

A step towards integrated environment of technology based learning and quality assessment framework

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I. Introduction

Using computer resources and Internet technologies for educational purposes, is being seen as E-Learning in present day scenario. Initiatives such as developing eContents and setting up of infrastructure at school or higher education level are already started in India long back. Referring eContents and online courses for national level entrance examinations is growing day by day. Some of the courses are available for free and others on some price. Open Universities, Government Organizations and other academic institutions are slowly adopting online training as means for imparting requisite skills to their students and as a supplement method to traditional physical class room environment. There is no doubt this initiative of online learning has potential to reach millions of users when compared to traditional training methodologies.

At the same time there is a concern about requirement of a quality framework for online learning environments. This will ensure long term sustainability of eLearning and also benefit the end users in getting quality education through online mode. There are several proposals made towards this direction by different researchers in the past and standard bodies. However, when the eLearning quality models become integral part of online learning environment its value or impact can be realized. To do this several factors need to be considered. A move towards this direction is the focus of this article.

The quality frameworks usually emerge from the commonly used best practices that solve a particular purpose in a defined way. In order to arrive at a quality assessment framework in eLearning, we need to look at current practice of instructional delivery process and how effectively it can be replicated or improvised by adopting technology. At the same time we also need to look at the associated technological challenges.

Usually a learner is said to have learned the subject when his ability in accomplishing the task corresponding to the subject is judged. To assess this factor the only instrument that is available is assessment of student's knowledge level. Student's knowledge level will improve when he is given sufficient details about the subject matter. Sufficient details are nothing but information about what the student is expected to know/perform after completion of the course, actual content supplemented with illustrations/demonstrations wherever required, additional information about the topic's background or advanced details and a self-assessment.

If these details are designed using technology in such a manner that would help students in engaging themselves in learning actively, having curiosity about a topic, probe critical thinking skills and allow them to interact with the content in a variety of ways (which can be regarded as necessary elements to judge one's motivational level) then the content is expected to be used by many and thus can be regarded as quality content. This can be addressed by effective utilization of text and multimedia coupled with little programming skills for event generation, notification and handling in content development process.

Developing content using multimedia technology is considered as a collaborative effort of instructional designer, subject matter expert, multimedia expert, videographer etc. In this situation, a uniform comprehensive set of guidelines corresponding to each role in their efforts of content development will be the first step towards building a quality assessment framework.

This exercise will eventually help in defining quality criteria that the online course contents and hosting platform will need to meet in order to be of sufficient quality to be offered to its users will be the next step. Once the quality criteria consisting of measurable quality dimensions are prepared development of corresponding measurement methods will be the next step. Finally, development of tools to assess the conformance to quality criteria based on the methods developed and integration of the same with online course hosting platforms will be the right direction towards facilitating quality conformance verification of online courses. This exercise helps in moving towards a national level policy on quality assessment practices of eLearning technology and courseware which not only harmonize the eLearning quality assessment practices but also provides an effective mechanism for monitoring and adaptation of necessary changes to meet the present and future challenges in online learning.

II. An Initiative towards Quality Assessment Framework for online courses and hosting platform

Centre for Development of Advanced Computing, Hyderabad has taken an initiative in defining and building a quality model with appropriate measurement approaches for online course contents development and hosting platform. A detailed research study done and a proposal towards quality assessment of eContents by Satyanarayana, et. al can be found here [2] and for online hosting platform by Sarat Chandra Babu, et. al can be found here [1].

Based on the work carried out in the above papers, quality criteria for development of online course contents is proposed as “A set of individual course contents suitable for offline and online reading which are organized in to a course with objectives or expected learning outcome associated with each of them, visual and auditory legible, interoperable with course delivery platform, understandable to readers and having sufficient coverage of information”.

Majority of the online courses are being offered through web platform. Web has become a defacto method for dissemination of information. Hence, quality criteria for web based applications are equally applicable to online courses hosting platform when Web is used as a medium for offering courses. Its quality criteria is proposed as “A platform which can support delivery of online courses according to the instructional strategy, meets the minimum expected performance in terms of its access through Internet, secured from most common web vulnerabilities, accessible and is easy to use”.

The online course contents quality dimensions are based on factors concerned with (a) Technology (b) Content. Technology factors deals with assessing impact of technological errors that creep in to the content development and content factors deals with assessing usefulness of the content based on predefined rubrics.

As a whole the quality framework for assessing online course contents and its hosting platform is depicted through a pictorial representation below.

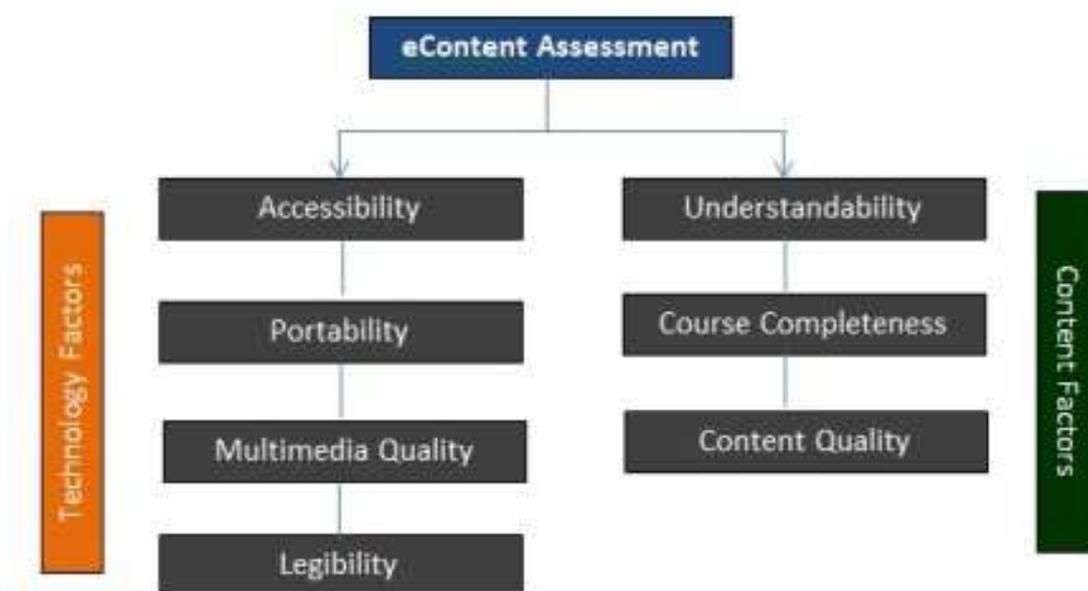


Fig 1: eContent Quality Criteria

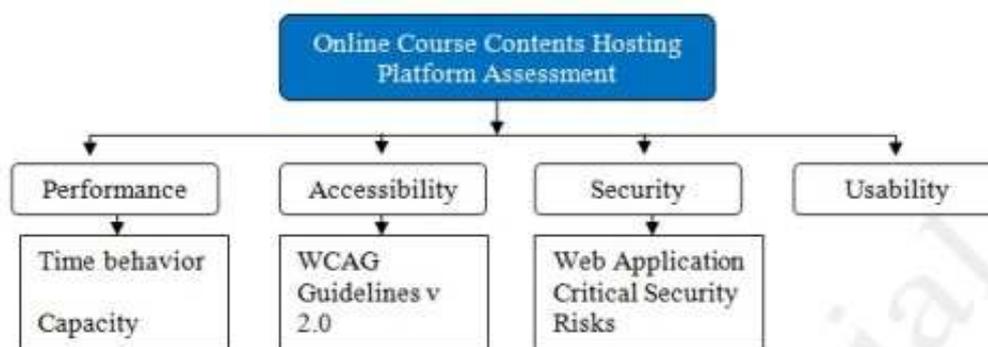


Fig 2: Hosting Platform Quality Criteria

III. Online Course Contents Quality Dimensions:

(A) Accessibility (WCAG Guidelines) is one of the most widely supported guidelines in almost all the word processors and web page editors. This support will enable people with physical disabilities to use assistive technologies in using content effectively.

(B) No reference metrics for impairment analysis of multimedia content such as audio or video elements reduces the video quality assessment time as the subject matter expert need not focus on technical errors that creep in to the video at the time of its recording.

(C) Legibility of the content has direct impact on readability of the material. In the empirical study conducted by Satyanarayana et. al [1] students have expressed that consistency in font style, size and color etc., quality of images used in the material and color contrast are the dominating factors in influencing text content legibility.

(D) Readability of the text is most important as it has direct impact on understandability. Readability is generally affected by length of sentences, vocabulary and legibility. Content is considered to be easily understandable when its readability value is high.

(E) Sharable content object reference model (SCORM) is ISO standard for content aggregation and runtime environment. The events generated within the content due to user's action such as clicking a button, drag and drop etc., can be communicated to course hosting environment through SCORM's runtime environment. Thus SCORM's runtime environment will act as a bridge between course content and tracking & analysis module of course hosting environment. This is useful in understanding student's motivation level.

(F) Whether the course is complete in all aspects or not is another important aspect that needs to be judged. To accomplish this we need to verify whether the course is designed with sufficient details or not. This can be evaluated by looking at whether the content is prepared for both online and offline reading in different formats viz., pdf/html for running text and ppt/video for presentation, contains objectives/expected learning outcomes for each topic in the course, whether any reference material or assessment is attached to the content etc.

When the course is designed with conformance to all the above quality dimensions it can be regarded as suitable for online learning.

IV. Hosting Platform Quality Dimensions:

(A) Performance refers to the extent which the online course contents hosting platform can support simultaneous requests while meeting minimum response time constraints. It is difficult to define the minimum recommended response times due to various factors such as application's functionality, network bandwidth etc. Usability studies by Jakob Nielsen reported that 0.1sec as the limit for having the user feel the system is reacting instantaneously, 1 sec is the limit for the user's flow of thought to stay uninterrupted and 10sec as the limit for keeping the user's attention focused on the dialogue. In the present scenario of Internet based applications meeting these time limits depends on network latency especially when the web content is hosted at remote places. Hence, an approach to find out the percentage of deviation from minimum expected response time and determining its grade level is proposed in [2]. The minimum expected response time has to be determined by the hosting service provider to know whether the hosting site is reachable as expected in ideal network conditions after performing few trial runs from remote places through Internet.

Using observed average response time and expected response time of an URL, percentage of deviation and associated scale has been proposed as below.

Deviation %	
<26	VERY GOOD
>25	GOOD
>50	AVERAGE
>75	NOT SUITABLE FOR ONLINE LEARNING

This approach can be used during internal audit trails and serves as a benchmark during future upgradations of the hosting platform. A deviation of 25% corresponds to 250 ms or ¼ of a second if the minimum expected response time determined as 1000ms and observed response time is 1250ms. For business oriented applications a delay of 250ms results in losing of site traffic to some extent which may not be the case with the online learning platforms.

(B) Apart from the performance of the hosting platform it is also important to check whether the application is prone to exploitation of any critical web application security risks as an end-user will try to upload various documents corresponding to course work. The Open Web Application Security Project (OWASP) releases list of top 10 web

application vulnerabilities every year and the top 5 almost remain consistent with minor changes in the order of their impact in a particular year.

(C) User satisfaction in terms of degree to which the application is easy to operate, a user is satisfied with their perceived achievement of pragmatic goals, confident in using the application again is required to be judged.

The final score of the Usability test reflects the usability score of an individual. Based on below grading mechanism the score obtained can be categorized in to one of four groups. A. Bangor et. al, [3] given detailed report on how individual Simple Usability Scale scores can be mapped to an adjective scale.

>85	VERY GOOD;
<=85	GOOD;
<73	AVERAGE;
<70	NOT SUITABLE FOR ONLINE LEARNING;

Then mode/median (as the case may be) of the ordinal data will determine the usability of the online hosting platform as one of the above categories. However, the end users should be given a task to be performed concerned with usage of the system so that individual score can be obtained.

(D) Accessibility refers to the extent to which the application supports people with the different capabilities can access the hosting platform. W3C has given recommendations on accessibility guidelines for web pages.

V. Use Case Scenario

With the above quality assessment framework in place it will be useful to the academic and training institutes in making the course contents free from technical and non-technical errors before publishing them online and verify whether their hosting platform is meeting the specified quality criteria so that any necessary corrective steps can be initiated. Like how a book gets its reputation gradually after it is read by several readers same would be the case with the integrated environment of quality assessment framework and online learning environment.

Integration of this framework with Learning Management Systems will provide a first-hand report on quality of the online course initiative of academic institutes as the course offering starts only after preliminary check of technical and non-technical errors as described in this article.

VI. Acknowledgements

We acknowledge all the members who worked in this effort and the sponsoring agencies for their invaluable support in this initiative.

VII. References

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Dr. N Sarat Chandra Babu is presently working as the Executive Director of Society for Electronic Transactions & security (SETS), Chennai. Dr. Sarat obtained his Ph.D. from IIT, Delhi. At SETS he is leading the teams working for Cyber Security specifically in the areas of Cryptology and Computing; Hardware Security; Network Security. He has considerable experience of over three and half decades in R&D, Project implementation and Co-ordination, Education and & training. Prior to joining SETS, he worked as Executive Director, C-DAC Bangalore and Founder Director of C-DAC Hyderabad. He worked at Department of Electronics, Govt. of India (Presently MeitY) at various levels. He contributed to first digital exchange while working at Indian Telephone Industries Ltd.(ITI), Bangalore. He worked as faculty at REC, Warangal (presently NIT, Warangal). He has guided number of projects in the areas of e-Learning, e-Security, Ubiquitous computing, IOT, System software for HPC etc. He took initiatives to transfer technology of R&D outcomes to industry. He has published around 70 papers in various National and International Journals & Conferences. He is a Senior Member-IEEE, Fellow-IETE, Life Member CSI and Member in ACM.



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