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Development of a Conveyor-Based Practice Performance Assessment Tool with Android Control to Improve Vocational High School Students' Work Readiness

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ABSTRACT

The unemployment rate for vocational high school graduates is still very high. Unemployment occurs because the level of work readiness is still low. Work readiness can be improved by applying competence mastery-oriented learning. Competence that is complete requires measurement tools or assessment of student work competencies to measure competency success. Therefore, this study aims to: (1) produce a product in the form of a practical performance assessment tool for students in the conveyor-based pandemic era with android control; (2) know the quality and performance of the developed tools; This research is development research using the method of combining the waterfall method and Borg & Gall. This research focuses on product functionality so that testing is carried out by technicians with input from experts from the industry. The research data were obtained from observations, interviews, document studies, and questionnaires. The results of this study are as follows: (1) the product developed already has basic functions and can be operated using Android; (2) the results of testing by technicians from the aspects of functionality, reliability, efficiency, maintainability, and portability obtained a conformity percentage of 90% (Very Good), so that the tool can be used to test student work readiness in vocational schools or training institutions.

Keywords: vocational, students, work readiness, Android

INTRODUCTION

Vocational High School (SMK) is a place that plays a role in forming human resources who have skills and are ready to work after graduation. SMK is a formal education that organizes education to prepare students to become productive individuals so that upon graduation, they are expected to be able to compete in finding jobs or filling job vacancies in the industry according to their competence. SMK aims to provide a labor market at the sub-professional level. However, in 2020 the SMK response rate is still the highest among other levels of education, namely 8.49 percent. Unemployment occurs because of the low readiness of students to work. Job readiness is very beneficial for students to develop their competencies [1][2].

Job readiness competence is the main capital needed by vocational school graduates to find work and get a job. Various efforts have been made to improve the work readiness competence of SMK students by improving the quality of skills, knowledge, and work attitudes of SMK students. Vocational students' work readiness can be increased by improving the quality of learning, especially in measuring student competence. Many competency measurement methods and infrastructure have been developed, but there are still many weaknesses, especially in the fulfillment of competency test-supporting infrastructure [3][4][5][6]. As long as this competency test is still carried out in a simple manner and without industry participation. So that the quality of competence is not in accordance with the needs of the world of work and industry. Not only that, the industry also expects learning aids that can be controlled remotely so that industrial practitioners can more easily monitor and guide the implementation of learning and competency tests [7][8][9].

METHODS

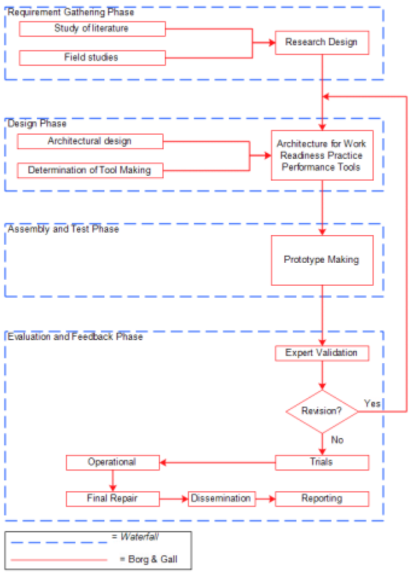

Figure 1. Development Research Methodology with Waterfall and Borg & Gall Approach

This research is developed with the Waterfall development research model approach [10] and the Borg & Gall research model [11], which the researcher has modified. Figure 1 is a flow chart for the development research methodology used in this study. The first model is used for the tool development process, and the second model includes elements of education. There are three stages carried out in this study, namely the data collection stage, the product design stage, and the product assembly and testing stage. Tests are carried out by education and training assessors and assessors from the industry on the functionality of the product, which includes the suitability of the purpose with the shape of the tool, the effectiveness of the tool to support the function of the tool, the ease and practicality of using the tool, and the final quality of the tool.

The process of making tool prototypes is divided into two stages, the first stage is the manufacture of hardware, and the second stage is the manufacture of software. Hardware and software are made manually with the help of students. Android software applications are developed using android studio. Therefore, tool testing is carried out using a model approach related to functionality aspects which include suitability, effectiveness, and practicality, to produce a final product that has a good quality [12]. Literature books are used to find problems and gaps in tool-making materials. Data collection through interviews was assisted by using a questionnaire to determine the ability needs of SMK graduates and job training institutions. The suitable assessors for tool testing are practitioners, vocational teachers, trainers, and industry experts.

RESULT AND DISCUSSION

The first stage is the data collection stage. Data collection was carried out by gathering information from questionnaires and literature studies. The results of the data collection stages were consulted with media experts as a basis for inputting design ideas and making product prototypes. The results of the data collection stages can be seen in Table 1.

Table 1. Data Collection Stage Results

No	Result
1.	Ease of operation.
2.	According to function and purpose.
3.	Easy to maintain.
4.	Punctuality.
5.	Flexible.
6.	Security in use.
9.	Tools must be easy to carry (portable).

[13]

The results of the data collection stage from users (industrial assessors and education and training assessors), to produce qualified tools, appropriate materials are needed. Suitable materials can be seen in Table 2.

Table 2. Materials needed

No	Result
1.	E18-D80NK Infrared Obstacle Avoidance Sensor Proximity Switch Arduino
2.	220V 100W Motor AC 6000 RPM
3.	Aluminium plate
4.	Plywood Board
5.	3D Print Gearbox Machine
6.	Belt motor connector.
7.	Control Panel System
8.	Conveyor belt
9.	Arduino Uno R3.
10.	Bluetooth Module ESP32

After analyzing users' needs (schools and industry) and materials for making tools, the next stage is the product development stage. The product development stages include product prototype design validation activities by media experts and industrial informatics to obtain product feasibility. The results of the validation test by experts concluded that the product could meet the criteria for learning aids adjusted to Table 2.

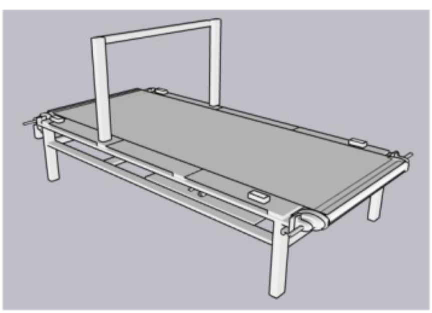

Figure 2. 3D Design Tool

The next stage is the assembly and test phase of the 3D design that has been made. The design starts by making the basic frame that meets the aspect that there are installed barriers and a safe distance according to the health protocol and then installing the conveyor/walking wheel drive machine. After that, the controls for controlling the drive parts are added. Figure 3 is a prototype design of the tool before being tested.

Figure 3. The appearance of the Tool Prototype Before Trial

After the prototype tool has been assembled, the next step is to test the tool. Testing is done by running the essential functions created by the developer. Tests are carried out by performing manual forward and reverse functions. The next test uses an automatic timer set for 10 minutes, 15 minutes, and 20 minutes with safety so that the tool does not fall using an infrared sensor. The results of testing the essential functions went well without any problems, and the time specified on the automatic timer function worked according to the actual time (on time).

The prototype of the finished tool is then given an additional function, namely remote control. The added remote control uses a Bluetooth module controlled with a mobile application, namely an Android-based application. Functions in the mobile application have primary uses such as the control box on the device, namely forward control, reverse control, timer 10 minutes, 15 minutes, 20 minutes, and added manual time control from 1 minute to 50 minutes. Figure 4 is a display on an Android device.

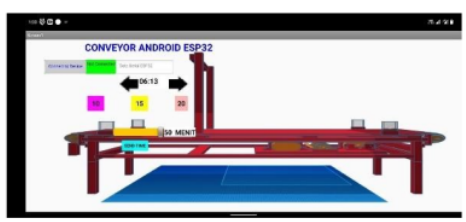

Figure 4. Display Control Application on Android Device.

The next stage is the product testing stage which is carried out by education and training assessors and industrial assessors. Industry experts and practitioners perform tool testing and software testing. Industry experts from Gama Auto Service conducted the first test, and the second was carried out by practitioners from the Automotive Jogjakarta Center. The aspects to be tested are product functionality which includes the suitability of the purpose with the form of the tool, the effectiveness of the tool to support the function of the tool, the ease and practicality of using the tool, and the final quality of the tool. The data obtained from the test results by the assessors were then calculated using the formula shown in Table 3. The results of the product testing stages received positive and good responses. So, it was concluded that the tools developed were feasible and could be used to assess students' practical performance.

Table 3. Research Data Category Formula

No	Score Interval	Category
1.	$Mi + 1,50\ SDi < X \leq Mi + 3\ SDi$	Very Good
2.	$Mi < X \leq Mi + 1,50\ SDi$	Good
3.	$Mi - 1,50\ SDi < X \leq Mi$	Not good
4.	$Mi - 3\ SDi < X \leq Mi - 1,50\ SDi$	Poor

[14]

Explanation :

Mi : Ideal average

X : Value earned

SDi : Ideal standard deviation

Mi : ½ x (the number of ideal max scores + the number of ideal min scores)

SDi : 1/6 x (number of ideal max scores – the sum of ideal min scores)

The results of the tests carried out have ten items of assessment indicators. Therefore, the highest ideal score obtained is 40, and the lowest score is 10. The ideal standard deviation value obtained is 5. So the conversion of the four-scale value can be seen in Table 4.

Table 4. Conversion of Four Scale Values for Testing Tools

No	Score Interval	Category
1.	$32,5 < X \leq 40$	Very Good
2.	$25 < X \leq 32,5$	Good
3.	$17,5 < X \leq 25$	Not good
4.	$10 < X \leq 17,5$	Poor

[15]

The average accumulated test scores from industry assessors and training assessors for testing tools for each aspect is 36; then the results are matched in Table 4. The results of the test scores for tools get tool quality with a scale of "Very Good" with a percentage of conformity of 90%. If a graph is made, it can be seen in Figure 5.

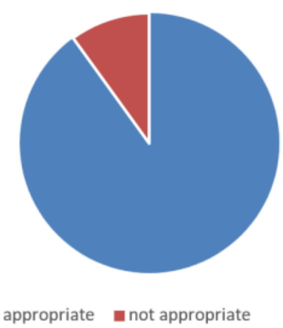

Figure 5. Conformity Results from Tool Testing.

A well-implemented Conveyor-Based Practice Performance Assessment Tool with Android Control is expected to be able to improve the work readiness of SMK students [15][16][17][18]. This is in accordance with several studies which state that Android-based learning aid media can improve the competency of SMK students. Not only that, industry-based android-based learning aid media is able to meet the competency needs of industrial work[19][20][21].

CONCLUSION

Based on the results of the above discussion, it can be concluded that the developed tool can function well. The tool can perform essential functions that are operated manually and can be operated using an Android device. The tools developed have fulfilled the product functionality aspects, which include the suitability of the purpose with the shape of the tool, the effectiveness of the tool to support the function of the tool, the ease and practicality of using the tool, and the final quality of the tool. This can be proven by the achievement of the conformity value assessed by the assessor, who reached the conformity value of 90%.

This research can still be developed by adding several supporting components that can be accessed easily with the help of mobile phones. Not only that, the system that is easy to implement can be used not only for learning but also in modern industry as a production control system.

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