Quality Frameworks and Standards in E-Learning Systems

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Abstract - The e-Learning systems are one of the areas that have proven their own importance in promoting the use of IT technologies in academia environment. However, the growing need for such systems requires the adoption of a quality design approach based on a recognized quality frameworks and standards comprising sets of well defined criteria. This paper investigates the existing quality frameworks (SCORM, IEEE P1484 and IMS Global Learning Consortium) and standards (ISO/IEC 19796, Open ECBCheck and ISO 9126) dedicated to the e-Learning systems.

Keywords - Software Quality, E-Learning, E-Learning Quality, Standards, Frameworks

I. INTRODUCTION

Quality is most often defined as “fitness for purpose” that is related to the needs of the user or that the ‘product comply with defined requirements’ (Rekkedal, 2006). Over the years, different definitions have been attributed to the term “quality”. To Crosby, 1979 it is “conformance to user requirements”. Watts, 1989 refers to quality as “achieving excellent levels of fitness for use”, while IBM coined the phrase “market-driven quality” which is based on achieving total customer satisfaction” (Abran et al. 2004).

In April 2002, a web-based survey was carried out in five European languages (English, French, German, Spanish, and Italian) over 450 respondents to analyze important questions about the quality of e-Learning products and services. The survey was distributed through the European Training Village the website of the European Commission's Agency for Vocational Training. Respondents were from all EU countries and the results of the survey (Massy, 2002) shows that:

- 61% of all respondents rated the quality of e-Learning negatively - as ‘fair’ or ‘poor’;
- The two most important criteria for evaluating quality in e-Learning are that it should ‘function technically without problems across all users’ and have ‘clearly explicit pedagogical design principles appropriate to learner type, needs and context’;
- A very small number (4) of respondents from 3 different countries gave an excellent rating.

In 2004, the European survey has been carried out among 5,023 people and 1,407 completed it (Ehlers et al. 2005). The questionnaire deals with five blocks of topics: (a) e-Learning in general, (b) quality in e-Learning in general, (c) use/implementation of quality instruments in e-Learning, (d) experience with quality instruments and approaches, and (e) issues of statistics/demography.

The study has shown that quality plays a key role in the success of e-Learning and learning in general, and among the most important observations, the following have been noticed:
Learners must play a key part in determining the quality of e-Learning services: a learner orientation is imperative in the area of quality;

- Culture of quality in education and training: quality development must become a core process for educational organizations;
- Quality must play a key role in education policy;
- Quality development as the norm in the educational landscape;
- Quality services might be created;
- Open quality standards must be widely implemented;

The paper is organized as follows: section 2 is dedicated to the quality standards, section 3 describes the quality frameworks and section 4 presents our conclusion.

II. QUALITY STANDARDS

In 2005, the new quality standard for learning, education, and training, ISO/IEC 19796-1, was published and aimed at helping educational organizations to develop quality systems and to improve the quality of their processes, products, and services (ISO/IEC, 2005). The standard serves as a reference supporting adaptation to the specific requirements of the organization. It includes process description (e.g. evaluation of didactic methods), methods (e.g. identification, alternatives, and priorities), objectives (e.g. adequate selection of one or more didactic concepts), target group (competencies and learning styles), organization, relations, etc. (Rekkedal, 2006). However, since the standard is a reference model, it has to be adapted to the needs of an organization. Pawłowski, 2007 suggests a quality adaptation model to successfully implement the standard in educational organizations and to support the variety of involved actors.

In 2010, an international quality standard for e-Learning programs - “Open ECBCheck (e-Learning in Capacity Building)” - was officially released (last version: ECBCheck, 2012). ECBCheck is an accreditation and quality improvement scheme for e-Learning programs that supports organizations in measuring the success of their programs and allows for continuous improvement though peer collaboration. More than 40 international, regional, and national capacity-development organizations participated in the development of this standard. ECBCheck provides a set of quality criteria to assess e-Learning program design, development, management, delivery and evaluation, as well as the quality of learning materials, methodology, media, technology and e-tutoring. These quality criteria are: 1) Information about organization of program; 2) Target Audience Orientation; 3) Quality of Content; 4) Program/ Course Design; 5) Media Design; 6) Technology and 7) Evaluation & Review.

Chua and Dyson, 2004, proposed ISO 9126 as a tool to evaluate the e-Learning systems for teachers and educational administrators. Their research into e-Learning systems aims at assisting educators in evaluating the quality of the system and incorporates frameworks to support decision making regarding review of existing systems and the purchase of new ones. They also proposed enhancements of the model by extending the usability characteristic with additional quality attributes such as: consistency, simplicity, legibility, and color use and by including the “user satisfaction” as a global characteristic of the model. Furthermore, they state that the ISO model does not specify the particular teaching and learning activities needed for good learning and proposed for the software developers without educational expertise a checklist of tools and attributes to gain an efficient course management.

Padayachee et al. 2010 used the ISO 9126 model for selecting generic external systems quality characteristics and sub characteristics for user evaluation of course management system (Course management systems are...
interactive systems that enable educators, with minimal technology expertise to design, develop and deliver e-Learning content as well as measure the outcome of e-Learning courses). The objective of the research study was to validate the effectiveness of the ISO 9126 quality model for evaluating the quality of e-Learning systems. Authors suggest creating domain specific quality criteria that relate to selected characteristics and sub-characteristics of the ISO model. The e-Learning quality criteria corresponding to the first four quality characteristics of ISO 9126 were developed to aid in evaluating users’ view of quality for e-Learning systems and to obtain feedback from educators in higher education using questionnaires and interviews. Furthermore, ISO 9126 has been customized to identify acceptance criteria and evaluate a B2B (business to business) application (Behkamal et al. 2008). Authors reviewed and compared the existing quality models, defined the B2B electronic commerce and described the customization approach of the ISO 9126 to the B2B applications. The quality characteristics of B2B applications were determined and new quality characteristics have been identified and added to the ISO model. These characteristics have the highest ranking and significance in B2B applications.

On the other hand, The ISO 9126 was used to evaluate the mobile learning by using additional metrics that are (Parsons and Ryu, 2006):

- Metaphor: does the learner have an overall vision of the learning process?
- Interactivity: is the learner able to interact with other users and/or tutors?
- Learning content: does the learner feel that the learning component is of high quality?

### TABLE I

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<thead>
<tr>
<th>Standards for eLearning</th>
<th>Description</th>
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<td>ISO/IEC 19796-1 (ISO/IEC, 2005)</td>
<td>• ISO/IEC 19796-1 is a quality standard following the principles of quality management developed for learning, education and training in general and it has been adopted to the specific needs of developers and providers of online services and digital resources in many implementations and projects;</td>
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<td>• The ISO/IEC 19796-1 standard was developed by the Working Group 5 &quot;Quality Assurance and Descriptive Frameworks&quot; of the standardization committee ISO/IEC JTC1 SC36;</td>
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<td>• The quality standard contains the reference process model “Reference Framework for the Description of Quality Approaches” (RFDQ) to help stakeholders in learning, education, and training especially in e-Learning or blended learning to document and (re-)define their everyday processes;</td>
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<td>• The reference process model of ISO/IEC 19796-1 is the integration of two main reference models-generic process model and generic description model;</td>
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<td>• The reference process model covers the whole lifecycle of the needs analysis, design, development, realization and evaluation of any learning opportunity or process including e-Learning and blended learning.</td>
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<td>OpenECBCheck (ECBCheck, 2012)</td>
<td>• Is a new certification and quality improvement scheme for e-Learning courses and programs in international Capacity Building;</td>
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<td>• It supports capacity building organizations to measure how successful their e-Learning programs are and allows for continuous improvement through peer collaboration and benchmarking;</td>
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<td>• The ECBCheck tool can also be used for internal quality check of the courses and programs.</td>
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<td>ISO 9126 (ISO/IEC, 1999)</td>
<td>• Was proposed as an international standard for software quality measurement in 1992. It is a derivation of the McCall model.</td>
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<td></td>
<td>• The most common used quality standard model. There are several</td>
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TABLE II
QUALITY FRAMEWORKS DEDICATED TO E-LEARNING SYSTEMS

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<tr>
<th>Frameworks for the eLearning</th>
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| SCORM (ADL, 2001; SCORM, 2004) | • The Sharable Content Object Reference Model.  
• Is an XML-based framework used to define and access information about learning objects so they can be easily shared among different learning management systems (Birnbaum, 1989).  
• SCORM was developed in response to a United States Department of Defense (DoD) initiative to promote standardization in e-Learning.  
• 1997 Advanced Distributed Learning (ADL) Initiative network has been formed to create a way to make learning content portable across various systems.  
• ADL created the first version of SCORM, which originally stood for Shareable Courseware Object Reference Model.  
• It was designed to facilitate moving course content and related information (such as student records) from one platform to another, to make course content into modular objects that can be reused in other courses, and to enable any LMS to search others for usable course content. |
• Established in December 1996 by the organizations: IEEE, Microsoft, EduTools, Kutz & Assoc., Osaka University, Carnegie Mellon, MITRE and US Army;  
• First standard released in June 2002;  
• This standard specifies the syntax and semantics of Learning Object Metadata, defined as the attributes required to fully/adequately describing a Learning Object.  
• For this Standard, a learning object is defined as any entity--digital or non-digital--that may be used for learning, education or training.  
• Examples of Learning Objects include multimedia content, instructional content, learning objectives, instructional software and software tools, and persons, |

III. QUALITY FRAMEWORKS

There are various frameworks for e-learning systems they are developing. Chua and Dyson (2004) listed three frameworks:

- The IEEE Learning Technology Standard Committee (LTSC) reference model, IEEE P1484.1 LTSA which is focusing on reusability and portability attributes,
- The Sharable Content Object Reference Model (SCORM) that supports content compatibility (the portability of content from one e-Learning system to another) and the reusability of learning objects,
- The Instructional Management Systems (IMS) project that defines technical specifications to ensure interoperability between e-Learning systems (IMS Global Learning Consortium).

Others though, such as IEEE 1061, has 3 levels of quality characteristics, sub-characteristics, and attributes.
- Defines 21 attributes that a quality product must exhibit. The 21 attributes are arranged in six areas: functionality, reliability, usability, efficiency, maintainability and portability.
- Has identified three models of software product quality (internal quality, external quality and quality in use).
- ISO 9126 has been used to evaluate the e-Learning systems for teachers and educational administrators to support decision making regarding review of existing systems and the purchase of new ones (Chua and Dyson, 2004).
- ISO 9126 model has been used for selecting generic external systems quality characteristics and sub characteristics for user evaluation of course management system (Padayachee et al. 2010).
One of the important drawbacks of these standards is that they focus on technical aspects of e-Learning systems and do not include the usability aspect (how the user will interact with the system) and are specially designed for technical trained system developers (Klasnic, Lasic-Lazic and Seljan 2010). Furthermore, they are too complicated for the average educators or educational administrators to understand and apply when choosing an e-Learning system (Chua and Dyson, 2004).

IV. CONCLUSION

This paper described the existing quality frameworks and standards developed for the e-Learning systems. Based on these studies, one can say that the technical quality frameworks are difficult to understand and apply by the average educators when choosing an e-Learning system. Indeed, there is a need to develop instruments and techniques to be applied by all involved actors of the organization. In addition, ISO/IEC 19796-1 is a promising quality standard but should be adapted to the specific needs of the developers and providers of the online services and digital resources. It appears that there is a need to make further research to bring this abstract standard into practice and implement it successfully in the educational organizations.

On the other hand, the ISO 9126 quality model is the most applied in the software engineering community for the evaluation of their software systems. It is easy to understand and apply but needs additional quality characteristics related to the pedagogy and design of the e-Learning systems. The Open ECBCheck standard designed several distinct criteria areas to assess courses or programs (ECBCheck, 2012) that could be combined with the ISO 9126 quality model to improve the course management.

Our current research is focusing on further investigations to customize the ISO 9126 model to the e-Learning domain and to build an integrated quality evaluation tool for the e-Learning systems.
REFERENCES
(Arranged in the order of citation in the same fashion as the case of Footnotes.)


Proceedings of SACLA Conference.


