Software Quality Assurance of Cyber Society v1.0 to support online learning during the COVID-19 Pandemic

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Abstract

In this paper, we present the result of software quality assurance of the Cyber Society v.1.0. This paper is a continuation of the previous work. The Cyber Society is built by using the Massive Open Online Courses (MOOCs) model. This website is a development in the practice of technology-based learning during the COVID-19 Pandemic in Indonesia. The objectives of this study are functionality, reliability, efficiency, maintainability, and usability testing.Based on the results of this research, it can be concluded that: (1) the result of functionality testing has a very good scale that the percentage obtained is 99.5%; (2) the results of the reliability testing is the "very good" quality; (3) based on the result of the efficiency testing, especially the response time on the typical website is very strong, with adequate response time only on the course page; (4) runs well and with "very good" results satisfies the portability aspect; and (5) the result of usability testing has a very good category. Therefore, based on the testing of aspects through Software Quality Assurance (SQA) using the ISO 9126 model to test the feasibility of this software, it can be concluded that The Cyber Society website can be categorized as feasible.

Keywords: E-learning, MOOCs, SQA, ISO 9126, COVID-19.

Introduction

Currently, the development of technology had increasingly rapid and massive that is required by all fields [1]. We can be seen from various user activities that are aimed to use technology, such as gathering data through the internet by journalists, integrating hospital information systems in different hospitals, cataloging and organizing data using web-accessible databases, etc[2]. Thus, technological developments also extend to the educational system, including the management of the education process [3][4].

In this modern era, the model of best practices and lessons to the concept of transferring knowledge instead of fostering character in children. As illustrated by many universities in Europe, even the current education trend no longer has to be in the classroom. Most European universities only implement online learning by uploading lecturers' modules frequently and face-to-face via Skype or Google Hangout [5]. Online higher education is now more or less required to be an archive of teaching materials for both teachers and students [6]. Otherwise, the learning process depends only on a qualified internet network, so that it can operate optimally. This technology-based learning is also part of the implementation of the smart city model that is being implemented in developed countries and is beginning to be developed in Indonesia. The Regional Government continues to look forward to the construction of smart cities in their respective cities which are considered as a solution to the complex problems of a region towards more advanced development [7].

A project-based learning model for students is used to ensure that learning patterns will work smoothly. For illustration, in the Alpenseminar-Vermessen Summer Block Course in Geometry, students climb several mountain peaks in the Alps at the Austrian-German border and practice geometry concepts to solve problems encountered in the field [8]. Interest in incorporating adventurous and outdoor education ideas, encouraged by mobile technology, has increased in many countries [9]. Therefore, EU countries are very familiar with technology-enabled learning.

It is not possible to pursue the application of technology-based learning optimally in Indonesia. Mohamad Nashir, Minister of Research, Technology, & Higher Education (Menristekdikti), revealed that Indonesia is still weak in the areas of higher education and training, preparation for science and technology, and sophistication for innovation and company[10]. The standard of education and readiness to face the Indonesian Industrial Revolution 4.0 appears to be quite critical. Mohamad Nashir clarified that Indonesia's readiness to face the 4.0 industrial revolution was still below Malaysia, Singapore, and Thailand, and Indonesia was in 36th place based on the global competitiveness index at the 2017-2018 World Economic Forum [10]. The government must aim to increase the productivity of Indonesian graduates and society based on these data so that it is not poor.

The strategic objective of The Ministry of Research, Technology, & Higher Education is currently to try to expand the program and service models that include or use more (online) digital technology. Digitization and computerization are the notions of schooling in the period of the industrial revolution 4.0[11]. This supports learning experiences that do not understand space and time, do not have to be face-to-face with the instructor, and do not have to come face-to-face with the instructor anytime, anywhere, or with anyone [12]. The philosophy of education 4.0, defined by the use of digital technologies in the learning process, better known as the cyber method, follows this education trend [13], [14]. Therefore, in the field of infrastructure and education staff, enhancing the standard of learning needs to be enhanced to master ICT skills as basic competencies in the 21st century period.

In the 21st century, electronic learning (e-learning) has undergone a major evolution. In the 21st century, the stages of growth of e-learning, beginning from the idea of blended learning to intelligent learning, are being developed[15]. Beginning in 2020, intelligent learning concepts will evolve rapidly by interacting a lot across the Internet of Things (IoT) and in combination with artificial intelligence[16]. Furthermore, thecreationof e-learning does not simply present online content but must be communicative and interesting[17].

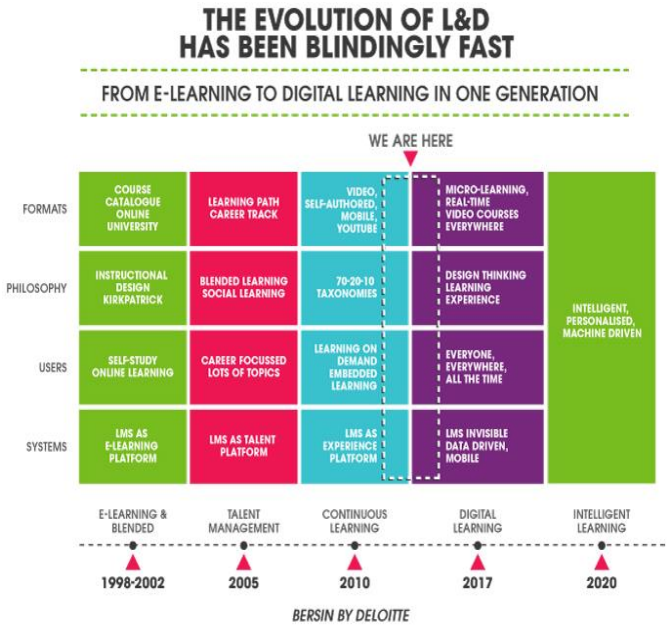

Fig. 1. The history of e-learning, which continues to evolve every time [16]

These are expected that the Cyber Society will become a proto type of intelligent learning concepts that can be built in the 21st century and become future- proof technology[18]. At this point, the definition of the Cyber Society applies to the model of Massive Open Online Courses (MOOCs). MOOCs will be learning techniques that continue to grow in Indonesia due to the large population, as well as efforts to improve public access to education and training[19][20]. The development of the Cyber Society proto type is indeed very necessary and important, as the need for technology-based learning is very strong to boost the advancement of education in Indonesia. Software Quality Assurance isused to assess the viability of the Cyber Society system, therefore this article will address the results of the Cyber Society 1.0 SQA study.

Method

Research and Development (R&D) is the approach used for this research. This study aims to combine enjoyable learning with technological developments. The production of the research will create a prototype of electronic learning (e-learning) products that can facilitate learning in a classroom that collaborates with technology.

This e-learning development uses the Software Development Life Cycle (SDLC) approach to software development. The model SDLC used is the Waterfall model defined in five stages of development, such as (1) requirements analysis and definition; (2) system and software design; (3) implementation and unit testing; (4) integration and system testing; and (5) operation and maintenance. This approach is a method of software design starting from the analysis phase before the software can be used [21]. The process of software development that is carried out is the step of needs analysis, design, programming (coding), testing, software activity. Whereas at the stage of the system analysis, it is categorized into several aspects, that is functionality, reliability, efficiency, maintainability, and usability [22][23].

Results and Analysis

The development of e-learning has an impact on students to improve their competencies. Based on previously reviewed publications on system development, The CS website is expected to be a medium of online-based learning with real-time concepts without any limitations on time, age, and distance [24]. The test was carried out at this stage using the ISO 9126 model.

3.1 Functionality Testing

Testing functionality aspects is one of the methods for testing current functional processes in the developed application. The research process was carried out by 10 experts (expert judgment) consisting of IT lecturers, educational lecturers, ICT professionals, and web developers. The test results of the functionality tests carried out by experts can be listed in Table 1 below.

Table 1. The results of testing aspects of functionality

No	Procedure	Result	
		Success	Failed
1	Open the URL CS website	10	0
2	Navigationisworkingnormallywithoutanybarriers orbrokenlinks	10	0
3	The Menus can connect to the intended link	10	0
4	The main page video wentwell	10	0
3	The linkontheCulture menu canbeopenedandenteredontheCulturepage	10	0
4	The linkonthecourse menu canbeopenedandenteredonthecoursepage	10	0
5	Linksonthe media menu canbeopenedandenteredonthe media page	10	0
6	The linkonthecontact menu canbeopenedandenteredonthecontactpage	10	0
7	Performtyping in thecontact area	10	0
8	Logintothe administrator	10	0
9	Logout from system	10	0
10	Thereis a warningwhenyouenterthewrongusername/password	10	0
Administrator			
11	Checkforincomingmessages	10	0
12	Delete the incoming messages	10	0
13	Edit the culture site in the system	9	1
14	Add the video link in the media	10	0
15	Edit the video link in the media	10	0
16	Delete the video link in the media	10	0
17	Updatethedescriptionofthehomeonthesystem	10	0
18	Updatethedescriptionoftheculture data pageinthesystem	10	0
19	Updatethedescriptionofthe media data	10	0
20	Updatethedescriptionofthecontact page	10	0
Total		**199**	**1**

Based on the test functionality results presented in table 1 above, the percentages are as shown in:

Success : (199/200) x 100% = 99,5%

Failed : (1/200) x 100% = 0,5%

Basedontheanalysisofthe data testfunctionality, thepercentageobtainedis 99.5%. The valueobtainedindicatesthatthequalityofthewebsite in termsoffunctionality has a “verygood”scale. Therefore, the Cyber Society website that has been developed has met aspects of functionality.

3.2 Reliability Testing

Application testing ontheaspectofreliabilityiscarriedoutusingthe WAPT Pro 5.0 andLoadImpactapplicationstomeasurethe level ofstress testing ofthedevelopedapplicationandtomeasurethe level ofreliabilityoftheapplication. The resultsofthetestusing WAPT Pro 5.0 isshown in Table 2 below:

Table 2. Results of the WAPT Pro 5.0 Stress Testing Metrics

Metric	Success	Failed	Percentage	Result
Sessions	10	0	100%	Very high
Pages	13	0	100%	Very high

Hits	480	5	98,96%	Very high	1,49 MB and the number of requests or requests is 49.

The results of the WAPT Pro 5.0 tools in table2revealthat 99.65 % is the average benefit of stress testing. Thus, there liability aspect of the Cyber Society v1.0 website developed, it can be concluded that based on stress testing the WAPT Pro 5.0 tool shave“verygood”quality.

3.3 Efficiency Testing

To calculate the response time and see the tasks or functions that are carried out in the application, testing for the efficiency aspectis performed. Using many web browsers to measure the degree of performance on the web site https:/demo.jogjadev.com/cybersociety/. in this measure. Testing was performed using the website https:/www.bitcatcha.com/ during the first response time by repeatedly re-testing with the following results:

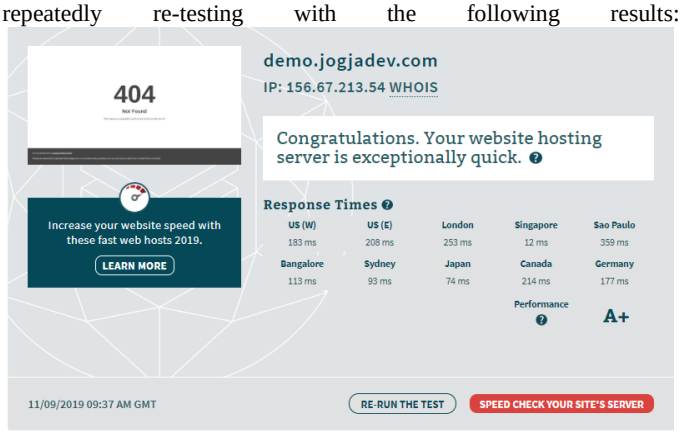

Fig. 2. Testing the 10th response time

The performance provided is based on the results of the response time conducted, according to the explanation on the website. The optimal ranking for your server response speed should be B + and above, for the best user experience. It should be atleast C + (the result of the out come description on https:/www.bitcatcha.com/).

The second test can beper formed using GTMetrix, which is used to test a website's performance. GTMetrixis a blend of Yahoo Slow! Tool. Tool. Google Page speed, whichis web-based. Here are the results of the https:/gtmetrix.com/ pageuse of GTMetrix, that is:

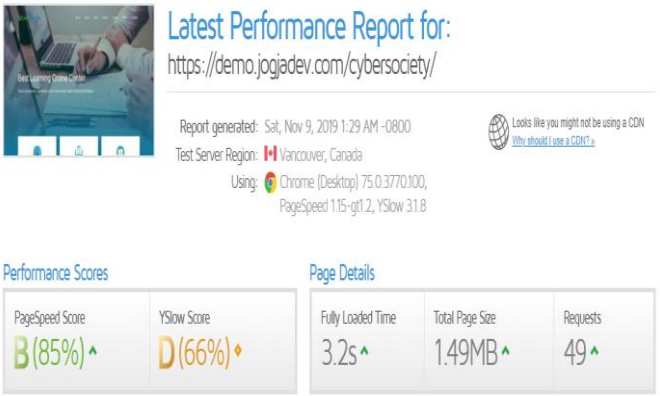

Fig. 3. The results of the performance report on GTMetrix

Based on the above findings, it can be found that the Page Speed score has a B value of 85 %. Although with the importance of D, theYslow score is 66 %. The effects of the fully-loaded time (download time) can be seen in the page info, namely: 3.2 seconds. Therefore, the shorter the loading time is, the better. There will be 3x loaded time trials on the website in the future. While the page size is

The response time on the typical website is verys trong, with adequate response time only on the course page. So it can be shown that the page needs to be changed. The test result susing GTMetrix can be seen in Table 3 below.

Table 3. Test results using GTMetrix

No	Tasks of the Category	*Responsetime(second)*		
		1st Test	2nd Test	3rd Test
1	Main Page	3,2	3,5	3,0
2	Culture Page	6,7	6,5	5,9
3	Course Page	10,2	11,3	9,3
4	Media Page	2,8	2,5	2,4
5	Contact Page	3,4	3,6	3,8
6	Administrator Page	3,5	3,2	3,3

Page Speed can also be used to conduct performance checking through the https:/developers.google.com/speed/pagespeed/insights/ link to see accurate results. Figure 4 showed that, when opened from the desktop, the output of the website is very good, hitting a value of 93 with an average speed index of 1.5s with a maximum late input potential of 70ms. And there have been many diagnoses involving repair.

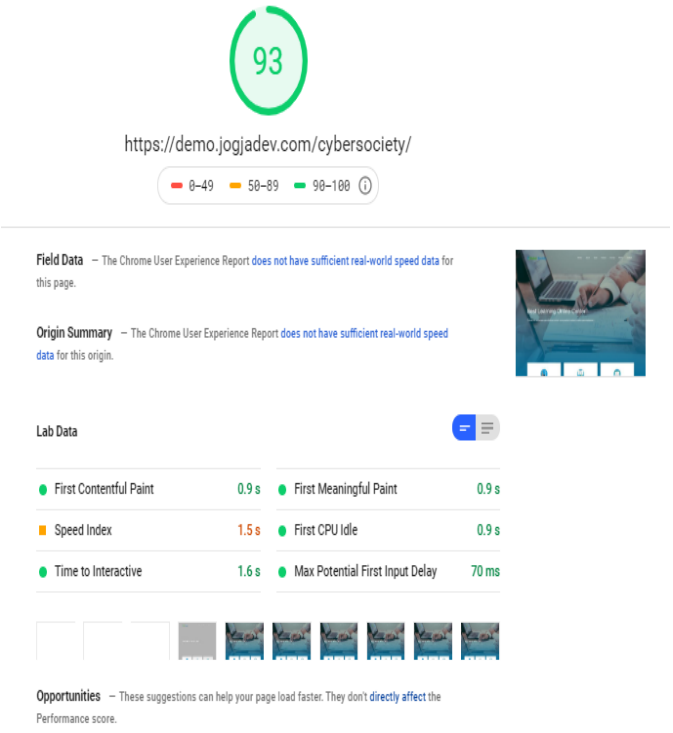

Fig. 4. Testing the performance of the website when opened on the desktop

Once the website is accessed with a smart phone, the next test is the success result. It can be seen in Figure5 that it has moderate efficiency when the website is opened with a smart phone, which is worth 75 with a speed indexo f 4.9s with a maximum possible delay of 250ms.

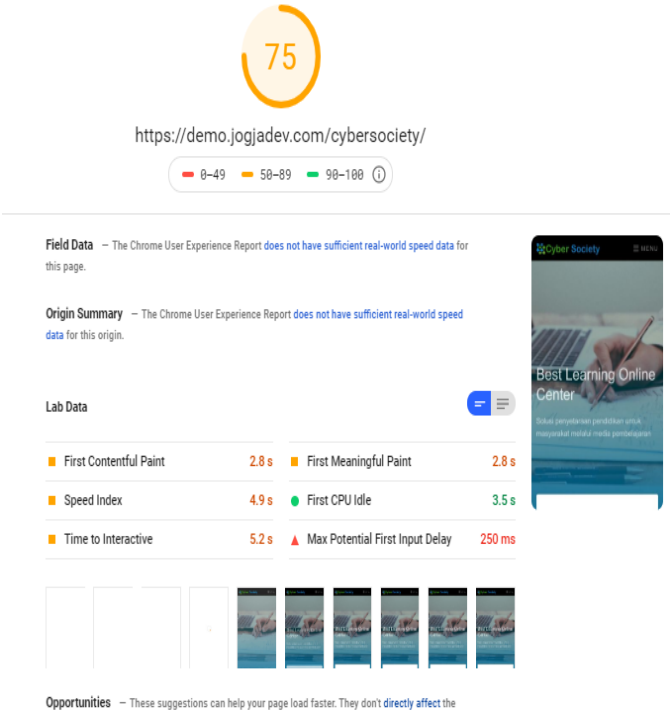

Fig. 5. Testing the performance of a website when opened on a smartphone

3.4 Portability Testing

Research on the portability aspect is carried out to test the program on desktop and mobile computers in many different browsers. It can be concluded that there is no flaw in opening the e-learning website and it is running well. Table 4 shows the effects of browser tests on desktop and smart phone. The Cyber Society v1.0 program, therefore, runs well and with "verygood" results satisfies the portability aspect.

Table 4. Test results using GTMetrix

No	Browser	Result
Browser Desktop		
1	Google Chrome	Success
2	Mozilla Firefox	Success
3	Internet Explorer	Success
4	Opera Browser	Success
5	Safari Browser	Success
Browser Mobile		
6	Chrome Mobile	Success
7	Opera Mini	Success
8	UC Browser	Success
9	Web Browser Mobile	Success
10	Firefox Mobile	Success

3.5 Usability Testing

It is carried out by providing questionnaires to the broader community in the field of thorough usability testing for users. So that we will figure out the state of the condition of the system used by society. A total of 100 respondents filled out this questionnaire. Most of them were between the agesof 16-30 years (41 %), 31-45 years (39 percent), 46-60 years (16 %), over 61 years (3 %), and under 15 years, based on the age of the respondents. (Percentage 1). Besides, the following statistics were generated by respondents to the questionnaire that filled in statistics on the work in progress: (1) % were lecturers; (2) 17 percent are students; (3) 9 % are teachers: (4) % are self-employed; (5) 3 percent work other than the data provided; and (6) % are government civil servants.

Using the SUS questionnaire, the e-learning system carried out usability checking. Table 5 displays the outcomes of the questionnaire that was delivered randomly to 100 people. The resulting data is determined based on the Outcome Score / Maximum Score formula x 100 percent based on the questionnaire that has been distributed. The highest score is considered to be 4 answered by the respondent. Thus, the percentage outcome is 75,325 points, based on table 5.

Table5. SUS questionnaire result

No	Phrase	Score	
		Result	max
1	I think that I would like to use this feature frequently.	307	400
2	I found the feature unnecessarily complex.	310	400
3	I thought the feature was easy to use.	262	400
4	I think that I would need the support of a technical person to be able to use this feature.	309	400
5	I found the various functions in this feature were well integrated.	259	400
6	I thought there was too much inconsistency in this feature.	302	400
7	I would imagine that most people would learn to use this feature very quickly.	316	400
8	I found the feature very cumbersome to use.	313	400
9	I felt very confident using the feature.	326	400
10	I needed to learn a lot of things before I could get going with this feature.	309	400
Total Score		3.013	4.000

The next move is to assess by recognizing there liability attribute via the accuracy of alpha Cronbach. The results of alpha Cronbach analysis with the aid of the SPSS 25 application are the following, that is:

Table6. results of the Cronbach'sAlpha coefficient interpretation

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,948	,949	88

Basedontheresultsofthe data above, Cronbach'salphais 0.948. After comparingitwiththeAlphaCronbachtable, thevalueof 0.948 is in the"verygood"category.

3.6 Discussion

The prototype Cyber Society system is now running properly. It also needs optimum growth, however, notably in increasing the amount of bandwidth so that a lot of space can be handled. Moreover, to support distance learning, this system can be applied.

Basedonthe testing ofaspectsthroughSoftwareQuality Assurance (SQA) usingthe ISO 9126 model totestthefeasibilityofthissoftware, itcanbeconcludedthat The CyberSocietywebsitecanbecategorized as feasible.

Conclusion

We conclude that (1) the result of functionality testing has a very good scale that the percentage obtained is 99.5%; (2) the results of the reliability testing is the "very good" quality; (3) based on the result of the

efficiency testing, especially the response time on the typical website is very strong, with adequate response time only on the course page; (4) runs well and with "very good" results satisfies the portability aspect; and (5) the result of usability testing has a very good category. Therefore, based on the testing of aspects through Software Quality Assurance (SQA) using the ISO 9126 model to test the feasibility of this software, it can be concluded that The Cyber Society website can be categorized as feasible.

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