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State of the Art of Mobile Learning in Jordanian Higher Education: An Empirical Study

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Abstract: A new approach to learning is mobile learning (m-learning), which makes use of special features of mobile devices in the education sector. M-learning is becoming increasingly common in higher education institutions all around the world. The use of mobile devices for education and learning has also gained popularity in Jordan. Unlike studies about Jordan, there are many studies that thoroughly analyze the situation of m-learning in other countries. Thus, it is important to understand the current situation of m-learning at Jordanian universities, especially in light of the COVID-19 pandemic. While there have been some studies conducted prior to COVID-19 and a few studies after COVID-19, there is a need for a comprehensive study that provides an in-depth exploration of the current situation, student adoption, benefits, disadvantages, and challenges, particularly following COVID-19. Therefore, this study utilizes a sequential exploratory mixed research method to investigate the current state of the art of m-learning in Jordanian higher education with a particular focus on student adoption, benefits, disadvantages, and challenges. Firstly, the study explores the existing literature on m-learning and conducts 15 interviews with educators and learners in three Jordanian universities to gain insights into their experiences with m-learning. The study then distributes a survey to students at four Jordanian universities, representing both public and private universities, to generalize the results from the qualitative study. Additionally, the study investigates the relationship between student enrollment in public/private universities and the adoption of m-learning. The study came to the conclusion that students have a positive opinion of m-learning and are also willing to use it. However, there are a number of disadvantages and challenges to its adoption. Additionally, there is a relationship between student enrolment in public/private universities and the adoption of m-learning. These findings have important implications for institutions that want to incorporate m-learning into their undergraduate and graduate degree programs, as they aid decision-makers in these universities in creating frameworks that may be able to meet the needs of m-learning.

Keywords: educational mobile applications; mobile learning; Jordanian higher education; perceptions; adoption

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1. Introduction

The use of mobile devices has increased significantly throughout the last ten years, such that 95% of people on Earth live in places with access to mobile networks [1]. According to the predicted number of mobile devices worldwide, there are currently 15.96 billion mobile devices in use worldwide, and by 2025, that number is estimated to rise to 18.22 billion [2]. By 2027, there will be 7.7 billion smartphone subscriptions, increasing from the 6.23 billion thought to be in use in 2021 [3].

Smartphones that can access the internet and execute applications are the most popular form of mobile devices, according to [4] and in this study. Lebanon had the highest rate of smartphone usage, with 86%, followed by Jordan with 85%.

A growing number of services are occasionally accessible through mobile devices. It is crucial to keep in mind that mobile devices, especially mobile phones, have become a dependable solution to many challenges appearing in daily life, such as learning and education wherever and at any time [5]. Therefore, mobile devices are now becoming an essential tool in higher education, giving both students and lecturers easy access to effective instructional materials and a means of interacting with one another. Mobile devices have proven to be useful in education, enabling students to learn in a more interactive and interesting way, in addition to serving as key communication tools. The primary features that promote the growth of mobile device usage are portability and wireless connectivity, where users can communicate while traveling because of these characteristics [6]. Mobile phones are regarded as practical and affordable teaching instruments in the context of education due to the fact that they are more affordable than desktop or laptop computers. [7]. Additionally, recent research shows that m-learning has the potential to be used for enhancing student learning in higher education environments [8,9].

In the last few years, m-learning has transformed from a theoretical idea to a genuine enhancement that supports the teaching and learning environment [10]. The concept of m-learning in the context of education and learning is defined as utilizing small mobile devices, such as smartphones, PDAs, iPods, and tablets as flexible tools for learning [11]. Thus, the term refers to an approach to teaching and learning that makes use of portable electronic devices [12]. M-learning maybe viewed as either a new e-learning platform or the logical extension of e-learning with stronger customized processes [13,14]. Various studies have reviewed the topic of m-learning; most of them highlighted the new issues and trends of m-learning in a certain context, domain, and time period. Chiu-Lin [15] identified that while the area of m-learning research has demonstrated consistent development, upcoming studies require more attention to the benefits of m-learning instead of studies that compare m-learning to other traditional learning methods.

1.1. Purpose and Motivation of the Study

The pace of technology adoption in Jordan's higher education institutions has been persistent, and there have been a number of cases in the literature where mobile devices have been used in the teaching process. Most studies on m-learning now use mixed research methods, as stated in [14]. On the other hand, [15] explored the top six major educational technology-based learning journals to investigate trends in m-learning research and observed that, from January 2010 to December 2015, most researchers utilized the quantitative approach for evaluating how effective m-learning is. In some ways, statistical analyses are attempts to model phenomena that occur in the real world; however, no statistical model is perfect, and it must be inaccurate in some way because models can be faulty for a variety of reasons, including false assumptions, poor specification, and poor model-building techniques [16]. Since most studies on m-learning in Jordan follow the quantitative approach through which they test a model, there is a growing demand for exploratory research on the current state of m-learning in Jordanian higher education that investigates lecturers' and students 'understandings of m-learning [17,18].

Additionally, numerous exploratory studies that look into the situation, adoption, disadvantages, benefits, and challenges of m-learning in other countries can be found in the literature. However, there is a scarcity of studies of this kind that are conducted in Jordan. Therefore, this study provides a thorough examination of the usage of m-learning in Jordanian higher education with an emphasis on the benefits, drawbacks, and challenges that Jordanian students face while implementing m-learning. The study also focuses on investigating whether student enrolment in public/private universities influences how students accept and adopt m-learning, besides defining the necessary requirements for m-learning adoption in Jordanian higher education.

Since m-learning is an educational technology that includes both educators and learners in its implementation, the study focused on how both learners and educators perceive the utilization of such technology in the qualitative phase of this study. To generalize the

findings with respect to learners' perspectives, the quantitative phase was completed. A later study will generalize the findings from the qualitative phase regarding the opinions of educators.

1.2. Research Questions

The main research question that established the base for this study was:
What is the current situation of m-learning in Jordanian higher education?
This primary question is divided into a number of sub-questions:

1. What are the Jordanian learners' and educators' perceptions of m-learning?
2. What are the benefits of implementing m-learning in Jordanian higher education institutions?
3. What disadvantages and challenges do Jordanian higher education students encounter while implementing m-learning?
4. What are the requirements for adopting m-learning in Jordanian higher education?

Regarding the first four sub-questions, the following question was asked:
Can the results derived in the previous sub-questions be generalized to the study population?

5. Is there any relationship between student enrollment in public/private universities and the adoption of m-learning?

The rest of the paper is structured as follows:
Section 2 presents a background on m-learning in higher education and m-learning in Jordanian higher education institutions. The research methodology is provided in Section 3. Section 4, Section 5, Section 6, and Section 7 present the results, the discussion of the results, the conclusion and future work, and the study limitations, respectively.

2. M-Learning in Higher Education: Use and Implementation

The utilization of educational technologies and m-learning has reshaped higher education, making it more accessible, effective, and interesting for students. Educational technologies seek to improve and simplify the learning and teaching processes by making good use of the appropriate technical resources. Learning management systems (LMS), tablets, smart boards, intelligent tutoring systems (ITSs), blogs, social networks, and forums, among many other technologies, are recently employed by higher education institutions to assist in the learning process [10].

M-learning is critical to the process of teaching and learning at universities all over the world [19], as teaching and learning are greatly affected by m-learning [20]. Over the past ten years, there have been numerous reviews of m-learning; each article provided crucial details that helped researchers better understand how mobile devices are used in educational settings [21].

Basak et al. [22] examined the literature that has already defined the terminology, perspectives, advantages and drawbacks, and comparisons between electronic learning (e-learning), digital learning (d-learning), and m-learning; the study demonstrated that digital learning is the umbrella under which m-learning and e-learning fall.

To study the challenges of utilizing m-learning in higher education, [23] used first-year undergraduate students to examine the impact and challenges of using iPads in math classes. This study was conducted at the American University of Sharjah (AUS) in the United Arab Emirates (UAE). Moreover, [24] explored the impact of using mobile phones for educational purposes as well as the issues and challenges related to adopting m-learning in higher education in Iran. Furthermore, a study by [25] investigated the challenges of adopting m-learning in Kuwait's higher education institutions and demonstrated that both students and lecturers have full awareness of m-learning and its applications. Their findings showed that both learners and educators had optimistic views of m-learning. In the United Arab Emirates (UAE), also [26], investigated the opportunities and challenges of m-Learning that university students face and concluded that there is a great deal of benefits for students through using mobile devices and that, according to the students' opinions,

the benefits outweighed the challenges. These studies provided thorough investigations of the benefits and challenges.

Jordanian universities are not an exception; they are also utilizing m-learning to improve learning and educational environments resulting from the highly advanced communication and information technologies that have made their way into the country [27].

Before the revolution in using m-learning, according to the COVID-19 pandemic, many researchers looked into the challenges and factors that affect its use. Althunibat [5] explored the variables affecting the intentions of learners in Jordanian universities to adopt m-learning. The "Unified Theory of Acceptance and Use of Technology," (UTAUT), the "Theory of Reasoned Action," (TRA), and the "Technology Acceptance Model" (TAM) are all examined in this study. The researchers used a survey that was conducted among several student groups from various universities and communities. Approximately 250 respondents' responses to the survey questions were used to gather the necessary information. Their results showed that the proposed m-learning model regarding the perceived usefulness and ease of use is comprehensive. However, this research did not look at other factors that may affect students' intentions to use m-learning and did not explore any disadvantages or challenges.

Moreover, ref. [28] looked at Jordanian students' needs and preferences for m-learning design and students' concerns about using m-learning to investigate the aspects that impact students' readiness and intentions to use m-learning in Jordanian higher education. The results show that a number of issues, such as complexity, social influence, relative advantage, user satisfaction, and the personality of learning, have an effect on students' plans to utilize m-learning. Still, there are many other technical, social, administrative, or economic aspects that may influence students' intentions to use m-learning that are not investigated, and this study did not investigate the existence of more challenges or drawbacks.

Furthermore, ref. [29] tried to determine whether quality factors, such as service quality, system quality, and information quality, as well as individual opinions, such as how useful and easy it is to use, are the causal factors to Jordanian students' plans to employ m-learning and to their satisfaction, which leads to enhanced use of m-learning. Consequently, the authors integrated the updated DeLone and McLean's model (DL and ML) with the technology acceptance model (TAM). They distributed 400 questionnaires, and the findings demonstrated that quality factors had a substantial impact on both learners' intentions to use m-learning and learners' satisfaction. In addition, they concluded that perceived usefulness significantly affects this intention, and both satisfaction and intention to use significantly impact utilizing m-learning. This study focused on the quality perspective, and it ignored other perspectives such as social, economic, pedagogical, and administrative perspectives.

Moreover, these studies were conducted prior to the COVID-19 pandemic and worldwide lockdown, which made using e-learning compulsory rather than an option. As a result, e-learning is now required, and options include m-learning or desktop and computer learning. Many studies were conducted during and after the pandemic. For example, [30] investigated students' feelings about m-learning platforms in order to specify the key elements that affect how often students use them. The data was collected using an online quantitative survey, and the findings showed that quality of service and content had a key impact on how useful learners thought m-learning platforms were. Additionally, behavioral intentions to utilize m-learning platforms were meaningfully affected by perceived usefulness and ease of use. Again, the main focus of this study was on the quality perspective, and it ignores other perspectives and challenges.

Furthermore, [31] found that the genuine use of m-learning applications was important and positively affected by factors related to awareness, technology, experience, and training. Additionally, according to [32], through the mediation of student satisfaction, functional, design-quality, and usability factors positively affect the actual use of mobile learning systems. Thus, the focus again was on the quality and technological perspectives.

Additionally, [32] findings also suggested that institutional policy, change management, and support from top management have a positive impact on how frequently m-learning systems are really used, which is an addition that focuses on the administrative perspective.

The COVID-19 pandemic has revolutionized the state of m-learning in Jordan's higher education. Although previous studies added information to the literature and studies similar to [33] investigated the use of m-learning for teaching, we believe that m-learning requires additional research because it has not yet been thoroughly explored in Jordanian universities. The purpose of this paper is to fill this gap in previous research.

3. Methodology

This study used a sequential exploratory mixed method design, which entails gathering and analyzing qualitative data in the first phase, followed by quantitative data in the second phase, in two distinct periods, as shown in Figure 1. Thus, the study intends to fill a research gap and obtain a comprehensive picture of the current state of m-learning. This is conducted by interviewing students and lecturers in the first phase to ask about the primary elements that influence (positively/negatively) the utilization of m-learning. The interview transcripts are then analyzed, and the results are used to develop a questionnaire to be used in the second phase. Then, a sample of the population is given this questionnaire. The rationale for developing a questionnaire is to see if the qualitative results can be generalized to the whole population. There is no doubt that different methods of inquiry have the potential to give fruitful results, and it is anticipated that other scholars may follow up on that. By utilizing many sources and methods at various stages of the research, it is feasible to capitalize on the benefits of each type of data collection while minimizing the limitations of any strategy [34,35], enhancing data quality and reliability [36–40].

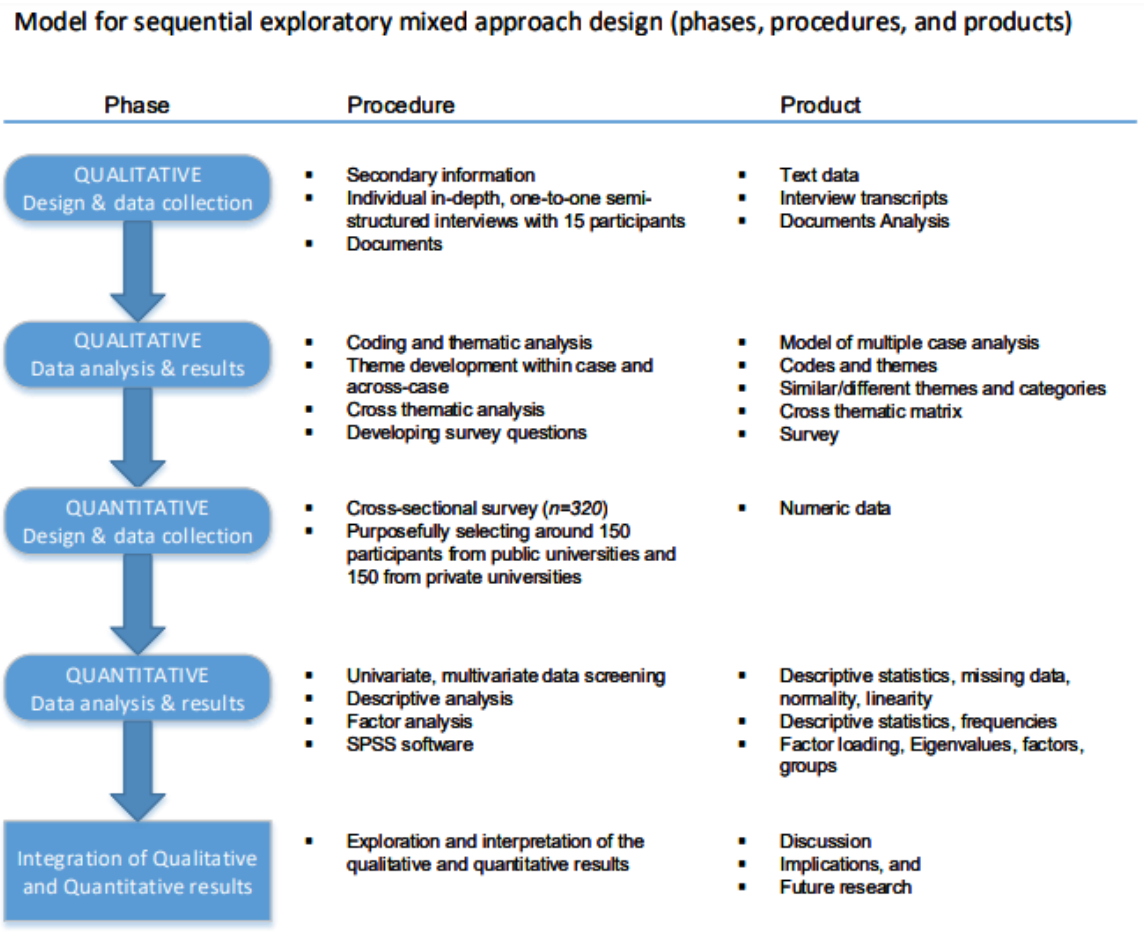

Figure 1. Model for sequential exploratory mixed approach design procedure and products.

3.1. First Phase: Qualitative Phase

The goal of the qualitative phase is to obtain a comprehensive understanding of the current state of m-learning to answer the research questions. In this phase, secondary information and a multiple case study technique [41–43] were used. Document analysis and semi-structured interviews were the data collection instruments utilized during the qualitative phase. Thus, various sources are employed, these are: Primary factors are determined by analyzing the relevant literature, and interview questions are developed to look into m-learning-related issues in the Jordanian higher education. Therefore, conducting qualitative research may assist in determining the focus of the data collection, where the researchers are more interested in understanding behavior with reference to m-learning than they are in testing hypotheses.

The validity of the interviews was confirmed by presenting it to (3) reviewers with expertise and specialization from Philadelphia University, Al Ahliyya Amman University, and the University of Petra. The interview's consistency was checked by role-playing with two individuals from the sample to assess the clarity of the questions and their lack of ambiguity, as well as the time that is required for the interview, which is found to be 40 min. In addition, the questions were found to be clear to the respondents. Then, the interviews were conducted during the period (25 October to 10 November 2022). Respondents were interviewed in acceptable locations, such as their offices and on university campuses and gave permission to record the data. Thus, the data is collected through reliable interaction with stakeholders.

Then, fifteen semi-structured, in-depth one-on-one interviews at three universities were conducted (Philadelphia University in the northern governorate, Al-Ahliyya Amman University in the middle governorate (both Philadelphia University and Al-Ahliyya Amman University are private universities), and the University of Jordan in the capital city). Five participants (two lecturers and three undergraduate students) from each university offer richness and depth to the case description; the interview questions are based on information from literature analysis. The interviews were conducted in order to determine benefits, drawbacks, challenges, and requirements that are not found in the literature or found in the literature about m-learning in countries other than Jordan. Twelve transcripts were then produced from the recordings of the interviews (three interviews were excluded). Later, thematic analysis was employed for coding the data in these transcripts. Researchers wrote, filtered, cleansed, and documented notes on each interview immediately following the interview. The information from the interview transcripts is interpreted after the transcripts have been analyzed.

The researchers selected higher education lecturers from different disciplines who have at least two years of teaching experience and who taught both online and in classroom. The researchers ensured that all interviewees had mobile devices, were able to access the internet, were able to download mobile applications, and used their mobile devices for educational purposes. Only two lecturers and one student were excluded because they were using their devices only for phone calls and messaging.

3.2. Second Phase (Quantitative Phase)

After getting the results of the qualitative phase, the second phase (quantitative) was started, during which a questionnaire was developed. The objective of developing a questionnaire was to find out if the qualitative results can be used to generalize the findings of this research for the whole population. In other words, the results of the qualitative phase were used to build the questionnaire. Additionally, some content in the questionnaire was built based on the literature about other countries, which was not found in the literature about Jordan. A closed-ended questionnaire was developed and sent to the undergraduate students at four Jordanian universities (public and private) in various faculties and departments. Students' perceptions were measured using a 6-point Likert scale, from strongly disagree to strongly agree. Higher scores showed more optimistic views on m-learning. By providing students access to the questionnaire online, all the

data was collected. The questionnaire consists of 52 questions derived from various earlier studies and based on the findings of semi-structured interviews. Based on the four themes that were identified during the qualitative stage, the questionnaire was divided into four sections. A section was established for demographic information; another was for students' views regarding utilizing m-learning; and a third for the primary benefits, disadvantages, and challenges associated with utilizing m-learning. A pilot test with fifteen respondents from the three universities indicated that the questionnaire required no modifications.

To discover the participants' unprompted responses and to prevent the bias that can result from recommending answers to the participants, we provided the option "other" for most questions.

Population and Sample

In this study, the population of interest is all students enrolled in Jordanian universities who use m-learning. However, since it may not be feasible or practical to survey the entire population, a sample of 320 students was selected from the four previously mentioned universities.

It is worth noting that 12 incomplete responses were excluded from the study, leaving a total of 308 complete responses. The response rate of the survey was very high at 0.963, indicating a high level of participation among the sampled students.

Furthermore, the Cronbach's alpha value of 0.891 suggests that the survey is reliable, indicating that the questions were consistently measuring what they were intended to measure.

The sample size of 320 is considered acceptable for an exploratory study, as it allows for a good representation of the population while remaining manageable for the researchers. Additionally, the participants were selected from different faculties in the four universities, which may increase the generalizability of the findings to the entire population of Jordanian university students who use m-learning.

4. Results

4.1. Qualitative Results

The key themes from the qualitative phase were benefits, drawbacks, challenges, and prerequisites for adopting m-learning in Jordanian higher education institutions.

4.1.1. Benefits of M-Learning

M-learning has the ability to improve students' motivation to learn in several ways. It gives students the opportunity to access learning resources anywhere and anytime. This helps in increasing students' engagement with learning content where students can access e-books, educational applications, videos, and other materials according to their preferences. For example, this type of interactive collaborative learning may help students to get rid of the feeling that they are disconnected from their colleagues and lecturers, which results in motivating them to engage more in the learning process and helps them to complete both classwork as well as homework. Additionally, m-learning helps in providing students with opportunities for collaborative learning, which facilitates group work and collaboration through different applications and forums. This collaboration helps motivate students to engage in the learning process. Furthermore, the real-time assessments and feedback on students' learning progress help increase students' motivation to continue working and keep learning.

The availability of courses on multiple devices and the availability of information anytime and anywhere is another benefit that was mentioned. Thus, the portability of mobile devices is also considered because students' can carry their mobile devices and they can bring them to class.

The accessibility of mobile devices as an educational tool is one of its key mentioned benefits. They enable students to access learning tools and resources from anyplace at any time through their mobile devices. For students who might not have access to traditional

educational materials, such as textbooks or libraries, this is particularly crucial. Mobile devices offer a way to bridge this knowledge gap, enabling students to get the knowledge they require to succeed.

Interactive learning, through enhancing interactions between learners and educators, reduces communication barriers and improves communication between lecturers and students using the student's preferred channels. In other words, students can interact with each other and with the lecturer without having to be in the same place at the same time, which helps to avoid failures in the learning process due to delayed communication. Additionally, these interactions enable knowledge sharing between students and lecturers as well as between students and lecturers themselves. Students may have access to a variety of educational apps and software through the use of mobile devices, which can improve the learning process. These applications can be used for designing interactive lessons, offering personalized learning experiences, facilitating communications between all stakeholders, and monitoring student progress.

As well, collaborative, innovative, blended, and independent learning is a key benefit. M-learning is distinguished by the incorporation of elements of innovation and excitement into the learning process via the rejuvenation produced by students' usage of digital devices in learning. Moreover, blended learning can be achieved by combining m-learning and traditional learning. Thus, giving students access to more resources via mobile devices develops their independence and improves their ability to collaborate and submit their work on time, especially when combined with other learning models such as project-based learning.

Supporting students with learning difficulties was also mentioned by a number of lecturers. This is achieved through its ability to take into account the individual characteristics of learners, m-learning overcomes many challenges associated with students who have learning difficulties, and it does not require the direct integration imposed by traditional education. Lecturers think that the least fortunate group of students are those with learning difficulties. From their experience, allowing students to use mobile devices during class projects makes it possible for this group of students to find material quickly and efficiently, and the use of some applications can assist in compensating for any skills gaps they may have.

Meeting deadlines and submitting work on time is an additional mentioned benefit where m-learning helps students meet deadlines and submit their work on time. As with using their mobile devices, students have full access to assignments and course materials and can meet deadlines by working whenever and wherever it is convenient to them. Moreover, using educational applications helps remind students of their deadlines by using notifications about approaching deadlines. Those students who struggle with time management can benefit from such features. Additionally, having assignments and projects on students' mobile devices helps them make the most of their time by working anytime and anywhere, for example, while waiting for an appointment.

Overall, by giving them more flexibility, reminders and notifications, and the ability to work on projects whenever and wherever they want, mobile learning can assist students in meeting deadlines and submitting their work on time.

4.1.2. Disadvantages of M-Learning

Many disadvantages were mentioned by interviewees; the most important disadvantages that were mentioned by most of them were electronic cheating, health problems, mental and social issues, and the availability of education.

The occurrence of electronic and group cheating, whose techniques have changed and advanced, is a major disadvantage of m-learning. Thus, exams have become a major burden for universities, where new policies are adopted to protect staff and students and hundreds of cases of electronic cheating are discovered each year, reducing the reliability of exam results. Almost all the interviewed lecturers reported this challenge. Moreover, two

students were complaining that they started to depend on cheating instead of studying for exams and quizzes.

All lecturers and students also expressed concerns about the amount of time students spend in front of screens, which results in health problems. Additionally, mental and social issues were mentioned, where people with autism may experience issues due to a lack of social interaction. Many lecturers reported that the use of mobile devices may motivate autistic behavior due to the lack of social interaction.

Finally, not providing the educational service to students who lack the necessary technology is a disadvantage that was mentioned by three lecturers.

4.1.3. Challenges of M-Learning

Challenges as shown in Table 1 include social challenges (social distraction), cultural challenges, pedagogical challenges, technological challenges, mental challenges, and administrative challenges.

Table 1. Qualitative Results: Benefits, drawbacks, challenges, and prerequisites of m-learning.

Benefits	Disadvantages	Challenges	Prerequisites of M-Learning
1. Enhancing students' motivation to learning. 2. Availability of courses on multiple devices. 3. Interactive learning. 4. Collaborative, innovative, blended, and independent learning. 5. Supporting students with learning difficulties. 6. Meeting deadlines and submission on time.	1. Electronic Cheating. 2. Health Problems. 3. Mental and Social Issues. 4. Availability of Education.	1. Technical restrictions. 2. Screen size is a problem. 3. Restricted memory. 4. Network speed. 5. User interface is not user friendly. 6. Health problems. 7. Electronic cheating. 8. Availability of educational services. 9. Social isolation.	1. Administrative and Institutional Requirements. 2. Infrastructural Requirements.

Many social challenges were described by the interviewees, because one of the biggest challenges is to observe students while they are learning. Additionally, there is a potential that students become distracted, lose focus, visiting entertainment websites and social networks, and ignoring the learning process.

Economic challenges were also reported such as concerns about mobile devices cost and the cost of internet service were confirmed by both learners and educators. Furthermore, cultural challenges were mentioned. In other words, a significant aspect is the cultural norms and trends, according to which many members of the community, including parents, think that using such devices for learning is impossible because they could distract students away from their studies. Students reported that the most difficult thing is when it comes to convince parents or other family members that they are studying and not just using the device for fun. Students also added that whenever their parents start to blame them for using their mobile all the time, they start sharing the learning material on their mobile device with them and show them their discussions with the lecturers and with their colleagues. Old style lecturers think that it is impossible that students use their mobile devices for learning without being distracted.

Pedagogical challenges were also a concern, this pedagogical shift towards this kind of student-cantered learning suffers from the lack of sufficient and comprehensible theories and models for this type of learning. If lecturers are not trained on using m-learning style, it can be challenging for them to effectively incorporate it within classroom management tactics. They may struggle with how to manage students' use of mobile devices during class as well as with how to effectively use available platforms.

Technological challenges were reported as it is challenging for educators and parents to keep up with the rapid development of technologies on mobile devices. Moreover, there

are many usability issues because of the applications that were originally developed for desktop computers and then adjusted to fit mobile devices.

Mental challenges were also identified that students may lack the self-control to participate fully in the lessons if they do not believe they are being given the correct instructions. Shifting to virtual, live classes instead of only attending online courses enhances accountability.

Many interviewees highlighted a number of administrative challenges. The universities' administrations do not encourage using m-learning and using mobile devices in classrooms. Moreover, they do not have clear rules and procedures for the use of mobile devices inside classrooms.

4.1.4. Requirements for Adopting M-Learning

Administrative and institutional requirements as well as infrastructural requirements are identified as the main requirements for the adoption of m-learning.

Administrative and institutional requirements imply that the university administration should be convinced of the value of integrating and applying m-learning in the teaching and learning environment, as well as the academic and administrative staff. Hence, educational institutions should establish their own institutional guidelines and approaches for m-learning. Universities should also offer technical assistance and support to both learners and educators so that they can concentrate on their studies and education rather than worrying about technological issues. Last but not least, institutions should promote the idea that learners and educators shouldn't worry about data privacy.

Regarding infrastructural Requirements include the availability of the infrastructure required for mobile education, which take into consideration providing learners and educators with the required wireless mobile devices and technologies used in modern wireless networks. Moreover, the availability of internet connection services, wireless device accessories such as printers, headphones, and chargers are important. Additionally, universities should provide the relevant LMS to enable lecturers to deliver the educational material, to organize and manage the learning content and activities. Moreover, m-learning materials should be specifically designed to be used on mobile devices, with an emphasis on interactive materials that are simple to use on small screens. Additionally, the material should be current, pertinent, and interesting.

4.2. Quantitative Results

To answer the research sub-question: "Can the results derived in the previous sub-questions be generalized to the study population?" the study used an online survey that consists of four sections to gather information. The first section was used to collect information about the participants' age and gender and demographic information. The researchers wanted to ensure that students had mobile devices to use in the classroom in order to study the benefits, drawbacks, and challenges. Therefore, the second section of the questionnaire asks about owning mobile devices and using them to support learning. Questions to determine the advantages, drawbacks, challenges, and requirements for adopting mobile learning made up the third and fourth sections.

As shown in Table 2 which demonstrates the demographics of the research., male respondents composed up 57.8% of the sample (178 male students), compared to female respondents' which was 42.2% of the sample (130). Approximately 74.4% of the respondents were youths (18 to 22 years old). Approximately 89.9% of the 308 respondents were undergraduate students who are doing bachelor's degrees at the universities surveyed, and 10.1% were graduate students who are registered in master's programs in the surveyed universities. A mobile internet-connected device, such as a smartphone or tablet, was owned by all participants (100%). Android (51.8%) is the most popular operating system for these devices, followed by iOS (45.8%) and (2.9%) of respondents weren't sure what operating system their mobile device used. Finally, 99.7% of the respondents said they are able to download mobile applications on their devices. Thus, Table 2 displays the

outcomes of mobile device usage; the results show that students in both private and public universities use their mobile devices for learning in different ways.

Table 2. Demographic and sample information.

		Auni	Puni	Juni	Yuni	Overall
Gender	Male	61 (70.1%)	75 (56.4%)	18 (45.0%)	24 (50.0%)	178 (57.8%)
	Female	26 (29.9%)	58 (43.6%)	22 (55.0%)	24 (50.0%)	130 (42.2%)
	Total	87	133	40	48	308
Age	18–22	72 (82.8%)	80 (60.0%)	33 (82.5%)	44 (91.7%)	229 (74.4%)
	23–27	12 (13.8%)	48 (36.1%)	7 (17.5%)	3 (6.3%)	70 (22.7%)
	28–32	1 (1.1%)	3 (2.3%)	0 (0.0%)	1 (2.1%)	5 (1.6%)
	>32	2 (2.3%)	2 (1.5%)	0 (0.0%)	0 (0.0%)	4 (1.3%)
	Total	87	133	40	48	308
Education	Undergraduate	85 (97.7%)	110 (82.7%)	36 (90.0%)	46 (95.8%)	277 (89.9%)
	Graduate	2 (2.3%)	23 (20.9%)	4 (10.0%)	2 (4.2%)	31 (10.1%)
	Total	87	133	40	48	308
Own smartphone	Yes					308 (100%)
	No					0 (0.0%)
	Total					308
Operating system	Android	26 (29.9%)	76 (57.1%)	23 (57.5%)	33 (68.8%)	158 (51.3%)
	iOS	57 (65.5%)	55 (41.4%)	14 (35.0%)	15 (31.3%)	141 (45.8%)
	Do not know	4 (4.6%)	2 (1.5%)	3 (7.5%)	0 (0.0%)	9 (2.9%)
	Total	87	133	40	48	308
Ability to download apps	Yes	87 (100.0%)	132 (99.2%)	40 (100%)	48 (100%)	307 (99.7%)
	No	0 (0.0%)	1 (0.8%)	0 (0.0%)	0 (0.0%)	1 (0.3%)
	Total	87	133	40	48	308

Table 3 shows the purposes of using mobile devices. Overall, most respondents in both private and public universities (98.6%) thought they use their mobile phones to access social media when asked about the most common tasks they perform on mobile devices. Additionally, 88.6% of respondents said they used their phones for messaging and phone calls for communication. Third-placed (69.8%) respondents thought they use their phones for learning through attending online lectures. Additionally, learning-related tasks, such as studying and reading eBooks, receive high scores. Furthermore, other tasks and playing games were mentioned.

Table 3. Mobile device usage.

	Auni	Puni	PrivateUniv	Juni	Yuni	PublicUni	Overall
Phone calls and messaging	71 (81.6%)	121 (91%)	192 (87%)	38 (95%)	43 (97.7%)	81 (92%)	273 (88.6%)
Social media	78 (89.7%)	117 (88%)	195 (88.6%)	37 (92.5%)	44 (100%)	81 (92%)	276 (98.6%)
Games	51 (58.6%)	72 (54.1%)	123 (55.9%)	21 (52.5%)	21 (47.7%)	42 (47%)	165 (53.6%)
Learning (attending online lectures)	40 (46.0%)	102 (76.7%)	142 (64.5%)	33 (82.5%)	40 (90.9%)	73 (83%)	215 (69.8)
Professional communication	25 (28.7%)	35 (26.3%)	60 (27.3%)	9 (22.5%)	5 (11.4%)	14 (15.9%)	74 (34%)
Studying (reading eBooks)	47 (54.0%)	99 (74.4%)	146 (66.4%)	30 (75%)	37(84.1%)	67 (76.1%)	213 (69.2%)
Reading material added by lecturers	31 (35.6%)	78 (58.6%)	109 (49.5%)	29 (72.5%)	36 (81.8%)	65 (73.9%)	174 (56.5%)
In the lecture	24 (27.6%)	73 (54.9%)	97 (44.1%)	29 (72.5%)	31(70.5%)	60 (68.2%)	157 (51%)

Table 4 demonstrates results from the third section on students' perceptions of m-learning which measures how mobile device use affects the learning process. Overall, the findings indicated that 69.5% of the students wanted lecturers to use mobile devices during class. Approximately 84.1% of the respondents also agreed that it has altered the educational process, which indicates that Jordanian students are positive toward mobile learning. Moreover, regarding the benefits, 82.1% think that m-learning increases student motivation.

Table 4. Students' perception of mobile learning.

Survey Questions	Auni	Puni	PrivateUni	Juni	Yuni	PublicUni	Overall
Do you use a mobile device as a learning tool?							
yes	86 (98.9%)	128 (96.2%)	**214 (97.3%)**	40 (100.0%)	48 (100.0%)	**88 (100.0%)**	**302 (98.1%)**
no	1 (1.1%)	5 (3.8%)	**6 (2.7%)**	0 (0.0%)	0 (0.0%)	**0 (0.0%)**	**6 (1.9%)**
Do you have previous experiences using mobile devices in the classroom?							
yes	72 (82.8%)	121 (91.0%)	**193 (87.7%)**	40 (100.0%)	45 (93.8%)	**85 (96.6%)**	**278 (90.3%)**
no	15 (17.2%)	12 (9.0%)	**27 (12.3%)**	0 (0.0%)	3 (6.3%)	**3 (3.4%)**	**30 (9.7%)**
Do you think that lecturers and students should make use of mobile devices in education?							
yes	59 (67.8%)	81 (60.9%)	**140 (63.6%)**	36 (90.0%)	38 (79.2%)	**74 (84.1%)**	**214 (69.5%)**
no	2 (2.3%)	5 (3.8%)	**7 (3.2%)**	1 (2.5%)	0 (0.0%)	**1 (1.1%)**	**8 (2.6%)**
maybe	26 (29.9%)	47 (35.3%)	**73 (33.2%)**	3 (7.5%)	10 (20.8%)	**13 (14.8%)**	**86 (27.9%)**
Do you think that mobile devices change classrooms?							
yes	64 (73.6%)	83 (62.4%)	**147 (66.8%)**	38 (95.0%)	42 (87.5%)	**80 (90.9%)**	**227 (73.7%)**
no	9 (10.3%)	19 (14.3%)	**28 (12.7%)**	0 (0.0%)	2 (4.2%)	**2 (2.3%)**	**30 (9.7%)**
maybe	14 (16.1%)	31 (23.3%)	**45 (20.5%)**	2 (5.0%)	4 (8.3%)	**6 (6.8%)**	**51 (16.6%)**
Do you think that mobile devices affect the educational process?							
yes	68 (78.2%)	110 (82.7%)	**178 (80.9%)**	36 (90.0%)	45 (93.8%)	**81 (92.0%)**	**259 (84.1%)**
no	7 (8.0%)	7 (5.3%)	**14 (6.4%)**	1 (2.5%)	2 (4.2%)	**3 (3.4%)**	**17 (5.5%)**
maybe	12 (13.8%)	16 (12.0%)	**28 (12.7%)**	3 (7.5%)	1 (2.1%)	**4 (4.5%)**	**32 (10.4%)**
Do you think that mobile devices affect a student's motivation to learn?							
yes	73 (83.9%)	102 (76.7%)	**175 (79.5%)**	37 (92.5%)	41 (85.4%)	**78 (88.6%)**	**253 (82.1%)**
no	6 (6.9%)	17 (12.8%)	**23 (10.5%)**	1 (2.5%)	2 (4.2%)	**3 (3.4%)**	**26 (8.4%)**
maybe	8 (9.2%)	14 (10.5%)	**22 (10.0%)**	2 (5.0%)	5 (10.4%)	**7 (8.0%)**	**29 (9.4%)**
Do you think that mobile devices affect your educational achievement?							
yes	54 (62.1%)	84 (63.2%)	**138 (62.7%)**	38 (95.0%)	41 (85.4%)	**79 (89.8%)**	**217 (70.5%)**
no	20 (23.0%)	19 (14.3%)	**39 (17.7%)**	1 (2.5%)	3 (6.3%)	**4 (4.5%)**	**43 (14.0%)**
maybe	13 (14.9%)	30 (22.6%)	**43 (19.5%)**	1 (2.5%)	4 (8.3%)	**5 (5.7%)**	**48 (15.6%)**
How do you rate the use of your mobile device (as a learning tool) in the classroom under the guidance of the lecturer?							
Excellent	29 (33.3%)	49 (36.8%)	**78 (35.5%)**	20 (50.0%)	16 (33.3%)	**36 (40.9%)**	**114 (37.0%)**
Very good	32 (36.8%)	27 (20.3%)	**59 (26.8%)**	13 (32.5%)	25 (52.1%)	**38 (43.2%)**	**97 (31.5%)**
Good	20 (23.0%)	46 (34.6%)	**66 (30.0%)**	3 (7.5%)	4 (8.3%)	**7 (8.0%)**	**73 (23.7%)**
Poor	4 (4.6%)	7 (5.3%)	**11 (5.0%)**	3 (7.5%)	2 (4.2%)	**5 (5.7%)**	**16 (5.2%)**
Very poor	1 (1.1%)	2 (1.5%)	**3 (1.4%)**	1 (2.5%)	0 (0.0%)	**1 (1.1%)**	**4 (1.3%)**
I did not try it before	1 (1.1%)	2 (1.5%)	**3 (1.4%)**	0 (0.0%)	1 (2.1%)	**1 (1.1%)**	**4 (1.3%)**

Overall, 37% of the students thought that using mobile devices in the classroom while being guided by the lecturer was an excellent learning tool. It received ratings of 31.5% very good, 23.7% good, 5.2% poor, and 1.3% very poor. Approximately 1.3% of the students admitted they had never tried mobile learning.

Students were asked to rank the challenges that affect the adoption of m-learning. This section of the questionnaire was built based on the results from the qualitative phase, as specified by both lecturers and students in the interviews. Students were therefore asked to rate their agreement with the following statements:

1. "Social distractions such as using social media and entertainment websites and ignoring lessons pose challenges to m-learning"; this is classified as a social challenge.
2. "My parents think that using such devices for learning is impossible"; this is classified as a cultural challenge.
3. "The lack of sufficient comprehensible theories and models for this type of learning"; this is classified as a pedagogical challenge.
4. "It is challenging to keep up with the rapid development of technologies on mobile devices. Moreover, Size of memory and screen size are problematic"; these are classified as technological challenges.

5. "The universities' administrations do not encourage using m-learning and using mobile devices in classrooms"; this is classified as an administrative challenge.
6. "Mobile devices have high cost and the cost of internet service is high as well"; this is classified as an economic challenge.

Responses ranged from 1 for strongly disagreeing to 6 for strongly agreeing. As shown in Table 5, the findings showed that social challenges that achieved an overall average weighted score (WS) of 4.80 in both public and private universities are ranked as the most reported challenges in adopting m-learning. The second most common challenge was cultural. The third was pedagogical; the fourth was technical; the fifth was economic; and the sixth and final challenge was administrative, with an overall weighted score of 3.68.

Table 5. Challenges of mobile learning adoption in Jordanian higher education.

	Auni	Puni	PrivateUni WS	Juni	Yuni	PublicUni WS	Overall WS
Social challenges	4.10	4.70	**4.40**	5.40	5.00	**5.20**	**4.80**
Economic challenges	4.60	4.10	**4.35**	3.90	3.50	**3.70**	**4.03**
Cultural challenges	4.10	3.60	**3.85**	5.00	4.80	**4.90**	**4.38**
Pedagogical challenges	4.20	3.90	**4.05**	4.60	3.90	**4.25**	**4.15**
Technical challenges	4.10	3.90	**4.00**	4.50	3.90	**4.20**	**4.10**
Administrative challenges	4.30	3.5	**3.90**	3.60	3.30	**3.45**	**3.68**

Table 6 shows the average weighted scores for respondents' evaluations of the disadvantages of adopting mobile learning. Students were asked to rate how much they agree with the disadvantages of m-learning that were specified in the qualitative phase by evaluating them from 1 for strongly disagreeing to 6 for highly agreeing. The results demonstrated that the health issues, which had an overall average weighted score (WS) of 5, are listed as the most commonly mentioned disadvantage of using m-learning. The second most frequent drawback was social isolation that resulted from students becoming socially isolated; third was the availability of educational services for those with a lack of sufficient financial support; fourth was associated with memory limitations; fifth was the screen size issue; then the network speed and electronic cheating came in sixth place, with an overall weighted score of 4.08. Technical restrictions came in last place, with an average weighted score of 3.43.

Table 6. Students' evaluation of the disadvantages of adopting mobile learning in Jordanian higher education.

	Auni	Puni	PrivateUni WS	Juni	Yuni	PublicUni WS	Overall WS
Technical restrictions	4.10	3.80	**3.95**	3.10	2.70	**2.90**	**3.43**
Screen size is a problem	4.30	4.10	**4.20**	4.10	4.00	**4.05**	**4.13**
Restricted memory	4.60	4.20	**4.40**	4.20	4.00	**4.10**	**4.25**
Network speed	4.40	4.20	**4.30**	3.90	3.80	**3.85**	**4.08**
User interface is not friendly	4.20	3.40	**3.80**	2.90	2.90	**2.90**	**3.35**
Health problems	4.50	4.70	**4.60**	5.50	5.30	**5.40**	**5.00**
Electronic cheating	3.40	3.40	**3.40**	4.80	4.70	**4.75**	**4.08**
Availability of educational services	4.40	4.40	**4.40**	4.50	4.00	**4.25**	**4.33**
Social isolation	4.00	4.40	**4.20**	5.20	5.40	**5.30**	**4.75**

Students were then asked to rate the statements again from 1 to 6; these statements were all derived from the interviews in the qualitative phase of the study. The reason for asking students to rate them is to generalize the results from the qualitative phase. According to Table 7′s findings, there is insufficient support for mobile learning at Jordanian universities. Universities encourage students with an average weighted score of 4.2 and a 4.23 for the availability of facilities for m-learning. Additionally, the average score for how much lecturers support m-learning was 4.10. With an average weighted score of 4.9, the internet accessibility for students' mobile devices was almost very good.

Table 7. Current state of m-learning.

To What Extent Do You Agree with the Following:	Auni WS	Puni WS	PrivateUni WS	Juni WS	Yuni WS	PublicUni WS	Overall WS
The university encourages students to use modern technology.	4.40	4.20	**4.30**	4.30	3.90	**4.10**	**4.20**
There are facilities for using mobile devices inside the classrooms.	4.3	4	**4.15**	4.3	4.3	**4.30**	**4.23**
Lecturers encourage students to use their mobile devices for learning in the classroom.	3.7	3.9	**3.80**	4.5	4.3	**4.40**	**4.10**
Mostly, I have internet on my mobile device for an hour or more every day.	4.7	4.8	**4.75**	5.1	5	**5.05**	**4.90**
I have the skills to use my mobile device to learn.	4.8	5.1	**4.95**	5.5	5.1	**5.30**	**5.13**
If I want to use e-mail, I prefer to use a mobile phone rather than a computer.	4.5	4.5	**4.50**	5.1	5.2	**5.15**	**4.83**
Mobile devices are very useful in the classroom.	4.4	4.7	**4.55**	5.1	5	**5.05**	**4.80**
Mobile devices increase cooperation between students.	4.7	4.8	**4.75**	5.3	5.3	**5.30**	**5.03**
Mobile devices are a good place to keep some study materials.	4.8	5.3	**5.05**	5.4	5.4	**5.40**	**5.23**
Mobile devices are very important and helpful in the learning process.	4.7	5.1	**4.90**	5.3	5.2	**5.25**	**5.08**
Social media apps help me learn better than educational apps.	4.4	4	**4.20**	3.3	2.6	**2.95**	**3.58**
The use of mobile learning management systems such as MS Teams brings the lecturers closer to students in a beneficial way	4.6	4.7	**4.65**	5.2	4.8	**5.00**	**4.83**
Mobile devices make the learning process faster.	4.7	5	**4.85**	5.1	4.9	**5.00**	**4.93**
Blended mobile learning helps solve the problem of individual differences between students.	4.7	4.7	**4.70**	4.8	4.9	**4.85**	**4.78**
Blended mobile learning increases students' creativity.	4.6	4.6	**4.60**	5.1	4.9	**5.00**	**4.80**
Mobile devices enable students to access a vast amount of data related to university classes.	4.9	5.2	**5.05**	5.3	5.2	**5.25**	**5.15**
I agree with using my mobile device for education, for example, to search for information, exchange resources, or benefit from apps.	4.9	5.2	**5.05**	5.6	5.3	**5.45**	**5.25**
The availability of information anytime and anywhere is helpful.	4.9	5.3	**5.10**	5.5	5.3	**5.40**	**5.25**
Mobile learning enhances interactions between learners and educators reduces communication barriers and improves communication between lecturers and students.	4.7	4.9	**4.80**	5.4	5.2	**5.30**	**5.05**

The fifth research sub-question: "Is there any relationship between students' enrolment in public/private universities and the adoption of m-learning?" To answer this question, the relationship between student enrollment in public/private universities and the adoption of m-learning was tested. We established the following hypothesis:

H0. *There is no significant relationship between student enrolment in private/public universities and the adoption of m-learning.*

H1. *There is a significant relationship between student enrollment in private/public universities and the adoption of m-learning.*

Based on the regression statistics provided in Table 8, there is a significant relationship between whether a student is enrolled in a private or public university and their adoption of m-learning in Jordan. The significance level of the F-test (p-value) is 0.0014; this p-value is less than the significance level of 0.05, which indicates that there is evidence to reject the null hypothesis (H0) that there is no significant relationship, and that there is a significant relationship between private/public university enrollment and the adoption of m-learning.

Table 8. Testing the significance of the relationship between private/public university enrollment and the adoption of m-learning.

	Regression Statistics							
Multiple R	0.181144							
R-square	0.032813							
Adjusted R-square	0.029652							
Standard Error	0.44573							
Observations	308							
ANOVA	df	SS	MS	F	Significance F			
Regression	1	2.062544	2.062544	10.38149	0.001410016			
Residual	306	60.7946	0.198675		*p*-value			
Total	307	62.85714						
	Coefficients	Standard Error	t Stat	*p*-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1.16129	0.04622	25.12526	2.31×10^{-76}	1.070340991	1.25224	1.070341	1.25224
Adoption of m-learning	0.178245	0.055321	3.222032	0.00141	0.069387742	0.287101	0.069388	0.287101

The coefficient of determination (R-squared) is only 0.032813, indicating that the independent variable of private/public university enrolment explains only 3.28% of the variation in the adoption of m-learning.

Moreover, the coefficient for private/public university enrolment (0.178245) is statistically significant at a p-value of 0.00141, indicating that there is a positive relationship between private/public university enrolment and the adoption of mobile learning. However, the coefficient is relatively small, which means that the effect of private/public university enrolment on the adoption of m-learning is weak.

5. Discussion of the Results

Back to the study questions, it can be noted that m-learning is widely used in Jordan's higher education institutions and has the potential to have a positive effect on the teaching and learning processes. Universities in Jordan have implemented various m-learning approaches, including educational mobile applications, social media, and other mobile-based technologies. Some universities have also developed or used mobile-based learning management systems to facilitate communication and collaboration between students and instructors.

The research results showed that Jordanian university students have optimistic thoughts about m-learning and want to see it used more in face-to-face, blended, and online learning, which is proven by previous research, such as [5], in Jordan. This result was also proven by previous research in other countries, where [23] came to the conclusion that while most students who are involved in the experiment, do not plan to use the technology in the future, they have positive opinions of the use of iPads in the lecture hall, which indicates positive opinions of m-learning. Moreover, [25] reached the same conclusion. Thus, this finding is consistent with those reported in the literature. The use of m-learning in higher education in general and in Jordanian higher education in particular has the potential to revolutionize teaching.

Mobile devices can improve student engagement, motivation, and learning outcomes by giving students flexible and open access to course content and learning activities. However, in order to fully utilize m-learning, it is crucial to tackle the challenges related to

its implementation and get beyond the disadvantages. Additionally, m-learning activities that are pedagogically acceptable and in accordance with the objectives of the course should be created, and content that is compatible with mobile devices and their small screen size should be designed.

Social challenges were the most scored challenges; consequently, universities should ensure that students are not distracted. There must be strict policies that discourage social distractions brought on by the use of mobile devices. Examples include blocking social networks on university campuses and putting regulations and policies in place. Moreover, to ensure that all students have equal opportunities, universities should offer students free internet access. Additionally, workshops promoting m-learning are essential for persuading parents to permit their children to use it, lecturers to utilize it, and students to encourage their peers to use it. On the contrary, [28] studied the social influence and found it to be a facilitator of m-learning adoption in Jordan. Additionally, technical challenges received a reasonably high overall average weighted score of 4.10, which shows that students generally accept their existence. This finding is consistent with earlier research, such as that in [44]. As well, cultural challenges average weighted score was 4.38, which is also relatively high. Cultural challenges were proven to be a challenge for adopting m-learning [24]. Back to the literature, [25] also reported cultural, pedagogical, institutional, social, and technical challenges.

Regarding the benefits identified in this study, some were consistent with the benefits identified by [19], such as learning anytime and anywhere and interactive and collaborative learning. Most students thought that m-learning has the potential to increase student motivation, and this is similar to what ref. [45] identified.

The results suggest that there is a statistically significant relationship between a student's enrollment in private or public universities and their adoption of m-learning in Jordan. However, the magnitude of the relationship is relatively weak, as indicated by the low R-squared value. Further research may be necessary to explore other factors that may be affecting the adoption of m-learning in Jordanian higher education. According to our review of the literature on m-learning in general and in Jordan in particular, no studies have addressed this issue and studied the relationship between student enrollment in public/private universities and the adoption of m-learning.

M-learning is used in higher education institutions in nations that have developed in the field of education, including the United Kingdom, the United States, Australia, and European nations [46]. These nations have worked extensively to maximize the potential of m-learning. M-learning has the potential to renovate teaching and learning in the Jordanian higher education system. While there are benefits and drawbacks associated with m-learning, universities need to address the challenges to ensure that they implement effective and efficient m-learning programs. The results show positive outcomes; however, it can be perceived that Jordanian universities are not fully utilizing m-learning in teaching and are not yet prepared for this adoption of m-learning. This is because the results demonstrate that requirements for this adoption that were specified during the qualitative phase of the study did not receive high-weighted scores. Universities should encourage both learners and educators to use m-learning and provide them with the required professional development and training to effectively integrate m-learning into their learning and teaching practices.

6. Conclusions and Future Work

The objective of this study was to investigate and understand the situation of m-learning in Jordanian higher education. The study used a sequential exploratory mixed research method, where in the first stage the researchers analyzed the literature about m-learning. Then, fifteen semi-structured interviews were conducted. The results of the qualitative part were used to build an online survey that was distributed to students at four Jordanian universities.

This research study ensured that the study's participants had access to mobile devices, such as smartphones and tablets, that were connected to the internet and that they could use them for educational purposes. The findings indicate that, while using mobile learning has numerous benefits, it also has many drawbacks and challenges. According to the study's findings, students are open to adopting mobile learning and have a favorable attitude towards it. Additionally, the results suggest that there is a statistically significant relationship between the students' enrolment in private or public universities and their adoption of m-learning in Jordan. Nonetheless, the findings indicate that there are certain issues with implementing this technology in Jordanian higher education institutions.

M-learning has been found to be a cornerstone of higher education and essential to the learning process. It has the potential to improve soft skills for both learners and educators while also encouraging improved communication between all parties involved in the educational process. Although m-learning is utilized and regarded as an efficient teaching tool in developed countries, in Jordan—a developing country—where higher education institutions are still not fully employing m-learning, this is not the case. The researchers think that initiatives for providing students access to mobile devices, such as iPads, are necessary for having a thorough understanding and completing their studies. These findings have significant implications for universities that wish to integrate m-learning in both undergraduate and postgraduate degree programs. These findings help decision-makers at these universities establish frameworks that have the potential to fulfill the requirements of m-learning.

Therefore, this study used a variety of methodologies to create reliable and valid results. Additionally, internal consistency evaluations, such as the "Cronbach's Alpha Reliability" test, were carried out in the study to provide proof of validity and reliability.

The research recommends that higher education institutions should pay attention to providing the necessary infrastructure for m-learning and putting in place the necessary policies, strategies, and procedures.

There are plans for future work on finding a precise specification for the functional and non-functional requirements of educational mobile applications, as well as ongoing work on developing an evaluation framework for educational mobile applications.

7. Limitations of the Study

As a limitation of this study, we have focused on four Jordanian universities. In addition, the sample size is acceptable for an exploratory study, however, the generalization of the findings may not be accurate due to the 308 responses, and the possibility that not all mobile learners' perceptions might be applied equally. Future studies could give a greater understanding of students' preferences and attitudes towards the use of mobile technology for learning if they were conducted among a wider survey sample, which would include a variety of university students as well as lecturers and administrators from across the country.

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