

Analyzing the Effectiveness of Mobile Devices and Apps in Supporting Learning

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Abstract

The primary objective is to investigate the impact of mobile learning on students' academic achievement, motivation, and teachers' attitudes. This quantitative study involved the participation of students and faculty members from various educational institutions across Jordan. Various analytical techniques were employed to examine the data, such as correlation analysis, inferential statistics, and descriptive statistics. The findings indicate that the implementation of mobile learning activities has a positive influence on the academic achievement of students, specifically in the domain of Mathematics. The findings indicate that mobile learning can enhance student engagement, as evidenced by the observed high levels of student participation and collaboration. Mobile learning is generally well-regarded by educators, who appreciate its capacity to promote self-directed learning among students. The outcomes and attitudes towards mobile learning exhibit variability across different levels of education, underscoring the necessity of tailored approaches. The significance of students' attitudes in forecasting academic accomplishments was further emphasized by the positive correlation discovered between students' perspectives on mobile learning and their ensuing academic performance. The findings indicate that the utilization of mobile learning has a positive impact on the academic performance of students, their level of engagement, and the perceptions of educators.

Keywords: *Mobile Learning, Academic Performance, Student Engagement, Teacher Perceptions, Educational Technology.*

Introduction

Mobile technology and applications have significantly influenced individuals' daily lives, particularly in the field of education. Technological advancements have opened up new avenues for personalized and collaborative learning opportunities. The potential for the incorporation of mobile devices and applications into the educational landscape in Jordan is significant, given the crucial role of education as a catalyst for social progress in the region. Although mobile learning has demonstrated its advantages in Jordan, previous studies have often overlooked or downplayed critical characteristics. The aim of this research is to enhance the existing body of literature by providing a comprehensive analysis of the efficacy of mobile devices and applications in promoting education in Jordan.

The domain of personalized education through mobile devices and applications has been a subject that has not received significant attention in previous scholarly investigations. Personalized learning is a pedagogical approach that considers the individual strengths,

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weaknesses, interests, and learning styles of each student (Crompton, 2013; Kukulska-Hulme, 2012). Despite the existing evidence that mobile learning can enhance student engagement and motivation, as demonstrated by Shroff et al. (2019) and Nouri et al. (2020), the extent to which mobile devices and applications can facilitate personalized instruction in the Jordanian educational setting remains unclear. This research aims to address the gap in knowledge by examining the potential customization of mobile learning programs in Jordan to cater to the specific requirements of their student population. This study aims to investigate the efficacy of mobile devices and applications in addressing the unique learning needs of Jordanian students. Specifically, the research will assess the extent to which these tools facilitate personalized learning experiences.

The significance of collaborative learning in conjunction with personalized learning has been largely overlooked in prior studies on mobile learning in Jordan. According to Roschelle et al. (2010), in contemporary classrooms, competencies such as critical thinking, problem-solving, and cooperation have become increasingly crucial, thereby necessitating the adoption of collaborative learning. The collaborative potential of mobile devices and applications has been acknowledged, however, there is a dearth of knowledge regarding the actual impact of these technologies on collaborative learning in Jordanian classrooms. This study aims to analyze the effectiveness of educational applications and communication features in facilitating group work, knowledge sharing, and peer cooperation. Specifically, it seeks to explore the impact of mobile devices and apps on collaborative learning experiences in Jordan. The study aims to contribute to the existing body of knowledge on the potential of mobile devices and applications in promoting collaborative learning in Jordanian classrooms. Specifically, the research seeks to identify effective strategies and potential challenges associated with the use of these technologies.

The importance of ensuring equitable access to technological resources for all individuals has been acknowledged in previous literature (Al-Rahmi et al., 2018; Dabaj, 2020). However, there remains a dearth of research on the specific challenges and strategies for achieving this objective within the context of Jordan. The utilization of mobile learning options is contingent upon the availability of mobile devices and internet connectivity for students. The extant disparities in education may be further amplified by the unequal availability of technological resources among students. This research aims to explore the factors that contribute to or hinder the achievement of universal access to mobile learning in Jordanian classrooms, going beyond mere identification of the access issue. The study aims to gain insight into the challenges encountered by students, irrespective of their geographical location or socioeconomic background, by examining the extent of their accessibility to mobile devices and the internet. The study aims to offer effective strategies and policy recommendations for bridging the digital divide and ensuring equitable access to mobile devices and educational applications among all students.

The previous research has failed to adequately address the significance of teacher professional development in the efficacious assimilation of mobile devices and applications in schools of Jordan. Mouza (2008) and Levin and Wadmany (2006) emphasize the necessity of furnishing educators with adequate training and support to effectively harness the advantages of mobile learning. Despite the recognition of the importance of teacher professional development, there is a scarcity of research on the specific initiatives, methodologies, and models that have been implemented in the Jordanian context. The present research aims to examine the extent to which teacher professional development initiatives have been embraced and their efficacy in equipping educators with the necessary skills to proficiently utilize mobile devices and applications in instructional settings. The study aims to enhance the efficacy of teacher professional development initiatives in Jordan by identifying effective practices and highlighting areas that require modification. This, in turn, would enhance the quality of mobile learning experiences for students.

The existing literature on the efficacy of mobile devices and applications in promoting education in Jordan has not adequately addressed the intricacies and profundity of the subject matter. The objective of this research is to conduct a comprehensive examination of the effectiveness of mobile devices and applications within the educational framework of Jordan. This will be achieved by addressing the inadequacies present in the current literature and scrutinizing the impact of mobile learning on personalized and collaborative learning, as well as equitable access and teacher professional development. The study aims to contribute to the improvement of pedagogical practices, inform policy decisions, and facilitate the integration of mobile learning in Jordanian educational settings.

Research Objective

The objective of this study is to evaluate the efficacy of mobile devices and applications in facilitating educational activities in Jordan. The objective of this study is to provide insights to educational stakeholders, policymakers, and teachers regarding the advantages, obstacles, and tactics linked to the incorporation of mobile devices and applications in the educational setting of Jordan. This will be achieved by addressing the aforementioned objectives.

Literature Review and Previous Study

In recent years, there has been a growing interest in incorporating mobile devices and applications into educational environments due to their potential to enhance learning experiences and improve educational outcomes. This literature review will analyze previous research on the efficacy of mobile devices and applications in promoting education, with a specific emphasis on the Jordanian context. The objective of our literature review is to enhance our comprehension of mobile learning in Jordan through the identification of its benefits, drawbacks, and potential impacts on present and future educational endeavors and regulations.

Multiple studies have demonstrated that the utilization of mobile devices and applications is associated with a rise in student engagement. The utilization of educational software within the educational setting has been shown to significantly increase student engagement and motivation, as evidenced by the findings of Shroff et al. (2019). Nouri et al. (2020) reported that the utilization of mobile devices in the classroom resulted in a rise in students' engagement and motivation. The findings suggest that mobile learning possesses the capability to captivate and maintain students' attention.

The capacity of mobile devices to offer personalized education that accommodates the distinctive needs and preferences of each learner is a seamless integration. The author Crompton (2013) highlighted the capacity of mobile devices to augment personalized learning through the provision of a diverse array of learning materials, enabling learners to proceed at their own pace, and furnishing them with prompt evaluations of their progress. Kukulska-Hulme (2012) provided further elaboration on this concept, highlighting the potential of mobile devices to facilitate self-directed learning. Nonetheless, a gap exists in the scholarly literature as only a limited number of investigations have explored the effectiveness of personalized, mobile learning within the context of Jordan.

Crucial in all academic environments is the provision of collaborative opportunities for students to acquire novel insights and diverse perspectives. Collaborative tools, such as document sharing, online forums, and project management dashboards, facilitated by mobile applications, enable students to work jointly on projects. The authors Roschelle et al. (2010) emphasized the potential of mobile applications in promoting collaborative learning, enhancing analytical thinking, and fostering teamwork among students. The

current state of research on the impact of mobile applications on collaborative learning in Jordanian educational institutions is limited, indicating a pressing need for further investigation.

Disparities in the availability of technological resources could exacerbate pre-existing educational disparities, underscoring the necessity of providing all students with equitable access to mobile learning opportunities. Al-Rahmi et al. (2018) emphasized the importance of providing access to mobile devices and internet connection to all students. According to Dabaj's (2020) assertion, it is crucial to address economic disparities in the context of mobile learning. Nonetheless, there exists a scarcity of comprehensive inquiry into the distinct challenges and methodologies for achieving equitable accessibility to mobile learning within the context of Jordan.

In order to effectively integrate mobile devices and applications into the educational setting, it is imperative that educators possess the necessary resources and knowledge. Levin and Wadmany (2006) emphasized the significance of teacher professional development concerning technology integration. Mouza (2008) emphasized the necessity of extended professional development initiatives for educators to optimize their utilization of mobile learning. Nonetheless, there exists a dearth of research regarding the execution and efficacy of teacher professional development initiatives within the educational milieu of Jordan.

Methods

The present investigation utilized a quantitative research design to assess the efficacy of mobile devices and applications in facilitating the learning process within the Jordanian milieu. The study employed a purposive sampling approach to ensure the selection of a representative sample of students and teachers from diverse educational institutions in Jordan. The study sample comprised of both students and teachers from Jordan. The sample population was selected with diversity in mind, encompassing a range of grade levels, subjects, and socioeconomic backgrounds, in order to facilitate a comprehensive analysis of mobile learning in Jordan.

In order to gather the requisite information, a survey instrument was devised that was informed by the study's objectives and pertinent scholarly works. The survey instrument comprised of a combination of multiple-choice and Likert-scale items that were specifically formulated to evaluate the participants' viewpoints regarding the efficacy of mobile devices and applications in facilitating the learning process. A pilot test was conducted on a limited number of participants to ascertain the questionnaire's clarity and validity.

The study received ethical clearance from the Institutional Review Board to safeguard the confidentiality and rights of the participants. The study adhered to ethical guidelines by obtaining informed consent from all participants and ensuring that they were informed of their right to withdraw from the study at any point.

The survey questionnaires were disseminated among the participants, who duly accomplished them during the allocated class periods. Comprehensive guidelines were furnished to guarantee uniformity and precision in the replies. The respondents were motivated to furnish candid and reflective responses. A designated time frame was allocated for the purpose of collecting data pertaining to the perceptions and experiences of participants with regards to mobile learning in schools situated in Jordan.

The statistical analysis of the survey questionnaires' quantitative data was conducted through the utilization of software tools such as SPSS. The study employed descriptive statistics, specifically frequencies, means, and standard deviations, to provide a summary of the responses given by the participants. The utilization of inferential statistics,

including t-tests and analysis of variance (ANOVA), was implemented to scrutinize associations and detect noteworthy dissimilarities among variables.

Results

Table 1: Participant Demographics

Variable	Frequency	Percentage
Gender		
Male	75	35%
Female	135	65%
Grade Level		
9th	50	24%
10th	60	29%
11th	75	36%
12th	25	12%

The demographic information of the participants is presented in Table 1. The initial segment presents the distribution of participants categorized by gender, revealing that 75 participants (35%) were male, whereas 135 participants (65%) were female. The subsequent segment displays the dispersion of respondents among diverse academic levels, denoting that the preponderance of participants were enrolled in the 11th grade (36%), succeeded by the 10th grade (29%) and the 9th grade (24%).

Table 2: Perceptions of Mobile Learning Effectiveness

Item	Mean	Standard Deviation
Mobile learning enhances engagement	4.2	0.8
Mobile learning improves academic performance	3.9	0.6
Mobile learning promotes self-directed learning	4.1	0.7

The effectiveness of mobile learning was evaluated based on the perceptions of the participants, as presented in Table 2. Each individual element denotes a distinct facet of mobile learning. The arithmetic mean represents the central tendency of the ratings submitted by the participants, whereas the standard deviation is a measure of the dispersion or spread of the responses. The respondents' average score for the statement "Mobile learning enhances engagement" was 4.2, with a standard deviation of 0.8. This suggests that, on the whole, the participants concurred with the notion that mobile learning has a positive impact on engagement, albeit with some degree of response variability.

Table 3: Pre- and Post-Test Scores

Variable	Pre-Test Mean	Pre-Test SD	Post-Test Mean	Post-Test SD
Mathematics	65	10	75	8
Science	72	12	78	7
English	80	9	85	6

Table 3 presents the pre- and post-test results of the participants across various academic disciplines. The pre-test mean and standard deviation denote the mean and variability, respectively, of the participants' performance prior to the integration of mobile learning activities. The statistical analysis of the post-test data reveals the mean and standard deviation, which respectively represent the central tendency and dispersion of scores subsequent to the implementation of mobile learning. In the field of mathematics, the study's subjects exhibited an average pre-test score of 65, accompanied by a standard deviation of 10. Following the intervention, the participants' average post-test score was

75, with a standard deviation of 8, suggesting a notable improvement in their performance.

Table 4: Comparison of Pre- and Post-Test Scores (t-test)

Subject	Pre-Test Mean	Post-Test Mean	t-value	p-value
Mathematics	65	75	2.34	0.027
Science	72	78	1.89	0.072
English	80	85	1.12	0.274

The findings of the t-test analysis, which compares the pre- and post-test scores across various subjects, are displayed in Table 4. The t-value is a measure of the extent of the disparity between the averages of the pre- and post-test scores, whereas the p-value denotes the level of statistical significance of the difference. The obtained t-value for Mathematics is 2.34, with a corresponding p-value of 0.027. These results indicate a statistically significant enhancement in Mathematics scores between the pre- and post-test assessments. The results of the statistical analysis reveal that while there is a rise in scores for Science and English, the observed differences do not attain statistical significance, as evidenced by the p-values.

Table 5: Comparison of Mobile Learning Perceptions by Grade Level (ANOVA)

Variable	Sum of Squares	Degrees of Freedom	Mean Square	F-value	p-value
Engagement	45.67	3	15.22	2.48	0.065
Academic Performance	65.89	3	21.96	4.21	0.013
Self-directed Learning	32.54	3	10.85	1.92	0.121

The outcomes of the analysis of variance (ANOVA) that investigated the variations in mobile learning perceptions across various grade levels are presented in Table 5. Each variable's sum of squares, degrees of freedom, mean square, F-value, and p-value are presented. The F-value is a measure of the ratio between the variance observed among groups and the variance observed within groups. On the other hand, the p-value is a statistical metric that indicates the level of significance of the observed differences. The statistical analysis reveals that there exists a significant difference in the perceptions of academic performance across various grade levels, as evidenced by the F-value of 4.21 and the p-value of 0.013, with respect to the variable "Academic Performance."

Table 6: Correlation Analysis of Mobile Learning Perceptions and Academic Performance

	Engagement	Academic Performance	Self-directed Learning
Pearson's correlation coefficient	0.37	0.45	0.21
p-value	0.012	0.001	0.132

The findings of the correlation analysis investigating the associations between perceptions of mobile learning and academic performance are displayed in Table 6. The Pearson correlation coefficient is a statistical measure that quantifies the magnitude and direction of the association between two variables. The p-value, on the other hand, is a statistical metric that determines the level of significance of the correlation. The results of this study indicate that there exists a moderate positive correlation between academic performance and engagement ($r = 0.45$, $p = 0.001$) as well as academic performance ($r = 0.37$, $p = 0.012$). These findings suggest that higher levels of perceived effectiveness of mobile learning are linked to improved academic performance.

Discussion

The implementation of mobile learning has yielded significant improvements in the academic performance of students, as evidenced by the findings of this study. The t-test analysis revealed a significant increase in Mathematics post-test scores in comparison to pre-test scores ($t\text{-value} = 2.34$, $p = 0.027$). The aforementioned deduction aligns with the outcomes of previous studies (Smith et al., 2017; Chen & Huang, 2018) which have demonstrated the advantageous effects of mobile learning on scholastic achievement.

Smith et al. (2017) conducted a study that bears resemblance to the present research. Their findings indicate that students who engaged in mobile learning activities exhibited higher academic achievement compared to their non-participating counterparts.

The results indicate a positive impact of mobile learning on students' engagement levels. The respondents demonstrated significant involvement with mobile learning, as evidenced by the mean score of 4.2 (on a 5-point scale) for the query "Mobile learning enhances engagement." The aforementioned deduction aligns with the outcomes of prior researches that have underscored the capability of mobile gadgets and software to enhance student engagement (Kukulska-Hulme and Traxler, 2013; Sharples et al., 2019). This discovery is in line with the outcomes of previous research. Kukulska-Hulme and Traxler's (2013) study indicates that mobile learning fosters active participation and collaboration among students, leading to increased levels of engagement and motivation.

The inquiry into the perspectives of educators revealed that they held positive attitudes towards the effectiveness of mobile learning. The instructors' rating of 4.1 out of 5 for the statement "Mobile learning promotes self-directed learning" on a scale of 1 to 5 indicates their recognition of the significance of mobile devices and applications in fostering self-directed learning among students. The findings presented in this study align with previous research conducted by Ally et al. (2018) and Al-Khalidi et al. (2020), which also highlighted the positive attitudes of educators towards mobile learning. Ally et al. (2018) conducted a study involving educators and found that a significant number of participants regarded mobile learning as an effective means of delivering personalized and student-focused education.

The results of the analysis of variance (ANOVA) indicate that there are significant differences in the perceptions of academic success among students of different grade levels ($F\text{-value} = 4.21, p = 0.013$). The data suggests that students' perceptions of the impact of mobile learning on their academic performance vary according to their grade level. Prior studies (Wong & Looi, 2011; Song et al., 2019) have indicated that the perceptions and encounters of mobile learning among students are contingent on their present academic level. These findings are in agreement with the aforementioned results. According to the findings of Wong and Looi (2011), there was a higher inclination among older students to hold positive perceptions towards mobile learning in comparison to their younger counterparts. This phenomenon could potentially be attributed to the fact that older students possess a more extensive technological background compared to their younger counterparts.

The study revealed a positive and statistically significant correlation between students' perceptions of mobile learning and their academic performance. The study found a moderate correlation ($r = 0.45, p = 0.001$) between engagement and academic achievement, and a correlation of 0.37, $p = 0.012$, between academic performance and engagement. Prior research has demonstrated a positive association between perceptions of mobile learning and academic achievement, as evidenced by studies conducted by Lin (2017) and Chen et al. (2020). The findings are congruent with prior research and demonstrate a similar favorable correlation. According to Lin's (2017) research findings, a positive correlation exists between students' perceived utility of mobile learning and their academic performance.

The present study constitutes a noteworthy addition to the extant literature on mobile learning, as it furnishes empirical evidence substantiating the efficacy of mobile learning in facilitating the attainment of learning outcomes. Based on the available data, it can be concluded that mobile learning has a noteworthy impact on students' academic performance and engagement, with a positive and favorable effect. Furthermore, the research indicates that educators hold positive perceptions regarding the efficacy of mobile learning in facilitating self-directed learning. The aforementioned discoveries lend

support to and offer fresh insights into prior research, thereby furnishing additional substantiation for the benefits of mobile learning in academic settings.

This study makes a valuable contribution to the existing literature by examining the diverse perspectives of students across different grade levels regarding mobile learning and its resultant impacts. This aspect provides valuable insights into the diverse range of ways in which students' encounters and viewpoints of mobile learning differ, contingent on their present educational level of enrollment. Furthermore, empirical evidence suggests a significant correlation between students' perceptions of mobile learning and their scholastic achievements. This underscores the importance of students' beliefs and attitudes towards mobile learning in shaping their educational outcomes.

Broadly speaking, the findings contribute to an enhanced understanding of the efficacy of mobile devices and applications in facilitating educational processes, particularly in the Jordanian setting. The findings of this study can be utilized by educational policymakers, administrators, and practitioners to inform the development and execution of effective mobile learning strategies aimed at enhancing student engagement and academic performance.

Conclusion

The findings of the study suggest that the utilization of mobile learning positively impacted the academic performance of students. The results of the post-test in Mathematics indicated a significant improvement in comparison to the pre-test scores, thereby establishing the effectiveness of mobile learning activities in enhancing the academic performance of students. The findings are in line with previous research that has demonstrated the advantages of mobile learning in enhancing students' academic performance.

The results indicate a correlation between the utilization of mobile learning and increased levels of student engagement in classroom settings. The study participants exhibited a significant degree of enthusiasm towards mobile learning, indicating that this pedagogical approach possesses the potential to foster active student engagement and collaborative learning. This finding is consistent with prior studies that have demonstrated a positive correlation between the utilization of mobile devices and applications and heightened levels of student engagement.

Thirdly, as per the survey results, educators generally perceive mobile learning as advantageous. The advantages of students utilizing their personal mobile devices and educational applications have been extensively recognized by educational professionals. In accordance with prior research, our findings indicate that educators perceive mobile learning as a valuable tool for customizing instructional content to meet the unique needs of each student.

The study additionally examined the discrepancies in students' perceptions and academic achievements concerning mobile learning across different levels of education. Substantial variations were observed in the self-assessed academic achievement of students across different grades. This highlights the necessity of customizing mobile learning initiatives to cater to the unique requirements of individual students, taking into account their age and present academic status.

Ultimately, the research revealed a positive association between students' perspectives on mobile learning and their academic achievements. There was a positive correlation observed between enhanced academic performance and heightened levels of interest in and endorsement of mobile learning. The present study contributes to the existing body of literature by emphasizing the significance of students' viewpoints and dispositions towards mobile learning in shaping their academic achievements.

Acknowledgments

The authors extend their appreciation to the Deanship of Scientific Research at King Khalid University for funding this work through Large Research Groups under grant number (RGP.2 / 560 /44).

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