The application development of digital based student competencies test

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Abstract. This competency test application was developed using the Waterfall Model with the help of software such as XAMP server, PHP, MySQL, JavaScript, Hypertext Markup Language and Cascading Style Sheet for template design. The development of this application using a Waterfall model defines several phases and must be completed one by one to move to the next step. Waterfall model is recursive because each stage can be repeated without stopping to perfection. This advanced application is handy for students and lecturers. The students can directly see the final results and print them into PDF documents in the form of the report after completing the questions. These test results can be used to evaluate the learning process and predictions on the competitiveness of alumni.

1. Introduction

Advances in communication technology are an extensive impact on all aspects of human life, especially computers and the Internet. This technological advancement brings people to a new civilization and way of life and has an impact on the world of education [1]–[5]. One of the uses of computers in the field of assessment in the world of education is known as the CBT (Computer Based Testing).

CBT is defined as a series of computer-based tests or judgments whether it involves a stand-alone computer or connected to an internet network and most of the problem uses multiple-choice forms [6]. The questions presented in the written test can be transformed into digital tests and accessible to students via computer [7]–[12]. CBT also allows the development of problems that integrate movies, sounds, and animations in it so that the form of questions can be designed more contextual [12], [13]. The model is suitable for student competency test exercises independently. This model is aligned with our learning habits where at the end of the lesson, the teacher provides questions for the students' concept comprehension exercise [13], [14].

An online assessment is expected to offer some benefits to institutions and learners. These include [15]:

- Analysis of response time to question level to better distinguish between candidates
- Video in question, especially for scenarios in authentic assessment.
- The previous response determines adaptive testing, where the next question to ask.
- The existence of problem banks and question randomization to reduce fraud.

2. Materials And Method

In this section, the development cycle and conceptual design (the use cases diagram) of this digital-based competency testing application will be explained.

2.1 Development Life Cycle

The Waterfall model defines several phases and must be completed one by one to move on to the next step. The Waterfall model is recursive because each stage can be repeated nonstop until perfect. Figure 1 illustrates the different phases of the Waterfall SDLC model. Waterfall methodology is one of the models used in software design [16][17].
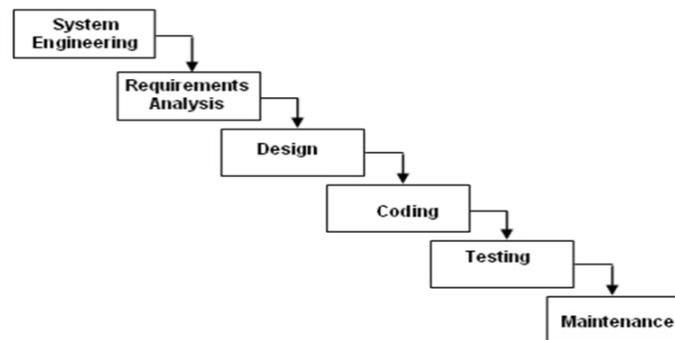

Figure 1. Waterfall model

Here are the phases in the waterfall model:
1. System / Information Engineering and Modeling. This phase begins by searching for the needs of the whole system to be applied into the form of software, and this stage is often called Project Definition.
2. Software Requirements Analysis. To know the nature of the program to be created, then the software engineer must understand about the information domain of the software, such as the required functions, e.g., user interface.
3. Design. This process is used to transform the above needs into a representation into the "blueprint" form of software before coding begins.
4. Coding. To be understood by the machine, in this case, is the computer, then the design had to be transformed into a form that can be recognized by the device, that is into the programming language through the process of coding.
5. Testing / Verification. All software functions must be tested, so that the software is free from errors, and the results should be entirely following the needs that have been defined previously.
6. Maintenance. Maintenance of software is required, including in it is development, because the software is not always made just like that.

2.2 The Student

In the use case diagram images show that students will enter the email and password to get into the system. Once introduced into the system then students can:
   a. View profiles and change accounts
   b. View class and course information
   c. Competency test exam
   d. See the results of competency tests
   e. Press the Logout button to exit the system.

2.3 The Lecturer
In the picture below the use case diagram shows that the lecturer can do:
  a. to insert questions into the database
  a. to put the course into the database
 b. to add a class into the database. Set the time and make the quality of the problem
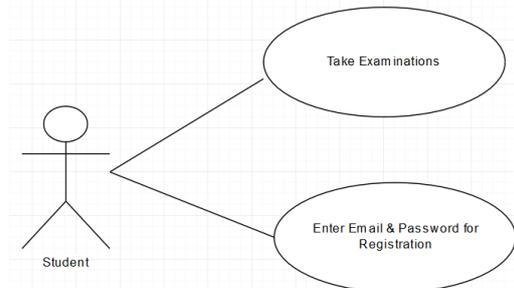
**Figure 2.** Use Case Diagram for Student
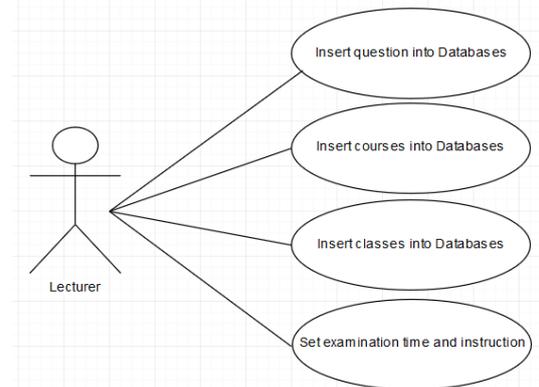
Figure 3. Use Case Diagram for Lecturer

3. Result and Discussion

Competency test application system consisting of 6 (six) different pages include the student enrollment page, student login page, lecturer login page, faculty and student profile page, system usage page, uploading page of questions, and test result page.

3.1 Student Login Page
This page is the main page, where each student opens the competency test page, and then this page is the first to appear, as shown in figure 4. To enter into the system, the student must fill in the email and password.

Figure 4. Main Menu

3.2 Registration Form Page
Any student who will perform a competency test must first register with the system, as shown in Figure 5.

Figure 5. Field of Registration Form

3.3 Competency Test Page
After the student enrolls and logs into the system, the student can start the competency test, wherein this competency test, the student must answer every question that is displayed on the screen, if they have responded to the student can press the following questions button to continue to answer the next question, as shown in figure 6.
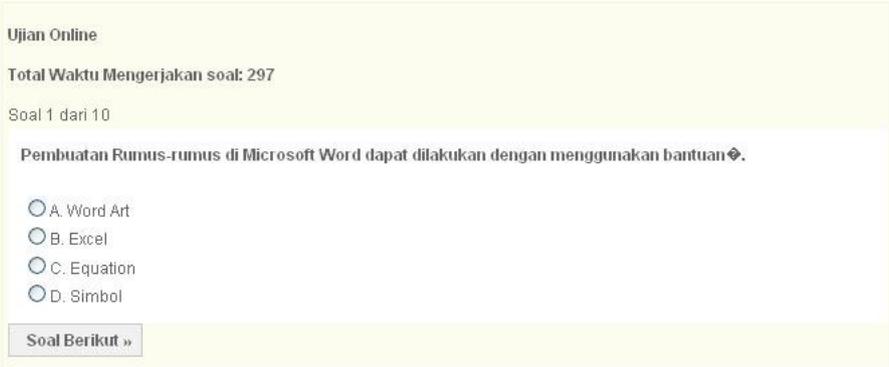
Figure 6. CompetencyTest

3.4 Competency Test Results Page
Figure 7 is the result of the competency test, after the student finishes the questions, in the last session to see the final result, the student can print the test result to paper or the PDF document.

Figure 7. Competency Test Result

The product development result is a digital-based competency test app that can be operated on a computer or laptop online. This type of problem in this application is a multiple choice.

Components contained in this Competency Test Application include:
1. In the initial view can be conditioned to enter the user password.
2. Instructions for the use of the Competency Test Application containing information about the application, the prohibition during the exam, the information about the questioner, the method of randomization.
3. Course information tested on the competency test
4. Registration of competency test participants
5. Login participants
6. Start button to work on the problem
7. Time display goes backward.
8. The answer selection button that changes color if clicked on the answer that is considered correct
9. The following questions button to continue to answer the next question
10. End the last problem can automatically see a list of issues that have been done.
11. On the results page, there is Information about right and wrong answers and number of questions (Total Questions), maximum score (Full Score) and the value obtained (Your Score).
12. There is a Print Result Test button to see the results of competency tests and graduation details.
13. Print Button to PDF to display competency test results in pdf documents.

4. Conclusion

This digital competency test application program is used to obtain competence map of student ability by using a certain standard. This mapping is useful for improving the teaching and learning process as well as to ensure the quality of graduates. The results of this standardized test can be used to evaluate the learning process and predict the competitiveness of alumni.

5. References

[1]   J. Simarmata, "Prototype Application Multimedia Learning for Teaching Basic," vol. 7, pp. 264–266, 2018.

[2]   D. Napitupulu *et al.*, "Analysis of Student Satisfaction Toward Quality of Service Facility," *J. Phys. Conf. Ser.*, vol. 954, no. 1, 2018.

[3]   S. Sriadhi, S. Gultom, R. Restu, and J. Simarmata, "The Effect of Tutorial Multimedia on the Transformator Learning Outcomes Based on the Students ' Visual Ability The Effect of Tutorial Multimedia on the Transformator Learning Outcomes Based on the Students ' Visual Ability," *IOP Conf. Ser. Mater. Sci. Eng. 384 012059*, 2018.

[4]   J. Simarmata, A. Djohar, J. Purba, and E. A. Juanda, "Design of a Blended Learning Environment Based on Merrill's Principles," *J. Phys. Conf. Ser.*, vol. 954, no. 1, 2018.

[5]   T. Limbong and P. D. P. Silitonga, "LOCAL DEVELOPMENT APPLICATION OF LEARNING CONTENT-BASED MULTIMEDIA BATAK TOBA SCRIPTS."

[6]   R. G. Jimoh, K. S. Abduljaleel, and Y. K. Kawu, "Students' Perception of Computer Based Test (CBT) for Examining Undergraduate Chemistry Courses," *J. Emerg. Trends Comput. Inf. Sci.*, vol. 3, no. 2, pp. 125–134, 2012.

[7]   R. Rahim *et al.*, "Internet based remote desktop using INDY and socket component," vol. 7, pp. 44–47, 2018.

[8]   G. Gunawan *et al.*, "Mobile Application Detection of Road Damage using Canny Algorithm," in *Journal of Physics: Conference Series*, 2018, vol. 1019, no. 1, p. 12035.

[9]   J. Simarmata, J. P. Purba, and E. A. Djuanda, "Perancangan Prototype Model Pembelajaran Berbasis Blended Learning Untuk Meningkatkan Proses Pembelajaran," 2017.

[10]   J. Simarmata, J. P. P. As'ari Djohar, and E. A. Djuanda, "IMPLEMENTASI MODEL PEMBELAJARAN BERBASIS BLENDED LEARNING UNTUK MENINGKATKAN HASIL BELAJAR SISWA."

[11]   T. Limbong, E. Napitpulu, and P. B. N. S. Sriadhi, "Learning Application Soft Skill for Facial with Computer Assisted Instruction Model," 2018.

[12]   J. Simarmata *et al.*, "Learning Application of Multimedia-Based-Computer Network Using Computer Assisted Instruction Method," *Int. J. Eng. Technol.*, vol. 7, no. 2.13, pp. 341–344, Apr. 2018.

[13]   T. Limbong *et al.*, "The Implementation of Multi-Objective Optimization on the Basis of Ratio Analysis Method to Select the Lecturer Assistant Working at Computer Laboratorium," *Int. J. Eng. Technol.*, vol. 7, no. 2.13, pp. 352–356, Apr. 2018.

[14]   A. R. S. Tambunan, "USING COMPUTER TECHNOLOGY IN STIMULATING STUDENTS ACHIEVEMENT OF ENGLISH VOCABULARY," 2011.

[15]   A. Fluck, D. Pullen, and C. Harper, "Case study of a computer based examination system," *Australas. J. Educ. Technol.*, vol. 25, no. 4, Sep. 2009.

[16]   J. Simarmata, *Rekayasa Perangkat Lunak*. Penerbit Andi, 2010.

[17]   Roger S. Pressman, *Software Engineering: A PRACTITIONER'S APPROACH*, 5th ed. Thomas Casson, 2001.