

Interoperability for Online Learning platforms and Quality in Higher Education

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Abstract:

This research is an extended works that presents the broad multidimensional reference model for E- Learning standard as the main result. The importance and task of interoperability as well as quality development and their relationship which will be defined and analyzed in King Khalid University, Particularly in E- Learning where association and interdependence is apparent. This research is based primarily on secondary data provided by E- Learning Deanship and E- Learning Experts of King Khalid University. Open Ended questionnaire is designed to collect data from E- Learning experts and E- Learning website is evaluated with the focus of E- Learning reference model. In this research Interoperability and Quality Development relationship will be defined with its extent of presence in King Khalid University. Categories of E- Learning standards with its dimensions will be defined too with respect to King Khalid University. After a short introduction of the relevant E- Learning standardization committees and initiative (ISO/IEC JTCISC 36, IEEE LTSC, IMS and ADI) their published standards and specification are used to evaluate the Reference Model for E- Learning Standards particularly for King Khalid University. As an effect it can be stated that the reference model is covering all kinds of E- Learning standards and that is applicable and appropriate for their differentiation and categorization prevailing in King Khalid University. In ending, a revelation of challenges for potential for E- Learning standardization is outline for the prospect. This study of Interoperability of Reference Model for E- Learning and Quality Development can then be used on any system, not only for information technology system. This research will show the method of establishing the relationship of quality model and E- Learning reference model for educational organization.

Keywords: E-Learning standards and specifications, Interoperability, Quality Development, standardization committees and initiatives, e-Learning Standards classification

INTRODUCTION

This contribution will address these two questions and provides some first answers how to assure and to improve the interoperability and the quality of e-Learning. A general finding is that standards can support both objectives by providing international accepted solutions. The main objective of this contribution is to start the discussion about the interoperability of e-Learning offers and about the quality development responsibility the quality improvement in e-Learning supported by learning standards and specifications. The particular benefit of



learning standards and specifications for interoperability and quality development will be pointed out by proposing the reference model for e-Learning standards concluding with a vision and needs analysis for further activities. Generally speaking, interoperability means the ability of exchange and re-use of information and resources between different systems. In this way it is a requirement for the quality development in e-Learning facing the access to the best learning, education, and training solutions and their usage. Therefore interoperability is a precondition and a request for quality development that can be described and defined in different ways. Standards are offering a special support and have been accepted widely for the aims of interoperability. Focusing the educational sector, interoperability is an objective and a task only for few use cases and application scenarios at present. Educational and learning standards providing interoperability have been discussed and developed for only a short time. They can be classified by their focuses on domains, entities, and implementation scenarios. E-Learning as a special lively part of the educational sector has approached open questions of interoperability from the very first, due to the precondition to solve the technological problems. Based on the debate on the development of technological and learning technology standards, interoperability has to be addressed in respect of the quality of learning, education, and training offers and learning processes. So this contribution is structured in several parts:

The first part defines interoperability and describes characteristics of good practice. And also the general preconditions of quality development and quality improvement in e-Learning are focused based on these findings in view to King Khalid University, interoperability of reference model for e-learning and quality development

The second part provides the fundamentals for a later discussion in detail: Analyzing learning, education, and training in general and especially in the field of e-Learning in King Khalid University the relevant dimensions are differentiated first. Using these distinctions a generic classification model of educational and learning standards is proposed that is applicable for e-Learning. The third part carries out the evaluation of these categories and classifications. An overview over the e-Learning standardization committees and standardizations initiatives is followed by the description and analysis of their standards and specifications allocated and matched to the dimensions of the classification model. At the end the vision and the further needs of interoperability and quality development are outlined. The perspective will be broadening up to the horizon of future chances for the improvement of e-Learning by the application and implementation of standards and specifications for interoperability and quality development. The contribution concludes with current activities and the identification of the most important topics for research and development in e-Learning standardization.

Interoperability and Quality Development

In this article we will define the terms interoperability and quality development first. Then the relationship and interdependence between these two concepts will be pointed out. Finally we will describe the support and the importance of quality standards and specifications for the objectives of interoperability and quality development in King Khalid University. Interoperability and quality development are the main challenges of e-Learning today. The acceptance, the realization, and the success of e-Learning offers depend on their interoperability and quality. In this contribution we will show that interoperability and quality development cannot be prescribed in a specific manner, but there is always the need for an adaptation and specification concerning the given situation. Interoperability means more than technical conformance: It covers the whole range of requirements and characteristics from any systems and has to be addressed at all different levels and domains. The term 'system' is used here in its broadest sense including human beings, societies, and any kind of technical and

natural networks: A system consists of internal communication and relationship between all its elements, entities and members and can be defined against its external environment. (cf. Luhmann 1998; Maturana/ Varela 1992). The epistemological (theory of nature or ground of knowledge) problems regarding the recognition of a system by another system can be suppressed here especially if we are focusing on e-Learning. It is impossible for external systems (e. g. teachers or other persons or systems) to observe and follow the internal learning processes of a learner. Learning progress, knowledge and competencies are always built by the learner itself and we cannot prove a causal connection between learning offers and learning processes, we can only assume some relationships and effects (cf. for the theory of cognition Luhmann 1998). Implying these preconditions we can therefore define interoperability as follows: **Interoperability** means the ability of exchange and reuse of every kind of information and resources in any way within or between different systems. Based on this definition four different scopes of interoperability can be differentiated in relation to given systems:

- **Internal:** The interoperability is only established between the internal elements, entities and members within one system.
- **Directional:** The interoperability exists in the direction from one system towards another system, but there is no feedback loop or reciprocal relation (e.g. only import without export).
- **Mutual:** The mutual interoperability allows the exchange between different systems in both directions.
- **General:** The interoperability looks for achieving exchange between all given systems in general. The different interoperability scopes are applicable for the formal distinction of interoperability. But interoperability is a complex subject with many facets and dimensions: A detailed differentiation is needed for the application sectors regarding the specific domains and implementation scenarios. That is also true for the multi-dimensional term of quality development.

In a general way quality development can be defined as follows:

Quality development covers every kind of measurement, assurance, optimization, and continuous improvement of the quality within given systems. According to interoperability quality development can also be described formally by the chosen scope. Quality is not a fixed characteristic belonging to subjects or systems but depends amongst others on the point of view and the scope. The following differentiation of the scope into three quality dimensions has become widely accepted (cf. Donabedian 1980):

1. **Potential dimension:** What are the potentials for the quality development in the future?
2. **Process dimension:** How can the processes be described and optimized for the purpose of quality development?
3. **Result dimension:** How can the quality development be supported regarding given results and systems?

Here the space is missing to discuss the whole long-term debate on the quality issues, aspects and approaches (cf. Deming 1982, Juran 1951, and for an overview cf. Stracke 2006). Therefore we focus only on the common characteristics of interoperability and quality development and their relationships in the field of e-Learning. Focusing the educational sector in general interoperability is an objective and a task only for several use cases and application scenarios at presenting in Educational and learning standards. Interoperability have been



discussed and developed only for a short time. E- Learning as a special lively part of the educational sector has approached open questions of interoperability just from the beginning due to its need and precondition to solve the technological problems. But the focus was only technological interoperability first. Based on the debate on the development of technological and learning technology standards, interoperability has to be also addressed in respect of the quality of learning, education, and training offers and learning processes. In this understanding interoperability is a requirement and an enabler for the quality development (not only, but especially) in e-Learning facing the access to the best learning, education, and training solutions and their usage and improvement. There is no development and improvement of the e-Learning quality without interoperability between the involved systems (in the broadest understanding): Learners, teachers, and learning objects and technology systems need to exchange and re-use information and resources between each other. Therefore interoperability is a request and a precondition for the quality development: Both can be described and defined in different ways using the same domains, entities and implementation scenarios. Standards are offering a special support and have been accepted widely for the aims of interoperability as well as of quality development.

1. For the quality development in e-Learning a three steps model has been developed starting from the individual level over the organizational level up to the involvement of all stakeholders (cf. Hildebrandt/ Stracke/ Jacovi 2006).

2. Generic Reference Model for e-Learning Standards

This article provides the Generic Reference Model for e-Learning Standards based on differentiation of the mainly relevant dimensions and categories. After a short survey on standards in general categories of e-Learning standardization are presented pointing out especially the three main dimensions of e-Learning standards on which the Reference Model for e-Learning Standards is based.

Overview on standards in general

First we have to point out the main objectives of standards in general: Standardization always aims at achieving benefits in the ratio of effects and efforts. One main benefit of a standard should be its economical benefit that could be reached e. g. by the establishment of the interoperability of different systems or by the re-use of learning objects (interoperability of resources). And also quality tasks could normally raise economical benefits in a long-term, e. g. by harmonization of the terminology or by introducing a quality reference model. Interoperability (in its broad sense) and quality development can be called the two main purposes of standardization to gain economical benefit especially in the field of e-Learning. Focusing on standardization in a theoretical way we have to distinguish between different general types of standards and specifications:

Formal standards: Formal standards also known as "de-jure standards" can only be developed in consensus processes by the official standardization organizations that are the International Organization for Standardization (ISO) and the International Electro technical Commission (IEC) on the international level and are always publicly available.

Community specifications: Community specifications are developed by communities or forums and they are normally available in public as open specifications. Examples for such communities with relevance for e-Learning are: the Institute of Electrical and Electronics Engineers, Inc. (IEEE) and the World Wide Web Consortium (W3).



Industrial specifications: Industrial specifications are developed mostly domain-specific for branches by industrial consortia and could be open specifications, i. e. publicly available, or closed specifications, i. e. only available for the consortium members.

Organizational specifications: Organizational specifications are developed internally as closed specifications. This classification is used generally for standards and specifications. In addition it is to mention the special case of the term "de-facto standards" that is used for proprietary organizational, industrial or community specifications with worldwide acceptance (e. g. Microsoft Windows). The specifications are often also called "standards" for facilitating the communication. Therefore we will also adopt this practice in this article from now on. After this general view on standards and specifications we are now analyzing the different categories of e-Learning standards.

Categories of e-Learning standards

A lot of categories can be identified focusing on the complex field of E-Learning standards. The reason is that e-Learning standardization has to deal with many dimensions and stakeholders ranging from technical over didactical to quality issues. Before we are analyzing the three main dimensions more in detail other additional categories that could also be addressed are listed in the following. On the one hand it can be distinguished between providers and users of e-Learning that have often different interests, needs, and preferences. E-Learning standards can mainly address and support either the users or the providers, or both. Regarding the organization using or providing e-Learning it is possible to differentiate the organizational levels on which an E-Learning standard is focusing: learning offers (e. g. content, learning objects), processes, and (business units of) the whole organization. This list is not exhaustive, there could be also added other categories. It serves only the purpose to spotlight the multi-dimensional complexity of e-Learning standards. Next to these listed categories of e-Learning standardization there are three categories of e-Learning standards that can be regarded as the main dimensions.

The three main dimensions of e-Learning standards are:

1. **Types of e-Learning standards**
2. **Domains of e-Learning standards**
3. **Entities of e-Learning standards**

Three main dimensions of e-Learning standards: In the following the three main dimensions of e-Learning standards will be described shortly by their classifications.

1. Types of e-Learning standards

Three types of e-Learning standards can be differentiated

- **Implementation standards:** Implementation standards are developed to ensure the interoperability within all domains of e-Learning.
- **Conceptual standards:** Conceptual standards are offering generic and theoretical solutions to compare and harmonize the entities and objects corresponding to the standard.
- **Level standards:** Level standards define the quality level that should be reached by the application of the e-Learning offer and are often used for certification aims. These three types of e-Learning standards can be attributed to the two main purposes and functions of e-Learning standardization which are interoperability and quality development (see above). Implementation standards are focusing the interoperability within all domains and level standards are addressing the quality development. Conceptual standards can support

both the quality development (e. g. by providing generic frameworks or reference models) as well as the interoperability by implementing and adopting the concept. These three levels are following a typology from Lindner (cf. Linder 2005) with modifications of their scopes and renaming of the first level. The figure 1 shows the types and purpose of e-learning standards.

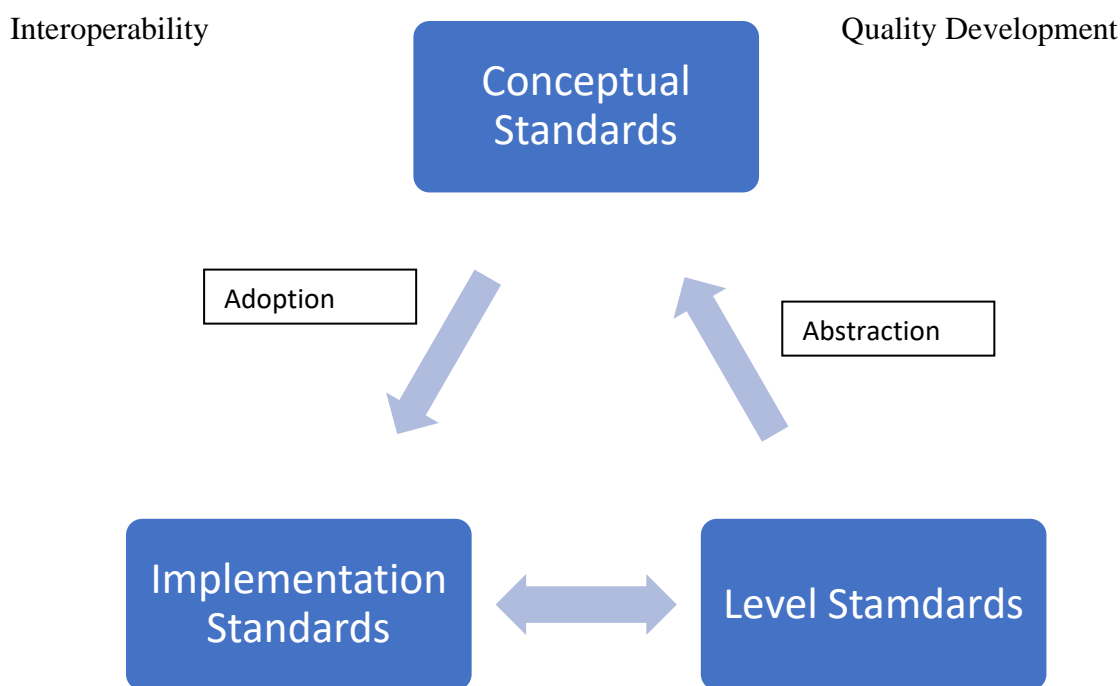


Figure 1: Types and purposes of e-Learning standards

The differentiation of the implementation standards (and their corresponding conceptual standards) is not so easy. Depending on their focus many different types of implementation standards can be identified: metadata standards, architecture standards, infrastructure standards, interface standards, etc.

Domains of e-Learning standards

The dimension domain is describing which topic and subject the e- Learning standard is addressing mainly. There are six main domains of e-Learning.

- **Meaning:** The domain meaning focuses the general understanding and deals with e. g. the disciplines semiotics, pragmatics, and semantics. For other categorizations of e-Learning standards cf. e. g. Lindner (2005) or Pawlowski (2005).
- **Quality:** The domain quality covers all aspects of the development, assurance and management of quality and deals with e. g. results, processes, and potentials.
- **Didactics:** The domain didactics deals with all pedagogical questions and issues concerning e. g. methods, learners, and environments.

- **Learning technology:** The domain learning technology includes all technological solution especially developed for learning objectives and purposes and deals with e. g. data exchange, interfaces, and accessibility questions.
- **Learning content:** The domain learning content covers all aspects that are necessary for e-Learning objects and deals with e. g. the resources, and their aggregation, and packaging.
- **Context:** The domain context combines all other disciplines and information with regard to e-Learning and its given context and deals with e. g. rights, laws, and experiences. E-Learning standards can cover one domain or a combination of these six e-Learning domains.

Entities of e-Learning standards

The domain entity depends on the main object that the e-Learning standard is focusing on. Across the domains there are six entities and objects that e-Learning can address:

- **Learning environment:** The entity learning environment covers the organizational and pedagogical management and structure of e-Learning offers including the infrastructure and all services and processes.
- **Roles:** The entity roles deals with the different defined groups within an e-Learning solution (e. g. learner, teacher, tutor) and includes also the focus on single persons.
- **Methods:** The entity methods concerns the used methods defined for and used within an e-Learning environment.
- **Learning systems:** The entity learning systems deals with all technological and conceptual questions (including the architecture) regarding the systems used within e-Learning.
- **Learning resources:** The entity learning resources covers all content offers that are components of the learning system.
- **Practice:** The entity practice concerns all relevant information experiences in respect of the realization and the usage of an E-Learning offer. E-Learning standards can also correspond to more than one entity in combination.

Reference Model for e-Learning Standards

The Reference Model for e-Learning Standards consists of these three main dimensions: Types, domains and entities of e-Learning standards. It can be represented by drawing a cube with these dimensions.

The following figure 2 shows the dimensions of the Reference Model for e-Learning Standards:

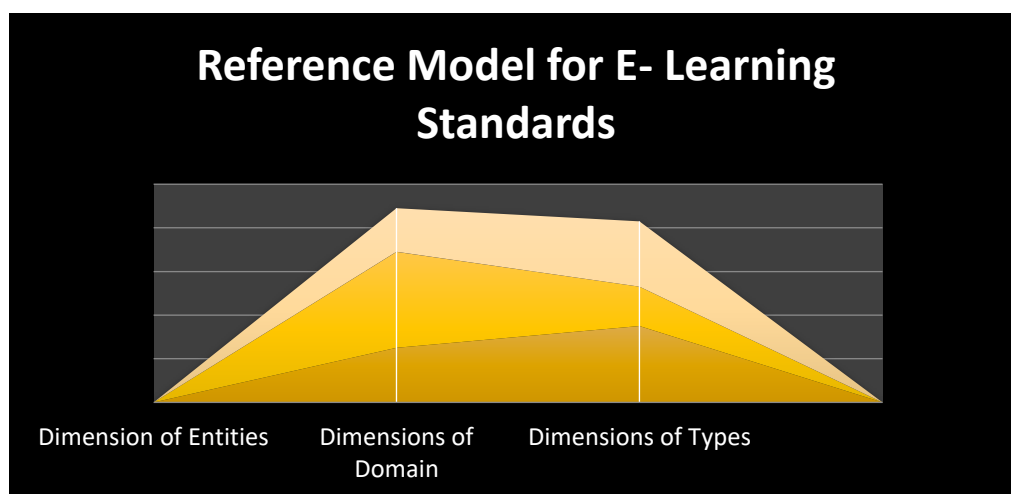


Figure 2: Reference Model for e-Learning Standards

Every e-Learning standard or specification can be classified and specified according to the dimensions with possible combinations and overlapping. Therefore the application of and the integration into the Reference Model for e-Learning Standards should be appropriate for all e-Learning standards and specifications. The next article will examine and evaluate this reference model based on the existing e-Learning standards and specifications.

Standardization committees and standards in e-Learning

In this article a general overview on standardization will be given followed by an analysis of the current main standardization initiatives in e-Learning and their published standards and specifications.

Overview on standardization in general

A lot of standardization initiatives are working in the fields of e-Learning. According to the committees and initiatives different kinds of standardization can be distinguished:

- **Formal standardization:** Results are formal de-jure standards
- **Standardization by experts:** Results are specifications that are normally open, i.e. publicly available.
- **Standardization by organizations:** Results are specifications that can be open or closed, i. e. only available for the involved organizations.

In the following the four main standardization initiatives are introduced by an overview, and presenting their structure, scope and developed standards and specifications.

ISO/IEC JTC1 SC36SC36 overview:

ISO/IEC JTC1 SC36 is the e-Learning standardization committee of the first joint technical committee from the two international standardization organizations ISO and IEC. Therefore SC36 is the only official formal standardization body for e-Learning at international level. The abbreviation stands for: "International Organization for Standardization (ISO)/ International Electro technical Commission (IEC) Joint Technical Committee 1 (JTC1) – Information Technology - Subcommittee 36 (SC36) - Information Technology for Learning, Education, and Training (ITLET)". Members of SC36 are National Bodies (NB), either as participating with the requirement of involvement in standardization activity and of voting or as observing with involvement in standardization activity but without vote.

The structure of SC36:

SC36 is currently divided in six Working Groups (WG) that are working on the development of new standards:

- WG1: Vocabulary
- WG2: Collaborative technology
- WG3: Learner information
- WG4: Management and delivery of learning, education, and training
- WG5: Quality assurance and frameworks
- WG6: International standardized profiles

The scope of SC36:

The scope of SC36 is defined as: "Standardization in the field of information technologies for learning, education, and training to support individuals, groups, or organizations, and to enable interoperability and reusability of resources and tools" (SC36 2002).



The standards developed by SC36:

SC36 has developed two de-jure standards:

- ISO/IEC 24703 "Information Technology - Learning, Education, and Training — Participant identifiers".
- ISO/IEC 19796-1 "Information Technology - Learning, Education, and Training — Quality Management, Assurance and Metrics

In addition there are several standardization projects in progress with one standard on accessibility on the way to publication (ISO/IEC 24751-1). ISO/IEC 24703 is a formal standard specifying the data type of participant identifiers in learning, education, and training including bindings and was published in May 2004. It can be regarded as an implementation standard mainly developed for the domain "learning technology" and focusing on the entity "roles".

ISO/IEC 19796 is a multi-part formal standard for the quality management and quality assurance in learning, education, and training. Its Part 1 provides a common framework to describe, specify, and understand critical properties, characteristics, and metrics of quality harmonizing existing concepts, specifications, terms, and definitions for learning, education, and training. The process model is called the Reference Framework for the Description of Quality Approaches (RFDQ) and was published in November 2005. It can be regarded as a conceptual standard mainly developed for the domain "quality" and focusing on the entity "learning environment".

IEEE LTSC overview:

IEEE LTSC is the Learning Technology Standards Committee (LTSC) of the international association Institute of Electrical and Electronics Engineers, Inc. (IEEE). Only individual experts, no organizations or enterprises can join IEEE LTSC. Therefore IEEE LTSC is a standardization organization by individuals. Specification are developed by the working groups and approved by a formal process managed by the IEEE Standards Association.

The structure of IEEE LTSC:

IEEE LTSC is currently divided into four Working Groups, (WG) that are working on the development of new specifications:

WG 4: Digital Rights Expression Language

WG 11: Computer managed instruction

WG 12: Learning object metadata

WG 20: Competency data standards

The scope of IEEE LTSC:

The scope of IEEE LTSC chartered by the IEEE Computer Society Standards Activity Board is to develop technical specifications (called "technical standards" by IEEE LTSC), recommended practices and guides for learning technology.

The specifications developed by IEEE LTSC:

IEEE LTSC has developed six specifications ("technical standards"):

- □IEEE 1484.1 "IEEE Standard for Learning Technology — Learning Technology Systems Architecture".
- IEEE 1484.11.1 "IEEE Standard for Learning Technology — Data Model for Content Object Communication".



- IEEE 1484.11.2 "IEEE Standard for Learning Technology — ECMA Script Application Programming Interface for Content to Runtime Services Communication".
- □IEEE 1484.11.3 "IEEE Standard for Learning Technology — Extensible Markup Language (XML) Schema Binding for Data Model for Content Object Communication".
- □IEEE 1484.12.1 "IEEE Standard for Learning Technology — Learning Object Metadata".
- IEEE 1484.12.3 "IEEE Standard for Learning Technology — Extensible Markup Language (XML) Schema Definition Language Binding for Learning Object Metadata".

IEEE 1484.1 is a community specification and "specifies a high-level architecture for information technology-supported learning, education, and training systems that describes the high-level system design and the components of these systems". It is describing especially the third layer of system components from the five layer architecture included in the informative annex B and was approved and published in 2003. It can be regarded as a conceptual specification mainly developed for the domain "meaning" and focusing on the entity "learning systems".

IEEE 1484.11.1 is a community specification and "describes a data model to support the interchange of data elements and a runtime service (RTS)" based on the specification "CMI Guidelines for Interoperability", version 3.4, developed by The Aviation Industry CBT Committee (AICC) and was published in 2005 (approved in 2004). It can be regarded as an implementation specification mainly developed for the domain "learning technology" and focusing on the entity "learning systems".

IEEE 1484.11.2 is a community specification describing an ECMA Script application programming interface (API) for content-to runtime- services communication based on the specification "CMI

Guidelines for Interoperability", version 3.4, developed by The Aviation Industry CBT Committee (AICC) and was published in 2004 specification mainly developed for the domain "learning technology" and focusing on the entity "learning systems".

IEEE 1484.11.3 is a community specification providing a XML binding of the specification IEEE 1484.11.1 using the W3C XML schema definition language to allow data model instances in XML and was published in 2006 (approved in 2005). It can be regarded as an implementation specification mainly developed for the domain "learning technology" and focusing on the entity "learning systems".

IEEE 1484.12.1 is a community specification containing a conceptual data schema that describes the structure of a metadata instance for a learning object. It was approved and published in 2002 and is well known as the first learning object metadata specification called LOM.

It can be regarded as a conceptual specification mainly developed for the domain "learning content" and focusing on the entity "learning resources".

IEEE 1484.12.3 is a community specification providing a XML binding of the specification IEEE 1484.12.1 using the W3C XML schema definition language to allow data model instances in XML and was approved and published in 2005. It can be regarded as an implementation specification mainly developed for the domain "learning content" and focusing on the entity "learning resources".

IMS overview:

IMS Global Learning Consortium, Inc. (IMS) is an international standardization initiative with organizational membership. Only organizations as contributing members have the right to develop IMS specifications and charters and the right to vote. The objective of IMS is the development and the promotion of technical specifications for interoperable learning technology.

The structure of IMS:

The development of the specifications is an internal, closed process open only for the organizational members. Finally approved by the IMS Technical Board the final version is published as an open specification made available online on the web for free after registration.

The scope of IMS:

The scope of IMS is to develop and to promote "the adoption of open technical specifications for interoperable learning technology" (also called "technical standards" by IMS).

The IMS specifications are aiming at direct adoption and implementation. Thus they are normally specific and sometimes small technical specifications developed for particular application scenarios and use cases. The main and well-known IMS specifications are: IMS Content Packaging (CP) is an industrial specification providing "the functionality to describe and package learning materials, such as an individual course or a collection of courses, into interoperable, distributable packages" by a manifest including metadata, information about resources and organizations, and sub-manifests. Its last version 1.1.4 was published 2004-November-1. It can be regarded as a conceptual specification mainly developed for the domain "learning content" and focusing on the entity "learning resources". IMS Learner Information Package (LIP) is an industrial specification facilitating the collection and exchange of information about individual or group learners or producers of learning content by the main elements: accessibilities, activities, affiliations, competencies, goals, identifications, interests, qualifications, certifications and licenses, relationship, security keys, and transcripts. Its last version 1.0.1 was published 2005-January-17. It can be regarded as a conceptual specification mainly developed for the domain "didactics" and focusing on the entity "roles". IMS Learning Design (LD) is an industrial specification providing "a containment framework of elements that can describe any design of a teaching-learning process in a formal way". It is based on the "Educational Modeling Language" (EML) originally developed by the Open University of the Netherlands. This meta-language allows the integration of different pedagogical approaches and the modeling of "units of learning" by adding any content aggregation specification. IMS Learning Design was published 2003-February-13. It can be regarded as a conceptual specification mainly developed for the domain "didactics" and focusing on the entity "methods".

IMS Question and Test Interoperability (QTI) is an industrial specification providing an abstract data model for the description of questions, tests and result reports and their data exchange by using the extensible Markup Language (XML). Its last version 2.0 was published 2005-January-24. It can be regarded as a conceptual specification mainly developed for the domain "didactics" and focusing on the entity "learning systems".

IMS Simple Sequencing is an industrial specification providing "a method for representing the intended behavior of an authored learning experience such that any learning technology system (LTS) can sequence discrete learning in a consistent way". It was published 2003-March-20. It can be regarded as a conception specification mainly developed for the domain "didactics" and focusing on the entity "methods".



ADL overview:

ADL was initiated by the Office of the Under Secretary of Defense for Personnel and Readiness (OUSD P&R) and is part of the Department of Defense (DoD) of the United States of America. Although it is calling itself "ADL initiative" it is a governmental office without membership offers (neither for individuals nor for organizations). The developing procedure and the approval of ADL specifications are closed allowing only review and comments after the publication.

The structure of ADL:

ADL is a governmental office, there is no information given about its internal structure.

The scope of ADL:

The scope of ADL is expressed by its vision "to provide access to the highest-quality learning and performance aiding that can be tailored to individual needs and delivered cost-effectively, anytime and anywhere".

The specifications developed by ADL:

ADL has developed one main specification as an integration of different specifications from standardization initiatives:

1. **Sharable Content Object Reference Model (SCORM)** Sharable Content Object Reference Model (SCORM) is an organizational specification providing the support of the conformance and of the data and information exchange between different learning management systems (LMS) and for learning content. Its last version SCORM 2004 3rd edition was published in August 2006. ADL is using the image of a bookshelf for explaining SCORM and its document suite. SCORM consists of four "books":

2. **Content Aggregation Model:** It includes the IEEE 1484.12 (LOM) specification (see above), the content structure developed by AICC, the IMS Content Packaging specification and the sequencing information specification developed by IMS.

3. **Run-time Environment:** It includes the IEEE 1484.11.1 (RTS) specification (see above) and the IEEE 1484.11.2 (ECMA Script API) specification

4. **Sequencing and Navigation:** It includes the sequencing information and behavior specification developed by IMS. Only LMS products and contents can be conformant to SCORM 1.2 or SCORM 2004. ADL has asked ISO/IEC JTC1 SC36 for a review process of SCORM and has proposed the idea to move the future evolution and maintenance of SCORM to an (not yet existing) International Consortium for Interoperability (ICIL). SCORM can be regarded as a conceptual specification mainly developed for the domain "learning technology" and focusing on the entity "learning environment".

RESEARCH DESIGN AND METHODOLOGY

The aim of the study is to arrive at a comprehensive picture of interoperability of Quality Development and E- Learning in King Khalid University.

The table 1 shows design and methodology of the survey are explained below.



Table 1: Design and Methodology of the survey

Section of Questionnaire	Description of Content
E- Learning in general	Involvement in e- learning Role in E- learning Length of involvement with e-learning
Quality in E- Learning	Involvement with quality in e- learning Personal understanding of quality Sources of information about quality in e- learning Importance of Quality e- learning Use of Quality approaches /quality strategies National and International support for quality in E- Learning
Use of Quality instruments in e- learning	Use of Quality Approach Type of Quality Strategy Reasons for non Use Reasons for use of quality strategies Familiarity with quality approaches(unprompted naming of five approaches Full description of one these approaches
Experience of quality instruments and approaches	Cost Number of Users Evaluation regarding the approach
Questions on statistics and demography	Type of Institution Target groups of e- learning provision/ branch(in the case of providers) Level of education/ training provided by the institution Number of Employees Respondents own role Country Age Educational Qualification

RESULTS

Quality department at e-learning deanship (King Khalid University) established in the later part of the year 1431 (2010), the main task of this department is to raise the awareness of quality in e-learning, especially the quality of e-courses to achieve the standards and to get the accreditation, while at the same time to promote best practices and stimulate innovation and excellence in teaching and learning online. In addition, the quality department also works at the level of e-learning program by measuring performance and improvement efforts of the initiative.

Objectives were to - Train faculty members on how to apply e-courses standards of quality, Create and implement the accreditation process of the e-courses quality, Measure the efficiency, effectiveness and customer satisfaction for e-learning and Identify gaps and development opportunities in e-learning program and launch appropriate projects to fill gaps and take advantage of the opportunities for improvement.

Overview on Quality standards and Specifications

King Khalid University has adopted international quality standards from the "Quality Matters" to be the basis for regulating the quality of e-courses. "Quality Matters" provides a guarantee of quality e-courses, based on faculty and peer review, based on the latest scientific research and practical experience in the field. The quality assurance process designed to reach

continuous development and improvement after making sure of the quality level of the e-courses with collaborative methodology.

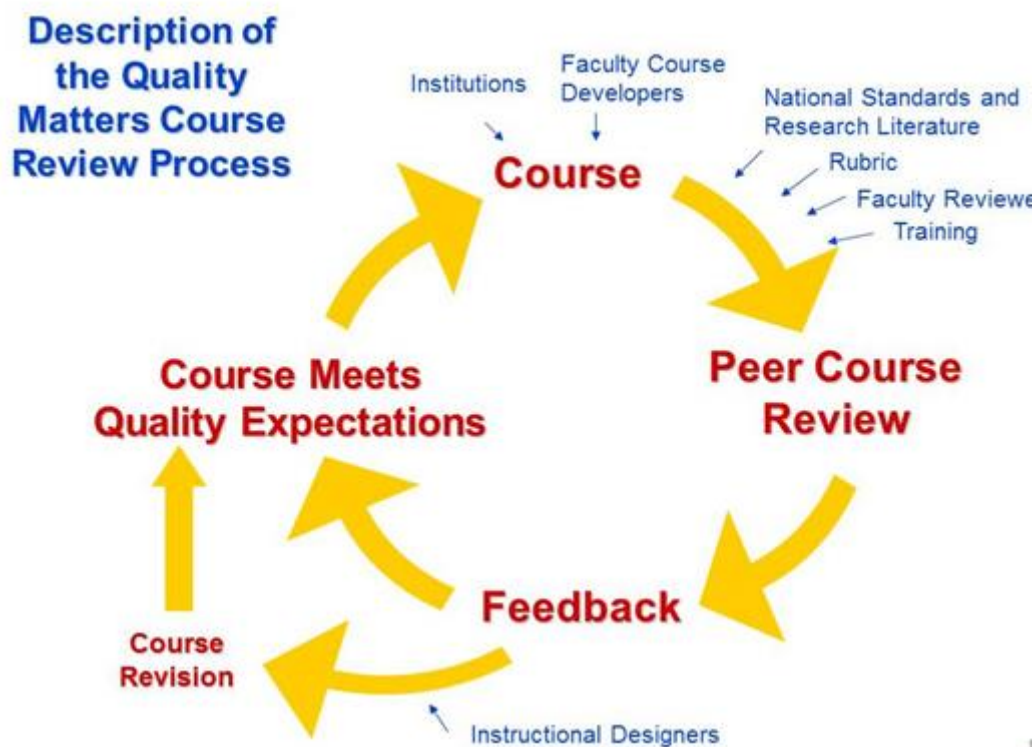


Figure 3: Description of Quality Matters Review Process

The requirements of the electronic courses quality:

In King Khalid University "Quality Matters" uses a system based on the measurement tool in the process of reviewing e-courses. This tool was developed based on research, standards, best practices, experiences, and instructional design principles with a focus on consistency and integration of standards 2 to 6 Quality Matters.

The quality standards included in this measurement tool concerned with the e-course design, which is not developed to measure other areas such as the teaching of the e-course, earning management system used to present the e-course, or to assess the faculty member in terms of training or readiness.

Measurement tool consists of eight general standards, and each of these general criteria consists of a number of specific criteria. In general, the general standards covering the following areas:

- 1- Course Overview and Introduction
- 2- Learning Objectives
- 3- Assessment and Measurement
- 4- Resources and Materials
- 5- Learner Engagement
- 6- Course Technology
- 7- Learner Support
- 8- Accessibility

Still Interoperability between Quality development and E- Learning in King Khalid University is not yet widen but having bright and strong intensification attempts to achieve through Policies and regulations for capture, reuse, and sharing of data, learning objects and other learning resources where Practices are still emerging, policies are not yet formulated. Clear Quality development policies and regulations are to be formulated and broadly understood for E- Learning.

For Policies, regulations and norms for student and faculty communication, access to online resources, performance assessment, monitoring, quality assurance and privacy, existing policies and practices are based on traditional learning and are too restrictive therefore has to be reviewed. Also Fresh policies, regulations and practices are crafted, reflecting the realities of the E- Lifestyle Intellectual property policies and processes.

CONCLUSION

This research has broadened the information on interoperability and quality development in e-Learning and on e-Learning standardization in the future for King Khalid University. Prospects and Strategies for the Improvement the acceptance and usage of E-Learning and Promoting and implementing of Quality standards for adaptation in E- Learning and also Harmonizing quality management and assurance in E- Learning in the higher education system.

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