The Development of a Competency Testing Systems: Adopting TAM to Explore User's Acceptance

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Abstract:

The main problems of learning evaluation using paper based-test are inefficient time and cost. Technology can be used as a system to evaluate the learning process. Using technology can save time and cost of implementing learning evaluations. The aims of this study are to create a software product that can be used to evaluate the learning process. This software product is designed to be used by the test organizer or test committee, the teachers and the students (test takers). This software product was developed using Waterfall Model with five stages of development; communication, planning, modeling, construction, and deployment. The testing was conducted by using Blackbox Method and TAM Theory by considering the aspect of usefulness and the aspect ease of use. The analysis was based on the flow of the current test system. The web-based platform enables ease of access for conducting work in various places. According to the result, the Developed Skills Competency Test System is accepted and can be used by the user as an evaluation system.

Keywords: computer-based test, learning evaluation, skills competency

Introduction

The development of technology increasing demand for effective and efficient performance. One of the important sectors that need to be improved is education (Tulangow, 2011). Some example of technology that has been used in education is an online library and web-based learning (e-learning). Besides of that, one of the highlights in technology development in education area is a testing system where are many of educational institutions such as schools, universities or the other non-formal institution still use the manual way like a paper-based test. According to this situation, some problems might come up such as lacking the question or answer sheets that can make trouble for students to answer and finish the test (Susanto, 2013). So that this is the time for the conventional test to be integrated with computer-based test technology.

Learning evaluation is a part of learning process. Learning evaluation is one of the processes that impossible to be done by the school because evaluation is one of learning system components (Haruman, 2015). School as an educational institution is expected to use technology to help them organizing the learning process and saving time and school budget so that the remaining time can be used for other things in order to improve the quality of education. By developing the online-based test, the data result will be presented neatly and able to access anytime. The model of the question with multimedia will be various, and the students will easy to understand and feel satisfied while doing the test (Nugroho, 2009).

The aims of this study are (1) to develop the web-based skills competency test system according to Vocational High School's needs as the system requirements reference and (2) to test the system feasibility using the TAM theory.

Review on Related Study

The online-based skills competency test system can increase the teacher and student performance. The teacher and students performance in learning evaluation became faster and easier. According to the research by Brailler, Schwanz, Palm & Irwin (2015) entitled *Online Testing: Comparison of Online and Classroom Exams in an Upper-Level Psychology Course*" stated that online-based test can increase the student performance comparing to the paper-based test. Meanwhile in Tulangow's research (2011) entitled "Web-based Test System" stated that by using web-based test system, conducting test/examination, scoring, and reporting the test result will be easier and faster from the time and cost aspect. Nugroho (2009) on his research entitled "Online Testing on Productive Subject" stated that by using online-based test, the model of question will be more variety so that the students will easy to understand and feel satisfied while doing the test. In Susanto's research (2013) entitled "Honggo, H. (2013). Online Test Design on Web-based STMIK GI MDP" said that by using online testing, the method of test item randomization is pretty effective to avoid cheating among students. As Fahmi (2011) on his research "Online Test System Model Design" stated that testing system equipped with test item randomization model makes the test item vary. Therefore, the designing or developing should be done to create a skills competency test system, so that can help teachers and students in improving the evaluation performance faster and easier.

Research Method

The research stages of skills competency test system development are referring to Waterfall Development Model (Pressman, 2010) that consist of communication, planning, modeling, construction, and deployment. The steps of Waterfall development model is explained as follows

Figure 1. Step of Waterfall Development Model

Communication

In this stage, the researcher was conducting an interview where the result is the school has used computer based test with Moodle in the previous final test and got several problems such as a disconnected server, slow access, incompatible installation, and inputting the test items to the server problem.

The software criteria that expected by the school are a software that can show the test item one page one test item randomly, the student's answer auto save on the server to prevent the data loss due to unexpected power shut down, answered and unanswered test item notification icon, option to play audio function, Microsoft Excel compatibility, calculation and test item correction function and data input (student data, test items, formula and multimedia) and test item adjustment (duration and passing grade) function.

Planning

In the planning stage, the researcher was analyzing the software and hardware requirements for developing the software. The researcher used Codeigniter 3 software with PHP version 5.5 and MySQL version 5.6.2 which is bundled in XAMPP version 1.8.3 installed on Windows 7 32 bit or above. The minimum hardware requirements for running XAMPP are 1 GHz processor, 1 GB RAM, and 16 GB free space hard disk. After being developed, the software needs a user to operate the software and the user will be the exam administrators, teachers, and students.

Modeling

In the modeling stage, the researcher was making a use case diagram, flowchart design, creating DFD and ERD, interface design, table and relation for software development design. Figure 2 below is the design of use case diagram for skills competency testing system usage.
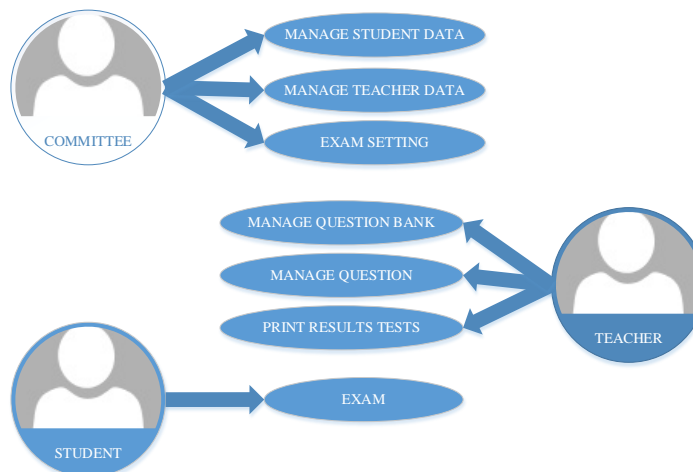

Figure 2. Use Case diagram

The use case diagram is used to find out the activities that can be done between the user and system. The diagram above shows that each user has each own different activities. The exam administrator can manage the student data, teacher data, and the test adjustment. The teacher can manage the test items and the result of the test. Meanwhile, the student only can take the test by online.

After creating the use case diagram, the next step is creating the flowchart diagram. The flowchart illustrates the data flow from each procedure using easy and understandable symbols (Suherman & Pinotoan, 2008) as explained in figure 3 below.
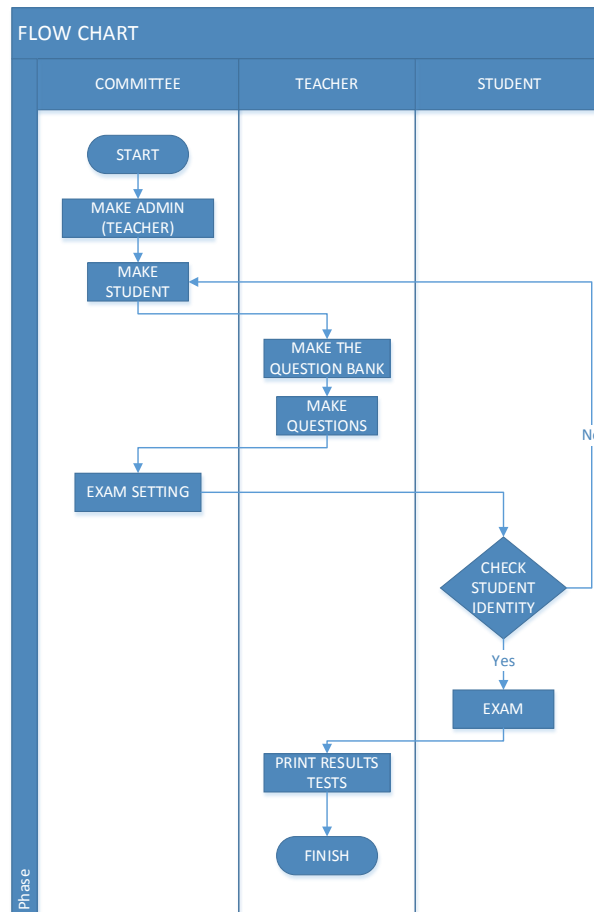
Figure 3. System flowchart

As the ways of software works that explained on the flowchart above, the program starts from the exam administrator to make an account for the teacher as the admin and students as the test takers. The process then continued for the teacher admin to create a question bank platform which is functioned as the test items database with attributes such as duration, a passing grade, the subject of study, and the number of test item that will appear on the test. After creating the question bank platform, the teacher admin now can create the test items that will be saved into the question bank. The next process the exam administrator will set the test where one of the settings is choosing which one of test item from the question bank that will be carried out in the test. The process is continued by checking identity by the students before the test and if they found a mistake, students can report it to the exam administrator to be updated. The last process is recapping the student's test result after the test finished.

Construction

In this stage, skills competency test system is starting to be developed. In construction stage, the system interface and functions are starting to be built.

Deployment

Deployment is the last stage of development where in this stage the researcher was conducting the software test. The researcher divided the test into two stages. On the first stage, the software functionality is tested with Blackbox method. On the second stage, the researcher was conducting the test to the user by using the TAM method. Meanwhile, the technique of the data analysis the researcher use the data percentage analysis formula as follows:

$$Percentage = \frac{The\ sum\ of\ test\ item\ score}{Maximum\ score} \times 100\ \%$$

Where:

Percentage   = the percentage of each test item

The sum of test item score   = the total score of respondent in all score categories

Maximum score   = the total of maximum score

(Riduwan, 2013)

Result and Discussion

Reseach Result

The result of this study is a skill competency test system that can be used as a learning evaluation media. This system is a web-based system that requires the web server in order to run it. The system has different features for three main users. The exam administrator can manage the system, the student data, and the test adjustment. The teacher admin can manage the question bank, test item, and the test result. Meanwhile, the test takers (students) can only take the test.

The example of a graphic interface of the skills competency test system can be seen as follows:
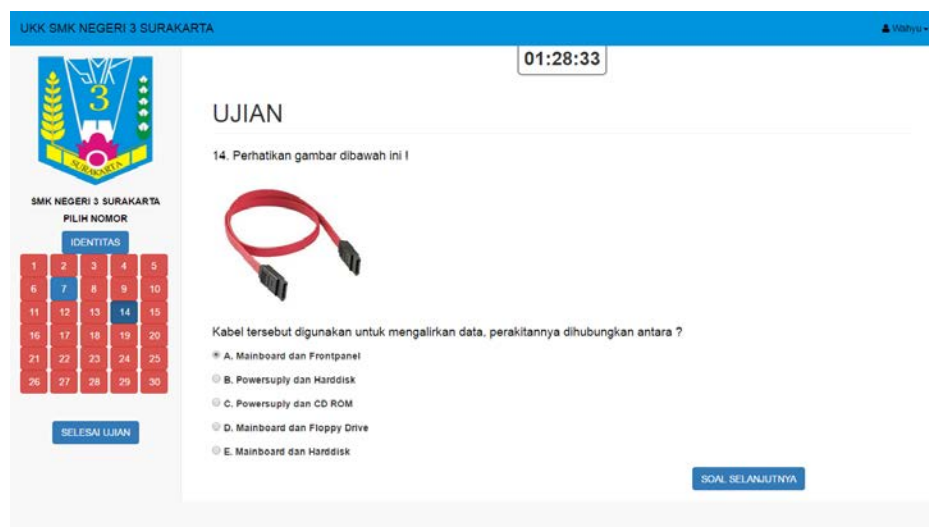

Figure 4. the test interface

The next process the researcher was conducting two kinds of tests (1) system functionality test and (2) system acceptability test. The Blackbox method will be used to test the system functionality and TAM (Technology Acceptance Model) method to test the system acceptability. The Blackbox test was done to find out the system functionality has run properly or not and TAM test to measure the user perception toward two aspects which are usefulness and ease of use.

The first test is Blackbox test. The Blackbox test was done by the researcher to ensure the software system run properly. In this test, the examiner was checking the functions on the system whether has run properly or found out a bug that needs to be fixed. The Blackbox test was conducted by five examiners one by one. The result of the Blackbox test can be read in the table below:

Table 2. The Blackbox Testing Result

	User Student	User Teachers	User Administrator
Tester 1	100%	90%	100%
Tester 2	100%	100%	100%
Tester 3	100%	100%	100%
Tester 4	100%	100%	100%
Tester 5	100%	100%	100%
Average	**100%**	**98%**	**100%**

It can be concluded from the result table above that all of the system function is working normally with the score 100% for administrator function, 98% for teacher function, and 100% for student function.

The next step is TAM testing. The test was conducted by two teachers and 12 students as the users by using a scoring rubric. The tested aspects are the usefulness and ease of use. The result of the TAM test shows the average score 93.57% from the students and 97.47% of the teachers. The detail of the result is explained below:

Table 4. Students TAM Testing Result

No	Rated Aspect	Value
1.	*Usefulness*	91.67%
2.	*Ease of Use*	95.48%
	Final Results (Percentage)	**93.57%**

Table 5. Teachers TAM Testing Result

No	Rated Aspect	Value
1.	*Usefulness*	99.23%
2.	*Ease of Use*	95.71%
	Final Results (Percentage)	**97.47%**

Table 3 and table 4 are the result of several aspects of TAM testing from teacher and student. The result of TAM testing from students is 93.57% and from a teacher is 97.47%.

Discussion

The web-based skills competency test system is used as a media to evaluate learning process. This software has three different users with its own function.

According to the result of the TAM test, the score 83.55% obtained from the students and 97.31% from the teachers. Comparing the resulting score to the acceptability criteria, it can be concluded that the developed skills competency test system is highly acceptable and can be used as media to evaluate the learning process. Following is the graph of TAM test score of skills competency test system toward acceptability criteria.
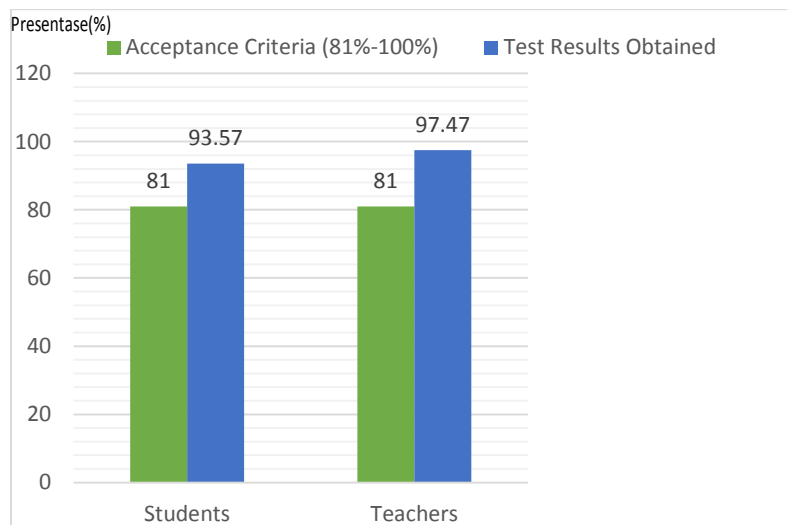
Figure 5. Graph of Application Score result

According to the TAM testing, it can be concluded that the developed software has several benefit such as (1) faster test scoring result because the student's answer will be corrected directly (2) improving performance with the capability to add multimedia (audio and pictures) and input data and formulas from Excel (3) improving the teacher's productivity by automatic scoring and passing grade calculation for each tested subject (4) improving teacher's effectivity by student's data input from Excel and automatic student's password and username update.

Conclusion

The resulting product is the web-based skills competency test system. There will be three different users to operate the software. The first is the exam administrator user that will manage the teacher admin, student's data and test setting, the second is teacher admin user with managing question bank, test item and the student's test result features and the last is test takers user that will be used by the students to take the test based on the applied test regulations.

The result of the TAM testing score from teacher shows that the product has 99.23% for the usefulness aspect and 95.71% for the ease of use aspect with the average score 97.47%. From the student's score, the product has 91.67% for usefulness aspect and 95.48% for the ease of use aspect with the average score 93.57%. Based on the TAM test result above, this system product is highly accepted by the users.

According to the TAM testing, it can be concluded that the developed software has benefits such as (1) faster test scoring result because the student's answer will be corrected directly (2) improving performance with the capability to add multimedia (audio and pictures) and input data and formulas from Excel (3) improving the teacher's productivity by automatic scoring and student's passing grade calculation for each tested subject (4) improving teacher's effectivity by student's data input from Excel and automatic student's password and username update features.

Follow Up

The skills competency test system needs to be improved in the future to give better content and better performance. The step of the next improvement or research the system can be developed for another platform and an operating system such as Android Mobile by considering the development of mobile devices and the factor ease of use that almost reach all society.

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