

Quality Assurance Framework for e-Learning



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Abstract

e-learning is now catching up resulting in proliferation of a large number of tools for hosting the content. Quality assurance of these tools and the content hosted is done on a very informal basis. Formal frameworks do not exist for evaluating the quality of the tools and the content. The identification and quantification of various quality metrics for e-Learning environment is an area of research in e-Learning. This invited talk suggests a Quality assurance framework for e-Learning, bringing-out the e-Learning environment to be considered, parameters to be quantified for quality assurance, database for storing the quantified metrics and a tool for Quality Assurance aggregation and analysis, which takes the inputs from various sources to generate reports on the Quality levels of the e-Learning environment.

Invited Talk

While quality is difficult to define, its importance is universally appreciated. Quality is described as a concept rather than a technique, so its implementation is very much dependent on the process at hand. The quality assurance system documents the procedures with the aim of ensuring that the overall process meets specified objectives and to demonstrate that the quality is a managed outcome.

e-Learning is considered to bring qualitative change in the way education is imparted, learning is happening and so on. This realization is still a dream to be achieved. The reasons are simple. There are number of e-Learning courses being offered at various universities, institutes etc. The question remains "How good is a course or how effective is the learning?" e-Learning environments consists of Learning Management Systems (LMS), Content Management Systems (CMS), Content authoring tools and the Content itself. A Learner is the customer who needs to be kept happy in any learning environment. This requires a high quality content and

user friendly, easily usable e-Learning tools (LMS, CMS etc.). The performance of the system in terms of imparting effective learning, availability of the system, durability of the content, interoperability of the systems across the platforms becomes important. To make sure that the vendors stick to some values, standards are here for e-Learning content development and e-Learning tools. These standards are driven by various organizations such as IEEE, DOD, ISO etc. IEEE's Learning technology Standard Architecture (LTSA), DOD's Advanced Distributed Learning (ADL) standards for content: Shareable Content Object Reference Model (SCORM) etc. It is essential that the learner is assured of the quality of education imparted, content that is available for the course etc. The metrics for quality for e-Learning components are addressed by many in the literature. Garvin [1] has suggested some quality criteria for managing quality of any product, which are performance, features, reliability, conformance, durability, serviceability, aesthetics and perceived quality. Nichols [2] has recognized five levels of e-Learning. They are Information Repository, One-Way Communications, Online Exercises, Two-Way Communications and Learning Objects. Nichols has also explained four distinct quality assurance procedures: The training process – quality assurance for e-Learning levels one to three; the consultancy and training process – for development at level four; The full project process – used in the development of major learning objects (level five) and development of courses into an RBL (resource-based learning) mode; the minor / single task project process –that ensures quality in additional activities.

Quality Assurance of the e-learning tool

The ISO 9126 QAS model was originally developed in 1991 to provide a framework for evaluating software quality. This standard defines a general framework for the evaluation of software Quality. It is more adaptable and can be used across many systems. Chua and Dyson[3] proposed the ISO 9126 Quality Model as a useful tool for

evaluating e-Learning systems, particularly for teachers and educational administrators. The authors demonstrate the validity of the model in a case study in which they apply it to a commonly available e-Learning system. Their work demonstrates that software quality assurance models could be adapted to e-Learning area.

Keeping the importance of QA for e-Learning, it is important to develop framework for formal quality assurance of e-learning content. As a first step to this quality metrics have to be developed that can be used for quantifying the various quality parameters of a e-Learning tool and the content. The development of quality metrics and the framework can become the base for developing the QA tools, which can collect data on various aspects, analyze and arrive at quality measures using well-understood models and then grade the e-Learning environments.

A suggestive framework for Quality assurance bringing-out the e-Learning environment to be considered, parameters to be quantified for quality assurance, database for storing the quantified metrics, standards compliance testing software for content and tools, and a tool for Quality Assurance aggregation and analysis which takes the inputs from various sources to generate reports on the Quality levels of the e-Learning environment is depicted in the Figure 1.

In this suggested framework of quality assurance three important aspects of quality are considered. They are given below:

- Operational characteristics (such as usability, security, reliability)
- Transition characteristics (such as portability, interoperability)
- Revision characteristics (such as testability, modularity)

The above-mentioned characteristics can further have sub-characteristics. For example Usability can be understood using sub-characteristics - understandability, learnability, operability, beautification. These are listed in the Table 1 for all the characteristics:

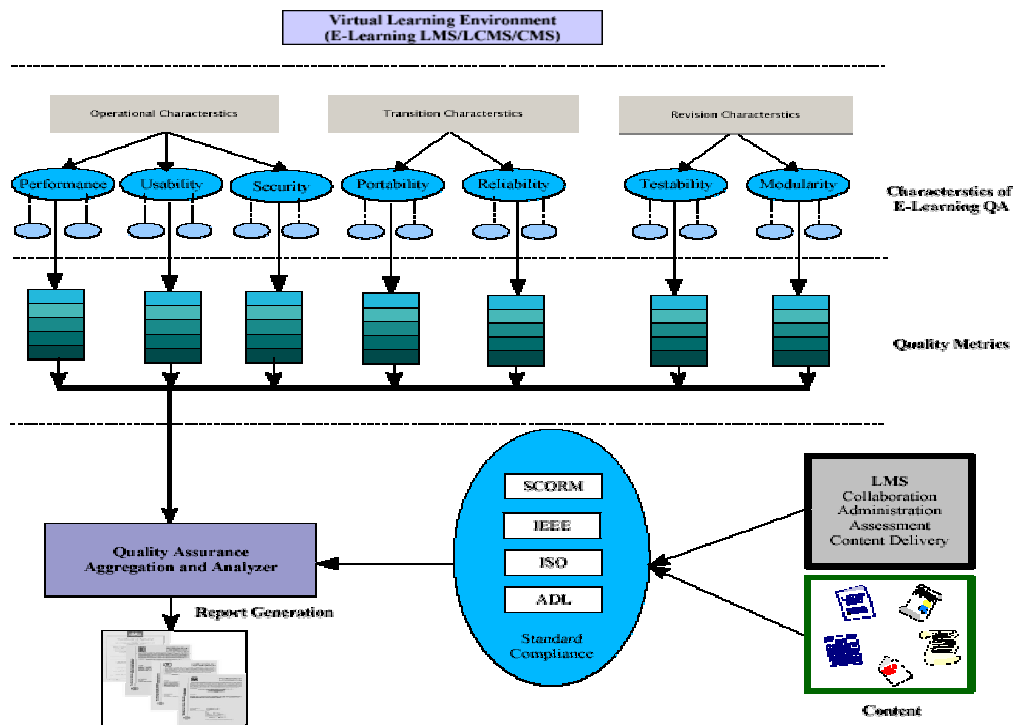


Figure 1 Quality Assurance Framework for e-Learning

The above framework depicts the need of QA aggregation and analysis tools, which takes various inputs from the LMS/LCMS tools, quantify them as desired, and get the inputs on the standards compliance of the content and tools as shown in the Figure.

QA for e-Learning effectiveness cannot be measured by simply evaluating either content or e-Learning tool. It needs to consider all components, processes and flows. It needs to build mechanisms of quantifying various observations. For example how do you judge that the content is fine: We need to measure user (instructor and student) satisfaction levels on the basis of setting questionnaire, which may pop-up while user is interacting with the learning resources and such a feedback from a large number of stakeholders may be aggregated and a metric may be formed to identify levels of satisfaction and may be recorded in the database.

As another example let us consider the compliance of standards. A user has an

every right to know whether the content is complying with standards. If content is Developed as per SCORM 2004, then we can use ADL's compliance test suites to check for the content's conformance to standards. The quantification in such case is in general binary (Yes/no). However we can set certain part of standard as very important, say, only metadata about Shareable Content Objects has to be in place and other aspects are not important. We may grade the extent of standards compliance.

Therefore in summary a QA tool for e-Learning need to have the following features:

- To be platform-independent (to run on both Windows and Unix/Linux environments)
- Obtains the quality metrics by analysing the tool for various features, automatically to the extent possible.
- Performance analysis by integrating the tool with open source performance analyzer (such as JMeter) GUI for

inputting subjective evaluation parameters.

- Integration with conformance testing tool (such as SCORM compliance tool) for standards compliance metrics

Characteristics	Sub-Characteristics	Explanation
Operational		
Usability	Understandability	Does the comprehend how to use the system easily?
	Learnability	Can the user learn to use the system easily?
	Operability	Can the user use the system without much effort?
	Beatification	Does the interface look good?
Reliability	Maturity	Have most of the faults in the s/w been eliminated?
	Fault tolerance	Is the s/w capable of handling errors?
	Recoverability	Can the s/w resume working and restore lost data?
Security	Authenticated access	Does the s/w prevents unauthorized access?
	Content security	Does the s/w prevents unauthorized channels to access database and content?
Transitional		
Portability	Adaptability	Can the s/w be moved to other environments?
	Insatiability	Can the s/w be installed easily?
	Conformance	Does the s/w comply with portability standards?
Interoperability	Maturity	Can the system interact with another system?
Revision		
Portability	Testability	Can the software be tested easily?
	Stability	Can the s/w continue functioning if changes made?

Conclusion

Arriving at QA frameworks, quantifying the quality metrics, and defining levels of QA is an area of research and is the need of the hour. A good beginning could be carried-out by using software quality assurance standards to identify characteristics and sub-characteristics. At the end of the day E-Learning managers need an assurance of the quality of tools such as LMS, LCMS etc; Teachers must be assured of quality of content and learners need to be assured of the quality of entire e-Learning system and the pedagogy.

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