Performance Analysis of E-Learning Websites Using Online Tool

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Abstract **-** To enhance the knowledge or even to learn something from beginning e-learning has become one of the most important tools, but we still do not have a correct comparison of which e-learning platform shall be used. This paper provides and extensive and clear comparative analysis of the famous e-learning platform so that user can make his decision accordingly.

We have compared eight e-learning platforms on various parameters like load time, first byte, start render etc. The results clearly shows different sites have different characteristics like UMass Boston Open Courseware has minimum load time which is one of the main concern apart from the content for the learner.

The analysis has been done using an online tool from webstest.org and various tests have been performed for different parameters, this paper has discussed the results based on the main concerns.

Keywords **-** NPTEL, E-learning, webtest, EDX

I. INTRODUCTION

According to Markus (2008) e-learning is a way which provides interface with electronic information available to the various users by the web based services and providing support. It is new way by which anybody can access the information regarding their interest by directly accessing the computers or by the face to face classroom setting (computer oriented). [1]

In the field of e-learning a lot of research and other innovative opportunities are available for all. It reduces the paper mode or we can say it provides a paperless education to the various learners. By doing registration on web mode they can even make them eligible for various certifications too. [2]

The objectives of E-learning match to the traditional learning objectives, and also relates to life-long learning objectives associated to cognitive, affective and psychomotor domains. E-learning is used by various areas to train their employees without leaving their work area to be updated in their field. [3]

The five major e learning components (Content Engagement, Usability, Audience, Page Design, and Course Structure) provide help to build knowledgeable online programs. [4]

The peer communication on the both the ends on learner and instructor end play a very important role in e-learning. Work has been done using Facebook Groups for School as the e-learning platform. [5]

E-learning systems are used as teaching and learning in universities globally. To deliver a course content Kenyan universities have adopted e-learning technologies. [6]

Survey of almost 60 e-learning sites and cloud computing has been extensively done in our work [7]. We have also analysed and compared various e-learning sites on the various factors(Complete Contents, Contents on One Page, Interface, Collaborations, Courses, Query handling, Fees, Duration of Courses, Certifications, Response time) [8].

The combination of education and technology can build dynamic teaching and learning experiences that provides a better learning way to them but some are not in favour of this [9] finds the factors creating problems in e-learning particularly on Learning Management Systems (LMS) in the Filipino context. A conceptual model was proposed based on the Technology Acceptance Model (TAM) which was extended through the integration of various predictor values as addition. The three–tier model was used which shows the behaviour of various users towards IT at three levels.629 students of Filipino college data were collected and by this a path model was developed which fill the gap of the factors creating problem in using e-learning. It provides guidance to various users for acceptance of e-learning.

Various e-learning resources are available [10] focuses on how to improve the content of the various e-learning websites by analysing and including factors like cognition, critical thinking and problem-solving skills. This paper focuses on hierarchical Bloom cognitive taxonomy and rich media formats based design of assessment questions. Eighteen weeks results were collected and it's showed improved academic output.

In Kagawa University e-learning platform is designed for learning computer networks, routing etc. [11] improved it by updating it by including multilingual support not only for Japanese learners but also detailed data is available for English/Portuguese/French spoken learners. By questionnaire and users comments they analysed the results.

Semantic web technologies based tool was proposed by conducting experiment on 32 students and found results which were better as compared to the plain native tool. It improves the lesson content. [12]

[13] It identifies and explores the critical factors for the satisfaction of learners and proposed a hybrid model that divides the success factors of web learning in four include the learner characteristics, the instructor characteristics, the system specificities and the social influence which shows how by this they can improve success ration of online learning.

Companies in Indonesia managing knowledge based system but this type of idea was not followed in Education system .In this model was proposed which includes E-learning based on knowledge management system which provides better availability and reusability of e-learning based education. [14].

[15] By using theory of technology acceptance model (TAM) they find a student's view about e-learning. Structural equation modelling approach in integration with Smart PLS software finds the learners adoption behaviour. They proposed the model which showed the positive perception of Malaysian students in context of e-learning.

[16] In this a method was proposed which was focused on self-learning and automation in e-learning system. It also includes traditional learning and also includes technologies like cloud, AI etc. which have not been automated. It showed by this learning becomes easy for every type of learner.

[17] By Technology acceptance model (TAM) and the service quality model of Parasuraman, Zeithaml, and Berry the satisfaction of learners was found. It also investigated the feedback of various learners of Taiwan by various factors analysis and questionnaire towards the e-learning and finally it founds the customer satisfaction of the persons who do job in Taiwanese electronics Corporations and take English language learning by mode of e-learning learners for Taiwanese business learners.

[18] Web mining is the sub field of data mining techniques by which knowledge is extracted from huge repository of data in web. In this web content and usage mining was used for contents and for user satisfaction content and collaborative filtering was used for personalised e-learning. By the use of mining techniques in e-learning it provides the data according to learner need.

The factors affecting the e-learning was analysed in [19] by collecting 354 learners of Virtual University of Pakistan and for hypotheses test equation modelling was used. In this conceptual model-the Pakistan E-learning Adoption model was proposed related to higher education.

In this the tool was designed to test the Cross Browser behaviour of various sites like Educational, Govt, Social networking sites etc. Various sites was tested and they found that educational and social sites showed least compliance as compared to government and commercial sites are 100% compatible with various browsers.[20]

By the mode of learning management system the blend learning approached was delivered to various learners which include various resources and delivery methods .This also includes various methods used by teachers to teach a variety of learners. [21]

[22]They analysed the 4 weeks data of 570 families of Botswana and found the results about what age group users were using what type of website, percentage of users, time spent on sites etc.

Various e-learning issues and challenges have been discussed. DSS, AI and Human computer interaction techniques makes e-learning more improves was included According to INDIA research community the various issues and challenges to be considered to improve e-learning. [23]

On the basis of survey they showed Impact of e-learning in Saudi Arabia and by this it showed how these results are useful for the future users and for West Asia and Gulf Countries. [24]

Web 1.0 is read only medium then Web 2.0 read/write medium and in this it included Effect of Web 3.0 in e-learning, its evolution and characteristics. Web 3.0 is read/write/executable which is very useful in e-learning was discussed. [25].

In a ubiquitous environment the users access to any services at anytime, anywhere through any device is the new dictum. It proposed an access control mechanism that adapted through means of gathering the dynamically changing contextual information that has an impact on access decisions. [26]

It presented a web based e-learning system that is completely concerned with the sign language for hearing-impaired community of Pakistan. It not only provides e-learning portal for deaf also for others who are fit but by this they can understand them. It also included text translation system which translated English to its equivalent Pakistani sign Language. [27]

This paper showed the impact of excessive use of internet on the cognitive development process and various elements of cognition amongst youngsters. The results were generated by taken the response from more than 500 youngsters from the New Delhi region. [28]

In the field of e-learning various parameters was taken for research like:

i) E-Learning for hearing impaired persons of Pakistan.
ii) Content Management system of E-learning
iii) Knowledge based e-learning
iv) E-learning for Malaysian Students
v) E-learning portal is designed for networking subject of Kagawa University and it also provides multilingual support.
vi) Various types of online sites are analysed for factors influenced the success ratio of e-learning.
vii) E-learning and use of computer was tested for Botswana families.
viii) E-learning impact was done on Saudia Arabia.
ix) E-learning availability at any time.
x) E-learning measured by cognitive factors
xi) Data mining used for e-learning
xii) Cross browser behaviour was analysed

So as per the above parameters which are used for research previously, we have chosen the e-learning sites for the computer students and in this by the tool we test all the top computer subjects sites and found the various factors which showed how easily computer learners can easily access the data by the mode of e-learning in very easy manner.

This paper is an extension of our previous work where comparison has been done by using an online tool and results have been verified and generated online using webtest.org.

II. TARGETED SITES

We have targeted eight below mentioned sites and checked them for various parameters using an online tool from webstest.org and finally analysed the sites depending on their load time.

A. Nptel

The Ministry of Human Resource Development (MHRD) funded the project known as The National Programme on Technology Enhanced Learning (NPTEL); by the web mode it provides e-learning which includes videos, text files to various learners of various fields like in Engineering, Sciences, Technology, Management and Humanities. It is combined efforts of the seven IITs and IISc Bangalore.

B. MIT Open Course Ware (MIT OCW)

MIT Open Course Ware (MIT OCW) is a scheme of the Massachusetts Institute of Technology (MIT) to gather all the material related to their educational courses online, i.e. free of cost available and anybody can access at any time. On April 4, 2001 the project was initiated.

C. The Open University

The Open University (OU) is public distance learning and research university, and one of the biggest universities in the UK for undergraduate education.

D. Coursera

It's an education focused company established by Stanford professors Andrew Ng and Daphne Koller. They offer online courses in various fields.

E. Openculture

It is a high quality educational media through World Wide Web. It provides resources free of cost.

F. Cosmolearning

Founded with the objective to provide free access to learn from the world's top scholars, CosmoLearning gathers and organizes educational content in an intuitive environment.

G. UMass Boston Open Courseware

UMass Boston OCW is a free and open educational resource for faculty, students, and self-learners worldwide.

H. edX

edX is an online learning destination and MOOC provider, offering high-quality courses from the world's best universities and institutions to learners everywhere.

III. METHODOLOGY USED

In this paper the speed of the various sites based on various factors has been tested using webtest.org.

A. Webpage Test .Org

It is an open source site which is developed and maintained by Google. It was originally developed by AOL for internal use and was open sourced in the year 2008 under BSD license. Its online version is run for the performance community benefit. It tests the various factors of the site like graphics, css, content, images, font etc and on the basis of various factors it calculates the load time, requests, renders time etc of the particular site. [17]

- **Load Time:** It is the time from when the user started Navigate to the page until the Document Complete event (when all of the page content has loaded).
- **Request:** This is the number of requests that had to be made by the browser for pieces of content on the page (images,java script, css, etc).
- The **Start Render time** is the first point in time that something was displayed to the screen. Before this time the user was staring at a blank page. This does not necessarily mean the user saw the page content, it could just be something as simple as a background colour but it is the first indication of something happening for the user.
- The **First Byte time** is the time from when the user started navigating to the page until the first bit of the server response arrived. The bulk of this time is usually referred to the "back-end time" and is the amount of time the server spent building the page for the user.
- **Bytes In:** This is the quantity of data that the browser had to download in order to load the page. It is also generally referred to the "Page Size".

IV. IMPLEMENTATION AND SYSTEM REQUIREMENT

A. System Requirements

WebPageTest can be configured to run all on one system (with the web server and test machines all running on the same PC) or with separate systems for the web server and testers. We have used windows 8.1 operating system as web server and Mozilla Firefox as browser.

B. Web Server

The Web Server can be any OS that supports PHP (Linux and Windows have both been tested).

C. Browsers

i) E9/Chrome/Firefox/Safari - ami-7a86ec15
ii) IE10/Chrome/Firefox/Safari - ami-bf80ead0
iii) IE11/Chrome/Firefox/Safari - ami-d498f2bb
iv) Linux (Chrome, Chrome Beta, Chrome Canary, Firefox, Firefox Nightly) - ami-64a7dc0b

V. RESULTS

On the basis of the contents and first view, Repeat view, document complete, DOM elements, requests ,bytes in, load time etc results have been generated using webtest.org and other backend factors which were included are images. Css, JavaScript, flash etc. Also the network related issues are measured by Content Distribution Network (CDN). Site wise results have been discussed below.

A. Nptel

On testing for various pages and several times it was calculated that Load Time for NPTEL was 82.597 s and First byte was 8.940 seconds as shown in Table 5.1 and figure 5.1.

Table 5.1

Sr No.	Site Name	Load Time	First Byte	Start Render
1.	nptel.ac.in	82.597s	8.940s	16.143s

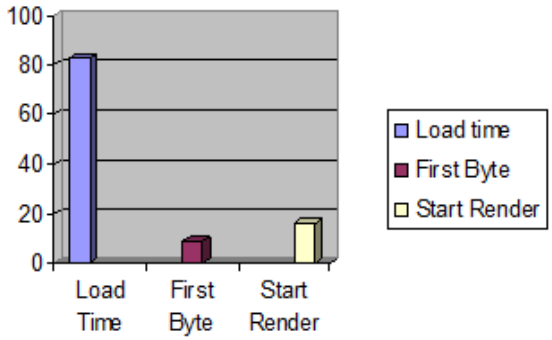

Figure 5.1 shows that NPTEL has load time of 82.59s

B. MIT Open Course Ware

Table 5.2 shows the results for MIT Open Course ware, the load time is 7.783s which is much lesser than NPTEL similarly for First byte and start render as shown in table 5.2 and figure 5.2.

Table 5.2

Sr No.	Site Name	Load Time	First Byte	Start Render
1.	ocw.mit.edu	7.783s	0.403s	1.338s

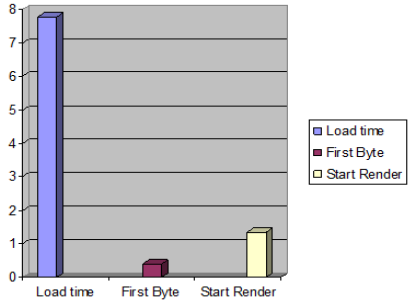

Figure 5.2 shows that MIT has load time of 7.78s

C. The Open University

Results of Open University are depicted in Table 5.3, which clearly shows that it has Load time of 8.607 s and Start render of 7.005 seconds. The same is shown in Figure 5.3

Table 5.3

Sr No.	Site Name	Load Time	First Byte	Start Render
1.	openuniversity.edu	8.607s	3.534s	7.005s

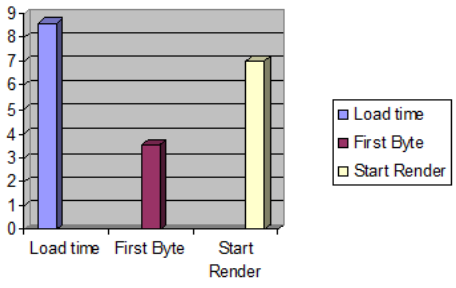

Figure 5.3 shows that The Open University has load time of 8.60s

D. Coursera

Table 5.4 shows the tabulated results gathered by webpagetest.org for Coursera it measured the load time as 17.338s and First byte as 1.242 seconds. Fig 5.4 shows the graphical view of the results gathered by the webpagetest.org.

Table5.4

Sr No.	Site Name	Load Time	First Byte	Start Render
1.	coursera.org	17.338s	1.242s	4.224s

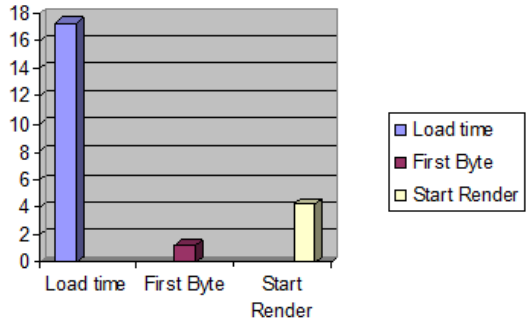

Figure 5.4 shows that Coursera has load time of 17.33s

E. Openculture

Load time for Open culture is computed as 42.953s and First byte is 1.323 seconds the complete results are shown in table 5.5 and Fig 5.5.

Table.5.5

Sr No.	Site Name	Load Time	First Byte	Start Render
1.	openculture.com	42.953s	1.323s	9.004s

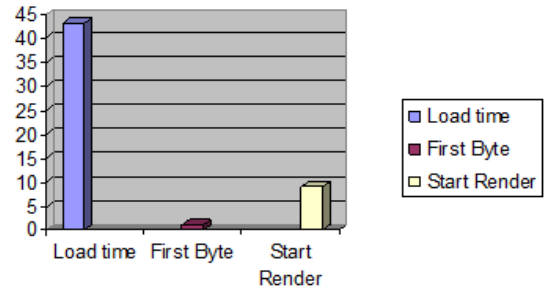

Figure 5.5 shows that Openculture has load time of 42.95s

F. Cosmolearning

Table 5.6 showed the tabulated results gathered by webpagetest.org for Cosmo learning it measured the load time as 11.159s which is the major factor for the comparison and other two factors are also calculated as shown in Table 5.6 and Fig 5.6.

Table 5.6

Sr No.	Site Name	Load Time	First Byte	Start Render
1.	cosmolearning.org	11.159s	1.626s	4.666s

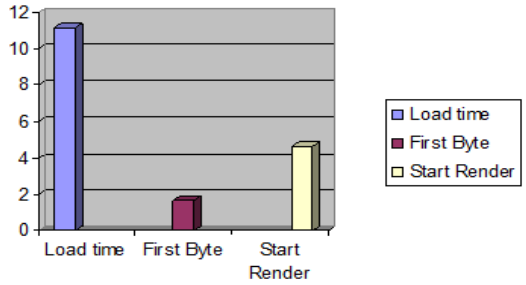

Figure 5.6 shows that Cosmolearning has load time of 11.15s

G. UMass Boston Open Courseware

UMass load time was calculated to be 6.312s and First byte as 1.717 seconds same is shown in Table 5.7 and Figure 5.7

Table 5.7

Sr No.	Site Name	Load Time	First Byte	Start Render
1.	ocw.umb.edu	6.312s	1.717s	5.725s

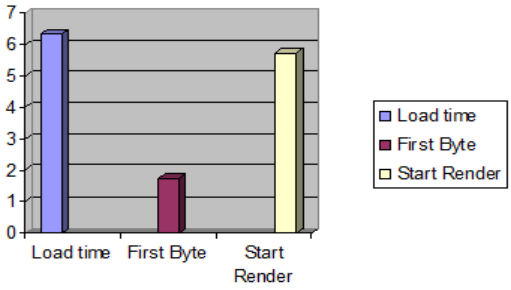

Figure 5.7 shows that UMass Boston OCW has load time of 6.31s

H. edX

Table 5.8 showed the tabulated results gathered by webpagetest.org for edX it measured the load time of 11.960s which is the major factor for the comparison and other two factors are also calculated. Fig 5.8 showed the graphic view of the results gathered by the webpagetest.org.

Table 5.8

Sr No.	Site Name	Load Time	First Byte	Start Render
1.	Edx.org	11.960s	0.265s	1.952s

Figure 5.8 shows that edX has load time of 11.96s

VI. COMPARATIVE COMBINED RESULTS

The individual sites have been evaluated in section 5 and in this section we have compared the overall results of all sites. As per Table 6.1 it has been found that Umass Open Boston Courseware has minimum load time so it is the most effective site in terms of speed and access. Other sites like MIT Open Courseware, The Open University and Umass Boston Open Courseware have load times less than 10 seconds, similarly sites like Coursera, Cosmolearning and edX have load time between 10 seconds and 20 seconds, Openculture has a load time of 42.953 seconds and NPTEL has the highest load time of 82.597 seconds. A detailed comparison for various factors has been shown in table 6.2.

Table 6.1

Sr No.	Site Name	Load Time
1.	nptel.ac.in	82.597s
2.	ocw.mit.edu	7.783s
3.	openuniversity.edu	8.607s
4.	coursera.org	17.338s
5.	openculture.com	42.953s
6.	cosmolearning.org	11.159s
7.	ocw.umb.edu	6.312s
8.	edX.org	11.960s

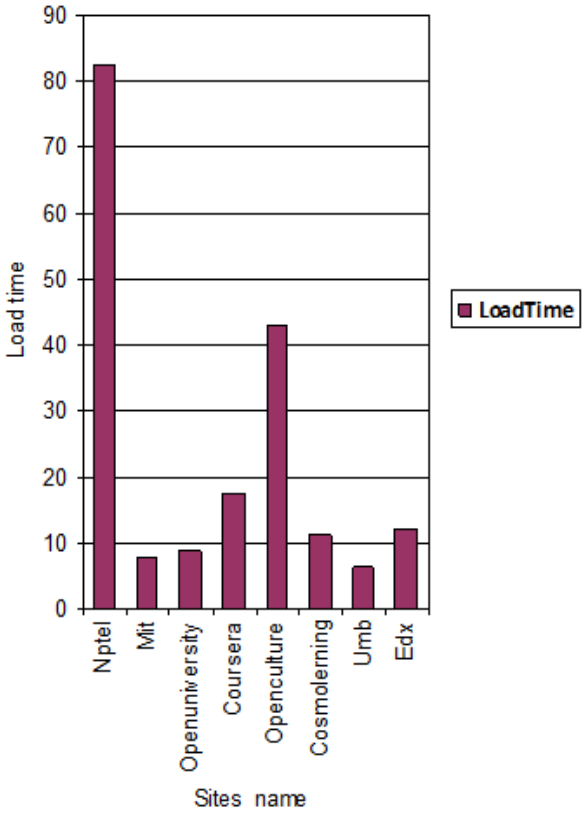

Figure 6.1 Graph for all sites

Table 6.2

Sr No.	Site Name	Load Time	First Byte	Start Render	Speed Index	Document Complete			Fully Loaded			
						Time	Requests	Bytes In	Time	Requests	Bytes In	Certifi -cates
1.	nptel.ac.in	82.597s	8.940s	16.143s	24897	82.597s	288	39,750 KB	90.567s	292	43,100 KB	42 KB
2.	ocw.mit.edu	7.783s	0.403s	1.338s	3931	7.783s	125	1,724 KB	7.958s	126	1,727 KB	55 KB
3.	openuniversity.edu	8.607s	3.534s	7.005s	8466	18.607s	147	1,321 KB	32.310s	196	1,452 KB	76 KB
4.	coursera.org	17.338s	1.242s	4.224s	4208	17.338s	139	1,715 KB	19.082s	145	1,743 KB	122 KB
5.	openculture.com	42.953s	1.323s	9.004s	29744	42.953s	293	9,076 KB	63.667s	345	9,671 KB	179 KB
6.	cosmolearning.org	11.159s	1.626s	4.666s	5350	11.159s	129	1,930 KB	11.159s	129	1,930 KB	83 KB
7.	ocw.umb.edu	6.312s	1.717s	5.725s	5763	6.312s	43	308 KB	6.561s	44	310 KB	10 KB
8.	Edx.org	11.960s	0.265s	1.952s	3559	11.960s	120	2,262 KB	14.335s	132	2,313 KB	127 KB

VII. CONCLUSION

In this paper top learning sites have taken and are tested by the online tool webpagetest.org.it tests the various factors of the site. By the results provided by the tool it is observed that the load time of one of the sites are very less and which provides in very few seconds. By this user can choose the site which is very easily and rapidly provides the results to the users. By this without browsing on various sites by keeping in mind the results of the particular research users can access the sites according to their needs. By this the time and search time of the various users are get saved and results and findings showed in this they can use in there day to day learning practices and utilize results of this in their learning. It also showed how some sites are too quick. So these results provide a better search options to various learners respective to their subjects.

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