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Instruction and Learning Design Consideration for the Development of Mobile Learning Application

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***Abstract*—**The use of information technology in education have changed not only the learners learning style but also the way they taught, where nowadays learners are connected with diversity of information sources with means of knowledge available everywhere. The advantage of network wireless technologies and mobility technologies used in the education and learning processes lead to mobile learning as a new model of learning technology. Currently, most of mobile learning applications are developed for the formal education and learning environment. Despite the long history and large amount of research on mobile learning and instruction design model still there is a need of well-defined process in designing mobile learning applications. Based on this situation, this paper emphasizes on identifying instruction design phase's considerations and influencing factors in developing mobile learning application. This set of instruction design steps includes analysis, design, development, implementation, evaluation and continuous has been built from a literature study, with focus on standards for learning, mobile application software quality and guidelines. The effort is part of an Omani-funded research project investigating the development, adoption and dissemination of mobile learning in Oman.

***Keywords*—**Instruction design, mobile learning, mobile application.

I. Introduction

THE methodology, approach, mechanism and philosophy used to deliver knowledge or information are often referred as instructional design, instructional technology, curriculum design ,educational technology and instructional systems design (ISD). Instructional Technology is the art, practice, study, and theory of design, management, utilization, development, and evaluation of learning processes. Curriculum design focuses on the learning content and, what the mobile will learn, while instructional design focuses on how mobile will learn. Educational technology can be defined as the practice and study to improving learning performance and facilitating learning process by creating, managing and using appropriate technological resources and processes [1], [2]. Instructional Systems Design is known as System Approach to Training (SAT). It is a formal process to design training is traditional instructor-led training or computer-based training. Instructional design models focus on identifying specific approach or methodology to be followed to facilitate the transfer of knowledge and information. Instructional Design is the systematic approach that develops the instruction specifications using instructional and learning theory to achieve the required instruction quality [3], [4]. It is referred as the entire process of analysis of learning objectives and the development of the targeted learning system to achieve those objectives. Instructional design for mobile learning includes development of mobile learning instructional materials and activities; and involves the evaluation of all instruction and mobile learner activities [5], [6]. Instruction designers and learning instructors recognize the potential of mobile technologies as a learning tool for learners and they have merged them into the mobile learning environment. However, a few investigation has been done to classify different examples of mobile learning in the context of distance education, and few instructional design guidelines based on a solid theoretical framework for mobile learning exist [7]-[9].

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II. Research Method

In order to identify accurately the instruction design phase's considerations and influencing factors in developing mobile learning application. A set of instruction design steps includes analysis, design, development, implementation, evaluation and continuous has been built from a literature study. In addition, background research with focus on standards for learning and mobile application software quality and guidelines. This research about the instruction and learning design consideration for the development of mobile learning application refers to the qualitative analyses of learning software quality characteristics.

III. Mobile Learning Application

Mobile learning refers to the use of mobile devices on the learning process considering two attributes mobility and wireless connection anywhere at any time on the right way. Typical examples of mobile devices used as learning tools include tablet, smartphones, laptops, personal media players and PDA [10]. Recently, it has been broadly recognized that mobile learning approach is not only about the used movable device but also about the learning design and learning across contexts [11]. In 2003, Brown has reviewed number of definitions, terms and descriptions and ends with mobile learning are as an extension of e learning. In 2006, researchers defined mobile learning as incorporation approach as transformative innovations for learning futures [12]. In 2007, mobile learning has been viewed as just a useful component that added flexibility to the learning process. Peters also stated that mobile learning is a subset of e learning and as a step to making the learning process just in time, just enough and just for me [13].

IV. Instruction Design Model

Instruction design is the systematic model to design, develop and deliver the instructional materials. The instruction design model analysis the learning requirements and development the needed system to meet the specified objectives. The instructional design model provides training and educational organizations design phases, management guidelines and how does the teamwork collaborate. The used instructional design model is customized to have different principles such as Analysis, Design, Development, Implementation, Evaluation, and Continuous. Each phase has an outcome that feeds into the subsequent phases [1]-[3].

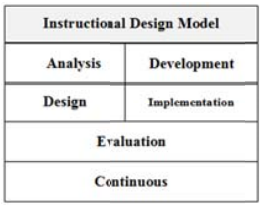

Fig. 1 Instruction design Model for Mobile Learning Application

V. Analysis

Analysis is the process of collecting the parameters of mobile learning system. There are many parameters need to be collected such as objectives, environment, design of course, instructional strategies audience, identify content, constraints, assessment strategies and formative evaluation, etc. However, all the considerations need to focus on the program development [4], [5]. In addition, there are many factors need to be considered in the analysis process including:

- Instructional goals.
- Assessment strategies
- Needs of the learners.
- Preferred learning styles.
- Expectations from training.
- Skills, behavior and learners attitudes.
- Current instructional used plans and policies and what needs to be developed and improved?
- Delivery options of mobile learning including face-to-face, online or blended.
- Learners' background including culture, experiences, interests, profession, education level, ages and educational goals.
- Type of formative evaluation.
- Type of technical support

This phase ends with proper set of instructional goal and the designers are better equipped to develop the instructions. [6]

VI. Design

The design phase is concerned with the design of specific mobile learning objectives. In this design, phase curriculum developers have to:

- Create an instructional strategy,
- Choose the course format
- Design assessments.

The main part for the instructional strategies development is learner participation, content presentation, construction of the instructional strategy component, pre-instructional activities and follow-through activities. The design phase involves setting up of mobile learning objectives, content, exercises, lesson planning, subject matter analysis, and assessment instruments and media selection [7]. This phase should be systematic and specific. Systematic refers to logical and orderly technique to identify, develop and assess set of planned strategies for attaining the project's objectives. Where specific refers to each part of the instructional design plan should be executed with more focus to details. The design phase may involve the following concerns:

- Create storyboards.
- Create prototype.
- Use visual design.
- Documentation of the project's instructional.
- Documentation of technical design strategy.
- User interface and user experience design.
- Apply instructional strategies according to the intended behavioral outcomes.

The design phase should consider the following factors:

- The project content.
- Look and feel of the site.
- Type of used user-interface.
- The designed mechanism for providing learners feedback.
- Type of learning activities divisions (lessons, units, modules etc.).
- Learners required cognitive skills to achieve the learning objectives.
- Collect information about the needed resources for completing the project.
- Type of project learning activities (one task or several tasks staggered over time).
- The used media for mobile learning material design (e.g. audio, graphics or video).
- Type of method, media and environment allow learners develop the cognitive skills.
- Type of targeted activities to be designed collaborative, interactive and individual etc.
- Type of used pedagogical approach for design (Constructivist or behaviorist etc.)

The well-designed learning objectives make an easy and smooth framework to start the development phase. The purpose of designing instructional mobile learning programs and materials is to improve performance and competencies in real-life settings. Mobile learning designers should take in consideration the practical concerns such as resources availability, staffing needs for the development of mobile learning instruction and materials, and cost-effectiveness of the whole project. [6], [8].

VII. Development

In this phase, the course materials will be created by instructional designers. In which that the courses were blueprinted in the design phase. Simply, in the development phase the course structure, assessments and content

assignments are built and material is uploaded based on the previous design phase. The process of producing, reviewing, authorizing and validating mobile learning application contents are done in this phase. It is the designer responsibility to ensure that the specified objectives and specifications are consistently met to maintain the quality throughout the Instructional Design stages. The process of producing, reviewing, authorizing and validating of mobile learning materials are done on development phase. In this phase, the designers concerns are the following factors:

- Learners respond to mobile learning experience.
- The effectiveness of mobile learning materials.
- The results of using mobile in learning process.
- Unexpected issues and problems arose.
- Things need to be changed.

This phase is often time-consuming comparing with the design phase. Therefore, it is the responsibility of mobile learning application designer to ensure that the targeted objectives and planned specifications are consistently achieved to maintain the material and application quality throughout the Instructional Design stages [6], [8].

VIII. Implementation

The process of implementation is concerned with the mobile learning application delivery to the learners. During the early stages of implementation process, learners and instructors may experience some problems and always-in demand of great support to gain the required skills to change the version of learning program. However, the required support is decreased as learners and instructors become more familiar with the new application version. Thus, the mobile learning designers develop guiding materials for facilitators and administrators of such new learning courses. In this phase, a training program should be developed for learners and facilitators. The facilitators' training should include mobile learning course curriculum outcomes, delivery method, and testing procedures. The learners' preparation includes training on new mobile learning tools (software or hardware). In this phase, the instructor should ensure that the mobile learning application is well functional. The implementation phase should consider the following factors [9], [10], [14]:

- The recorded information while learners are suing learning materials for the first time.
- The appearance of mobile learning material to the instructors for the first time (critical, enthusiastic, resistant, interested).
- The appearance of the training session to the instructors whether catches on rapidly or encounter unforeseen problems.
- The learners respond to the learning experience.
- Learners' reaction towards bugs.
- Backup technical or other issues.
- Implementation type (Small-scale or Large-scale).

IX. Evaluation

This phase deals with determination of instruction efficiency and effectiveness. This phase might use different types of evaluation such as:

- Formative
- Summative
- Process
- Outcomes
- Impact

Formative evaluation aims to identify and correct any faults or limitations in the mobile learning contents in the development phase that takes place at each stage of the project. This phase is intended to define the correct shortcomings of mobile learning materials in the development phase. Summative evaluation takes place after full implementation of mobile learning application to help learners to establish the influence of new mobile learning contents. Summative evaluation type occurs upon full implementation of the project to emphases on the value of the provided solution to the organization. This type of evaluation might be costly, very complex and time-consuming based on the nature of the project. Process evaluation attempts to determine the project strategies and plan implementation. The process evaluation is performed at the end of the project to monitor it from start to finish which leads to the assessment of cause-and-effect relationships between the developed components and outcomes. Outcome evaluation emphases on the project impact and the improvement have been achieved because of the whole project activities [6], [15]. Both short and long terms results can be included here. This type of evaluation can be used to measure the project clear benefits. An impact evaluation measures the deeper changes as well as long-term that have resulted from doing the project. The evaluation phase should consider the following factors:

- The impact of the provided mobile learning materials on the organization.
- Learners achievement of the expected mobile learning outcomes.
- Decision to revise or not mobile learning application before full implementation.
- The relevance of mobile learning objectives and course materials.
- The correctness of used materials.
- Analyze the learners' feedback.
- Measure the content reliability and validity.
- Learners' reaction assessment to the instructional materials [16]-[18].

X. Continuous

Continuous is very important to ensure that mobile learning material is always up to date and accurate. Where, it emphasis on continually improving mobile learning application considering both learning design and instruction design in all aspects including look and feel, content, functionality, etc. Learning design should consider:

- Pedagogical factors: The pedagogical aspects are categorized into six themes including:
  - Learning theories
  - Mobile learning material organization.

- Mobile learning material presentation
- Mobile learning material completeness.
- Mobile learning material quality.

The following are some critical factors that might affect the development of quality mobile learning content includes [19], [20]: Accuracy, Significance, Methods, Appearance

- Mobile learners support
- Social factors: The social factors are divided into five main themes:
- Acceptability.
- Sociability.
- Interaction
- Attitude
- Intellectual property
- Economic factors: The economic aspects are categorized into three main themes:
- Cost
- Feasibility
- Cost-effectiveness.

The Quality Assurance process of mobile learning material should be done iteratively and continually to ensure that any contents modification and any future improvement go through a systematic process of evaluation, assessment and approval before making it available [21]-[23].

XI. Conclusion

In this paper, set of instruction design steps for the development of mobile learning application has been proposed. The instruction design is composed from analysis, design, development, implementation, and evaluation and continuous of mobile learning application. The paper focuses on identifying each instruction design, phase considerations and influencing factors in developing mobile learning application. Each phase consideration can be used as guidance and best practices for the development of mobile learning. Future research will consider the proposed instruction design steps for the development of mobile learning application, to show the feasibility of the proposed approach and determine its suitability for mobile learning applications.

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