowledge sharing, social networking and community building, peer feedback and support, a sense of belonging, and a supportive learning environment. The literature review underscores the critical role of social factors in shaping student engagement within the realm of mobile learning. Research findings highlight that students' engagement is intricately tied to their ability to communicate, interact, and collaborate with both peers and instructors through the use of mobile devices. Furthermore, the act of cooperation through information sharing and collaborative problem-solving emerges as a crucial factor in maintaining high levels of engagement among students.

Similarly, students' satisfaction with using mobile learning, the usability of the mobile device, teaching strategies, and instructional content were found to influence students' engagement in the mobile-based flipped classroom [51]. Literature emphasizes that effective content design influences mobile learning engagement by ensuring that the material is relevant, interactive, adaptable, and engaging. motivates learners to actively participate and enhances their overall learning experience.

Another study by Zilka and Zeichner [53], added different factors such as differential interpersonal communication, feedback, and learners' intellectual and emotional needs. Contextual factors, as reported by Chang et al. [46], include the availability of resources and learning materials, as well as technical support for accessing instruction materials. These factors contribute to the flexibility and convenience of accessing learning materials.

Several studies highlight the engagement of students when using mobile learning. The dimensions of engagement vary in many studies. For example, students were found to be socially engaged while using mobile learning [34]. On the other hand, another study [36] found that students are engaged both behaviorally and cognitively while using mobile learning. Many factors were found to influence mobile learning engagement, such as students' proficiency with mobile apps, increased motivation, and potentially affecting their learning and academic achievement [41]. The role of motivational factors, both intrinsic (such as learning desire and self-regulation) and external (such as instructor and peer influence), is also found to impact learning engagement [43], [44]. Additionally, there are direct and indirect factors that influence engagement. Direct factors include elements such as subject matter and learning styles, while indirect factors encompass the learning platform, the availability of instructional content, socialization, and learning methods [42], [43]. Also, cultural factors significantly influence student engagement in mobile learning. Motivational factors, as stressed by Allen and Seaman [44]. This study aims to explore the level of engagement during mobile learning and the factors that influence student engagement in mobile learning. It is only from the students' perspective, using qualitative and quantitative methods, that valuable insights for improving online teaching and learning can be obtained.

3 METHODOLOGY

A mixed approach was used in this study to examine students' engagement in a mobile learning environment. Mixed-method design combines different types of

inquiry to achieve a comprehensive understanding of a phenomenon by integrating multiple sources of data [54]. The study employed a mixed approach, starting with the quantitative phase (using numbers), followed by the qualitative phase (based on personal experience). As a result, the qualitative findings were used to provide context for the quantitative data [55].

For the quantitative part, a pre-existing scale was utilized. For the qualitative part, a phenomenological approach was utilized because it was important for participants to have an experiential understanding of mobile learning.

Researchers adopted both quantitative and qualitative methods in a mixed-methods approach, which provides a more holistic view of engagement in mobile learning. They used a sequential explanatory design, starting with the collection and analysis of quantitative data through a questionnaire. Based on the initial quantitative findings, they then followed up with qualitative data collection methods, specifically using a semi-structured interview, to explain or elaborate on the quantitative results. This design allows for the initial establishment of trends or relationships using quantitative data, followed by a deeper understanding of the engagement during the mobile learning phenomenon through qualitative data. This means that quantitative data can identify trends and patterns, while qualitative data can uncover the underlying reasons and contextual factors, leading to a more comprehensive understanding of this phenomenon.

3.1 Research participants

A sample of 37 students was selected from two colleges: Applied Science and Art and educational sciences at Palestine Technical University Kadoorie (PTUK) randomly. Student's demographic characteristics are shown in Table 1.

Table 1. Student's demographic characteristics

Classification	Category	Number	Proportion
Gender	Male	6	16.2%
	Female	31	83.8%
GPA	Excellent	10	27%
	V.Good	15	40.6%
	Good	12	32.4%
Technical skills	Excellent	14	37.8%
	V.Good	16	43.2%
	Good	7	18.9%
College level	First level	3	8.10
	Second level	4	10.8
	Third level	9	24.3
	Fourth level	27	56.8

For the semi-structured interviews, 20 participants were purposefully selected [53]. Students with different specialties in chemistry, physics, math, and technology education extensively utilized mobile learning in their courses.

3.2 Data collection tools

Questionnaire: Data were obtained from the pre-existing scale that consisted of 20 items [57]. Validity and reliability analyses were conducted to assess engagement in four dimensions. To ensure validity, Pearson's correlation is calculated. Table 2 shows the correlation values.

Table 2. Pearson correlation of engagement scale

Item Number	Item	Correlation Coefficient
Behavioral engagement		
1	I do my best to attend my classes regularly when using my mobile device.	.781**
2	Mobile learning facilitates the note taking process.	.691**
3	Mobile learning helps me to revisit my notes.	.839**
Cognitive engagement		
1	Mobile learning supports searching for further information when I encounter something that confuses me.	.613**
2	Mobile learning helps me to understand concepts.	.674**
3	Watching videos many times to understand concepts is a good feature of mobile learning.	.697**
Emotional engagement		
1	I felt motivated to learn during mobile learning.	.716**
2	Mobile learning interests me.	.631**
3	I enjoyed using mobile learning.	.575**
Social engagement		
1	I am able to interact with my classmates while using mobile learning.	.549**
2	I always post comments in course discussions while using mobile learning.	.677**
3	Mobile learning encourages me to share learning materials.	.781**

To ensure reliability, Cronbach's Alpha was computed for each of the four engagement dimensions, as shown in Table 3. For emotional engagement, the score is .715; for behavioral engagement, it is .874; for cognitive engagement, it is .846; and for social engagement, it is .753. This indicates good reliability for the dimensions [58]. The Cronbach Alpha value for the entire questionnaire is .856, indicating high reliability. These findings indicate that the scale is a reliable tool for collecting data.

Table 3. Reliability of the engagement dimensions

Dimensions	Constructs (No.)	Cronbach's Alpha
Emotional	3	.715
Behavioral	3	.874
Cognitive	3	.846
Social	3	.753
Total	12	.856

Engagement mean scores were calculated for each dimension. Then, the resulting mean scores of the engagement were compared to a scale created by Daher [59]. According to that scale, scores between 0.8 and 1.8 were considered very low. Scores between 1.8 and 2.6 are considered a 'low engagement score', scores between 2.6 and 3.4 are considered a 'normal engagement score', and scores between 3.4 and 4.2 are considered a 'good engagement score' on this scale. Finally, engagement scores ranging from 4.2 to 5 are considered very good. A statistical analysis, known as a one-sample t-test, was performed to compare the average scores with a predetermined test value. Using Daher's [56] adopted scale in Figure 1.
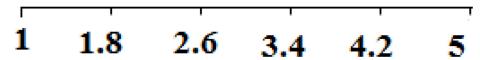

Fig. 1. Interpretation scale of the mean scores [56, p.5]

Descriptive statistical tests were used to answer the first question of the study, which focused on the level of engagement during mobile learning. The results are shown in Table 4.

Table 4. Pearson correlation results for factors influencing engagement

Item Number	Item	Correlation Coefficient
Instructor related factors		
1	Instructor's caring motivates me to learn.	.713**
2	Instructor's teaching style facilitates my learning.	.648**
3	Instructor's personality facilitates my learning.	.679**
4	Instructor utilizes effective teaching strategy while using mobile learning.	.661
5	Instructors' technical skills support my learning while using mobile learning.	.790
Student related factors		
1	My attitude influences me when using mobile learning.	.644**
2	Mobile learning influences my learning styles.	.607**
3	My communication skills are supported by mobile learning.	.668**
4	My technical skills influences my engagement while using mobile learning.	.783**
5	My personal traits influence my mobile learning.	.526**
Communication factors		
1	Communication with the instructor while using mobile learning affects my engagement.	.669**
2	Communication with my classmates while using mobile learning affects my engagement.	.671**
3	Feedback influence my engagement while using mobile learning.	.704**
4	Cooperation supports my engagement while using mobile learning.	.745**
5	Social interaction influences my engagement while using mobile learning.	.645

(Continued)

Table 4. Pearson correlation results for factors influencing engagement *(Continued)*

Item Number	Item	Correlation Coefficient
Content Design		
1	Content influences my engagement.	.645
2	Diversified content influenced my engagement.	.773
3	Using multimedia supports my engagement.	.575
4	Richness of activities facilitates my engagement.	.659
5	Attractive activities keep me engaged.	.665
6	Meaningful activities influence my engagement.	.635
Technical Support		
1	Accessibility affects mobile learning.	.588
2	Internet connection influences my learning by mobile devices.	.571
3	Technical assistance supports my mobile learning.	.650
4	Privacy feature affects my mobile learning.	.678

For the factors that influence student engagement, a pre-existing scale with 25 items was adopted in this study [38]. To assess the validity of the scale, a Pearson correlation was calculated, as shown in Table 5. To ensure the reliability of this scale, Cronbach's alpha was computed for each of the five influencing factors. For instructor-related factors, the reliability coefficient is .845. For student-related factors, it is .803. For communication, the coefficient is .853, and for content design, it is .832. Lastly, for technical support, the coefficient is .799. This indicates good reliability for the dimensions [58]. The Cronbach Alpha value for the entire questionnaire is .948, high reliability. The findings showed that the existing scale was a reliable tool for this study. Quantitative data analysis was performed using SPSS 21. Table 6 shows the descriptive statistics for the mean and standard deviation of the engagement dimensions.

Table 5. Reliability statistics

Dimensions	Constructs (No.)	Cronbach's Alpha
Factors related to instructors	5	.845
Factors related to students	5	.803
Communication factor	5	.853
Instructional content	6	.832
Technical Support	4	.799
Total	25	.948

Table 6. The descriptive statistics of students' engagement levels (N = 37)

Dimension	M	SD
Behavioral engagement	4.054	.54723
Cognitive engagement	4.2432	.74804
Emotional engagement	3.7523	.73032
Social engagement	4.0180	.6570
Overall	4.0213	.522

Semi structured interview: Participants who completed the questionnaire were interviewed. Participants were selected purposefully. Students were selected based on their mobile phone usage. Questions were asked based on the questionnaire results to clarify and confirm the qualitative findings. Interviews were held via Zoom for 30–45 minutes for each participant. A phenomenological method was utilized for this study to explore factors that influence students' engagement with mobile learning. The data was collected through verbatim transcriptions of individual interviews. These interviews were video and audio recorded, and students were encouraged to articulate their perspectives. The data collected from interviews was used to corroborate the information gathered from participants and support the identified themes.

3.3 Qualitative data analysis

To analyze semi-structured interviews, content analysis is conducted using both inductive and deductive methods. In order for researchers to use inductive reasoning to respond to the second research question, content analysis includes an abstraction process and grouping of material (Kyngäs) [60]. A codebook was used to identify themes and subthemes related to these factors, as shown in Table 7.

Table 7. Themes and subthemes of engagement factors

Themes	Sub-Themes	Codes
Factors related to instructors	Instructor' presence Instructor's teaching strategies and teaching styles	Flexible, interactive, self-confident, supportive. Focusing on the information quality rather than the quantity. Diversity of teaching methods, Teaching styles, active learning.
Factors related to students	Student commitments Learner technical skills Social, behavioral personality	Effort, dedication. Technical skill, dealing with mobile applications. Readiness, motivation, cooperation with colleagues.
Mobile social Interaction	Communication Social interaction Cooperation	Communication between learners with each other, communication between learners and the instructor, helping classmates, respect. Group activities. Instructor support
Instructional content and activities	Interactive and diverse learning content Use of multimedia	Interactive videos. Mimi videos, images, gamification
Technical Support	Portability and Internet access Usability of mobile devices	The speed and quality of the Internet. Modern electronic devices, sufficient storage

3.4 Trustworthiness

Following the transcription of the interviews, the researchers sent the transcripts to the participants for member checking. They requested confirmation from the participants regarding the accuracy of the content. Additionally, participants were asked to provide notes, make revisions, and include any additional information in the transcripts. It is important to note that no modifications or amendments were made to the original statements. Once the final themes were formulated, two professors specializing in educational technology were invited to analyze 10% of the transcriptions. They used the merged themes as a basis for assessing the accuracy of the transcriptions.

4 RESULTS

Students' engagement levels while using mobile learning were assessed by computing the means and standard deviations for four dimensions: emotional engagement, cognitive engagement, social engagement, and behavioral engagement. A one-sample t-test was performed to determine the statistical significance of the variation in each dimension with a very high level of engagement, as shown in Table 8.

Table 8. One sample test of level of engagement of four-dimensions and the high mean

Dimensions	M	t	Test Value = 4.20			Cohen's D
			Df	p	MD	
Behavioral engagement	4.054	−1.622	36	.113	−.145	0.26
Cognitive engagement	4.243	.352	36	.727	.043	0.05
Emotional engagement	3.752	−3.729	36	.001	−.691	0.86
Social engagement	4.018	−1.685	36	.101	−.181	0.27
Total	4.021	−2.198	36	.034	−.188	0.36

As shown in Table 8, a sample t-test was performed to examine whether the mean score for total engagement (M = 4.021) is statistically significant compared to the predetermined value of 4.20 (indicating a very high level). Results showed that the two means were statistically different (t = −2.198, p = 0.034) with a small effect size of 0.36. Accordingly, students were highly engaged while using mobile learning. For each dimension of engagement, the findings indicated that students were emotionally engaged, with mean scores for the emotional dimension (M = 3.75). There was a statistically significant difference (t = −3.729, p = .001) with an effect size of .86, which is considered large. There was no statistically significant difference for other dimensions of engagement.

4.1 Factors influencing student engagement while using mobile learning

Mean and standard deviation were calculated to explore factors affecting students' engagement while using mobile learning. These results are shown in Table 9.

Table 9. Factors influencing students' mobile learning engagement score means (N = 37)

Dimension	Mean	SD
Factors related to teachers	4.32	.56
Factors related to students	4.04	.54
Mobile social interaction	4.19	.63
Instructional content	4.24	.51
Technical environment	4.26	.59
Total	4.21	.47

As shown in Table 9, the mean total scores indicate the factors that influence learners' engagement while using mobile learning, according to Daher's

framework (M = 4.21). Correspondingly, students' engagement while using mobile learning was found to be influenced at a very high level.

Moreover, Table 9 shows that the influence of the five factors seemed to be very high, with average values ranging from 4.04 to 4.32. In particular, the factors related to teachers and the technical environment, respectively, were rated as M = 4.32 and M = 4.26. Instructional content was reported as the highest determining factor (M = 4.24), followed closely by mobile social communication (M = 4.19). The least determining factor was found to be student-related factors (M = 4.04).

To determine the weightage of these factors on a student's engagement, a multiple regression analysis is conducted, as shown in Table 10.

Table 10. Predicting factors of student's mobile engagement

Model	R	R	Adj R^2	SEE
1	.806[a]	.650	.594	.33292

Predictors: (Constant), technical skills, student, teacher, communication, content

The predicted model has an accuracy of 65.0% in describing the variation in the data, as indicated by the R-squared value. Therefore, it can be said that the model is moderately effective in capturing the variation in the dependent variable.

Standardized beta coefficients can be used to assess the impact of individual factors within the model. The "t" and "p" values approximate the impact of each predictor variable. Among the variables, teacher-related factors demonstrate the highest beta value of 0.615 with a p-value less than 0.05. However, variables such as "student-related factors, content design, mobile social interaction, "and technical support" are deemed insignificant because their p-values exceed 0.05.

For the qualitative part of this study, both inductive and deductive content analyses was conducted. Five themes emerged from the data, which are as follows.

Teacher-related factors: The participants mentioned above preferred having the teacher present while using their mobile devices. Teacher presence motivates students to be engaged while using mobile learning. Participants identified efficient strategies that facilitate their learning and align with their preferences and characteristics. Students mentioned that the utilization of digital tools on mobile devices, which introduced new approaches to learning and teaching strategies, has consistently motivated them to stay focused during class. Furthermore, a student explained this as follows: "Few lecturers utilize engaging mobile applications such as Padlet and Canva." I enjoyed learning with these applications; they have interactive features that are different from traditional learning. Padlet stimulates my thinking because the teacher utilizes brainstorming and collaborative strategies.

Student-related factors: It seems that one of the main factors related to students' engagement is their personality and social behavior traits. The participants reported, "I am an extroverted person and enjoy socializing with my classmates." "I found mobile learning to be a good fit for my personality." Another student added, "I started learning from others by using mobile learning." Students who used mobile devices while learning attended almost every lecture, submitted their assignments, and interacted with their classmates. A student commented, "I put a lot of effort into learning while using my mobile. I tried not to skip any classes, and it was so much fun." The presence of technical skills is crucial when using mobile learning. A student stressed, "I was able to use my mobile device with ease and stay engaged during my class because of my good technical skills. These skills supported my learning and

allowed me to solve technical issues such as downloading materials and sharing them with my classmates."

Mobile social interaction: Students discussed how their social communication, interaction, and cooperation influenced their engagement. When using a mobile device, students mostly interact with their peers and instructors, which enhances their engagement.

When students socialize and communicate with their peers using social forums in mobile applications that are integrated with Moodle, it enhances their engagement in tasks. Students commented, "While using m-learning, we leave comments, communicate with each other, and comment on a peer's post on Padlet. This helped us understand that we weren't alone in the class and allowed us to stay involved." A student said, "My interaction with the instructor and classmates keeps me engaged." A student said that one of his classmates became his close friend after discussing and sharing ideas, which motivated him to use his mobile device. Mobile social interaction encourages social connection and facilitates communication, thus encouraging students to stay engaged while they are learning. As students use their mobile devices, they are able to cooperate more with their classmates by exchanging information and acquiring knowledge, which helps them stay engaged. A student said, "We were always cooperating with each other by sharing information on how to solve technical problems and exchanging thoughts and ideas. This kept me engaged."

Instructional content and activities: Mobile devices feature multimedia content that affects participants' engagement. Participants who were interviewed used mobile devices to watch instructional videos in different places and at their own pace. A student mentioned, "Mobile learning encourages me to participate because I was able to communicate with my classmates and with the teacher. It provides a suitable learning environment that doesn't have many distractions to divert my attention." "Communication with mobile learning is characterized by the fact that there is no specific place and time, which helps me to collaborate and develop social interaction skills." Mobile learning, with its interactive content and diversified activities, boosts students' engagement. A student reported, "The interactive elements presented in the mobile content stimulate my thinking and make my learning experience fun."

Technical support: Three subthemes emerged that influenced the participants' positive attitudes. Students were able to access instructional content, watch videos on mobile learning management systems, and stay connected with their teachers and classmates. Many participants stressed that watching short videos and interacting with their classmates was much easier when using their mobile devices, as it allowed them to do so without any limitations of location or time. All the participants stated that they were able to access a mobile application to download and upload images and videos that were posted by their instructor. A student expressed her opinion in the following way: "I enjoyed using my mobile phone in class to watch videos. It was much easier than carrying my heavy laptop."

Usability of mobile devices: Using mobile devices had a positive impact on participants' engagement. Most participants were engaged when they were able to easily download applications from the app store. A student said, "Yes, it is a great idea to use mobile devices to access class activities." I can run it without any hassle. The app on my phone works anywhere and at any time; I just need to press the power button. Results for the technical features of mobile devices reveal the following subthemes: portability and Internet access, and usability of mobile devices.

5 DISCUSSION

The findings related to RQ1 pertain to whether there was a statistically significant difference in the total engagement scores and their dimensions. The emotional engagement of students who use mobile learning and total engagement scores were found to be statistically significant. Consequently, it seems that m-learning positively impacts students' engagement by allowing them to complete specific mobile activities using various applications, such as the Moodle mobile application. Results of previous studies have shown that mobile learning affects engagement [36], [38]. Moreover, many studies examining student engagement in higher education also support these results [61], [63].

For emotional engagement, it can be explained that students experience feelings of joy and excitement while using m-learning because it caters to their needs and learning styles through the Moodle mobile application.

Moreover, as m-learning was enhanced with various interactive mobile activities, students may have found enjoyment in using the Moodle mobile application along with other elements that were incorporated into their courses. This illustrates that the majority of students felt comfortable, relaxed, confident, and motivated while using m-learning during their lectures. The nature of the activities focused on multimedia elements such as mini videos, interactive videos, and educational games. This finding is confirmed by Lackmann et al. [64], who illustrated that emotional engagement can be influenced by the visual characteristics of multimedia learning materials. Moreover, it seems that the inclusion of m-learning elements and activities in this course enables students to share their opinions and provides them with opportunities to choose their study settings and learning preferences that best suit their needs. This, in turn, boosts their confidence and motivation throughout the course. This study reinforces previous findings that indicate a student's voice while using m-learning has emotional implications for motivation and confidence [41]. In line with this finding, the study [39] asserts that m-learning applications have an impact on students' emotional engagement. These applications are user-friendly and support interactive learning environments, which help to foster positive emotions during the learning process. This finding is consistent with the study conducted by Moya et al. [65], who observed that students expressed excitement and happiness when using mobile devices to access the Moodle application in a college course. It seems from these results that students are excited and happy to use mobile learning, as was found [66]. Students are comfortable using m-learning and enjoy it. As such, m-learning increases students' desire to be involved while they are learning [34]. Hewson [35] reports that emotional engagement is a prerequisite for other dimensions of engagement. Positive emotions, such as excitement and motivation, in a learning environment can stimulate and enhance students' attention, cognition, actions, and the development of social relationships.

The findings related to RQ2, "What are the influencing factors of students' engagement while utilizing mobile learning?" It has been found that the overall mean score of factors influencing learners' engagement while using mobile learning is very high. This indicates that certain factors have an impact on students' engagement in mobile learning. This is consistent with previous findings of [40], [43]. These findings show that learners' engagement in mobile learning is influenced by several factors that enhance students' motivation, learning outcomes, personalization, and interactivity with their mobile devices.

Quantitative results showed that factors related to teachers and the technical environment were ranked first and second among the results. This aligns with a

study conducted by [40] that found the most crucial factors affecting student engagement in online learning are teacher characteristics. This result complements qualitative findings. Teacher-related factors were found to be the highest-ranked major theme among other themes. This could be explained by teachers offering support and focusing on the quality of the instructional material. They achieve this by using diverse and personalized resources for each activity and teaching strategy, which helps to keep students engaged. Another explanation is that as teachers implement effective teaching methods with various teaching styles, they can engage students by incorporating mobile learning. These findings align with studies conducted by researchers [5], [49], [52], [53] who explored the factors related to pedagogical practices. They found that the implementation of gamification elements, interactive exercises, and collaborative learning activities provides positive learning experiences and motivates students to stay engaged.

It seems that by incorporating strategies and features that promote engagement, teachers can create a dynamic mobile learning environment that supports students in their learning process and improves it.

Moreover, quantitative research revealed that technical factors influence engagement in mobile learning. This aligns with the findings of researchers [54], who have shown that mobile learning engagement is influenced by various technical factors. These factors include device usability and functionality, connectivity and network reliability, user-friendly interfaces, compatibility with different mobile devices and operating systems, and access to relevant mobile applications and tools.

Furthermore, qualitative results indicate that factors such as student-related factors, mobile social design factors, and content design also impact mobile learning engagement. This complements the quantitative data by placing more emphasis on the factors related to students and social interaction, as previous studies have shown [49], [51], [53], [67].

This study's findings contribute to the existing knowledge by uncovering the factors that influence learning engagement while using mobile learning, which is an under-researched field.

Recognizing how students engage and the factors that influence their engagement, as studied here, will help shape and enhance the level of engagement, especially within the context of higher education institutions, and improve their learning experience.

6   CONCLUSION AND FUTURE WORK

According to the results, it seems that mobile learning has the potential to revolutionize education by serving as a pathway to an improved approach to learning that enhances student engagement. Based on the findings of this study, mobile learning appears to emotionally engage students. Mobile learning interactive content stimulates students' positive emotions and makes them feel enjoyable, motivated, happy, and excited. Students who use mobile learning feel satisfied with this type of learning and are more engaged. Furthermore, many factors were found to influence mobile learning engagement, such as teacher-related factors and technical factors, students' related factors, social mobile interaction, and content design [68].

Understanding and addressing these student-engagement factors in mobile learning should be given priority by policymakers and teachers. This focus can help educators design interactive and effective content that optimizes learning outcomes, creates effective social environments that promote student engagement, and

enhances professional development. The teacher is held accountable for creating effective content and managing this type of learning [69].

One of the main limitations of this study is its generalizability. The participants surveyed were exclusively sourced from two departments within one university. To broaden the scope, we recommend that future research include individuals from various disciplines, universities, academic institutions, students, and industry professionals. Additionally, our study focused solely on the factors and the correlation between these factors that influence mobile learning engagement. For further investigation, it would be advantageous to explore other dimensions of engagement, including motivational engagement.

Experimental studies should be carried out with students from diverse specialties. Furthermore, it is important to investigate faculty perspectives on these factors in order to complement students' perspectives.

In future research, the scope of investigating factors influencing student engagement in mobile learning could be expanded through experimental studies that manipulate engagement factors, compare the perspectives of students and faculty, analyze changes over time, test interventions, explore cultural aspects, and utilize learning analytics. The purpose behind these is to develop more robust theoretical and predictive models of mobile learning engagement, improve generalizability, examine causal relationships, and inform the design of optimized and personalized mobile learning environments that effectively enhance student outcomes.

7   ACKNOWLEDGMENT

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