

# Instructional Design in Modern Environments: Pertinent Mobile Learning Content Quality Features

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## ABSTRACT

This study highlights the most pertinent m-learning content quality features that should be considered by designers from the point of view of experts to determine students' perceptions about suggested quality features and to measure any statistically significant differences in students' perceptions due to their gender and technological skills. An exploratory sequential mixed research method was employed. A group of 20 experts in m-learning answered an open-ended question for the qualitative part, and a questionnaire with 31 items was answered by a purposeful sample of 200 students out of the entire population of 312 from seven Jordanian universities. The results revealed a list of content quality features. The overall perception of students was high with a mean of 4.15 and no statistically significant differences in students' perceptions due to their gender and technological skills. The study recommended studying the effectiveness of m-learning content features in Jordanian higher education institutions.

## KEYWORDS

Content, Features, M-Learning, M-Learning Applications, Quality

**Background:** This study highlights the most pertinent m-learning content quality features that should be considered by designers from the point of view of experts, to determine students' perceptions about suggested quality features, and to measure any statistically significant differences in students' perceptions due to their gender and technological skills.

**Method:** An exploratory sequential mixed research method was employed. A group of 20 experts in m-learning answered an open-ended question for the qualitative part, and a questionnaire with 31 items was answered by a purposeful sample of 200 students out of the entire population of 312 from seven Jordanian universities.

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**Findings:** The results revealed a list of content quality features. The overall perception of students was high with a mean of 4.15, and no statistically significant differences in students' perceptions due to their gender and technological skills were noted. The study recommended further researching the effectiveness of m-learning content features in Jordanian higher education institutions.

**Contribution:** This study adds to the limited literature about enhancing instructional design skills among instructional designers in m-learning. In the study, pertinent m-learning content features were recommended to enhance instructional design in the digital age. This study proposes innovative styles for designing content for m-learning in modern electronic environments.

## INTRODUCTION

In previous times, many educators viewed m-learning merely as a way to back up the learning process. With the spread of the COVID-19 pandemic around the world, this view has altered owing to the closing of educational institutions. M-learning has critically grown, and there is now a pressing need to unfold the benefits of m-learning.

Indisputably, the capability to design learning content for m-learning plays a major factor in impacting students' learning and academic achievement. Additionally, the quality features of the design have remarkable effects on the whole learning process. Indeed, m-learning content offers prospects for learners to learn anywhere and at any time.

This research attempts to discuss the required skills that designers in modern e-learning environments lack, especially in m-learning environments. Consequently, the results of this research may have a significant impact on m-learning designers.

For the learning content to be effective in the learning process in its various forms, there should be quality features of design to support the success of the developed content to enhance students' learning. Because of this, it is worth studying m-learning content. Consequently, quality features adopted are a key issue when designing m-learning content. Most web applications are lacking quality and do not meet pedagogical standards (Papadakis, et al., 2020). Furthermore, there is a lack of trust on the part of instructors in determining if the content is competent enough (Poultsakis, et al., 2021).

We should look out for "lack of quality" characteristics such as poor design. The diverse standards used in different studies do not consent to the establishment of a unified pattern (Martens, et al., 2018). This challenging situation is being traced in many studies (Papadakis, et al., 2020). For illustration, in his study, Rosell-Aguilar (2017) indicated that a limited criterion is typical in most contexts.

The study urges m-learning content designers to examine the views about mobility and reflect on this when designing their content features. This can be achieved through understanding the learners' behaviors. This study takes into consideration that an m-learning content design process is an educational one, rather than only a technical one. In this scenario, quality features are influenced by the content quality and by the way it is delivered to students through mobile technologies (Pocatilu & Boja, 2007).

## THE PROBLEM OF THE STUDY

The unprecedented wide spreading of COVID-19 has transformed the paradigm of the teaching and learning process. In Jordan, universities have launched compulsory distance education programs such as m-learning to avoid community health threats triggered by the pandemic. However, so far, there is a need to reconsider the methods of designing m-learning content in emergency e-learning environments as many instructors and students were not prepared for such e-environments through mobile and distance learning.

After reviewing many scientific studies related to m-learning, it is noted that most of these did not address the quality of the learning content to be developed for m-learning, as most studies

focused on general criteria and loose points without considering the details related to the skills of the twenty-first century.

Redesigning e-learning content helps solve the problem of keeping pace with distance learning and m-learning environments. In the wake of COVID-19, the sudden shift to distance learning has left many educational institutions scrambling to learn how to teach students digitally and how to choose appropriate strategies for teaching and tools to teach students in an m-learning environment. In these circumstances, attention has been given to the instructional design of content and activities, facilitation, and assessment to aid teachers in m-learning. To overcome the challenges of m-learning during the pandemic, educational institutions had to re-design m-learning content to develop new content that fit the m-learning style so that it could be accessed and to ensure fairness and inclusion in the design of the learning experience (Ozudogru, 2021). Adaptive learning environments can handle personalized learning requirements through adaptive content and activities or by adjusting the learning design to meet learners' abilities (Towle & Halm, 2005). M-learning content entails skills from strong theoretical knowledge to various technical skills and competencies. The researchers in this study leverage their experience in presenting diverse learning content design for m-learning. Therefore, the current study is seeking to answer the following questions:

1. What are the most pertinent m-learning content quality features that support emerging m-learning applications from the point of view of experts?
2. What are students' perceptions about suggested feasible m-learning content quality features by experts that support emerging m-learning applications?
3. Are there any statistically significant differences in student estimates of the most pertinent m-learning content quality features that support emerging m-learning applications from the point of view of experts concerning students' gender and technological skills?

### **Procedural Definitions of the Study**

M-learning: A learning system that uses cell phones and students' portable websites to deliver learning content for Jordanian universities for various courses.

Quality features: The sum of all instructional design, pedagogical, curriculum, technical, behavioral, economic, psychological, and social characteristics for m-learning content to fulfill learning needs at a certain moment in time for a learner. Quality can be observed in the type of interaction between the learner and the content.

### **Purpose of the Study**

This study seeks to provide knowledge for the guidelines that must be taken into account when designing m-learning content to solve problems since design requires a balance of analyzing how to approach the subject and all available solutions.

### **Significance of the Study**

Uniquely focused skills including knowledge of technology that supports m-learning content and knowledge of effective pedagogy are needed for successful learning outcomes.

Very few studies have been conducted to emphasize the quality features that should be met in designing m-learning content online. Therefore, this research may add to the knowledge conducted in this field, especially in Jordan.

Additionally, because this research provides some possible suggestions for such a design, this may influence designers and instructors to fine-tune their instruction.

Furthermore, program planners and supervisors may benefit from this research by offering more insights into the design of m-learning content. It is hoped that policymakers in higher education

institutions in Jordan contemplate the quality issue in m-learning, especially when planning and implementing the curriculum.

## THEORETICAL FRAMEWORK AND RELATED WORKS

The framework outlines an introduction to m-learning content, feasible m-learning content, and related works.

### M-Learning Content

Some educators view m-learning as a part of e-learning, while others consider it a stand-alone educational system that has its own merits. M-learning can achieve what e-learning has not achieved because the prices of smart devices are lower compared to computers. M-learning allows for dealing with applications, browsing mail, text, audio, and video messages, and instant replying to messages by notifying the sender of receiving the message or not.

M-learning is a form of distance learning, through which small and portable wireless devices such as mobile phones, PADs, smart phones, and tablets are used to achieve flexibility and interaction in the teaching and learning processes anytime and anywhere.

With the transfer of face-to-face teaching to distance learning, the educational norms have developed into more m-learning. M-learning is a novel stage for e-learning that does not have the same limitations, as m-learning is not just about converting subjects into electronic subjects, but rather the important ability of m-learning to nurture students who can solve problems and adapt to the technology of the time (Al-Armiti, 2015). M-learning has developed rapidly over the past few years, as it is considered a form of distance learning and the latest technology being used in education (Al-Ghuwairi, 2014).

M-learning is defined as “the process of delivering electronic content, supporting students, managing learning and distance learning interactions at any time and place” (Ramzy, 2016). It is also defined as “the ability to learn anywhere and at any time without the need for a permanent connection to wireless networks (Abu Al Haija, 2016). It is further defined as any activity that allows students to be more productive when using or interacting with information with a digital device that is regularly carried by the individual and has reliable communication, and can be used anywhere and at any time by wireless access (Fakomogbon & Bolaji, 2017). Students can easily access educational materials via wireless networks and mobile devices.

Many m-learning techniques offer many services, including SMS which allows the exchange of text messages, Bluetooth, media service, and social media applications that have voice, image, and video connectivity (Abu Rumman, 2016).

M-learning does not exchange normal educational sessions but rather offers new innovative paths for learning inside and outside the classroom, and m-learning is not just the use of tools. It depends on the design of m-learning content: creating quick and simple interactions, preparing flexible materials that can change according to the needs of the student, contributing to the learning experience using the characteristics and limitations of mobile devices, using mobile phone technologies as a learning medium and not just a tool for distributing learning content, and designing materials with student-centered approaches (Naismith & Corlett, 2006).

M-learning also allows the enhancement of the active participation of students in learning and the exchange of content among themselves (Parajuli, 2016). There are features to be impeded in m-learning environments to ensure its success, and these features include presenting it in a way that suits the objectives, the learning strategy, and the target group. In addition, m-learning activities are designed to achieve educational goals, in attractive, realistic ways and help build knowledge, free from details and complex fees. Moreover, it provides assistance, guidance, and links to facilitate the interaction of the student with the content. It formulates the educational objectives of the content

and selects the appropriate applications for the educational content. In other words, it is flexible in designing educational content.

M-learning has witnessed rapid development and spread in its applications locally and globally, and many Arab universities have implemented many courses within m-learning programs. With this development, educational institutions have focused on improving the quality of m-content, which has been one of the challenges facing the m-learning system, especially in universities.

M-content is one of the basic components of m-learning courses as m-learning is based on three foundations: content, technology, and services. The content represents the basic core in any process related to learning, and the m-learning content with its dimensions of conceptual construction, objectives, sequence of activities, interactions, and the way it is presented on the internet represents an m-learning system (Liu, et al., 2010).

M-learning content is a set of topics that learners must acquire during the learning process, using certain electronic media. It includes any form of data and information, written, audio, or visual, that is created or compiled and organized by educational entities, responsible for clear educational purposes, in a systematic and meaningful way. Then, it is communicated to learners through digital educational resources, media, and databases via computers and networks, so teachers and learners can use it in the education process in a systematic way that allows them to share visions, influence knowledge, trends, and behavior, to achieve specific educational goals for specific learners (Al-Dahshan, 2015).

M-learning content is created as normal content is created, despite the great difference between them, as the same approaches and strategies are used, as well as educational tools and methods, but much of the m-content is far from the required quality.

Some requirements have not been taken into account yet (Teo & Gay, 2006). Many instructors use m-content as a mechanism for delivering educational topics or content and do not employ standards and integrated functions to build content across these systems, which focus on paying attention to the skills of self-regulation of knowledge, encouraging learners to manage their learning processes. Therefore, it is clear that m-learning content is not only a page full of information and data placed on the internet, but is developed according to educational processes and the design of the content takes into account the pedagogical rules and the integration of education and its strategies within the teaching-learning processes and its design for m-courses and contents. Thus, impacting the learner positively and achieving good performance in learning. Effective m-content designed within sound educational strategies facilitates learning outcomes, in addition to enabling students to acquire the desired skills for higher education so that they can apply what they have learned differently (Brown & Voltz, 2005; Teo & Gay, 2006).

The accessibility of principles for m-learning content is important when the instructor determines the appropriate instructional strategy. The importance is determined by objectives that can be achieved accurately and easily in specific situations and help achieve desirable outcomes, teaching and interconnection in the elements of m-content, the lack of ambiguity, and the ease of understanding its steps and assumptions. The m-content comprises a set of components in a correlation, causal or explanatory relationship, and is comprehensive by taking into account a set of elements such as student characteristics, student treatment methods, classroom procedures, evaluation methods, and feedback (Qatami, et al., 2008).

According to adaptive learning, m-content and devices should be adaptive. Since m-learning is a social, not technical, phenomenon, m-content in m-learning can be embedded in physical and social contexts, as well as embodied through multimodal and interactive learning settings, involving not only the visuospatial dimension, but also the role of proximity, posture, gesture, facial expressions, tone of voice, and touch (Pegrum, 2019).

### **Feasible M-Learning Content**

M-content for m-learning is characterized by several advantages that dictate the necessity of using it in building and designing m-learning content. Following are the advantages of m-learning:

**Cost savings and alternatives:** The most important advantages are cost savings and alternatives (Al-Fiqi, 2018; Abdelbaset, 2011). The current conditions in the educational process are moving towards reducing costs and the strict restrictions imposed by copyright by producing and using m-learning content materials. Making them available for dissemination, saves costs and provides alternatives for the user of these materials.

**Encouraging competition:** The production and dissemination of m-content materials forced institutions that produce these learning materials and programs to reduce prices to stay in competition. The presence of educational institutions that produce and publish these materials will ensure the responsiveness of profit-seeking institutions to the users of these materials in terms of price and copyright.

**Linking education directly to improving life:** The use of m-learning content has helped to provide financially insecure students with one of the methods that enable them to link education directly to improving quality of life, as it contributes to reducing the cost of educational service, which directly helps raise the standard of living for this type of student.

**Realizing the real value of education:** The real value of education is what results from the education process in the form of a more skilled society capable of carrying out important research, addressing complex challenges, and allowing learners to enter the labor market and obtain new and creative job opportunities related to the development of society and the improvement of its aspects of life.

**Participation in its production:** It is very difficult for a single person to produce all the m-learning content needed, as the complexities of technology require teamwork. There is no individual who is an expert in producing different forms of m-learning content, as it requires various skills. For example, a science and mathematics instructor might be needed to write an accurate description of a certain subject. However, if this instructor produces one of the valuable e-learning contents and makes it available to other users, other instructors of the same subject who have other skills can add new m-learning content to that topic.

In learning content for m-learning, the transition of ideas should be smooth and sequential, presented and designed in a hierarchical structure format in the following order: title, facts, concepts and terminology, procedure, real-life examples, summary, and a short exercise. Educational objectives and learning content should always overlap. Each page in the learning material should also contain means and tools for translation and other functions to achieve the student's full understanding of the material. Language accuracy has to be adequate, including spell checks, grammar structure, and syntax structure. Learning content should contain keywords that would ease reaching the desired objective for students (Premlatha & Geetha, 2018).

It is clear that the criteria for m-learning are to improve its use in teaching. Because of this, those working in the use of m-learning in teaching must take into account the quality of the m-content provided through m-learning devices and focus on the general design for the user interface, such as how to navigate from one page to another until exiting the application. In addition, the design of activities and tasks should be compatible with m-learning applications. Therefore, m-learning content should be designed based on mobile design principles and should be offered in small chunks instead of presenting the whole material at once (Parsons et al., 2007).

The technical design should consider many elements including: the lines, which are one of the most important elements of the artwork included in the content and applications. There are multiple forms of line such as horizontal, vertical, italic, straight, non-straight, diagonal, parallel, perpendicular, curved, streamline, and helical line. The area length, width, and height or the size which is the amount of its own space and the space around it and taking into account the characteristics of the students. Color, where color takes into account its divisions of primary colors, secondary colors, and three-dimensional colors. Lighting and its shadows, especially in the preparation of photos and videos. The void, which is the space surrounding the artwork. The consistency or the use of the same page layout throughout the course, standardization of the use of different types of feedback, and uniformity of sizes and locations of content elements.

In the process of designing m-learning content, the designer must give more time and attention to the creative process of developing goals, designing learning activities and assessments, and making informed decisions about all the technologies used and how to integrate them with the learning content which fits students' needs and characteristics (Izhar, 2021).

The use of m-learning according to the characteristics of students is in itself an interest in individual differences. Individual learning is concerned with individual differences, as it focuses on the cognitive abilities and skill differences of a learner from other students, where the student is viewed from all sides. The content is not only a set of facts and knowledge, but rather a complex construction that includes all aspects of the student, his/her capabilities, and motives. A self-regulated approach to teaching lets students engage with the content and reflect on their learning experiences (Santoian, et al., 2022).

The learning content must be interactive and attractive, using multimedia elements in a manner commensurate with the learning objectives and allowing for the following:

**Repetition:** Learning activities should be designed so that students can repeat them in the event of a failed attempt. It is very important to create opportunities to achieve the end goal by trying repeatedly and thus improving the skill.

**Feasibility:** Learning activities should be achievable so that they are designed and adapted according to students' levels and skills.

**Gradation of difficulty:** Subsequent tasks are expected to be more complex, require more effort from students, and correspond to newly acquired skills and knowledge.

**Multiple paths:** To develop diverse skills of learners, they must be able to reach their goals through different paths. This allows students to build their skills through multiple strategies, which is one of the keys to the characteristics of active learning.

There are many gamification software programs, some of which are web-based (cloud services) and do not require special software installation and allow access anytime and anywhere. Among the most popular applications are Socrative, Kahoot, FlipQuiz, ClassDojo, Goalbook, and Duolingo. E-learning management systems have also recently taken care to include gamification strategies, which are led by Moodle by providing all gamification features and functions such as tracking progress and presenting badges.

In disseminating learning content through m-learning devices, the following should be applied. Obtaining information electronically, processing information, storing information using storage media, placing information in forms that suit students, and transferring the final product through communication networks until students receive it are important factors for the process of benefit and retrieval (Al-Nashar, 2000).

The m-learning environment provides a simple user interface offering assistance, guidance, and links, which makes it easier for the student to interact with the content and access the program. It also offers flexibility of browsing and the suitability of multimedia elements to the characteristics of students. The m-learning environment includes protection methods for students' data and is designed in accordance with the mobile web service (Naismith & Corlett, 2006).

Good user interfaces allow tasks to be completed easily, without complications. Graphic design, typography, and content production support the interfaces greatly in terms of helping to improve the design and the final output to attract students. It is necessary to maintain a balance between actual technical functions and designs aesthetics in the facade to reach a system that not only performs operations, but is also usable and adaptable to the needs of students.

M-learning devices are used in classrooms by many applications such as Mashups where students utilize multimedia by making new texts that include clips of images, audio, and video. Websites such as creative commons include open sharing with visual content. This motivates students when interacting with content, as mobile devices enable gesture and voice control, with most devices including video cameras to simultaneously capture and share content (Stevenson, et al., 2015).

The forms of digital content vary, including graphic information, which can be shared through social networks; video that communicates information instead of plain text, as the videos can be made through mobile learning devices; animated pictures that arouse the interest of the students and increase the rate of interaction; e-books, in which modern content and attractive design are taken into account; slide-share, which allows recording and uploading PowerPoint, infographic, or even Word files and allows follow up on views and downloads of materials; webinar lectures and discussions, including marketing, academic content, and hosting experts in a particular discipline; and e-mail newsletters that are used to create useful and publishable content.

The exchange of m-learning content between learners, themselves, and the instructor is a feature of m-learning. The majority of mobile devices have reduced their cost and the small size of these devices is easy to navigate and access educational information faster through the services provided by m-learning devices with downloading notes and e-books (Bukharaev & Altaher, 2017).

The value of m-learning content is perceived by assessing the quality of text, graphics, and multimedia, text clarity, the organization of hyperlinks, and the use of appropriate methods and techniques (Kazaine, 2015).

## **RELATED WORKS**

Designing m-learning content is gaining momentum, especially in terms of emerging m-learning applications. Many previous studies were conducted in different countries in an attempt to emphasize the quality features that should be adopted in any design of content for m-learning. Therefore, a related literature review of previous studies is presented to support the goal of the study.

Hirsh-Pasek, et al., (2015) indicated that there is not enough time, money, and resources available to assess each educational app. Therefore, educational apps are mainly unregulated and unapproved. They believe that an educational app must foster active, engaged, meaningful, and socially interactive learning.

A study showed that interacting with a vocabulary-focused app improved learners' vocabulary by up to 31% in just two weeks (Chiong & Shuler, 2010; Corporation for Public Broadcasting, 2011). Hence, there is a necessity to suggest features for the design quality of apps that will support the learning process.

Marsh, et al., (2015) indicated that appropriate quality and design encourage a varied range of performance and creativity for learners. Additionally, highlighted some content issues such as content suitability, higher-order thinking skills, ease of use, and cultural sensitivity.

A study confirmed that the use of gaming technology improves the ability to learn new skills by 40%. Play styles also lead to a higher level of commitment and motivation in users for the activities and processes in which they participate in m-learning based on modern ICT creates favorable conditions for implementing gamification as student data processing is automated, student assessment is tracked, and software tools can produce detailed reports (Zichermann & Linder, 2013).

A study found that m-learning still consists of a simple transition from presenting content based on the regular class to presenting it in the form of electronic texts. Focusing on cognitive strategies during the creation of e-content is still far from receiving attention. The focus is on the unique characteristics of m-learning that represent the physical dimension of the learners and the subject teacher and a model of asynchronous communication (Teo & Gay, 2006).

Abdul Latif, et al., (2017) aimed their study at developing a list to assess m-learning environments in light of global standards for educational technology. To achieve the objective of the study, a list of criteria for designing mobile learning environments was prepared, and the learning environments assessment card was designed in light of the criteria. The results indicated that standards were taken into account in the following axes: development of learning materials, instructional control, page layout in m-learning environments, interaction and feedback methods, usability, mobile learning tools, and m-content delivery.

Toktarova, et al., (2015) explored the basic requirements for m-learning tools and resources. The results of the study which was carried out with the students of the Applied Mathematics and Informatics Department showed a high impact of m-learning on the teaching and learning process in higher education. The modular approach used provided the flexibility and openness of the curriculum by providing students with opportunities to master learning materials of the whole training course in any sequence. Both the content of information frames and quality control of students' knowledge of the course materials had been carefully thought out.

In her study, Alkaradsheh (2009) presented the design and implementation of the m-learning content model. She focused on adapting the content presentation to select elements from various sources in a mobile environment, such as elements from the learner's profile, mobile device requirements, and connectivity. In addition, the study aimed at allowing efficient content adaptation which could be applied to any type of learning content by taking into account material that supports learning, such as summaries, quizzes, messages, objectives, and comments.

Pocatilu & Boja (2009) emphasized that a continuous quality management process needs to take place at several levels in m-learning. The multimedia educational software could implement features like photo or audio galleries, discussion forums, lectures and presentations, assignments, and other resources, and the type of multimedia support used to deliver content should be taken into consideration. They believe that there is no universal pattern for delivering learning content because it must be realized having in mind a particular target group. The analysis of the learner is a stage that takes place in the early phase of m-learning content development.

Referring to the relevant literature, a study concluded that one of the most important challenges that emerged is the design of learning content that fits the m-learning environment (Alhebeida, 2021), and another study recommended redesigning the teaching content according to models and theories of education (Alsaman, 2021).

## **METHODOLOGY OF THE STUDY**

The study followed an exploratory sequential mixed research design. The researchers utilized this type of research design to use quantitative data to confirm and validate their qualitative findings. First, a group of 20 experts in m-learning was chosen to answer one open-ended question for the qualitative research part. Second, using a quantitative research method, a self-administered questionnaire was distributed to collect data from students who had courses in m-learning to determine student perceptions about suggested feasible m-learning content quality features suggested by experts. The researchers believe that the qualitative and quantitative data needed for this research was valuable and their integration provided the researchers with a better understanding of the research problem (Creswell, 2013).

### **Participants**

A purposeful sample of 20 experts specializing in information technology and communications and educational technology from seven Jordanian universities during the academic year 2021-2022 were selected to answer the open-ended question. The specifications of experts varied in terms of their instructional experience, gender, and number of courses taught via m-learning. In addition, a group of 200 graduate students, 110 female and 90 male, from the same seven Jordanian universities was purposefully selected to answer the questionnaire. They had experience with m-learning courses during the academic year 2021-2022 which was corroborated by the admission and registration offices in their universities.

### **The Instrument of the Study**

To achieve the goal of the study, a review of the literature and studies related to the method of conducting the study was performed to answer the first research question of the study, where the researchers

formulated an open-ended question. This question was designed to give 20 experts in m-learning the chance to share their comments and suggestions and express their points of view regarding the design of suggested feasible m-learning content quality features. The question was “In your opinion what are the most pertinent quality features that should be included in any m-learning content ?” An open-ended question gives the participants a chance to provide answers in their arguments. An open-ended question permits researchers to take an all-inclusive and complete look at the subjects being investigated since respondents offer their input and opinions (Fribourg & Rosenvinge, 2013).

Open-ended questions may help in obtaining more accurate and clear information, understanding the participants’ opinions in-depth, and increasing the participants’ thoughtful answers of the subject of study (Creswell & Poth, 2016). Additionally, a questionnaire solely based on the most pertinent m-learning content quality features that support emerging m-learning applications from the point of view of experts was utilized to serve as the source for quantitative data to help in determining student perceptions about these quality features. The questionnaire consisted of 31 items. A five-point Likert scale ranging from (1) strongly agree to (5) strongly disagree measured student estimates.

This mixed research method represents more than just numbers and data. Researchers must encompass the data to interpret and realize the meanings and relationships within the data. According to Creswell (2013), it is more likely to see the combination of open-ended questions with closed-ended questions on a survey for gathering information.

### **Validity of the Questionnaire**

To verify the face validation of the questionnaire, it was presented in its preliminary copy to a group of specialists and educators. To ensure content validity, the questionnaire was presented to five faculty members who majored in educational technology, curriculum and instruction, and evaluation and measurement at the University of Jordan. The questionnaire was then presented in its final version.

### **Reliability of the Questionnaire**

The reliability of the questionnaire was ensured by measuring the internal consistency (Cronbach’s alpha) for the overall scale (0.88). This showed a high internal consistency value. This value is considered appropriate and reasonable for the purposes of applying the questionnaire.

### **Data Collection**

The data collection in an exploratory sequential mixed research design was followed. In the first stage, qualitative data was collected through an open-ended question that was submitted via e-mail to 20 experts who showed interest to participate in the study. Then, it was followed by collecting quantitative data through a questionnaire that was mailed to the entire population of graduate students (312), of whom 200 respondents completed and returned the questionnaire. The overall response rate for the entire population was 64%.

### **Data Analysis**

The participants’ answers to the open-ended question were analyzed using a thematic analysis method. Repeated data in the texts were revealed using different colors to classify them to axes. Each axis was then named and the data were unloaded within these axes (Savin-Baden & Major, 2013). The results of the study in its final form were presented after coding the data into categories and axes. The points of intersection were found in the participants’ answers to reach the results and recommendations of the study to highlight the most pertinent quality features for m-learning content that supports emerging m-learning applications.

To ensure the trustworthiness of the results of the open-ended question, the analysis was presented and discussed with several researchers. Taking into account that honesty is a quality of qualitative research, the researchers did not make predictions but rather derived facts by directly collecting,

analyzing, and examining data. In addition, the quantitative data extracted from student estimates were analyzed using the SPSS package to answer research questions 2 and 3.

## STUDY RESULTS

### Question 1

The qualitative data extracted from the open-ended question were analyzed. The results are shown in Table (1) arranged according to the frequency of their presence in answers.

Table 1 showed that 75% of the experts believed that the most pertinent m-learning content quality features that support emerging m-learning applications are “mobile content types including web content and audio files.” One expert who had more than 25 years of experience and taught more than 25 courses stated that “web content and audio materials is a must in any form of m-learning content.” Therefore, m-learning applications should be compatible to get along with web and audio files. Another expert who had 15 years of experience and taught more than 19 courses believed that web content and multimedia files are not accessories in m-learning content for m-learning but rather necessities.

One expert who had more than 10 years of teaching experience and taught 15 courses explicated that designing and producing different types of web content and audio files should be the main focus of instructor and student in the 21<sup>st</sup> century.

Also, 65% of the experts referred to the need for designing activities that help the learner to experience new knowledge in any form of m-learning content. One expert who had more than 14 years of experience and taught more than 18 courses stated that “it’s not anymore accepted for instructors to employ 20<sup>th</sup>-century teaching practices for 21<sup>st</sup>-century learners. Any m-learning content must include new skills necessary to succeed in 21<sup>st</sup>-century careers.” This leads to the reinforcement of the proverb about learning that says: what we hear we forget, what we see we remember, and what we do we understand.

Most of the experts (65%) highlighted the importance of employing the latest scientific developments. One expert who had 25 years of experience and 20 courses taught at the university level put it all together by emphasizing that “learning content for m-learning has to be revised to address new advancement in science and technology which resulted in producing new jobs or occupations.”

Peer-to-peer learning offers a team learning atmosphere with colleagues. Most of the experts (65%) believed that m-learning content should support peer-to-peer learning which may be a very influential means to overcome some restrictions on learning and gaining new skills. One expert who had 15 years of experience stated that “m-learning content should empower teamwork learning since when we are eager to learn a new skill, we first turn to our peers in this effort.”

Many of the experts (60%) expressed their willingness to include activities that develop subjective, mental, social, and cognitive dimensions in any learning content for m-learning. One expert who had more than 13 years of experience enlightened that by stating “in a very multifaceted digital world, enhancement of cognitive activities that develop subjective, mental, and social-functioning is increasing gradually.”

Many of the experts (60%) highlighted the necessity of offering diverse learning formats (web surfing, video watching), while 55% referred to presenting different types of activities (audio, visual, and sensory) in learning content for m-learning as an important aspect. One expert with 20 years of experience explicated that “in e-learning environments, such as m-learning, we should pay attention to the different styles where learners learn. Since visually (sic) learners may find themselves lost, bored, and behind those verbal learners. We should make sure that our content includes all visual, auditory, reading and writing, and kinesthetic learning styles.”

Our experts (60%) with different years of experience elucidated the urgency of innovative m-learning assessment tools to cope with learners in modern electronic environments especially “conducting comprehensive e-assessment via m-learning devices.”

**Table 1. Descending order of the proportion of the most pertinent quality features of m-learning content that supports emerging m-learning applications from the point of view of experts**

| Number | M-Learning Content Quality Features                                                                                            | Frequency | Percentage |
|--------|--------------------------------------------------------------------------------------------------------------------------------|-----------|------------|
| 1      | Content types include web content and audio files.                                                                             | 15        | 75%        |
| 2      | Designing activities that help the learner to experience new experiences.                                                      | 13        | 65%        |
| 3      | Employs the latest scientific developments.                                                                                    | 13        | 65%        |
| 4      | Provides a team learning atmosphere with colleagues.                                                                           | 13        | 65%        |
| 5      | Stimulates activities that develop subjective, mental, social, and cognitive dimensions.                                       | 12        | 60%        |
| 6      | Diverse learning format (web surfing, video watching).                                                                         | 12        | 60%        |
| 7      | Conducts comprehensive e-assessment via m-learning devices.                                                                    | 12        | 60%        |
| 8      | Allows learners to ask questions to develop their capabilities.                                                                | 12        | 60%        |
| 9      | Presents the different types of activities (audio, visual, sensory).                                                           | 11        | 55%        |
| 10     | It takes into account the stages of building technical activities (analysis, design, development, production, and evaluation). | 11        | 55%        |
| 11     | Refers to comments about activities in m-learning devices.                                                                     | 11        | 55%        |
| 12     | Includes organizing the form of educational activities (theory, laboratory practice, knowledge, and skills).                   | 11        | 55%        |
| 13     | Allows the use of interactive software utilities.                                                                              | 10        | 50%        |
| 14     | Includes regular tasks assigned to learners in or out of the classroom.                                                        | 10        | 50%        |
| 15     | Encourages learners to create contextual content through m-learning environments.                                              | 10        | 50%        |
| 16     | Refers to the simulated classroom.                                                                                             | 10        | 50%        |
| 17     | Includes effective applications.                                                                                               | 10        | 50%        |
| 18     | Supports diversity in the use of educational aids.                                                                             | 9         | 45%        |
| 19     | Allows learners to view achievements and projects via m-learning.                                                              | 9         | 45%        |
| 20     | Includes research-based learning guidelines.                                                                                   | 9         | 45%        |
| 21     | Refers to individual learning applications.                                                                                    | 9         | 45%        |
| 22     | Refers to using the notepad to take quick notes.                                                                               | 8         | 40%        |
| 23     | Refers to the selection of learning experiences to achieve the cognitive growth of learners.                                   | 8         | 40%        |
| 24     | Allows situated learning through effective teaching.                                                                           | 7         | 35%        |
| 25     | Organizes the content in a logical sequence.                                                                                   | 7         | 35%        |
| 26     | Fits diverse groups of learners.                                                                                               | 6         | 30%        |
| 27     | Focuses on the quality of education.                                                                                           | 6         | 30%        |
| 28     | Provides educational outputs according to comprehensive quality specifications.                                                | 5         | 25%        |
| 29     | Includes flexible learning style activities.                                                                                   | 4         | 20%        |
| 30     | Allows performing tasks transmitted via m-learning devices.                                                                    | 4         | 20%        |
| 31     | Promotes democracy in education.                                                                                               | 2         | 10%        |

Again, 60% of the experts emphasized the importance of “allowing learners to ask questions to develop their capabilities.” One expert with 15 years of experience stated that “questions stimulate discussions for learners and ultimately help in increasing their motivation and active learning through supporting them in practicing skills of analysis, synthesis, and evaluation.” Another expert indicated that “asking questions help learners to indicate the type of content that they are interested in unfolding more deeply.”

More than half of the experts (55%) that had more than 10 years of experience and taught more than 15 courses said that the type of activities that should be implemented in the m-learning content “takes into account the stages of building technical activities (analysis, design, development, production, and evaluation),” “refers to comments about activities in m-learning devices,” and “includes organizing the form of educational activities (theory, laboratory practice, knowledge, and skills).” One expert explicated that all learning activities should be meaningful and useful to the learner. He added that “the curriculum must afford a balance and diverse forms of activities for integration, such as pieces of reading, chunks of videos, writing reports, designing and producing artifacts, gathering and analyzing data, collaborating with peers.”

Half of the experts (50%) believed that m-learning content “allows the use of interactive software utilities” and “includes effective applications.” One expert with 15 years of experience emphasized that the type of software applications must be “versatile such as social applications, open-source software which brings quality content to engage and motivates learners seeking to attain new skills.” Results showed that “including regular tasks assigned to learners in or out of the classroom,” “encourages learners to create contextual content through m-learning environments,” and “refers to simulated classroom” had 50% of the experts’ remarks. One expert stated that “we need to include tasks for learners for more extended periods inside and outside the classroom and accomplishing some of these tasks should be connected to real-life challenges.” Another expert with 16 years of experience explicated that efficiency within m-learning content must be manifested in authentic applications to help learners cope in a fast-paced world, driven towards learning efficiency, through scaling and designing m-learning content to suit diverse learners from multiple places and backgrounds, interests, and motivations. He stated that “we must deliver learning in a form by dividing learning content via multiple and tiny chunks.” A third expert highlighted the need to include educational applications for children, specific functional applications, educational games applications, and language learning applications.

The following items had 45% of the experts’ agreement: “support diversity in the use of educational aids,” “allows learners to view achievements and projects via m-learning,” “includes research-based learning guidelines,” and “refers to individual learning application.” One expert highlighted the urgency of using diverse aids such as pictures, videos, and internet facilities to support the learning process and connect learners with real-life situations. Another expert emphasized the need to enhance content to motivate learners by preparing them for a changing working field. A third expert stated that “our m-content should support diverse teaching practices.” A fourth expert with 10 years of experience indicated that “the use of instructional aids should empower the learning process by making it more enjoyable and pleasant.”

Some of the experts (40%) highlighted the need to use a notepad for taking notes and the selection of learning experiences to achieve the cognition growth of learners. The experts believe that m-learning content should be aligned according to the characteristics of learners which is in itself an interest in individual differences, where individual learning is involved in individual differences which focuses on cognitive abilities. Therefore, 35% of the experts emphasized the need for m-learning content to “allow the situated learning through effective teaching,” and “to organize the content in a logical sequence.” In this regard, m-content is not a set of facts and metaphors. It is a complex combination that includes all aspects of the learner, his/her potential, and motivations. One expert with more than 10 years of experience stated that “we should design independent learning situations in our m-learning content.” Another experienced expert highlighted the need for any m-content to be “designed in a

chronological order.” Another expert proposed that “m-learning content should be alphabetically organized and presented to learners since this sounds more convincing, especially for text content.”

Tailoring content that “fits diverse groups of learners” and “focuses on the quality of education” had 30% of the experts’ approval for feasible m-learning content quality features. One expert with great experience emphasized that “we should pay attention to learner age group, gender, and cultural background when selecting images for characters within content.” Another expert indicated the urgent need to “know learners language proficiency and their prior knowledge of the subject matter within the content.”

A quarter of the experts (25%) suggested that m-learning content should “provide educational outputs according to comprehensive quality specifications.” One expert stated that for these educational outputs to be accomplished, it’s highly recommended to “clarify learning goals to achieve.” Another expert referred to the design of best instructional practices through attaining quality. Therefore, the m-learning content must be tailored to fit particular learner characteristics. For example, having materials in a learner’s primary language is important, as is using vocabulary at their reading level.

Drawing from the perspectives of the experts, 20% said to “include flexible learning style activities” and “allow to perform tasks transmitted via m-learning devices.” One experienced expert stated that “it’s a must to ensure contextually-appropriate content design in m-learning applications as a function of required learning goals.”

Lastly, a few of the experts (10%) indicated that any m-learning content should promote democracy in education. One expert highlighted the concept by stating that “embedding democratic culture, values, and practices may help learners to become active citizens within their societies.” The experts emphasized the need for content to support learners’ practices of freedom of choice and thought. One expert stated that “content should help learners build their independent personality and shape their own identities.”

## Question 2

The quantitative data collected from the questionnaire helped in determining student perceptions about the most pertinent m-learning content quality features that support emerging m-learning applications from the point of view of the experts.

Table 2 shows that mean scores for student perceptions ranged between 3.45- 4.68 and had a standard deviation of .752. The item in first place came with a mean score of 4.68 and a standard deviation of .702, followed by the item in second place with a mean score of 4.65 and a standard deviation of .690, while the item ranked last came with a mean score of 3.45 and a standard deviation of .839.

Table 2, shows that items from 1 to 20 had mean scores ranging from 4.00-4.68 while items from 21 to 31 had mean scores ranging from 3.45-3.95. Therefore, the findings explicated that a self-regulated learning approach lets students interact with the content and reflect on their learning with several m-learning applications (Giannakos, et al., 2016).

## Question 3

Means and standard deviations were calculated for student estimates according to their gender.

Table 3 shows a lack of statistically significant differences at the level of significance ( $\alpha \leq 0.05$ ) in student estimates attributed to their gender, based on the calculated T-value (1.72) with a level of statistical significance of 0.06.

Table 4 shows the differences between the means of student estimates according to their technological skills. To determine whether the differences between the means are statistically significant at the significance level ( $\alpha \leq 0.05$ ), a one-way analysis of variance was applied.

Table 5 shows a lack of statistically significant differences at the level of significance ( $\alpha \leq 0.05$ ) in student estimates attributed to their technological skills, based on the calculated P-value (1.62) with a level of statistical significance of 0.331. These values are not considered statistically significant.

**Table 2. Means and standard deviations for students' estimates of feasible m-learning content, arranged in descending order**

| Rank | M-Learning Content Quality Features                                                                                            | Means | Standard Deviations |
|------|--------------------------------------------------------------------------------------------------------------------------------|-------|---------------------|
| 1    | Mobile content types include (web content and audio files).                                                                    | 4.68  | .702                |
| 2    | Diverse learning format (web surfing, video watching).                                                                         | 4.65  | .690                |
| 3    | Conducts comprehensive e-assessment via m-learning devices.                                                                    | 4.62  | .723                |
| 4    | Allows the use of interactive software utilities.                                                                              | 4.60  | .731                |
| 5    | Stimulates activities that develop subjective, mental, social, and cognitive dimensions.                                       | 4.55  | .718                |
| 6    | Designing activities that help the learner to experience new experiences.                                                      | 4.51  | .661                |
| 7    | Employs the latest scientific developments.                                                                                    | 4.50  | .793                |
| 8    | Allows learners to ask questions to develop their capabilities.                                                                | 4.48  | .735                |
| 9    | Presents the different types of activities (audio, visual, sensory).                                                           | 4.44  | .727                |
| 10   | It takes into account the stages of building technical activities (analysis, design, development, production, and evaluation). | 4.40  | .880                |
| 11   | Refers to comments about activities in m-learning devices.                                                                     | 4.37  | .515                |
| 12   | Includes organizing the form of educational activities (theory, laboratory practice, knowledge and skills).                    | 4.35  | .681                |
| 13   | Provides a team learning atmosphere with colleagues.                                                                           | 4.30  | .776                |
| 14   | Refers to simulated classroom.                                                                                                 | 4.26  | .672                |
| 15   | Encourages learners to create contextual content through m-learning environments.                                              | 4.22  | .830                |
| 16   | Allows learners to view achievements and projects via m-learning.                                                              | 4.15  | .845                |
| 17   | Includes effective applications.                                                                                               | 4.12  | .838                |
| 18   | Supports diversity in the use of educational aids.                                                                             | 4.10  | .756                |
| 19   | Includes regular tasks assigned to learners in or out of the classroom.                                                        | 4.05  | .810                |
| 20   | Includes research-based learning guidelines.                                                                                   | 4.00  | .638                |
| 21   | Refers to individual learning application.                                                                                     | 3.95  | .682                |
| 22   | Refers to using the notepad to take quick notes.                                                                               | 3.90  | .750                |
| 23   | Organizes the content in a logical sequence.                                                                                   | 3.87  | .732                |
| 24   | Allows the situated learning through effective teaching.                                                                       | 3.85  | .750                |
| 25   | Refers to the selection of learning experiences to achieve the cognitive growth of learners.                                   | 3.80  | .713                |
| 26   | Fits for diverse groups of learners.                                                                                           | 3.77  | .703                |
| 27   | Focuses on the quality of education.                                                                                           | 3.75  | .750                |
| 28   | Allows to perform tasks transmitted via m-learning devices.                                                                    | 3.70  | .765                |
| 29   | Includes flexible learning style activities.                                                                                   | 3.66  | .787                |
| 30   | Provides educational outputs according to comprehensive quality specifications.                                                | 3.60  | .830                |
| 31   | Promotes democracy in education.                                                                                               | 3.45  | .839                |
|      | Total                                                                                                                          | 4.15  | .752                |

**Table 3. T-test results of the means difference of student estimates according to their gender**

| Level of Significance | T-Value | Means | Standard Deviations | Numbers | Gender | Scopes            |
|-----------------------|---------|-------|---------------------|---------|--------|-------------------|
| 0.06                  | 1.72    | 4.20  | .581                | 90      | male   | student estimates |
|                       |         | 4.05  | .511                | 110     | female |                   |

**Table 4. Means and standard deviations calculated for student estimates according to their technological skills**

| Means | Standard Deviations | Numbers | Technological Skills | Scopes            |
|-------|---------------------|---------|----------------------|-------------------|
| 3.97  | .472                | 111     | high                 | student estimates |
| 3.79  | .391                | 51      | moderate             |                   |
| 4.22  | .521                | 38      | low                  |                   |

**Table 5. Results of the one-way analysis of variance to the means of student estimates according to their technological skills**

| Level of Significance | P-Value | Squares Mean | Degree of Freedom | Sum of Squares | Source of Variance | Scopes            |
|-----------------------|---------|--------------|-------------------|----------------|--------------------|-------------------|
| 0.331                 | 1.62    | 0.44         | 2                 | 0.88           | among the groups   | student estimates |
|                       |         | 0.22         | 107               | 30.05          | within the groups  |                   |
|                       |         |              | 109               | 30.93          | Total              |                   |

## DISCUSSION OF RESULTS

The results of the first research open-ended question which asked “What are the most pertinent m-learning content quality features that support emerging m-learning applications from experts’ point of view?” is discussed in this section.

The results indicated that the majority of the experts (75%) who answered the open-ended question believed that the most pertinent m-learning content quality features that support emerging m-learning applications should include web content and audio file forms. Pedagogical characteristics of the multimedia educational software for m-learning content should allow learners to interact and to collaborate to satisfy their needs. Also, the content must attract learners and must reinforce their attention because in the m-learning setting the learner is rarely supervised by another person (Pocatilu & Boja, 2009). M-learning is no longer seen as a mobile device to display mobile content, but as a way to change our daily lives toward learning spaces (Pachler, et al., 2010).

To remain relevant, m-learning content must be developed to respond to new and emerging careers. The m-learning content should take into account accuracy, objectivity, and modernity. In addition, it should be characterized by comprehensiveness, relevance, consistency, and diversity.

Therefore, m-learning content that supports peer-to-peer learning is suited for situated cognition which represents the third generation in m-learning where situated learning plays a very dynamic part since learners gain knowledge, exercise the knowledge, get feedback from their peers, and reflect on their learning. The success of m-learning is closely linked to the ability of teachers to design learning content suitable for digital students and is considered one of the most important factors that makes technology integration successful in teaching and learning in the virtual classroom (Hyseni & Hoxha, 2020).

M-applications should support tracking how learners are engaged and progress and cite this in records delivered to learners and their institutions. Therefore, these types of applications need to be

applicable, fast, reliable, and compatible with multi-device support, and merge best technological practices.

Using diverse educational aids boosts classroom instruction that gains learner attention and motivates them to learn. Moreover, instructional support materials allow developers to use a large set of tools used to deliver content in various formats. The multimedia educational software could implement features like photo or audio galleries, discussion forums, lectures and presentations, assignments, and other resources to download on the mobile device (Pocatilu & Boja, 2009).

M-learning has been referred to as being personalized, situated, and authentic (Traxler, 2007). The idea of personalized learning is evident in the various teaching methods and respects the cognitive differences of the learner in his/her interaction with the environment and society. As a result, there is an urgent need to design learning content and the interface of mobile tools in a way that meets the diverse needs of learners where learning appears in a variety of situations to simulate and solve real world problems (Cardoso & Abreu, 2019; Santoianni, 2022).

It is clear from respondents that presenting content sequentially makes it easier for learners to follow and saves them from being disturbed. Certainly, this will help learners with special needs or learning preferences, by providing those alternate modalities such as reading text, listening to the audio, and watching a video. The instructional design of m-learning content should be comprehensive enough to achieve the stated objectives and learning outcomes to help the learner achieve learning objectives. In the early generation of m-learning, the focus was on transferring knowledge content to learners while, in its second generation the focus was shifted towards building knowledge, and in its third generation, the effort was mainly tilted towards more situated cognition (Santoianni, 2022). Situated learning supports instructors in order for them to turn their classrooms into groups of practice and see their students as novices in novel communities of learning.

Indeed, instructional design for mobile initiatives should take into consideration that understanding which materials to deliver via various means is important. This variety of choices is significant because learning is a human activity, quite diverse in its appearance from learner to learner (Dede, 2008).

Authentic education is offered with the freedom to study anytime, anyplace, and any content which helps the student's individualized needs (Zhang, 2019). The current challenge of m-learning is on adjusting e-learning contents to satisfy learners' desires. Therefore, content personalization may happen, integrating learning styles into adaptive learning over online classification models or adaptive learning systems (Truong, 2016).

The experts highlighted many suggested pertinent content quality features for m-learning that supports emerging m-learning applications. The most commonly suggested idea was that good user interfaces allow tasks to be completed easily, without the need for complications.

Graphic design, typography, and content production should greatly support the interfaces to improve the design and the final output to attract learners. It is also essential to preserve a balance between actual technical functions and design aesthetics within m-learning content to reach m-learning content that not only performs operations, but is also usable and adaptable to the needs of learners.

The findings emphasized that any type of m-content should regulate suitable forms of media for conveying information to learners, as well as the span of each module or lesson. Furthermore, learning objectives and learner characteristics should be considered in shaping learning activities and assessment strategies (Samoekean, 2021). These findings in our current study can be attributed to the fact that the experts are fully aware of the quality features of m-learning content, so this was manifested in their thematic responses toward m-learning content.

The results of the second and third research questions which asked "What are students' perceptions about suggested feasible m-learning content quality features by experts that support emerging m-learning applications?" and "Are there any statistically significant differences in student estimates of the most pertinent m-learning content quality features that support emerging m-learning applications from the point of view of the experts concerning students' gender and technological skills?" follow.

Overall, data indicated that students have a positive perception of the most pertinent m-learning content quality features that support emerging m-learning applications from the point of view of the experts. The findings indicated employing more student-centered learning design within m-learning content that satisfies the needs enforced by the COVID pandemic or any other similar situation or learning environment. The findings inferred that instructors need certain skills and knowledge for preparing quality features for m-learning content performed via multi-mobile devices and applications (Briz-Ponce, et al., 2017; Christensen & Knezek, 2018).

The data highlighted that analyzing learners' characteristics and learning styles is vital for designing appropriate learning activities (Gagne, et al., 2004; Gustafson & Branch, 2004). Hence, analyzing learners' characteristics and learning styles is crucial to identify how to deliver content, arrange activities, and conduct the assessment. The scope and nature of the content should determine appropriate types of m-learning applications which support situated learning. Meanwhile, learning objectives and learner characteristics should be taken into account in determining learning activities and assessment strategies.

This study showed that m-learning content quality plays an important factor in advancing m-learning in higher education institutions, which supports the study findings conducted by (Alwraikat & Al Tokhaim, 2014). These outcomes indicate that when learners feel the learning content is appropriate, they will adopt m-learning applications into their learning.

A lot of research has been done on m-learning, exclusively from a technical perspective as opposed to a pedagogical perspective. Therefore, many types of m-learning content may not be appropriate for the learners. Hence, we should eliminate any type of gaps within and between m-learning contexts, locations, devices, systems, learning tasks, and learning settings.

Most of the studies dealt with the nature of m-learning content from a technical side and rarely dealt with the educational aspect related to designing teaching in modern electronic environments. Many studies referred to this topic urgently and superficially without addressing the nature and form of the type of learning content, how to design it, the philosophy from which it is based, educational standards, and principles, and did not address topics related to situated learning that stems from many fields, such as educational psychology, social psychology, sociology, cognitive science, and anthropology.

Therefore, there is a need to re-purpose m-learning content. This gives scope for the emergence of newer pedagogies suitable for m-learning (Kukulka-Hulme, 2010). Since the learners will be engaged in m-learning in a variety of different settings, with a variety of devices with varying screen sizes, m-learning pedagogies need to be more dynamic and, therefore more complex. As a result, it is also important to look into navigation and interactivity including social interactivity aspects in the subject matter. Learners should have opportunities to relate or apply what they learned to their real lives (Alexander, et al., 2010). They added that learners need to be given opportunities to reflect, and to realize the value of a concept. Content reflection involves sharing thoughts about material. Process reflection includes perceptions, thoughts, feelings, and actions as participants shift through the material presented (Ostorga, 2006).

The results highlighted the need for designers of m-learning content to understand that in m-learning learners engage in short activity bursts. M-learners move from one device to another very quickly, and they want to continue their experience between them. A learner in m-learning environments is often a multi-tasker with their devices.

Demographic attributes and contextual factors could affect the embracing and teaching outcome of m-learning. This implies that the pedagogical design of m-learning content needs to be explicitly customized to satisfy the needs of context and learners. It is, therefore, reasonable to argue that learners would feel that it is much simpler to learn if the style of learning material suits the adopted learning system during the COVID-19 pandemic (Aznar-Díaz, et al., 2020).

## CONCLUSION

The adoption of quality features for designing m-learning content by designers to support the learning process is becoming conceivable. Utilizing the promising feasible suggested quality features in designing m-learning content, this study will contribute to the advancement of m-learning for long-life learning. The results of this study urge us to pay attention to learning skills and designing m-learning content and working to develop them among instructional designers and instructors within modern m-learning environments. Also, directing Arab programmers to create m-learning environments that work efficiently and effectively, such as those offered by international companies, commensurate with our societies, culture, and Arabic language. In addition, the design team for learning content for m-learning should include specializations and consultations by curriculum experts and instructional designers' specialists in learning content, educational psychology, multimedia, measurement and evaluation, instructors, representatives of the community, parents, and learners who can anticipate the future of m-learning environments and keep abreast of their continuous updates.

## RECOMMENDATIONS

Recommendations are offered in light of the results gained through the finding from the research questions. The researchers recommend more future studies to study the effectiveness of learning-content features while using m-learning in Jordanian higher education institutions. In addition, the researchers recommend more integration of learning experiences in formal and informal learning contexts, personal and social learning, and within m-learning applications.

Future studies should be geared toward investigating higher education institutions' implementation of mobile learning services within a clear policy regarding user training and educational profile. This provides a high degree of knowledge assimilation for learners.

## REFERENCES

- Abdelbaset, H. (2011). *Digital learning modules: A new vision for learning*. The World of Books.
- Abdul Latif, S., Al Shaer, H., & Al Jamal, A. (2017). Developing a card to evaluate mobile learning environments in light of international standards for educational technology. *Journal of Scientific Research in Education*, 6(18), 203–238.
- Abu Al Haija, R. (2016). *The effectiveness of mobile learning on self-organization of scientific concepts and the modification of alternative perceptions in the unit of the heart and circulatory system among fifth-grade students in the Nazareth district* [Unpublished Ph.D. thesis]. Yarmouk University, Irbid, Jordan.
- Abu Rumman, H. (2016). *The Impact of Mobile Learning on Listening, Speaking and Self-Learning Skills among Arabic-Speaking Students at the University of Jordan* [Unpublished Doctoral thesis]. University of Jordan, Amman, Jordan.
- Al-Armiti, M. (2015). *The Impact of the Use of Mobile Learning and Interactive Board on the Achievement of Seventh Graders in Mathematics in Jordan* [Unpublished Master's thesis]. University of Jordan, Amman, Jordan.
- Al-Dahshan, J. (2015). *Teaching and learning under mobile devices*. Joanna for Publishing and Distribution.
- Al-Fiqi, D. (2018). The effect of using the “RSRDLO” model to retrieve digital learning objects in developing the skills of producing the electronic courses among students of studies at the faculty of education, Tanta University. *International Journal of Internet Education: Association for Techno-logical and Human Development*, 221-244.
- Al-Ghuwairi, K. (2014). *The effectiveness of the mobile phone in the achievement of the Hashe-mite University students in mathematics and their attitudes towards it* [Unpublished Master's thesis]. The Hashemite University, Zarqa, Jordan.
- Al-Nashar, A. (2000). *Electronic publishing*. House of Scientific Culture.
- Alexander, M. E., Commander, N., Greenberg, D., & Ward, T. (2010). Using the four-questions technique to enhance critical thinking in online discussions. *Journal of Online Learning and Teaching*, 6(2), 409–415.
- Alhebeida, H. (2021). *Difficulties facing middle school teachers in using distance learning skills in the State of Kuwait* [Master's thesis]. Al al-Bayt University College of Educational Sciences.
- Alkaradshah, E. (2009). *Design and implementation of mobile learning content model* [Unpublished Master's thesis]. Middle East University, Amman, Jordan.
- Alsaman, S. (2021). Attitudes of basic and secondary education students in Jordan towards distance learning and its challenges in light of the Corona pandemic (COVID-19). *International Journal of Educational and Psychological Studies*, 1(9), 209–223.
- Alwraikat, M., & Al Tokhaim, H. (2014). Exploring the potential of mobile learning use among faculty members. *International Journal of Interactive Mobile Technologies*, 8(3), 4–10. doi:10.3991/ijim.v8i3.3682
- Aznar-Díaz, I., Hinojo-Lucena, F. J., Cáceres-Reche, M. P., & Romero-Rodríguez, J. M. (2020). Analysis of the determining factors of good teaching practices of mobile learning at the Spanish University: An explanatory model. *Computers & Education*, 159, 104007. doi:10.1016/j.compedu.2020.104007
- Briz-Ponce, L., Pereira, A., Carvalho, L., Juanes-Méndez, J., & García-Peñalvo, F. (2017). Learning with mobile technologies – students' behaviour. *Computers in Human Behavior*, 72, 612–620. doi:10.1016/j.chb.2016.05.027
- Brown, A., & Voltz, B. (2005). Elements of effective e-learning design. *International Review of Research in Open and Distance Learning*, 6(1), 1–7. doi:10.19173/irrodl.v6i1.217
- Budiman, R. (2013). Utilizing Skype for providing learning support for Indonesian distance learning students: A lesson learnt. *Procedia: Social and Behavioral Sciences*, 83, 5–10. doi:10.1016/j.sbspro.2013.06.002
- Bukharaev, N., & Altaher, A. (2017). Mobile learning education has become more accessible. *American Journal of Computer Science and Information Technology*, 5(2), 1–5. doi:10.21767/2349-3917.100005

- Cardoso, T., & Abreu, R. (2019). Mobile learning and education: Synthesis of open-access research. In Y. Zhang & D. Cristol (Eds.), *Handbook of Mobile Teaching and Learning* (pp. 313–332). Springer. doi:10.1007/978-981-13-2766-7\_85
- Chiong, C., & Shuler, C. (2010). *Learning: Is there an app for that? Investigations of young children's usage and learning with mobile devices and apps*. The Joan Ganz Cooney Center at Sesame Workshop. Retrieved from [https://pbskids.org/read/files/cooney\\_learning\\_apps.pdf](https://pbskids.org/read/files/cooney_learning_apps.pdf)
- Christensen, R., & Knezek, G. (2018). Reprint of Readiness for integrating mobile learning in the classroom: Challenges, preferences and possibilities. *Computers in Human Behavior*, 78, 379–388. doi:10.1016/j.chb.2017.07.046
- Corporation for Public Broadcasting. (2011). *Findings from Ready to Learn 2005-2010*. Washington, DC: Author. Retrieved from <http://www.cpb.org/rtl/FindingsFromReadyToLearn2005-2010.pdf>
- Creswell, J. W. (2013). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Sage Publications, Incorporated.
- Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage Publications.
- Dede, C. (2008). Theoretical perspectives influencing the use of information technology in teaching and learning. In J. Voogt & G. Knezek (Eds.), *International Handbook of Information Technology in Primary and Secondary Education* (pp. 43–62). Springer. doi:10.1007/978-0-387-73315-9\_3
- Fakomogbon, M., & Bolaji, H. (2017). Effect of collaborative learning style on performance of students in a ubiquitous collaborative mobile learning environment. *Contemporary Educational Technology*, 8(3), 268–279.
- Fribourg, O., & Rosenvinge, J. H. (2013). A comparison of open-ended and closed questions in the prediction of mental health. *Quality & Quantity*, 47(3), 1397–1411. doi:10.1007/s11135-011-9597-8
- Gagne, R. M., Wager, W. W., Golas, K. C., & Keller, J. M. (2004). *Principles of Instructional Design* (5th ed.). Wadsworth/Thomson Learning.
- Gustafson, K. L., & Branch, R. M. (2002). *Survey of Instructional Development Models* (4th ed.). ERIC Clearinghouse on Information & Technology.
- Hirsh-Pasek, K., Zosh, J. M., Golinkoff, R. M., Gray, J. H., Robb, M. B., & Kaufman, J. (2015). Putting education in “educational” apps: Lessons from the science of learning. *Psychological Science in the Public Interest*, 16(1), 3–34. doi:10.1177/1529100615569721 PMID:25985468
- Hyseni, Z., & Hoxha, L. (2020). *The impact of COVID-19 on education and on the well-being of teachers, parents, and students: Challenges related to remote (online) learning and opportunities for advancing the quality of education*. <https://www.researchgate.net/publication/341297812>
- Izhar, N., Al-dheleai, Y. M., & Si Na, K. (2021). Teaching in the time of Covid-19: The challenges faced by teachers in initiating online class sessions. *International Journal of Academic Research in Business & Social Sciences*, 11(2), 1294–1306. doi:10.6007/IJARBS/v11-i2/9205
- Kazaine, I. (2015). Quality assessment of electronic learning materials. *Research for Rural Development*, 1, 264–270.
- Kukulka-Hulme, A. (2010). Mobile learning as a catalyst for change. *Open Learning*, 25(3), 181–185. doi:10.1080/02680513.2010.511945
- Liu, P., Chen, C., & Chang, Y. (2010). Effects of a computer-assisted concept mapping learning strategy on EFL college students' English reading comprehension. *Computers & Education*, 54(2), 436–445. doi:10.1016/j.compedu.2009.08.027
- Marsh, J., Plowman, L., Yamada-Rice, D., Bishop, J. C., Lahmar, J., Scott, F., Davenport, A., Davis, S., French, K., Piras, M., Thornhill, S., Robinson, P., & Winter, P. (2015). *Exploring play and creativity in pre-schoolers' use of apps: Report for early years practitioners*. Retrieved from [www.techandplay.org/reports/TAP Final Report.pdf](http://www.techandplay.org/reports/TAP%20Final%20Report.pdf)

Martens, M., Rinnert, G., & Andersen, C. (2018). Child-centered design: Developing an inclusive letter writing app. *Frontiers in Psychology*, 9, 2277. Advance online publication. doi:10.3389/fpsyg.2018.02277 PMID:30574104

Naismith, L., & Corlett, D. (2006). Reflections on success: A retrospective of the mLearn conference series 2002-2005. *Proceedings of mLearn 2006: Across generations and cultures*. Retrieved November 15, 2021, from <https://telearn.archives-ouvertes.fr/hal-00197366/document>

Ostorga, A. N. (2006). Developing teachers who are reflective practitioners: A complicated process. *Issues in Teacher Education*, 15, 5–20.

Ozudogru, G. (2021). Problems faced in distance education during Covid-19 Pandemic. *Participatory Educational Research*, 8(4), 321–333. doi:10.17275/per.21.92.8.4

Pachler, N., Bachmair, B., & Cook, J. (2010). *Mobile learning: Structures, agency, practices*. Springer. doi:10.1007/978-1-4419-0585-7

Papadakis, S., Vaiopoulou, J., Kalogiannakis, M., & Stamovlasis, D. (2020). Developing and exploring an evaluation tool for educational apps (E.T.E.A.) targeting kindergarten children. *Sustainability (Basel)*, 12(10), 4201. doi:10.3390/su12104201

Parajuli, K. (2016). Mobile learning practice in higher education in Nepal. *International Council for Open and Distance Education*, 8(1), 41–54. doi:10.5944/openpraxis.8.1.245

Parsons, D., Ryu, H., & Cranshaw, M. (2007). A study of design requirements for mobile learning environments. *Journal of Computers*, 2(4), 1–8. doi:10.4304/jcp.2.4.1-8

Pegrum, M. (2019). *Mobile lenses on learning. Languages and Literacies on the Move*. Springer. doi:10.1007/978-981-15-1240-7

Pocaitilu, P., & Boja, C. (2009). Quality characteristics and metrics related to m-learning process. *The Amfiteatru Economic Journal*, 11(26), 346–354.

Poultakis, S., Papadakis, S., Kalogiannakis, M., & Psycharis, S. (2021). The management of digital learning objects of natural sciences and digital experiment simulation tools by teachers. *Advances in Mobile Learning Educational Research*, 1(2), 58–71. doi:10.25082/AMLER.2021.02.002

Premalatha, K. R., & Geetha, T. V. (2015). Learning content design and learner adaptation for adaptive e-learning environment: A survey. *Artificial Intelligence Review*, 44(4), 443–465. doi:10.1007/s10462-015-9432-z

Qatami, Y., Abu Jaber, M., & Qatami, N. (2008). *Teaching Design*. House of Thought.

Ramzy, H. (2016). The effectiveness of an electronic content management system based on mobile learning in developing some skills of using technological innovations among middle school teachers. *Arab Research Journal in the Fields of Specific Education*, 1(1), 45–104.

Rosell-Aguilar, F. (2017). State of the app: A taxonomy and framework for evaluating language learning mobile applications. *CALICO Journal*, 34(2), 243–258. doi:10.1558/cj.27623

Samoekan, S. (2021). Features, barriers, and influencing factors of mobile learning in higher education: A systematic review. *Heliyon*, 7(4), 1–10. doi:10.1016/j.heliyon.2021.e06696 PMID:33869873

Santoian, F., Petrucco, C., Ciasullo, A., & Agostini, D. (2022). *Teaching and Mobile Learning: Interactive Mobile Design*. Taylor & Francis eBooks. .10.1201/9781003052869

Savin-Baden, M., & Major, C. H. (2013). Qualitative research: The essential guide to theory and practice. Routledge. London. *Open Journal of Nursing*, 3(6).

Stevenson, M., Hedberg, J., Highfield, K., & Diao, M. (2015). Visualizing solutions apps as cognitive stepping-stones in the learning process. *Electronic Journal of e-Learning*, 13(5), 366–379.

Teo, C. & Gay, K. (2006). Concept map provision for e-learning. *International Journal of Instructional Technology Distance Learning*, 5(7), 17-32.

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