Quality Measurement of Mobile Based Academic Information System at Vocational High School

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Abstract : The Academic Information System (AIS) is a computerized system that aids in the management of teaching and learning activities. The aim of this research is to ensure the quality of academic information systems to guarantee the functionality and to find out whether it meets the ISO 25010 quality standard. Testing was conducted using 4 of 8 characteristics of the ISO 25010, namely functional suitability, portability, usability, and performance efficiency. 490 respondents consisting of grade 1 to grade 3 students from various majors at one of state vocational high school in Manado were involved in collecting questionnaire data. Several measurement tools are used in this research, such as Page Speed tools, and also Yslow tools. For the instrument itself to analyze the usability is using USE Questionnaire. As the conclusion, the application system was meet the ISO/IEC 25010 standard with functional characteristic is 84.7% (very high), portability aspect is 100%, usability condition is 90%. For the performance efficiency aspect scores 93.7 and 0.907 for time speed parameters.
Keywords : Academic Information System; ISO 25010; quality; vocational

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INTRODUCTION

An information system, according to Satzinger (2010) is a collection of interconnected components that gather, process, store, and provide data needed to fulfill business processes. Information systems are designed to offer users with relevant and accurate information at the proper moment. When compared to the manual technique of delivering information, the implementation of information systems is highly beneficial in solving challenges of providing information (Mufida et al., 2019).

Academic Information System (AIS) is a computerized system that aids in the management of teaching and learning activities, as well as the scheduling of classes and the maintenance of subject values. Students can access information such as subject timetables, grades for each course, and more through the Academic Information System. This method replaces a collection of files with a computer database system that can be used on any computer device and that all students can quickly access via cellphones. The academic department oversees this system, which allows it to present all the school's academic data.

Crosbi says in Sommerville (2001) that software must be designed in conformity with the needs and specifications of its users. A variety of models can be used to evaluate software quality. ISO 25010 is one of the several models available. The current worldwide standard is the ISO 25010 model. Functional appropriateness, dependability, performance efficiency, usability, maintainability, security, compatibility, and portability are among the eight qualities determined by this model, which are further separated into several sub-characteristics

(Wagner, 2013).

Functional testing, compatibility testing, usability testing, and performance testing are four features of mobile application testing, according to David (2011). In addition, to complete the quality test of a software product, Anwar in his thesis report, stated that it is necessary to have the perspective of developer on functional testing and usability (Waleed, 2015). When comparing David's mobile web quality standard to the ISO 25010 standard, it becomes clear that a web application must be tested for functional suitability, compatibility, usability, and performance efficiency.

The goal of functional appropriateness is to ensure that the program followed the scenario and produced the proper output in response to a certain action. Functional completeness, functional correctness, and functional appropriateness are sub-characteristics of this characteristic. When two or more software components are employed in the same hardware or software environment, they must be able to exchange information and execute the essential functions. The amount to which a product or system can be utilized by specific users to fulfill goals effectively, efficiently, and satisfactorily in the context of users is known as usability. Under specific scenarios, performance efficiency refers to memory or CPU usage, battery consumption, and accessing data from the server.

Based on the issues, this study was done with the goal of assuring the quality of the Academic Information System so that errors do not occur, as well as the features and functionality that the ISO 25010 standard promises. The functional appropriateness, portability, usability, and performance efficiency qualities are used in the test.

RESEARCH METHOD

The quantitative study of the Quality of Academic Information Systems for vocational high schools based on Mobile Web conducted at one of state vocational high school in Manado, Indonesia. Quantitative research, are used in this research, which according to Sugiyono (2013) is a method that is used to examine specific populations or samples, data collecting using research instruments, quantitative/statistical data processing, with the goal of testing predefined hypotheses. This study held between December 2021 to February 2022. Research site selection has been choosen for this research as this school has been appointed by the government to be the pilot model for another vocational high school in Manado. Three respondents involved in this study are programming experts as the functional appropriateness characteristics. These experts are choosen based on their work experience and also has been recognized by obtaining an international competency certificate. There are 490 students from varied majors such as software engineering, Computer and Network Engineering, and Multimedia, participated in the research on usability criteria. According to Nielsen (2012), a usability test requires at least 20 people to complete. Meanwhile, the vocational high school Academic Information System is the research subject for the compatibility and performance efficiency characteristics.

The following is the technique for testing the School Activity Information System: (1) Functional Suitability, i.e., web and mobile developers filling out a questionnaire in the form of a checklist of all functions of the School Activity Information System; (2) Portability, i.e., the School Activity Information System runs on a variety of mobile device platforms, including OS versions and screen resolutions; (3) Usability, students filling out a questionnaire (USE Questionnaire) containing 30 questions about the School Activity Information System; and (4) Performance Efficiency of this application is analyzed using 2 system tools, which are YSlow application and Page Speed tools. This systems tool will produce page speed score and an overall performance score which includes

content, cookies, CSS, images, JavaScript, and servers respectively.

Interviews, observation, and questionnaires were utilized to collect data in this study. At the planning stage, interviews are conducted to gather information with the goal of defining and analyzing the software requirements to be produced. On the features of performance efficiency, functional suitability, and compatibility, observations were made to aid the needs analysis process and data gathering in the testing process. Functional appropriateness testing employs the black-box testing method, which is carried out by online and mobile development professionals. All functions of the Academic Information System are tested using a questionnaire in the form of a checklist. Functional correctness, which consists of 10 questions, functional correctness, which consists of 10 statements, and functional appropriateness, which consists of four statements, are the three sub-characteristics of the functional suitability instrument. The test involves running the Academic Information System on a variety of Android and iOS smartphone devices with varying screen resolutions.

Nowadays, there are several models for product usability testing, such as TAM, UTAUT, and USE Questionnaire, However in this research, the usability testing research instrument is based on (Lund, 2001) USE Questionnaire. The main reason for USE Questionnaire is occupied for this study because this model has a ready-made questionnaire. This Questionnaire also has been translated and adjusted for the Sikatans software test. The USE Questionnaire comprises a total of 30 questions with four criteria: usefulness, ease of use, ease of learning, and satisfaction. For another testing, YSlow is used for performance efficiency assessment since they focus on time behavior sub-characteristics. Furthermore, functional appropriateness testing is carried out using descriptive analysis methodologies, which

entails measuring the proportion of the outcomes of testing each application function by online mobile developers who are programming specialists (programmers/developers). The Guttman scale was employed in this experiment. The percentage of eligibility is then calculated using the formula below:

$$Percentage = \frac{Given\ Score}{Maximum\ Score} \ x \ 100\% \quad (1)$$

With a little adjustment of the predicate term employed, the computation results are turned into a predicate statement (Guritno et al., 2011). Table 1 shows the distribution of the adjusted eligibility categories.

Table 1. Interpretation of Percentage

No.	Percentage	Interpretation
1.	0% - 20%	Worst
2.	21% − 40%	Bad
3.	41% − 60%	Enough
4.	61% − 80%	Good
5.	81% − 100%	Best

In line with the survey results, the test is carried out by executing the specified Activity Information System. Nougat (Android 7.0 – 7.1), Oreo (Android 8.0 – 8.1), Pie (Android 9.0), Android Q (Android 10), and Android 11 are the most popular operating systems among consumers. The system also, not just performed at Android Operating System but also run on the iOS Operating System (Apple). The percentage score of the test results is then computed and compared to the grading scale to establish the application portability aspect's quality level using the formula:

$$Percentage = \frac{Given\ Score}{Maximum\ Score} \ x \ 100\% \quad (2)$$

Usability testing uses a 5-point Likert scale with detailed responses. Strongly Agree

receives a score of 5, Agree receives a score of 4, Doubtful receives a score of 3, Disagree receives a score of 2, and Strongly Disagree receives a score of 1.

$$T_{Score} = \left(N_{SA} \, x \, 5\right) + \left(N_A \, x \, 4\right) + \left(N_{Do} \, x \, 3\right) + \left(N_D \right.$$

Description:

N_{SA} = Number of participants that strongly agree with the given statement

N_A = Number of participants that agree with the given statement

N_{Do} = Number of participants that doubt with the given statement

N_D = Number of participants that disagree with the given statement

N_{DS} = Number of participants that strongly disagree with the given statement

Once, we got the result of total score (T_{Score}), we use the following formula to measure the percentage of interpretation of usability characteristic:

$$Total_{percentage} = \frac{T_{Score}}{MaxScore} x \, 100\% \quad (4)$$

Description of formula (4) :

$Total_{percetentage}$ = Total Percentage of interpretation

T_{Score} = Total score

MaxScore = Maximum Score

The consistency or reliability of the instrument is then calculated based on the findings obtained utilizing the aforesaid questionnaire. Cronbach's Alpha calculations were performed using SPSS software, with Cronbach's Alpha results being interpreted in Table 2 (Gliem & Gliem, 2003).

Table 2. Cronbach's Alpha Consistency Value

No	Achievement Percentage	Interpretation
1	$r_{11} \geq 0{,}9$	Perfect
2	$0{,}9 > r_{11} \geq 0{,}8$	Good
3	$0{,}8 > r_{11} \geq 0{,}7$	Acceptable
4	$0{,}7 > r_{11} \geq 0{,}6$	Doubtful
5	$0{,}6 > r_{11} \geq 0{,}5$	Bad
6	$r_{11} < 0{,}5$	Rejected

The performance efficiency test comes after the usability test. The researchers employed YSlow characteristics to test their hypothesis. The test results from YSlow on the components of the amount of the document data bytes, the number of HTTP requests, and the final score/grade are used to analyze performance efficiency characteristics. Table 3 below shows the YSlow grade. When utilizing the Page Speed Test tool, we will get a result in seconds. The interpretation of J. Nielsen was employed in the analysis of response speed and online access (Nielsen, 2010). Later, this following table 4 will eventually be used as a reference for the study's efficiency level.

Table 3. YSlow Grade

No.	Score	Grade
1.	90 – 100	A
2.	80 – 89	B
3.	70 – 79	C
4.	< 69	D

Table 4. Nielsen's Response Time

Response Time	Description	User's point of view
<0.1 Second	Less than 0.1 second	Users believe the system is quick to respond.
<1.0 Second	Less than 1.0 second	Users notice a slight delay, but they can still concentrate on the web.
<10 Second	Less than 10 second	The maximum amount of time that consumers can stay engaged on the web
>10 Second	More than 10 second	Loss of user interest in the web

RESULTS AND DISCUSSION

A questionnaire in the form of a checklist of all functions in the system is used by two experts to test factors of functional adequacy.

The first expert is a teacher at one of state vocational high school in Manado who has worked in the field of Web and information technology, while the second expert is a ErraSoft System programmer who works with web-based apps and mobile developers. The following is how the functional appropriateness test is calculated:

$$Percentage = \frac{127}{150} \, x \, 100\% \, = 84.7\%$$

The percentage is 84.7 percent based on the results of the functional appropriateness test above. This result is subsequently turned into a predicate statement, indicating that the software's quality in terms of functional appropriateness is "Very High.". The system next coming for portability test, where this application is tested on a variety of mobile device platforms, including multiple OS versions and screen resolutions, and examined on variety browser application. This test was conducted on an Android-based smartphone running the most popular operating systems, namely Nougat (Android 7.0 – 7.1), Oreo (Android 8.0 – 8.1), Pie (Android 9.0), Android Q (Android 10), and Android 11. For the browser, this system was tested on Safari Browser (Mac), Opera, Chrome, and Firefox. As the result of this evaluation, this academic information system can work smoothly and does not reveal any problems or incompatibilities, according to multiple testing on various mobile devices and browsers. Based on the test results given, the portability percentage can be calculated as follows:

$$Percentage = \frac{11}{11} \, x \, 100\% \, = 100\% \quad (2)$$

For usability testing, the results obtained from respondents are as follows 279 students stated strongly agree, then 181 students stated agree, 30 students expressed doubt. Surprisingly, there are no student stated disagree or strongly disagree with that statement on questionnaire.

Therefore, T_{Score} can be calculated as follows:

$$T_{Score} = \left(N_{SA} \, x \, 5\right) + \left(N_{A} \, x \, 4\right) + \left(N_{Do} \, x \, 3\right) + \left(N_{D} \, x \, 2\right) + \left(N_{SD} \, x \, 1\right)$$
$$T_{Score} = (279 \, x \, 5) + (181 \, x \, 4) + (30 \, x \, 3) + (0 \, x \, 2) + (0 \, x \, 1) = 2209$$

$$Total_{percentage} = \frac{T_{Score}}{MaxScore} x \, 100\%$$

$$Total_{percentage} = \frac{2209}{2450} x \, 100\% \, = \, 90\%$$

Furthermore, calculations are also performed to determine the questionnaire's reliability and the percentage of usability aspect testing. Cronbach's Alpha coefficient was used to calculate usability reliability using SPSS software. Figure 1 shows the results of the calculations.

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded^a	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

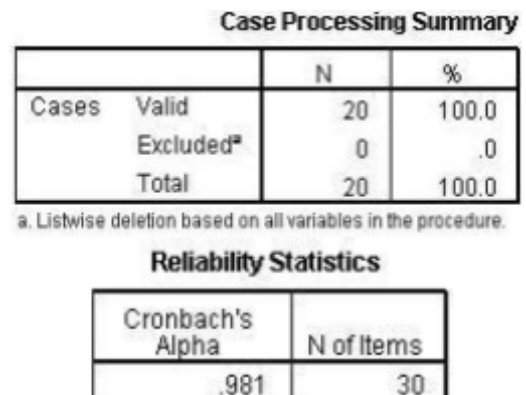| Cronbach's Alpha	N of Items
.981	30

Figure 1. Cronbach's Alpha Calculation Results with SPSS

Cronbach's alpha was calculated and found to be 0.981, hence it was considered perfect when compared to Table 2. On every page of the Academic Information System, performance efficiency testing is performed. Table 5 summarizes the findings of the performance efficiency test.

Table 5. Performance efficiency score

Page/URL	Page Load Time (second)	Overall Performance Score	Max Score
Login	0.962	95	100
Sign up	0.946	94	100
Home	0.979	93	100
Subject Schedule	0.948	92	100
Students	0.911	93	100
Teachers	0.861	95	100
Subjects	0.957	96	100
Reports	0.851	96	100
Teachers Profil	0.829	91	100
Students Profil	0.823	92	100
Average	**0.907**	**93.7**	**100**

Thus, the results of performance efficiency testing using Yslow reveal an average overall performance score of 93.7. When compared to Table 3, it shows grade A and an average access speed of 0.907 seconds per page acquired using Page Speed Test. If the load time is less than 10 seconds, the website is deemed to be good (Nah, 2003; Nielsen, 2010). As a result, it can be determined that the School Activity Information System has satisfied the performance efficiency criteria.

CONCLUSION

The researchers found that the Academic Information System that applied in one of state vocational high school at Manado has fulfilled the ISO 25010 quality standard based on the study's findings. The functional suitability characteristics are 84.7 percent (very high), the portability characteristics are 100 percent, the usability characteristics are 90 percent, and the value of Cronbach's alpha is 0.981 (perfect). The performance efficiency characteristics have an average overall performance score of 93.7, putting it in the grade A category, and the average access speed of each page is 0.907 seconds (good). More various software quality testing approaches should be used in future study, as well as developing ways to better disclose device quality and make recommendations based on global evaluation finding.

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