

Developing the Computer-aided Accreditation Assessment Application for Vocational Schools

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Abstract—This research aims to produce an application for assessing school accreditation at the Vocational High School level. This application is called the Accreditation Assessment Application of Vocational School. Also, this research is also expected to produce an accreditation assessment model for the 2013 curriculum (Indonesian national curriculum). This research was carried out at the National School/Madrasah Accreditation Agency through the Provincial Accreditation Agency in South Sulawesi. These research subjects are assessors from Universitas Negeri Makassar. The application of this research was developed and produced in the Department of Electrical Engineering's, Computer Laboratory. This research is designed in three stages. The first phase, a survey was conducted through a preliminary test of the existing assessment model in the South Sulawesi accreditation agency using needs analysis approach. The second stage of this research is developing products in the form of the alpha version. The results of this second phase were then continued in the third stage by conducting expert validation tests and analyzing user responses which are then revised. The results of this revision produced a beta version of the Accreditation Assessment Model for Vocational School. This research method was carried out by conducting testing surveys, Focus Group Discussions with stakeholders, one to one trial, small group trials, and expanded group testing stages.

Keywords—application, accreditation, vocational schools

I. INTRODUCTION

In the global era of the 21st century, the challenges faced by the Indonesian nation are enormous. The readiness of human resources is a keyword in facing these global challenges. The Government of Indonesia has made various efforts in order to prepare quality human resources. One of the efforts made is to give priority to the education sector. In order to improve the quality of education in Indonesia, the government has set National Education Standards. National Education Standards have a specific purpose.

National Education Standards (NES) have a specific purpose. SNP aims to guarantee the quality of national education in order to educate the nation's life [1]. The Ministry of National Education subsequently established the NES developed by National Education Standard Agency (NESB) in the form of a Ministerial Regulation. The designated NES is used as a reference to be achieved or exceeded by each education unit. In order to achieve national education standards by each education unit, including the expertise program unit in the vocational school, an assessment of the standards is determined. The assessment activity of eight national education standards is called

accreditation. By the mandate of Law Number 20 of 2003, the Government is conducting accreditation to assess the feasibility of an education unit. This was done as an effort to improve the quality of education in Indonesia through a good standard of education.

In this regard, the Government has established an agency called the National School/Madrasah Accreditation Agency through the Minister of Education and Culture Regulation No. 59 of 2012. National School/Madrasah Accreditation Agency is an agency that conducts an independent evaluation by determining the feasibility of a program or education units at the primary and secondary level of formal education concerning national education standards. In carrying out school/madrasah accreditation, this agency is assisted by the Provincial Accreditation Agency for School/Madrasah formed by the Governor, by Government Regulation Number 19 of 2005 concerning National Education Standards [1].

In conducting the accreditation process at the education unit level, National School/Madrasah Accreditation Agency through the Provincial School/Madrasah Accreditation Agency assigned assessors to conduct visitation. Visitation activities are carried out by visiting designated schools by the assignments of each assessor. After conducting visitation, the assessors filled out the assessment instruments reviewed by the National Accreditation Agency for School/Madrasah through Provincial Accreditation Agency for School/Madrasah. Completion of the instrument is carried out as a report to the Provincial Accreditation Agency for School/Madrasah in each province.

The process of filling out the school accreditation instruments that are currently run is mostly manual. The filling process still uses a table processing format that has not been automatically integrated with an online application. The process of manually filling instruments often has weaknesses [2]. The weaknesses that occur have an ineffective and efficient use of existing resources, resulting in waste in each process. Also, the process of accreditation in vocational school has high work complexity in the assessment and processing assessment process. The assessment process requires many criteria that must be met in the Vocational School Assessment conducted by assessors. So that many stages must be passed to get optimal results. These stages make that the work done has a high level of complexity especially because it is done manually. The occurrence of complexity due to the application of manual applications can lead to ineffective and efficient use of time and result in a high workload and a large risk of errors in the process of accreditation in Vocational School. It takes a computer-assisted vocational school accreditation assessment model on

the accreditation assessment application. Therefore, this research aims to develop valid and reliable computer-aided accreditation assessment models for vocational school by developing vocational school accreditation assessment applications.

II. RESEARCH METHOD

A. Types of Research

This research is rooted in Research and Development (R&D) research [3]. This research developed the software in the form of an accreditation assessment application was conducted using an engineering approach. The stages used in this research consist of need analysis and application development. Application development involves analysis, design, implementation, and evaluation. After an accreditation assessment application model is produced, the research was continued by testing the products developed by National Accreditation Agency for School/Madrasah assessors through Provincial School/Madrasah Accreditation Agency in the city of Makassar, South Sulawesi, Indonesia.

In general, the research roadmap is described as follows:

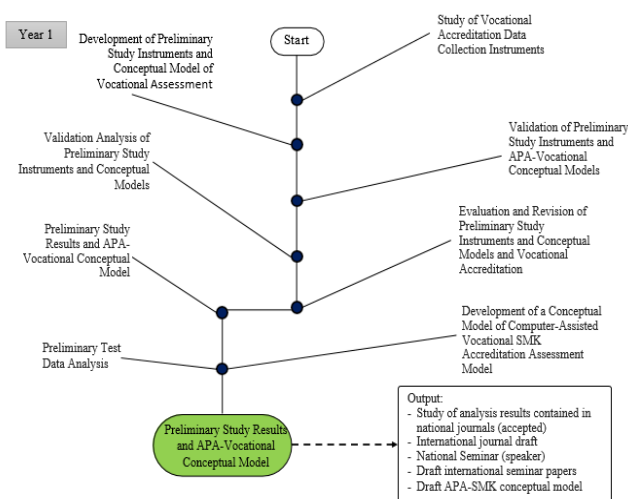


Fig. 1. Research road map from year 1, year 2, and year 3

B. Development Model

The application development used in this research is rooted in Howard [4]. In the development of an application, an approach and application development are required to determine the process of software engineering completion. Also, the application approach used is the prototype. Prototyping is one approach in software engineering that directly demonstrates how a software or software components works in its environment before the actual construction stage is carried out. Application development methods used can be seen in Fig. 2.

C. Development Procedure

The Borg & Gall research and development procedure [3], [5]. Primarily consists of two main objectives. Firstly, developing products, in this case, the application of vocational accreditation. Secondly, testing the effectiveness and practicality of the product. The first goal is to produce a product and the second is to test the product produced.

D. Product Trial

The initial phase of the trial of the Computer-aided Accreditation Assessment Application for Vocational Schools. This application was validated by senior assessors, visual communication design experts, and programming experts, and education evaluation experts (Fig. 3). Furthermore, product trials were carried out on individual assessment assessors, then to the small number of assessors and the last was carried out in a larger number of assessor groups.

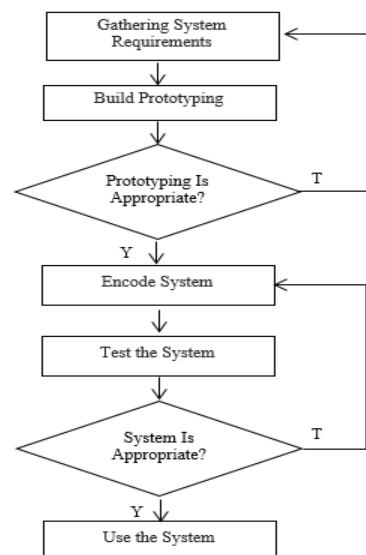


Fig. 2. Howard Application Development Model

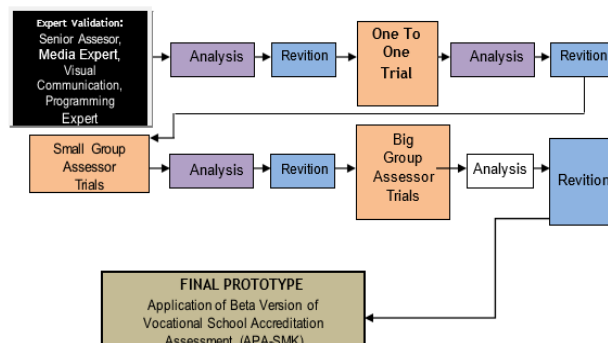


Fig. 3. Procedure for product testing of vocational accreditation assessment application

E. Data Sources and Data Collection Techniques

To capture various types of information from various sources, the following data collection techniques will be used:

1) *Focus Group Discussion (FGD)*: The FGD method is used to obtain information from sources related to the accreditation assessment in Vocational Schools. Initial data to be obtained in the form of knowledge of current accreditation applications, knowledge of accreditation models by assessors, and assessors' suggestions for accreditation applications in vocational schools.

2) *Interview*: This interview technique is used to obtain information from senior assessors regarding the development of vocational accreditation assessment applications. In

addition to the commission, the Provincial Accreditation Agency interviewed to obtain information regarding the application of school accreditation in general.

3) *Documentation*: This documentation method is used to obtain data and information on accreditation models in vocational schools related to content standards, process standards, curriculum standards, standards of educators and education personnel, management standards, financing standards.

F. Data Analysis Techniques

Each stage of this research and development analysis was carried out according to the purpose and objectives of the stage. In general, the analysis used in this study is a descriptive analysis that describes the results of the development, validator response, the results of the trial one to one, small groups, and extended groups. Analysis of software and hardware is done by considering the minimum specifications, by referring to the development of applications for accreditation assessment, namely efficiency and effectiveness, reliability, and validity.

III. RESULTS AND DISCUSSION

Based on the research that has been done, it is obtained a computer-aided accreditation assessment application for vocational school. This design used several applications such as Rapid PHP, and Sublime Text that supports web programming languages (PHP, HTML, CSS, and Javascript) as source code and MySQL as data storage media (databases) to form a computer-aided accreditation assessment application for vocational school. The approach method used in this research is research and development. The software development in the form of an accreditation assessment application is carried out with an engineering approach where the stages are needed analysis and application development.

The development includes analysis, design, implementation, and evaluation. After an accreditation assessment application model is produced, the research was continued by testing the products developed by National Accreditation Agency for School/ Madrasah assessors through Provincial Accreditation Agency for School/ Madrasah in the city of Makassar. The development model used in this research is the prototyping model. In this section, various software based on ISO 9126 [6]–[12] was discussed on the final product of the application. ISO 9126 testing is based on four characteristics, namely function, reliability, portability, and usability. Each type was carried out with a separate instrument, such as in the form of a questionnaire and the use of several web testing tools.

A. Functionality

The functionality test used an instrument that describes the sub-characteristics of suitability and accuracy [13]. Testing of security sub-characteristics using software web testing tools [14], while the testing software interoperability sub-characteristics were combined with portability testing because it has the same character. Instrument functionality that consists of 65 questions was validated by several expert lecturers. After validation, the validator provided some input so that this application becomes more valid. Every function that runs well, the validator provided a checklist on the tab

"Yes" which is worth 1. If the function does not work properly, the validator gave checklist on the "No" tab that is 0. Based on the questionnaire filled out by the validator, each validator gives a "Yes" answer from 65 questions. As a result, the results are by its function. Functionality testing recapitulation can be seen in table 1.

TABLE I. FUNCTIONALITY TEST RESULT

Evaluator	Answer	
	Yes	No
Validator 1	65	0
Validator 2	65	0
Validator 3	65	0
Validator 4	65	0
Validator 5	65	0
Validator 6	65	0

Based on table 1. It can be seen the percentage for each of the following assessments:

- Yes = $(65/65) \times 100\% = 100\%$
- No = $(0/65) \times 100\% = 0\%$

TABLE II. TEST DATA FUNCTIONALITY

No	Evaluator	Total Score	Maximum Score	Percentage (%)
1	Validator 1	65	65	100
2	Validator 2	65	65	100
3	Validator 3	65	65	100
4	Validator 4	65	65	100
5	Validator 5	65	65	100
6	Validator 6	65	65	100
	Total	390	390	100
	Conclusion	≥ 50% (Worth)		

Table 2 above shows that the total score of the six validators is 65 with a percentage of 100%. Accordingly, it can be concluded that this application that was developed is eligible in the trial phase. For security sub-characteristics, the application utilized web testing tool by using Sucuri Site Check which serves to check website security from malware. Malware or malicious software can cause some effects on the application by utilizing the security holes in the application. Malware can cause data theft, one type of data theft malware such as Bancos, Gator, LegMir, and Qhost (Internet Security: 44). Test results from this application can be seen in Fig. 4.

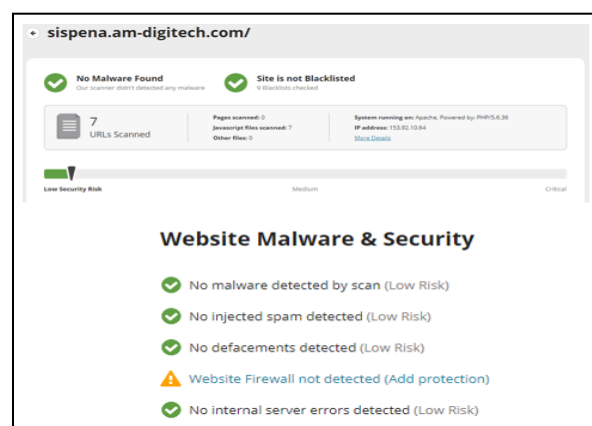


Fig. 4. Test Result Sucuri Web

TABLE III. TEST RESULT SUCURI WEB TEST

Security	Risk Level
Malware	Low
Injected SPAM	Low
Defacement	Low
Website Firewall	Medium
Internal Server Errors	Low

It can be seen from the results of the above tests that for the endurance of the website against malware, injected SPAM, defacements, and internal server errors have a low risk. Hence, no further improvement for the malware security feature. However, on the firewall website test, it was found to have moderate risk because this kind of protection can only be provided with assistance from third parties. Firewall security is not from the website application. Fortunately, Sucuri software offers services for firewall protection and thorough scanning on the website so that the website can be monitored continuously for security.

B. Reliability

For the reliability test, the application was tested using Stress Testing methods with Web Server Stress Tool [14]. Stress testing is one method of testing software that determines the durability of software by testing it outside the limits of regular use. The purpose of this test is to force a program to crash and find out how this program can work again as soon as possible. Crashes can be caused by the number of requests for access from many users at the same time. The Web Server Stress Tool was built in 1997 by a private company that is recognized as a member of the Cisco Solution Partner Program and VMware Technology Alliance Partner - Paessler AG. The Web Server Stress Tool consists of three types of tests, namely click test, time test and ramp test.

1) *Click Test*: Run test with a constant load amount until the user meets the number of clicks that have been generated. Here are the results of a Click Test with a virtual user number of 10 people with a delay time of 20 seconds and a total of 20 clicks.

View Logfile Results							
Logfiles		Results per User (Complete Test)			Results per URL (Complete Test)		
User No.	Clicks	Hits	Errors	Avg. Click Time [ms]	Bytes	kbit/s	Cookies
1	20	20	0	905	138,620	61.27	
2	20	20	0	6,521	136,043	8.34	
3	20	20	0	6,387	131,689	8.25	
4	20	20	0	547	138,620	101.28	
5	20	20	0	1,716	131,689	30.70	
6	20	20	0	964	138,620	57.53	
7	20	20	0	961	138,620	57.69	
8	20	20	0	6,437	137,503	8.54	
9	20	20	0	350	138,620	158.40	
10	20	20	0	490	138,620	113.20	

Fig. 5. Click Test per User Result

The results of the click test per URL from reliability testing are shown in Figure 7.

View Logfile Results						
Logfiles		Results per User (Complete Test)			Results per URL (Complete Test)	
URL No.	Name	Clicks	Errors	Errors [%]	Time Spent [ms]	Avg. Click Time [ms]
1	sispena	199	0	0.00	50,279	253

Fig. 6. Click Test per URL Result

2) *Time Test*: Run test with a constant load amount at a predetermined time. Time-test testing is carried out with a time of 60 minutes, with some virtual users of 10 people and a delay of 20 seconds.

View Logfile Results							
Logfiles		Results per User (Complete Test)			Results per URL (Complete Test)		
User No.	Clicks	Hits	Errors	Avg. Click Time [ms]	Bytes	kbit/s	Cookies
1	136	136	0	629	981,648	91.80	
2	135	135	0	659	974,430	87.60	
3	136	136	0	578	981,648	99.96	
4	135	135	0	668	974,430	86.42	
5	135	135	0	637	974,430	90.71	
6	134	134	0	759	967,212	76.10	
7	135	135	0	617	974,430	93.55	
8	134	134	0	720	967,212	80.24	
9	134	134	0	719	967,212	80.36	
10	135	135	0	565	974,430	102.12	

Fig. 7. Time test per user result

The results of the time test per URL of reliability testing are shown in Figure 8.

View Logfile Results						
Logfiles		Results per User (Complete Test)			Results per URL (Complete Test)	
URL No.	Name	Clicks	Errors	Errors [%]	Time Spent [ms]	Avg. Click Time [ms]
1	sispena	1,338	0	0.00	845,809	632

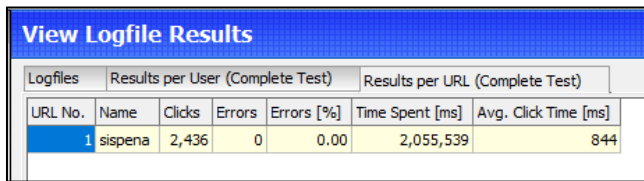
Fig. 8. Time test per URL result

3) *Ramp Test*: Run Test with the number of loads that are increasing at a predetermined time. The Ramp Test is carried out at 60 minutes with a virtual user number of 10 people and a time of 7 seconds delay.

View Logfile Results							
Logfiles		Results per User (Complete Test)			Results per URL (Complete Test)		
User No.	Clicks	Hits	Errors	Avg. Click Time [ms]	Bytes	kbit/s	Cookies
1	416	416	0	717	3,002,688	80.58	
2	378	378	0	762	2,728,404	75.74	
3	341	341	0	743	2,461,338	77.72	
4	306	306	0	723	2,208,708	79.87	
5	262	262	0	909	1,891,116	63.51	
6	229	229	0	816	1,652,922	70.79	
7	185	185	0	1,129	1,335,330	51.14	
8	149	149	0	1,194	1,075,482	48.36	
9	114	114	0	1,183	822,852	48.82	
10	77	77	0	1,385	555,786	41.69	

Fig. 9. Ramp Test per User Result

The results of the ramp test per URL from reliability testing are shown in Figure 10.



View Logfile Results						
Logfiles		Results per User (Complete Test)		Results per URL (Complete Test)		
URL No.	Name	Clicks	Errors	Errors [%]	Time Spent [ms]	Avg. Click Time [ms]
1	sispena	2,436	0	0.00	2,055,539	844

Fig. 10. Ramp test per URL result

Based on the results of the reliability testing of the three tests above, it can be concluded that the percentage of success from reliability testing using click test, time test, and ramp test is 100%, as in table 4.

TABLE IV. RELIABILITY RESULT TEST

Test Type	Error Percentage per User	Success Percentage per URL
Click Test	0.00%	100%
Time Test	0.00%	100%
Ramp Test	0.00%	100%
Average	0.00%	100%

C. Portability

Portability testing of this application uses help from the web testing tool, browserstack.com, where testing is done by cross-browser testing or checking applications using various browsers on desktop and mobile OS. Test results can be seen in the Figure below:

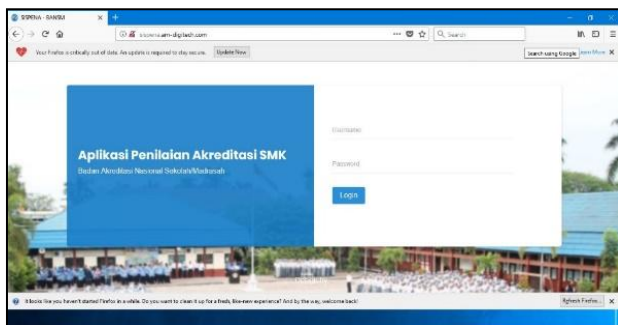


Fig. 11. Testing on Windows 10 with Mozilla Firefox

Portability testing results on Windows 10 with desktop type and using Mozilla Firefox 59 browser. It can be seen that the vocational school accreditation assessment application can be accessed on Windows 10 without experiencing errors.

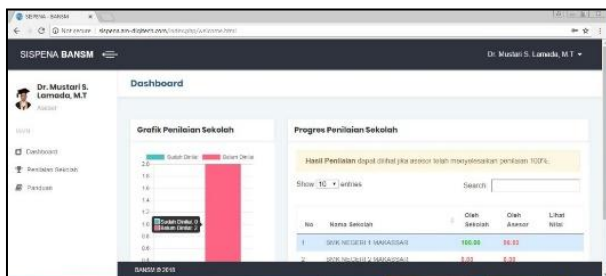


Fig. 12. Testing on Windows 7 with Google Chrome 68

Portability testing results on Windows 7 with desktop type and using the Google Chrome 68 browser. It can be seen that the vocational school accreditation assessment application can be accessed on Windows 7 without experiencing errors.

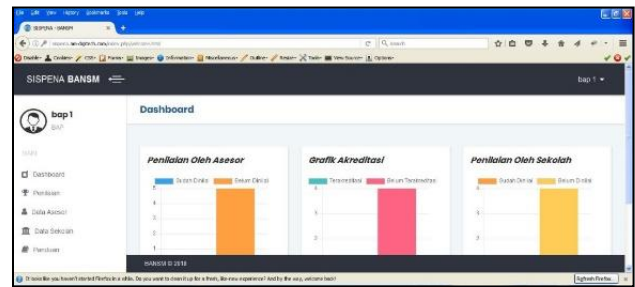


Fig. 13. Testing on Windows XP with Mozilla Firefox 50

Portability testing results on XP windows with desktop type and using Mozilla Firefox 50 browser. It can be seen that the accreditation appraisal application for vocational schools can be accessed on Windows XP without experiencing errors.

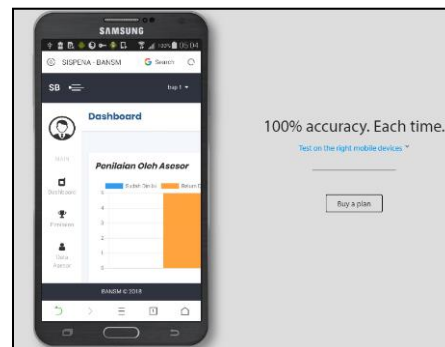


Fig. 14. Testing on Samsung Galaxy Note 4 with UC Browser

Portability testing results on the Samsung Galaxy Note 4 Android mobile that is accessed using the UC Browser. It can be seen that the vocational school accreditation assessment application can be accessed on the Android platform without experiencing errors.

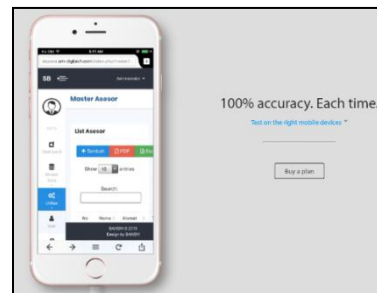


Fig. 15. Testing on iPhone 6S with Mozilla Firefox

Portability testing results on the iPhone 6S mobile that is accessed using the Mozilla Firefox browser. It can be seen that the vocational school accreditation assessment application can be accessed on the mobile iPhone without experiencing errors.

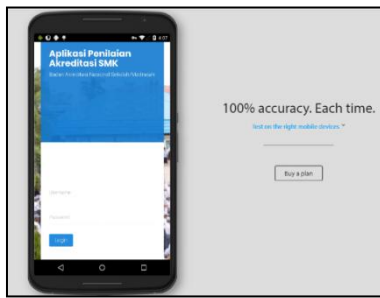


Fig. 16. Testing on Nexus Chrome

Portability testing results on the Nexus mobile are accessed using the Google Chrome browser. It can be seen that the vocational school accreditation assessment application can be accessed on mobile Nexus without experiencing errors.

TABLE V. PORTABILITY RESULT TEST

No	Operating System	Type	Browser	Result
1	Windows 10	Desktop	Mozilla Firefox 59	No Error Found
2	Windows 7	Desktop	Google Chrome 68	No Error Found
3	Windows XP	Desktop	Mozilla Firefox 50	No Error Found
4	Samsung Galaxy Note 4	Mobile	UC Browser	No Error Found
5	iPhone 6s	Mobile	Mozilla Firefox	No Error Found
6	Nexus	Mobile	Google Chrome	No Error Found

D. Usability

Usability is an essential factor in the development of a website because a website was created to meet the needs of users so that the ease of users in using the application must be prioritized. For usability testing, researchers used a questionnaire with the USE Questionnaire model by Lund [15] which contained 16 questions consisting of criteria of usefulness, ease of use, comfortable of learning, and satisfaction. The questionnaire was distributed to 12 people consisting of admin, lecturers, and students to get results as shown in table 6.

TABLE VI. PERCENTAGE OF TESTING USABILITY CHARACTERISTICS

Respondent	Expected Score	Maximum Score	Category
r1	80	77	Very Good
r2	80	79	Very Good
r3	80	78	Very Good
r4	80	76	Very Good
r5	80	78	Very Good
r6	80	75	Very Good
r7	80	78	Very Good
r8	80	78	Very Good
r9	80	78	Very Good
r10	80	76	Very Good
r11	80	78	Very Good
r12	80	77	Very Good
Average		77.33	Very Good

Based on usability questionnaire data in the table above, the analysis of user responses with an average value of 77.33 is in the Very Good category. The percentage of user responses can be seen in table 7.

TABLE VII. USABILITY PERCENTAGE RESULTS OF RESPONDENTS' RESPONSES

Category	Number of Respondents	Percentage
Very Good	12	100%
Good	0	0%
Fair	0	0%
Less	0	0%
Very Less	0	0%
Total	12	100%

Based on table 7 about the results of the percentage of usability responses of respondents obtained from 12 respondents, as much as 100% of the number of respondents said Very Good, while for the category of Good, Fair, Less, and Very Less as much as 0% or 0 of 12 number of respondents.

IV. CONCLUSION

This study obtained an effective, valid, reliable and practical assessment of computer-aided vocational school accreditation in the application of vocational high school accreditation. Test results using the ISO 9126 standard meet the functionality (100%), and reliability (100%) found no error. This research also found that portability can be used in various platforms, namely, on Windows 10 using the Mozilla Firefox 59 browser, Windows 7 using Google Chrome 68 browser, and Windows XP using Mozilla Firefox 50 browser. In Android Samsung Galaxy Note 4, the application could be used by UC Browser, iPhone 6S using Mozilla Firefox browser, and Nexus using the Google Chrome browser. Usability testing obtained results for flat the respondent's response was 77.33 with a very good category. This is seen from the results of questionnaire data analysis obtained from 12 respondents, with the results of as many as 12 respondents or 100% in the very good category, so that the accreditation assessment application for vocational school is declared valid and worthy of use.

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