Eligibility of Computer-based Application for Student Performance Assessment in Mechanical Workshop Practice

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Abstract: This research aims to develop a computer-based application for assessing student performance in taking mechanical workshop practical exams. The development method used in this research combines the ADDIE and Waterfall Development Models. The application is designed based on the practical performance observation instrument. The testing techniques used include Black box testing and Usability. Based on the analysis, the application can help smooth the student practice process.   Based on the test data, it is concluded that the practical performance assessment application developed has functioned to the plan, with a few notes (input) needing improvement in the change and delete menu section (edit data), the application of the information system for assessing practical student performance in technology and vocational fields is very acceptable and easy to operate by users. The novelty of this research includes two things, first, the object of assessment, namely the assessment of practicum subjects, and second the practicality of using the product, where the application developed iscomputer-based so that it is practical in use.

Keywords: Computer-based Application, Assessment, Practice Performance

1.   Introduction

The utilization of information technology in education is comprehensive, including management services, learning services, and information services for the community. According to Tarawneh, using computer technology and applications is part of the strategic orientation of educational development (Tarawneh, 2018). In educational services, especially learning services, computer-based information systems can be utilized for teaching resources, learning media, and assessment tools. They quoted Ansori's opinion that information technology in learning activities has three main functions: as a tool, as science, and material (Anshori, 2020). Information technology, especially computers, can function to store, analyze, and distribute information, including words, numbers, and images needed for learning. With information technology, teachers find it easy to improve the quality of education. The development of information technology as a learning tool is characterized by many computer applications that have been developed into learning media, storage tools, and data processing of measurement results(Chen & Wu, 2020; Liu, 2018; Smith et al., 2020). Stanisavlievic has researched the application of educational software in the classroom on a sample of 212 elementary school students. The results showed that almost two-thirds of the students were happy and wanted to learn continuously by using computers, and the students believed that it was the best way to learn at school(Cress et al., 2018; Lin et al., 2020; Stanisavljević-Petrović et al., 2015). In this context, a year

ago,Sahin and Ozenc examined teachers' views on using software in reading and writing in primary schools. His findings showed that software has helped in the concretization of teaching and the differentiation of activities, as well as minimizing individual differences between students(Abu Mukh et al., 2021; Jaiswal, 2020; Şahin & Özenç, 2021).

Research that aims to reveal the concept of the technology learning process based on students' perspectives was conducted by(Mazaya, 2019). The results show that technology-based practical work will run effectively if intended to explain its benefits to students, provide ease of accessing and using these technological devices, facilitate various knowledge between students, and use multimedia in the learning process(Moloo et al., 2018; Yamaç et al., 2020). Mazaya also argues that adequate facilities, teacher competence, student motivation, and a learning atmosphere influence the effectiveness of the technology learning process.

 In learning evaluation, the development of computer applications has increased the validity of measurements. The advantages of computer-based tools in assessing learning outcomes include flexibility in use and increasing the validity of measurement results(Tomasik et al., 2018). Research on the development of information systems in the form of computer applications in the field of learning evaluation has been carried out by(Fuady, 2016),who developed an online learning evaluation application for web-based distance education(Estriegana et al., 2019; Grodotzki et al., 2018; Kapilan et al., 2021). Then Prasetia, in 2017, developed an application to analysed the quality of learning evaluation instruments through research with the title development of a Web-based learning evaluation

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information system(Jou& Wu, 2012; Palloff & Pratt, 2009; Vania et al., 2018). Prasetia developed and tested software for learning evaluation. The analysis uses the type of development with the Waterfall model, the PHP programming language, JavaScript with the Laravel framework, and Subline as a code editor. The development hail program was tested at SMK Negeri 3 Singaraja using three testing methods, namely the Blackbox testing method (functional testing), the whitebox testing method (procedural testing), and the usability testing method (testing effectiveness and efficiency and user satisfaction)(Prasetia et al., 2017).Then Pratama developed a student assessment information system. This application was designed to calculate students' final grades with attendance input, assignment grades, midterm exam grades, and final semester exam grades. The method used to test the quality of this application is the Black box method with boundary value analysis techniques(Pratama et al., 2020). Susilowati (2013) conducted research titled Development of a Web-based Teaching and Learning Activity Evaluation System. The study resulted in a Web service provider for analyzing question items and learning completeness integrated with e-learning services already available at school(Khan, 2021; Kırbaş, 2020; Lee et al., 2016; Susilowati & Ashari, 2013). The focus of engineering education is technology, and students should apply their knowledge to a particular application[32].

Referring tothe studies above, no application development research has been found that is focused on evaluating practical learning, either a practicum, workshop, or
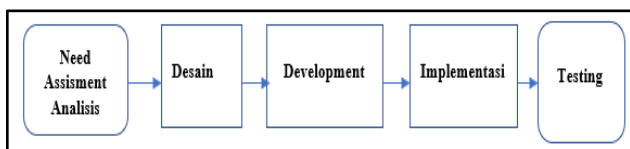

Fig 1. Steps of Computer-Based Application Development

Needs analysis is carried out to determine and clarify the needs of software users and develop these needs into program inputs and program outputs. The information of the developed application is a practical performance assessment instrument that contains aspects (dimensions), components (indicators), and items (descriptors) and a measurement scale. Dimensions, needles, and descriptors of functional performance tested for validity and reliability can be used as program inputs.

Performance tests can be designed to test one, two, or several skill elements according to the test's purpose. These elements include (1) quality of work. Indicators measured are accuracy, completion time duration, the product's appearance, or absence of visible errors; (2) students' skills in using tools and equipment. Indicators include fluency in use, efficiency, the accuracy of tool use, tool maintenance, and safety equipment; (3) Ability to analysed work and plan work procedures or arrange work

product-based practical knowledge. Based on this problem, the researcher intends to develop an application to help smooth the evaluation of mechanical workshop practice learning. The computer application is expected to be able to store and process data on the results of observations of the work process and the quality of work results when taking lessons or exams in mechanical workshop practices that are workshop in nature.

The problems that will be answered through this research include: (1) How to develop a student performance assessment application in a mechanical workshop practical exam; (2) Whether the student practical performance assessment application developed can function properly, (3) Whether the student practical performance assessment application developed can be accepted by users, especially lecturers teaching practical courses. The research aims to (1) Develop applications for student performance assessment in following the learning of electrical workshop practices; (2) Test the application of student performance assessment in following practical learning. Place Time Research, This research was conducted at the Faculty of Engineering, State University of Jakarta, in 2020.

2. Methods

Research Design

The development of computer-based applications adopts the ADDIE and Waterfall models. The steps can be seen in Figure 1.

steps from start to finish; (4) Speed in completing work; (5) Ability to make work decisions based on available information; (6) Ability to read diagrams, drawings, technical symbols, or use manuals or work instructions.

The ability to study worksheets, prepare practicum equipment, pay attention to the instructor's or teacher's explanation, imitate, or do practice, observe practical results, and make practicum reports, are also indicators of functional performance assessment.

Sampling Technique

The research was conducted at the Faculty of Engineering, State University of Jakarta, and this study focused on students doing engineering practicum. These characteristics were determined based on the lecturer's introduction to mechanical workshop techniques. The number of respondents was 25, divided into two groups. The first group of 5 people wasapplication, content, design, hardware, and learning experts. The second group of 20 people is potential users of the products developed. The sampling technique used was the purposive sampling method. The determination of the sample is based on the researcher's consideration of the most helpful respondents and representatives in the study (Sugiyono, 2015). The selection is determined based on knowledge of a

population, its members, and research objectives; the sample is taken randomly.

Data Collection Technique

The instrument used for observation consists of 4 indicators. Each indicator was developed into several question items. The instrument items were developed based on the needles. This item statement is then used as a checklist item in the observation instrument. The determination of the rating scale is given a value of 5 for yes answers, while no is assigned a value of 0. The decision of the scale value is intended to provide an acquisition number to the individual. The instrument lattice can be seen in table 1.

Table 1. Assessment instrument lattice

Indicator	Number Item	Item of number
Login	1,2	2
Student Activity	3,4,5,6	4
Assessment aspect	7,8,9,10	4
Assessment data	11,12,13,14	4
Assessment input	15,16,17,18	4
Score input	19,20,21	3
Score display	22,23,24,25	4
Graphic display	26,27	2
Total	27	27

Data Analysis Technique

Testing is carried out as part of the evaluation step in the ADDIE Model and is an integral part of the waterfall model. This step is done by testing the program. The types of testing carried out in this study include (b) Alpha Testing with Black box Testing Technique and beta testing.

Alpha testing is done to thoroughly test whether problems are found when the developed application is used. The technique used in carrying out this Alpha Test is black box testing. Black box testing is done without detailed knowledge of the system's internal structure or component being tested. It is also called behavioral, specification-based, input/output, or functional testing. Application Functionality Testing This student practice performance assessment application is carried out using one of the Black Box Testing (BBT) methods based on Boundary Value Analysis (BVA), namely functionality testing on Form Profile data. This method tests the quality of the application, which will be carried out through software testing documentation, including design, specifications, and coding, with the testing process, carried out to determine the level of errors that occur in the software by selecting the average value, minimum value and maximum value of the data to be tested(Snadhika Jaya, 2018). The results of this test are to show that the application can handle data, both average data and abnormal data.

Beta testing is testing done by involving real users. Product or application developers will ask several users to test functionally functional products. The number of beta testing users is usually also limited. The purpose of beta testing is like alpha testing, which is to look for bugs that may only be seen when many people in a natural work environment use the product or application. In addition, beta testing is also done to get feedback from real users and ascertain what they need. System Usability Scale (SUS) is a usability testing method that provides a fast and reliable measurement tool(Izabal et al., 2018) with a simple scale, which includes 10 statement items that give a global view of usability subjectivity assessment. The usability instrument uses a Likert scale with options 1 to 5. The number of objects is ten, so the maximum score is 50 minimum score is 10. The criteria used to determine the level of user acceptance are as follows. The percentage is calculated by the average number of scores per item divided by the number of items multiplied by 100%, which can be seen in Formula 1.

$$y = \frac{\Sigma \bar{x}}{\Sigma p} \times 100\%$$

(1)

Description:

y= percentage

$\Sigma \bar{x}$ = average number of scores

Σp= number of question items

The assessment format can be seen in table 2.

Table 2. Format of an assessment (Sugiyono, 2016)

Score (%)	Description
0-20	Strongly not accepted
21-40	Not accepted
41-60	Less accepted
61-80	Accepted
81-100	Strongly accepted

3. Results And Discussion

Results of Computer-Based Application Development

The design process results are carried out by translating user requirements with software representations. System design in development is made in an organized manner organized through flow charts. The application has several menus tailored to the student practicum activity assessment system. The following is a computer-based student practicum activity assessment system application design consisting of menu and screen display designs. The input menu is named the File menu and is used to enter data needed in the student practicum activity assessment application. The data required can be seen in table 3.

Table 3. Application Input Menu Design Results

Data	Description
Student	This menu contains student data that will be taken for practicum activities, including name and student identification number.
User	This menu contains user data for the student practicum activity assessment system. Administration name and password
Assessment Aspect	This menu contains the assessment aspects needed for the student practicum activity assessment system, including parts of practice preparation, process, practice implementation, and product aspects of practice.
Assessment Component	This menu contains the assessment components needed for the student practicum activity assessment system, including preparation of tools and materials, preparation of completeness and safety, knowledge, attitude, practical report work skills, and product quality.
Assessment Item	This menu contains the assessment items needed for the student practicum activity assessment system. Choose Measuring tools / Hand tools
Study Group	This menu contains student data in the same study group needed for the student practicum activity assessment system.
Score	This menu is used to calculate the value of practicum activities.

The output menu displays the valuation process results in the form of total scores per student, average scores per class, and graphical displays. The data contained in the output menu can be seen in table 4.

Table 4. Results of Application Output Menu Design

Data	Description
Score	The full menu is the student value menu used to obtain the total practicum score of each student. The average menu, namely the value, is used to view the importance of student practicum activities in the form of reports. The reports provided are grouped into two, namely: value per student and value per class.
Graphic	This menu views the value of student practicum activities through graphs. The graphs provided are grouped into three: graph per item and chart per total score.

The results of the development of computer-based applications have a main menu display or login menu containing the User name and password with the screen display as shown in Figure 2.
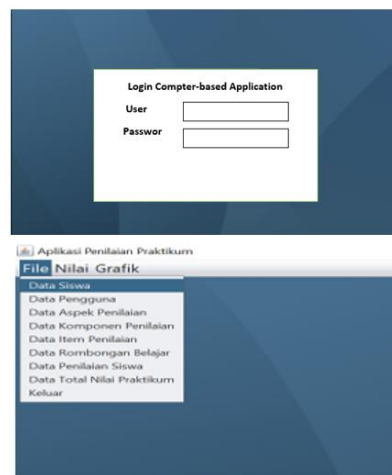

Fig 2. Main Menu Display Results

The student data menu display contains the student id, student id,class name, and add, change, delete, and search menu. The collection of the student data input menu is shown in Figure 3.

Eligibility of Application development

Based on the login / Main menu test results conducted by a team of experts, five people (respondents) they have answered yes, meaning that all respondents could log in. It can be concluded that getting the maximum score is 100%. The test results from the expert team can be seen in table 5.

Table 5. Expert Team test results.

Indicators	Activity	Expected performance	Yes	No	Descriptions
The Main Menu	Login	Users can use their name and password to log in	5	0	Function normally
		Participants can see the main menu consisting of Files, scores and graphs.	5	0	Function normally
	Student data	Student data input	5	0	Function normally
		Add student data	5	0	Function normally
		Change and delete student	5	0	Function normally
		Search for student data	5	0	Function normally
File menu	Assessment Aspect Data Input	Display the Assessment	5	0	Function normally
		Entering Assessment Aspects	5	0	Function normally
		Delete and add assessment	5	0	Function normally
		Search forAssessment	5	0	Function normally
	Assessment Item Input	Display the Assessment	5	0	Function normally
		Entering Assessment Aspects	5	0	Function normally
		Delete and add assessment	5	0	Function normally
		Search forAssessment	5	0	Function normally
Score menu	Score input	Calling out a name via ID	5	0	Function normally
		Entering Value per Item	5	0	Function normally
		Display value per item	5	0	Function normally
	Score display	Display student grades	5	0	Function normally
		Display the total score	5	0	Function normally
		Display the average grade	5	0	Function normally
		Displays the print value menu	5	0	Function normally
		Print grades	5	0	Function normally
Graph menu	Graph display	Display the graph menu	5	0	Function normally
		Display the value graph	5	0	Function normally
		Print the graph	0	0	not normally

The test results with users as many as 17 people gave all yes answers, meaning that a score of 100% stated that they could log in according to the rules, see the main menu, and see the sub menu, namely the Values and graphics files. Based on the evaluation results of the expert team and users, it can be concluded that this program functions and

is very well received, typically in the Login section. The results of the student data input menu test show that all respondents who tested the program stated that the student data input menu in the sub-menu section of the add and search menu could function properly. In contrast, the add-delete menu is not yet functional. The total score is 15 out of a possible maximum score of 20, or the results of Black-box testing for the student data input menu obtained a score of 75%. When entered, the criteria are accepted, and it can be concluded that this application can be accepted. Notes for the add sub-menu and delete sub-menu must be corrected. The same thing also applies to the input component indicator and item sub-menus. The test results of the value input menu using black box testing show that all activities function as planned, the score obtained is 55 out of a possible maximum score of 55. So, it can be concluded that the application program developed for the value input menu section is very feasible.

The results of the black-box test for the output menu show that the above shows that displaying student grades per practicum, grades per class, graph menu, and print menu can be displayed. This means that the application is functioning correctly. The print test is only up to displaying the results/print format. The application has not succeeded in printing grades, so the program must be refined. The score obtained is 10 out of a possible score of 15, so the total score of 67% when entering the criteria means that the value output program is still feasible. Alpha testing was carried out on three users with the Block Box Testing technique. In this case, the three users were the lecturers of the Practical courses; the results can be shown in table 6.

Table 6. Alpha test results with Black Box Testing Technique for 3 Users.

No.	Activities	U1	U2	U3	Work	Not Working
1.	Display the Grade Input menu	1	1	1	3	0
2.	Entering student ID in the Input menu	1	1	1	3	0
3.	Entering practical activity data	1	1	1	3	0
4.	Display after the score is inputted	1	1	1	3	0
5.	Menu display after inputting more than one score	1	1	1	3	0
6.	Menu Calculate Average score	1	1	1	3	0
7.	Saving score	1	1	1	3	0
8.	Display the average score	1	1	1	3	0
9.	Calculate the number of grades	1	1	1	3	0
10.	Displays the number of final grades per student	1	1	1	3	0
	Total				30	0

Based on table 6, it can be concluded that the application functions 100% when confirmed with the criteria in the excellent category. Thus, the electrical workshop test. The results are the same as the expert team test. Where all features work well. Some qualitative input from users involved in the Alpha test can be seen in Table 7.

Table 7. Recommendations Results

No.	Feedback Use
1.	The application is all functional except for the deleting data section Input can be entered easily but is not yet able to edit
2.3.	Features need to be added so that data input is not one by one. There need to be improvements to the system made; especially the change to delete sub menu
	For individual students, assessment is very appropriate. Group assessments need to be made more practical.

Beta testing is intended to determine whether the application is following what the User wants. Usability uses a Likert scale with options 1 to 5. The number of items is ten, so the maximum score is 50 minimum score is 10. The usability test results can be seen in table 8.

Table 8. Beta Test Results

Number of Items	A	B	C	D	E	The average score per item
1.	4	3	3	4	4	3,6
2.	5	5	5	5	4	4,8
3.	4	5	5	5	3	4,4
4.	4	5	4	5	3	4,2
5.	4	4	3	5	4	4
6.	4	5	5	5	4	4,8
7.	4	5	5	5	5	4,8
8.	4	5	5	5	4	4,6
9.	4	5	4	5	5	4,6
10.	5	5	5	5	5	5
	4.2	4.7	4,4	4,9	4,1	4,46

Based on the test results in table 8, the average number of item values divided by the number of items is 4.46. When divided by the maximum score value and multiplied by 100%, a discount of 92% is obtained, thus entering the category of very acceptable. It can be concluded that the application developed is very feasible to use to assess students carrying out mechanical workshop practicum.

The results of the Usability test or Beta test of this program obtained a score of 0.92 which means that it is very acceptable to the respondents. Qualitative input on the Usability questionnaire was received, among others, that student data input needs to be integrated with the website owned by the Jakarta State University. The application, if it is developed, has only been tested for the first time but has shown adequate results, namely for the level of suitability is appropriate and for overall acceptance is very

acceptable. There is one feature that has not functioned correctly, and it needs to be improved.

Other researchers and developments, such as(Susilowati& Ashari, 2013), who have developed a Web-based Learning Activity Evaluation system Case study at SMA Negeri Satu Surakarta, also commonly done this. The article's closing states that this research still needs much improvement, especially data security issues. Then(Fuady, 2016) researched with the title Development of an online learning evaluation system for distance education.Stated that the results of the first trial were not good. Saying that the results of the first trial still have improvements, and likewise, after the second trial, there still needs to be a new improvement in the third trial, the application can be declared usable by the User. Some of the input given by users includes. This application is very appropriate when used to assess individual practical exams, but it isn't elementary if used to determine groups. Some users suggested a manual to make using the application easier. A manual book is needed as an instruction to make it easier to use. Another suggestion is adding features that allow import from excel format to make adding enormous amounts of data easier. These inputs are used as weaknesses of this development application and as a basis for further development. It is still less practical when used to assess many people, so improvements need to be made to make applications more useful when used in large groups of students.

4. Conclusion

Based on the results of this study, the computer-based application for student performance assessment in mechanical workshop practice developed has functioned following the plan with a note that there needs to be a slight improvement, especially in the data edit menu. As a result of this development, computer-based applications for student performance assessment in mechanical workshop practice are highly accepted by users and easy to operate. To ensure the validity of the evaluation of practical results, aspects, components, and items should be taken from instruments developed and validated before using computer-based applications. Aspect data input is done in the same way as student data input. This menu is general, meaning that it can be used to assess the results of practical learning with different characteristics. The implications of this research provide an assessment of student performance that is very real without the interference of educators' feelings in giving evaluations.

The weakness of the research is that it has not been tested with a more significant number of students. This application has no self-evaluation assessment, so students can evaluate their abilities independently. In future research, further research needs to be carried out following the weaknesses of this research.

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