المحور الثالث: مستقبل التعليم والتعلم في مجتمعات المعرفة.

Theme III: The Future of Learning and Teaching in K-Societies.

Quality Dimensions and assessment of e-learning systems

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Abstract: E-learning should support right knowledge at the right time in the right way. Quality assurance of e-learning systems becomes a crucial factor in implementing such systems. What quality of e-learning systems actually means? What are the different dimensions of quality development? What are the software quality standards and are they sufficient enough or we still need new quality standards for e-learning systems? What is the difference between e-learning quality assurance and quality control? How quality dimensions of e-learning systems can be assessed and evaluated? This paper is an attempt and a step to answer the above questions.

Keywords: E-learning definition and types, quality dimensions of e-learning systems, e-learning quality standards, e-learning quality assurance, e-learning quality control, and quality assessment of e-learning systems.

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1. E-learning definition and types:

Internet has started reshaping education. Most researchers agree that the term e-learning refers to that part of distance learning relying on Web-based delivery systems. One of the most comprehensive definitions of e-learning was offered by William Horton (2001) as "E-learning is the use of Web and Internet technologies to create experiences that educate human beings". E-Learning is the acquisition and distribution of multimedia knowledge by electronic means specifically by networks of computers via variety of channels and technologies. E-Learning technology is an infrastructure that emphasizes on online delivery of information and hence accelerates learning process. Major components of an e-Learning system are subject experts, media developers, instructors, editors, designers, and technical experts (Kanedran, Johnny & Durga 2004). Laurillard (2006) defined E-Learning as "*Use of any of the new technologies or applications in the service of learning or learner support*". Laurillard (2006) argues that e-learning can make a significant difference in the process of learning and teaching for all the stakeholders who include students, tutors and academic institutions. E-Learning can improve the process of learning by measuring how quickly learners acquire a particular skill with reasonable ease and retaining their interest. This set of complex and new technologies will make an impact on the cultural, intellectual, social and practical experience of learning. E-learning also goes beyond the merely delivery of static content. It includes collaboration, both synchronous and as synchronous, as well as some type of shared learning experience with fellow students (Maggie and John, 2007). E-learning is facilitated and supported through the use of information and communications technology. E-learning can cover a spectrum of activities from supported learning, to blended learning, to learning that is entirely online. Technology has radically altered the surface of the educational landscape. Educational technology is the driving force in learning. Technological capabilities are constantly changing, so the best solution today may not be the best solution tomorrow. E-learning is preferred for a variety of reasons: it provides consistent and world wide training, reduces delivery cycle time, increases learner's convenience, reduces information overload, improves tracking and lower expenses (Welsh et all, 2003). Whatever the technology, learning is the vital element. There are several types of e-learning and combination such as: all online, blended or hybrid, asynchronous, and synchronous. Both the online and asynchronous approaches are self-directed and self paced methods of learning that enables learner to go back and review the material before going forward, if he/she failed a quiz or did not remember a key point. This increase knowledge and skills. The difference between the two is that online has no interaction between learners and instructors where the asynchronous learning will have some interaction. For instance there could be a discussion board where learners post comments during a time that is convenient to them and then the instructors will post back a response at a later time. Blended or hybrid learning is a type of learning that is a mixture of face to face and online learning. The online portion of this learning can be delivered in various ways, such as online tutorials, documents, interactive tests, presentations, audio, video, animations and many other types of interactive media. Typically, this approach involves approximately thirty percent of face to face classroom time combined with the remaining time spent online (Mitchell and Honore, 2007). The advantages of this type of learning are convenience, increased interaction, flexibility, increased learning, reduced seat time, higher retention and decreased costs. The hybrid approach is most valuable when an institution wants to leverage all of the e-learning advantages while still maintaining the

nuances that oftentimes face to face training provides to the learner. Synchronous learning occurs when there are interactions in real time. For instance, learning is conducted in a chat room or engaged other types of collaboration tools. In synchronous learning, both the learner and the instructor are present in the technology based learning environment. They can interact with each other instantaneously.

2. Quality dimensions of e-learning systems:

There are numerous definitions of quality. Quality is fitness for use (J.M.Juran, 1989). Quality is meeting or exceeding customer expectations at a cost that represents a value to them (H. James Harrington, 1991). Quality should be defined as surpassing customer needs and expectations throughout the life of the product. Quality means "meeting requirements". With this definition, to have a quality product, the requirements must be measurable, and the product's requirements will either be met or not met. With this meaning, quality is binary state; that is, a product is either a quality product or not. The growth of e-learning has increased greatly in recent years. Yet, there has been criticism of the quality of the systems currently being used. According to (Baruque et al., 2007) many organizations are still experimenting with e-learning, using different approaches, applying different technologies and models for the delivery of e-learning contents. Quality cannot be achieved by assessing an already completed product. The aim, therefore, is to prevent quality defects or deficiencies in the first place. The sooner a defect is located and corrected, the less costly it will be in the long run. (Majdi Adellatief, 2010) proposed four quality characteristics for e-learning systems named service content, system functionality, information technology, and system reliability. Then further, proposed a group of sub-characteristics for ensuring high quality e-learning systems. These characteristics and sub- characteristics are 1. Service content (technique: management well organized, student tracking, e-random tests, user profile, e-books, and e-announcements, teaching technique: self study, scheduling, book marking technique, notes and highlights, archives, online experts, recommended resources, and user feed back, delivered method: print, e-text, audio, communication, and video). 2. System functionality (browsing issues: virtual lab, multi-language, upload file, download file, navigation, link relevancy, level of scrolling, coupling among sub-sites, and label of position, usability: ease of use, site map, feedback technique, quality of help features, web-site last update, FAQ feature, E-mail directory, phone-fax directory, post mail directory, and addresses directory). 3. Information technology (communication, application sharing, discussion forum, E-mail services, interactive multimedia, virtual community, and virtual classroom, security: access privileges, privacy, cookies, and accessibility, interface issue: cohesiveness to groups, main control objects, course information, attractiveness, style uniformity, and stability). 4. System reliability (Mean Time Between Failure (MTBF), link errors, invalid links, broken links, number of destination nodes under construction, and number of dead-end).

Quality in the field of e-learning is not associated with a well defined measure. It is variable with respect to scope, perspective, and dimension (Pawlowski, 2003). Mugridge in 1991 presented an overview of a distance learning program in England and the factors associated with quality assurance in their programs. Factors were broken into three major areas: learner-content, learner-instructor, and learner-learner.

From my personal point of view, there are a number of classifications and dimensions that determine the nature of the approach to quality such: the focus that is whether the quality is related to the final output e-learning product or the different processes of developing it; the subjective, who is speaking about the quality? project manager, analyst, instructional designer, designer, web designer, developer, tester, integrator, auditor, subject matter expert, or learner, etc; the objective, educational process, subject domain, content, suitability of learning content for each learner now and in the future, course design, authoring tool, or e-learning elements (text, picture/image, animation, audio, video), Learning Management System (LMS) (registering, locating, scheduling, tracking, managing, reporting on learning activities, support of different possibilities of learning, integration of solution in the context of IS firm, wide administration range, compatibility with standards, the support of the applications of the other suppliers, possibility of using mobile communication); LMS applications (applications for learning (documents, examples), testing applications (tests, checking of tests), support applications (notepad, discussion forum, chat)) etc.; the method, for example, benchmarking, evaluation, or management approaches; and the perspective, qualitative or quantitative. Qualitative data deals with descriptions. Data can be observed but not measured (colors, appearance, usability, etc). Qualitative data is not using numbers, but is based on personal opinions and judgment. Qualitative data is related to quality. On the other hand, Quantitative data deals with numbers that can be measured such as (response time, number of errors or defects, cost, progress rate, etc). Quantitative data is related to quantity. Quantitative methods use a broad range of numerical approaches for solving problems. Qualitative assessment techniques are "softer" than quantitative tools, less accurate and less objective.

So, the requirements are the most important document. The quality system revolves around it. Everyone is committed to quality. Quality requires a commitment, particularly from top management. Close cooperation between all participants is required to make it happen. To ensure e-learning quality, well defined standards and procedures must be followed. E-learning quality assessment is a difficult task that involves human intervention and cannot be based only on an easy and reproducible methodology.

3. Some e-learning quality standards:

Over the years, various lists of software quality characteristics have been put forward, such as those of James McCall and Barry Boehm. Some of the leading quality standards for IT are ISO9000, Sarbanes-Oxley, ISO9126, Capability Maturity Model (CMM), and people CMM. Although the previous standards are still very helpful to e-learning systems, but they are insufficient alone because they are general software quality models and do not specify a particular teaching and learning activities needed for good learning (Chua and Dyson, 2004), (Britain, 1999).

So, I will present two of the most common e-learning standards:
3.1 European Quality Observatory (EQO) ISO/IEC 19796-1:2005:
European Quality Observatory (EQO) ISO/IEC 19796-1:2005 is a framework to describe, compare, analyze, and implement quality management and quality assurance approaches for educational products and services. ISO/IEC 19796-1 describes the processes of an e-learning

lifecycle. It essentially consists of two parts: 1. A description scheme for quality approaches, and 2. A process model as a reference classification.

3.2 Sharable Content Object Reference Model (SCORM):

SCORM was first released in January 2000. The final version was released in April 2013. SCORM is a software model that defines the interrelationship of course components, data models, and protocols such that content "objects" are sharable across systems that conform with the same model. SCORM is a "Reference Model" that: integrates industry specifications from many other organizations.

4. E-learning Quality Assurance and its components:

E-learning Quality Assurance (EQA) is systematic activities providing evidence of the fitness for use of the e-learning system. (EQA) is achieved through the use of established guidelines for quality control to ensure the integrity and long life of e-learning systems. Quality assurance is a set of support activities needed to provide adequate confidence that processes are established and continuously improved to ensure products that meet specifications and are fit to use. (EQA) plan is an outline of quality measures to ensure quality levels within an E-learning development effort. The plan is used as a baseline to compare the actual levels of quality during development with the planned levels of quality. The plan provides the framework and guidelines for development of understandable and maintainable code. (EQA) is a strategy for risk management. It exists because e-learning quality is typically costly and should be incorporated into the formal risk management of a project. (EQA) is a managerial function that prevents problems by heading them off, and by advising restraint and redirection. Auditing is an inspection activity that verifies compliance with plans, policies, and procedures. (EQA) activities can be categorized into testing, configuration management, and quality control. However, the success of (EQA) program also depends on a coherent collection of standards, procedures, conventions, and specifications as shown in figure 1.

Figure 1: E-learning Quality Assurance
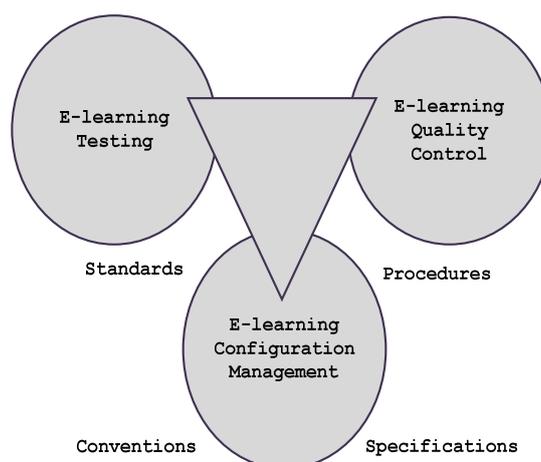
4.1 E-learning testing:

E-learning testing is a popular risk management strategy. It is used to verify that functional and non functional requirements were met. Tests are only as good as the test cases, but they

can be inspected to ensure that all the requirements are tested across all possible combinations of inputs and system states.

4.2 E-learning Quality Control:

E-learning Quality Control (EQC) is the process by which product quality is compared with applicable standards and action taken when nonconformance is detected. (EQC) is defined as the process and methods used to monitor work and observe whether requirements are met. It focuses on reviews and removal of defects before shipments of products. (EQC) consists of well-defined checks on a product that are specified in the product quality assurance plan. For e-learning products, (EQC) typically includes specification reviews, inspection of codes and documents, and checks for user-deliverables. Usually, document and product inspections are conducted at each life-cycle milestone to demonstrate that the items produced satisfy the criteria specified by the (EQA) plan. (EQC) is designed to detect and correct defects, whereas (EQA) is oriented toward preventing them. (EQA) is a managerial function that prevents problems by heading them off, and by advising restraint and redirection.

4.3 E-learning Configuration Management:

E-learning Configuration Management (ECM) is concerned with labeling, tracking, and controlling changes in the e-learning elements. It controls the evolution of an e-learning system by managing different versions and their relationships. (ECM) has a stabilizing effect when there is a great deal of change activity or a considerable risk of selecting the wrong e-learning component.

5. Quality Assessment of e-learning systems.

Now, the question is, how can we assess quality of e-learning systems? When there is a concern about the need for a specific quality characteristic in an e-learning system, then a quality specification with the following minimum details should be drafted: **definition/description:** definition of the quality characteristic; **scale:** the unit of measurement; **test:** the practical test of the extent to which the attribute quality exists; **minimally acceptable:** the worst value which might be acceptable, and below which the product would have to be rejected out of hand; **target range:** the range of values within which it is planned the quality measurement value should lie; **now:** the value that applies currently. Now apply the simple procedure:

Step1: Design a questionnaire for collecting data from all stakeholders reflecting quality classifications and dimensions.

Step2: Score assignment: each defined quality dimension is assigned a direct score between 0 and 1 (A higher value reflects a better quality dimension).

Step3: The quality score for each dimension is calculated as the average of different values which we obtained from different stakeholders.

Step4: Compute the value of each quality classification.

Step5: Compute the total quality of e-learning system in a bottom-up manner.

6. Conclusion:

In this paper, I represented e-learning definitions and types, quality dimensions in such systems, software, and e-learning quality standards, (EQA) and its components, and I

proposed a simple methodology for assessing the quality of such systems.

E-learning should support right knowledge at the right time in the right way. (EQA) becomes a crucial factor in implementing such systems. E-learning quality assessment is a difficult task that involves human intervention and cannot be based only on an easy and reproducible methodology. Implementing total quality management in e-learning systems is a lengthy process and hence should be done to every member in the educational system. E-Learning is a complex environment, and its measurement is expected to be multidimensional in nature. The evaluation of complexity is caused by large amount of intervening characteristics, attributes and by the complex logic relationships among attributes. There are still big differences in the produced material and a lack of an effective e-learning evaluation quality model (Baruque et al., 2007, Ozkan and Kosler 2009) especially there are many stakeholders of e-learning systems, whose views are very important indicators for a complete systems evaluation (Ozkan and Kosler 2009).

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