

## Technology Acceptance Model for Feasibility of computer-based test system in Indonesia

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### Abstract:

Indonesia is a country with rapid technological developments in all sectors including education. This can be proved by the government's success in applying computer-based test in 2014 junior high school (KEMDIKBUD, 2016). Many conveniences obtained when the exam using computer such as the assessment automatically, get feedback quickly and the question can be stored in the bank question (Fluck, Pullen, & Harper, 2009). In this research, computer-based test system will be developed based on the convenience as above and will be added some other features to suit of the school using waterfall development model (Pressman, 2010). Additional features include classroom major, question grouping in the question bank, user management and ease of registration during new year academic calendar. After developing system has been done, the CBT system is tested to one class at a vocational high school in Indonesia using an system feasibility instrument adapted from technology acceptance model (TAM) to know the level of feasibility the CBT system in perceived usefulness and perceived easy of use (Davis, 1989). The test results show that CBT system is very suitable for use in the class and can be applied to all schools in Indonesia.

**Keywords:** Computer-Based Test, Technology Acceptance Model, waterfall development model, computer exam

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## Introduction

The development of the world digital is now growing very rapidly, in particular in the field of information technology. The exchange of information Originally done with a conventional system has slowly switched in to digital. This is because the existing digital information technology is considered easier and faster to convey information. With the information technology (IT), Human work can be done more effectively and efficiently in various fields, one of which is in the sector of education (Himawan, 2011).

School as one of the educational institutions in Indonesia also continues to follow the development of technology, one of them by applying the process of learning and evaluation based computer. With increasingly widespread Progress in the field of information and communication technology, and the discovery of the dynamics of the learning process, the implementation of educational and teaching activities Increasingly demanding and acquiring varied learning media (Rasim, Setiawan, & Rahman, 2008). One attempt of computer use in learning is to apply computer-based testing. CBT is an effective solution for the mass evaluation using computer (Fagbola, Adigun, & Oke, 2013).

Ayo, Akinyemi, Adebisi, and Ekong (2007) explain basically that electronic examination (e-Examination for short) system involves the conduct of examinations through the web or the intranet and it reduces the large proportion of workload on examination, training, grading and reviewing. Many of the benefits for using computer in education especially on the application of exams.

In this research, CBT system will developed according the school needs in Indonesia include grade majors management, user management, question grouping in question bank, ease for registration during new academic calendar, flexibility in exam (play and stop student exam process), and exam report. The process of development this CBT system is using waterfall model by Pressman (2010). After all the development process has been completed, the CBT system is tested to vocational high schools to get feedback and system feasibility using the instrument sheet. The instrument contains a statement of the perceptions of usefulness and ease of use adopted from the technology acceptance model (TAM) by Davis (1989).

## Research Methods

The development process of this computer-based test system using the waterfall development model. At least there are 5 phases in this model which can be seen in figure 1 below.

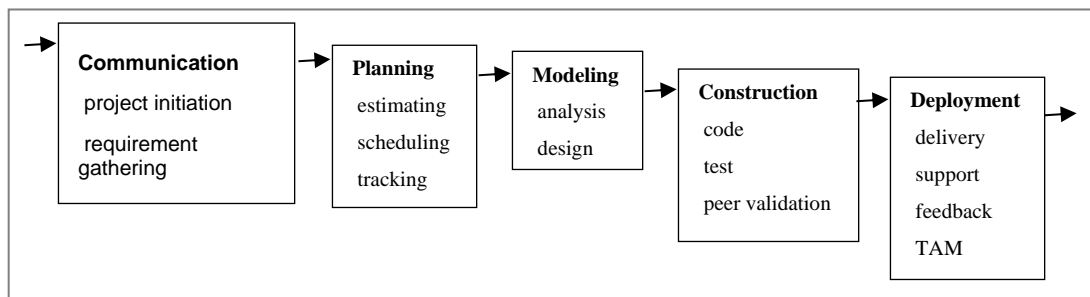


Figure 1. Scheme of waterfall development model (Pressman, 2010)

## Communication

This is the first phase of the study by interviewing one of the vocational high schools to determine the basic requirement gathering for the CBT system. The interview data obtained at this phase as follows:

- The question is multiple-choice which can be randomized by the system along with its options
- There is a review / feedback question after the student has finished the exam
- The users can report test results into excel files
- The question are managed into question bank
- The homeroom teacher can monitor the student's exam assessment
- Students are grouped according to the classroom majors and the management process is easy.

## Planning

Before starting to develop it is necessary to set minimum requirements of hardware, software and system detail functional requirements. CBT system is expected to run well with the minimum device requirements i.e. 4GB of Random Access Memory (RAM), 500GB of Harddisk and intel core i3-2330M CPU @2.20 Ghz. While the minimum requirements software for the CBT system needs are windows 7 or later, Newer Google Chrome, Xampp web service bundle 5.6.30 (PHP 5.5.19, Apache 2.4.10 and MySQL 5.0.11). The functional requirements of the CBT system are grouped into 3 users (admin, teacher and student) respectively are as follows:

Functional requirement for admin

- Can make system settings, include general settings, academic year settings, class majors, course settings (superadmin only)
- Admin managements (superadmin only)
- Classrooms majors' managements
- Users (teachers and students) managements
- Course registration include with the instructor
- Knowing the school statistics exam and schedule information
- Report the student's exam assessment
- Question banks monitored
- Report all student result for personal in class

Functional requirement for teacher

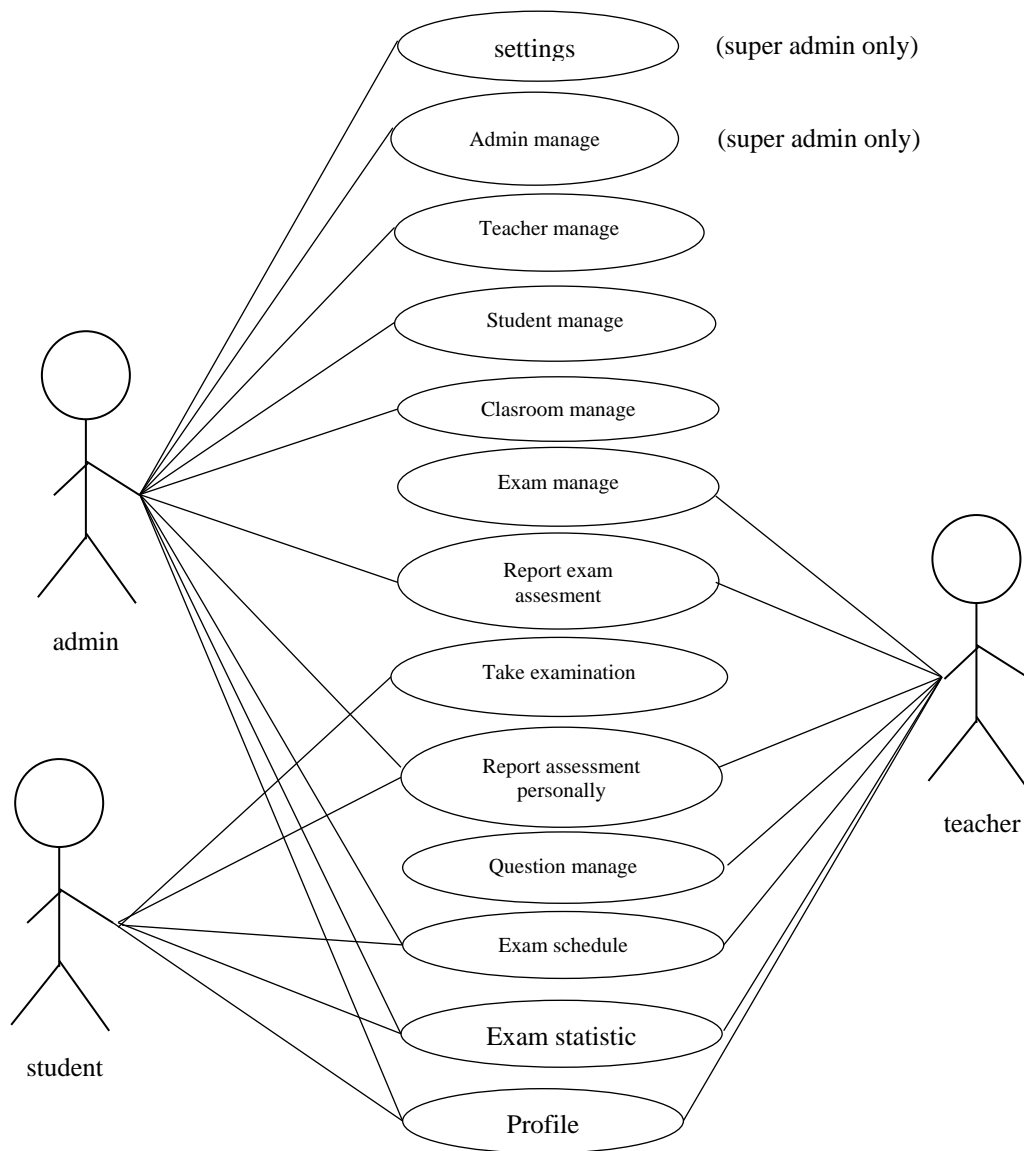
- Exam managements
- Report the exam assessment
- Question management in question bank
- Exam assessment monitoring for homeroom teacher
- Report all student result personal in class for home teacher
- Flexibility in examination process (play and stop the student exam)
- Knowing the school statistics exam and schedule information

Functional requirement for student

- Knowing the school statistics exam and schedule information
- The result of assessment can be known automatically
- Report all exam result in class majors
- Have feedback to the question after the examination was ended
- Exam managements grouped by class majors

## Modeling

In this phase, The CBT system created its workflow design based on the functional requirements needs already made. Refers to the waterfall development model, the design is made use case diagram, flowchart, and entity relationship diagram. Here is the use case diagram design of CBT System:



**Figure 2. Use Case Diagram CBT System**

Use case diagram displays the activity of each user in the CBT system briefly. The next steps are designing a flowchart design of CBT system, it is can be used to describe the business and operational step by step workflows of components in a system. An flowchart diagram shows the overall flow of control. However, figure 3 presents the flowchart diagram for the CBT system developed.

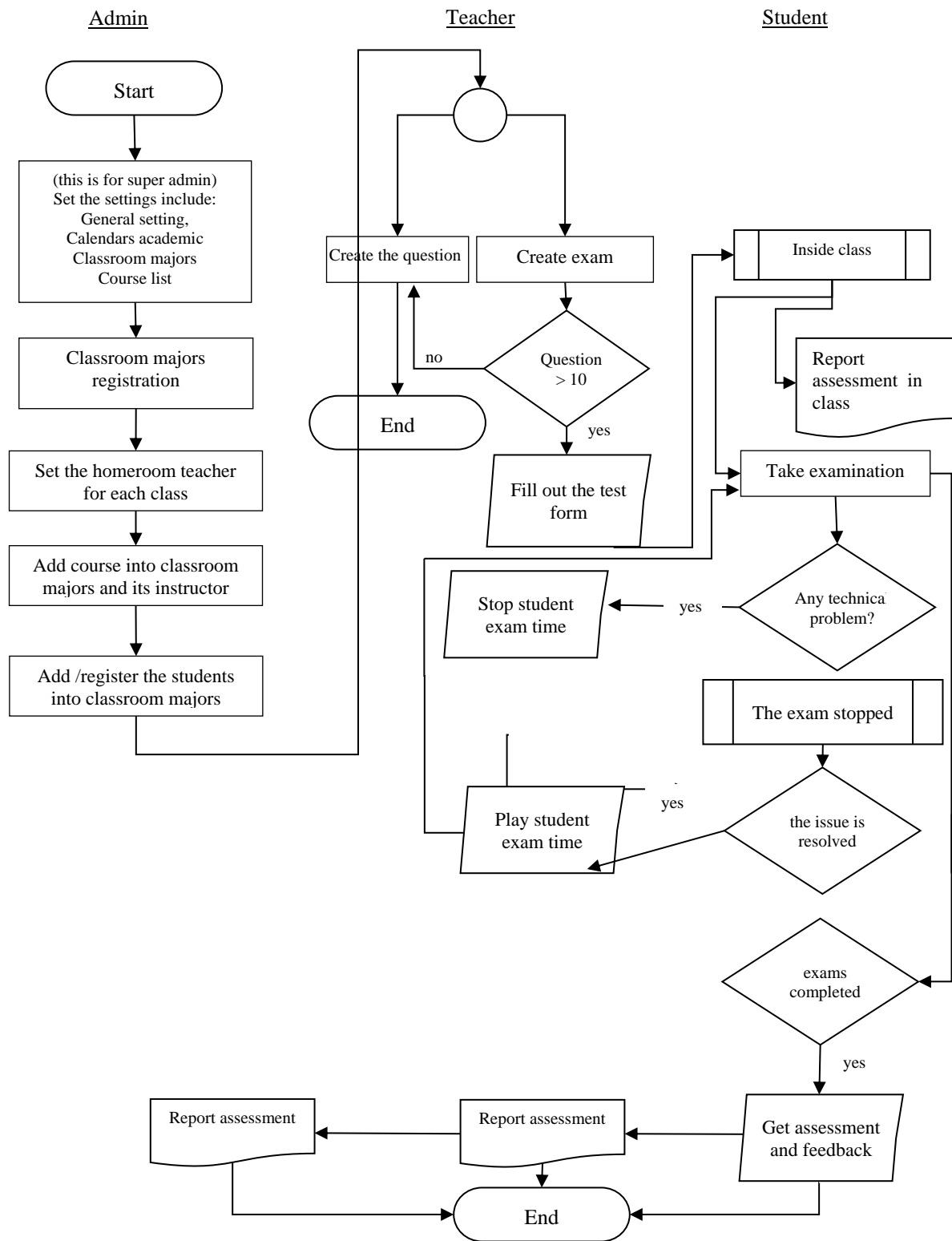


Figure 3. Flowchart of CBT System

The data flow diagram starts from the highest level commonly called as DFD level 0 / context diagram. This diagram is used to find out the relationship directly what users can do with the CBT system. The data flow diagram depicted in figure 4 below shows the relationship among the entities in the CBT system.

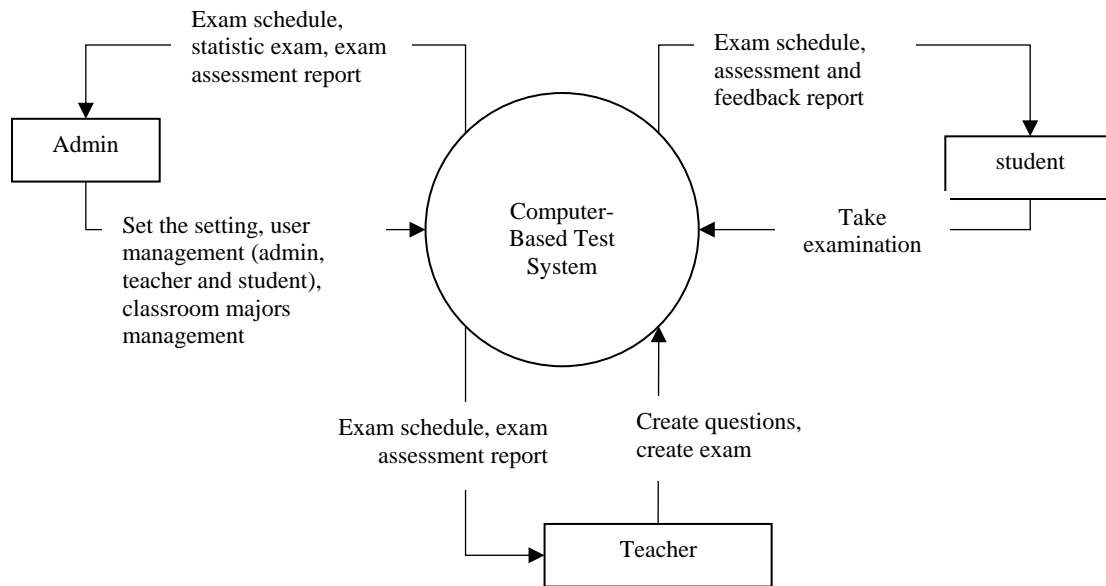
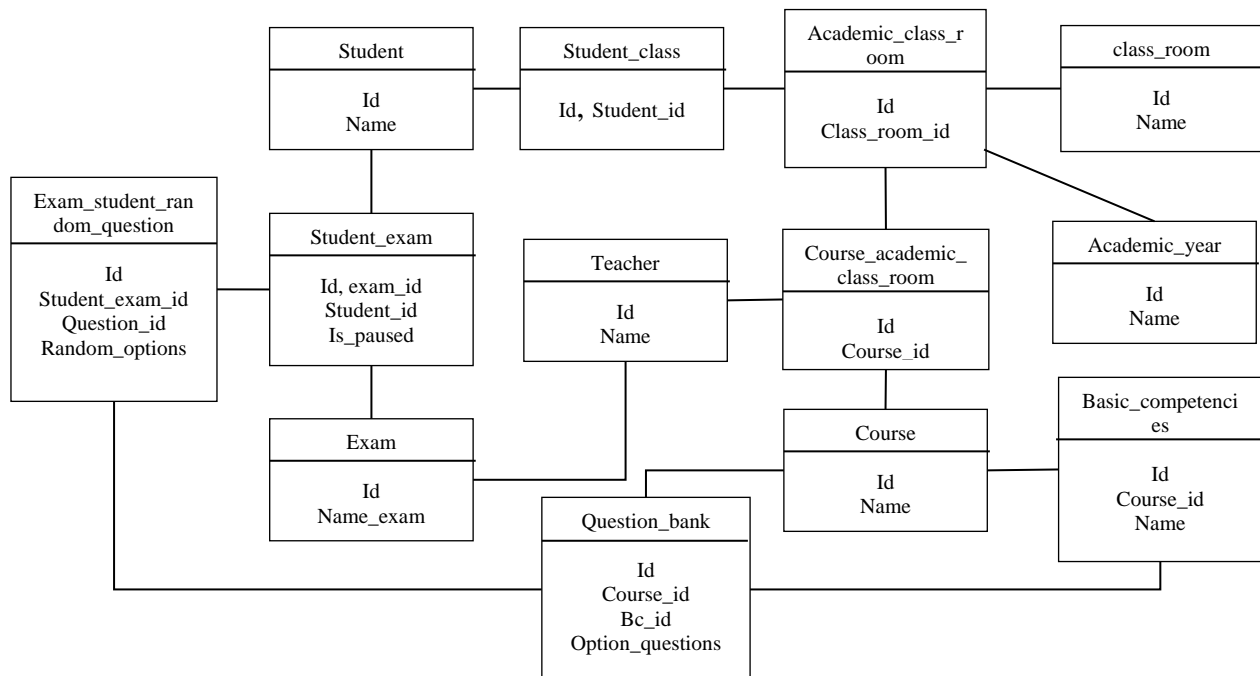


Figure 4. Data Flow Diagram for the CBT System

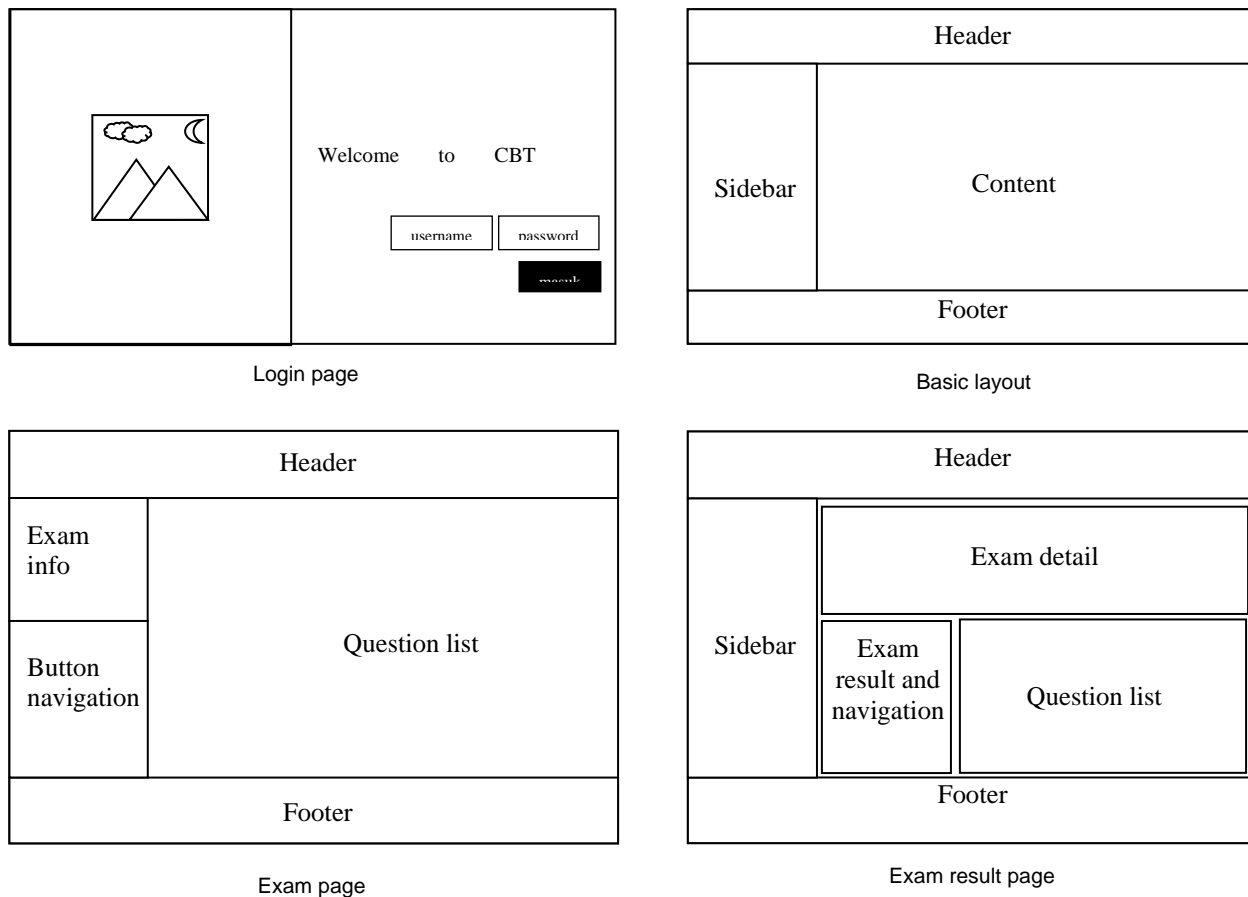
The entity 'admin' assigned to make arrangements relating to the CBT system, but it also served to manage the users of the CBT system and do the management of the class majors. As feedback, the entity 'admin' will get the exam schedule, exam stats and exam assessment report. The entity 'teacher' can make question in the question bank and create an exam and also will get exam schedule, and exam assessment report. The entity 'student' can take the examination if there is a test intended for the student. After the students have finished the exam, the student will directly get the assessment and feedback from CBTsystem.

The relationship among the entities that make up the CBT system is modeled using the entity-relationship diagram presented in figure 5 below.



**Figure 5. Entity relationship diagram for the CBT System**

As the last step in the modeling phase is to create a prototype CBT system so that the development CBT system can be build quickly. The prototype is illustrated as in figure 4 below.



**Figure 6. Prototype Design Sample for CBT System**

### Construction

This phase is to create a real CBT system by combining code scripts. CBT system made based on website and have programming languages such as PHP (Hypertext Preprocessor), Javascript, CSS (Cascading Style Sheet), HTML (Hypertext Markup Language), and MySQL (My Structured Language). In the development process, there are various kinds of trials such as self-testing, test with lecturer or testing with classmate (peer validation).

The development of CBT system is based the research from Abdel Karim and Shukur (2016) about the aspects that should be in the design of the CBT system interface in order to run optimally. Aspects are applied in CBT systems such as letters (type, size, color and style / style), background color, question grouping, time calculation and number of questions per page. Types of questions are also grouped into several criteria based on their difficult, difficult and moderate difficulty as research conducted by Mustakerov and Borissova (2011).

### Deployment

The last step is the deployment phase, the CBT system is ready to be tested in vocational high school to find out the feasibility of this developed CBT system. Each user from the school (1 admin, 2 teacher and 28 student) used the CBT system and also provided instruments containing the system's feasibility statement based on technology acceptance model (TAM) (Davis, 1989). While the feasibility assessment indicator uses Likert scale with range between 1 – 5 (Likert, 1932). The feasibility indicators measured by the technology acceptance model is about the perception of usefulness and the perception of ease of use

when each user using the CBT system. The content of feasibility statement of the CBT system based on TAM are below:

**Table 1. The content feasibility statement based on TAM for CBT System**

No	Scale item	Number of statement for		
		Admin	Teacher	Student
<b>Usefulness</b>				
1	Work more Quickly	2	2	2
2	Job Performance	1	2	2
3	Increase Productivity	2	2	2
4	Efectiveness	3	3	3
5	Makes Job Easier	1	1	1
6	Useful	1	1	1
<b>Easy of use</b>				
7	Easy To learn	2	2	2
8	Controllable	2	2	2
9	Clear and Understanable	2	2	2
10	Flexible	2	1	1
11	Easy to Become Skillful	2	2	1
12	Easy to Use	1	1	1
<b>Total statement</b>		21	21	20

The result from collecting data instrument based on TAM on this phase as follows:

**Table 2. The Result of TAM Instrument for Admin**

No	Indicator of feasibility	Percentage (%)
1	Usefulness	92
2	Easy of use	94
<b>Average</b>		93

**Table 3. The Result of TAM Instrument for Teacher**

No	Indicator of feasibility	Percentage (%)
1	Usefulness	90
2	Easy of use	92
<b>Average</b>		91

**Table 4. The Result of TAM Instrument for Student**

No	Indicator of feasibility	Percentage (%)
1	Usefulness	83,5
2	Easy of use	81
<b>Average</b>		82,25



## Result and Discussion

Generally, the development of CBT system is divided into three different users i.e. CBT system for admin, teachers and students. Each user has different access rights and features.

### CBT System for Admin

Admin is a spearhead of the running of a CBT system, by setting the right system all the processes will run correctly. Figure 7 shows a setting page that can only be accessed by an administrator to manage the entire CBT system.

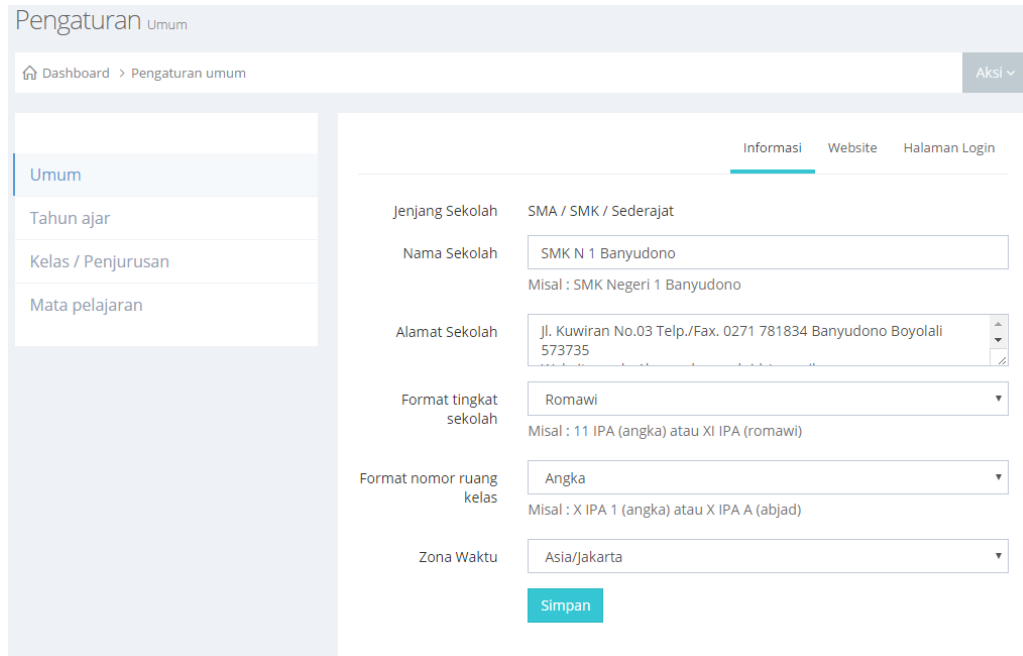


Figure 7. Setting page

### CBT System for Teacher

One of the features of this CBT system development for teachers is when the exam runs, the teacher can monitor the student exam progress directly. If students get a technical problem while doing exams (e.g. can't connect to the server / computer hangs / other), students should ask the teacher to stop his exam time. Once the technical problem is resolved, the student should contact the teacher to resume it.



Figure 8. Teacher Monitored Student examination Progress

### CBT System for Student

Figure 8 showing the examination process page for student. The page is divided into three sections: exam information, navigation question number, and question list on the right of the CBT system. Students can select / replace answers by pressing the option button a / b / c / d or e. The navigation button can change the background color based on the status of the existing question (white background: not done; green: done; dark green: done but still in doubt; yellow: hesitant and has not done the question). The flag button (right of the question number) is used to indicate a question of doubt.

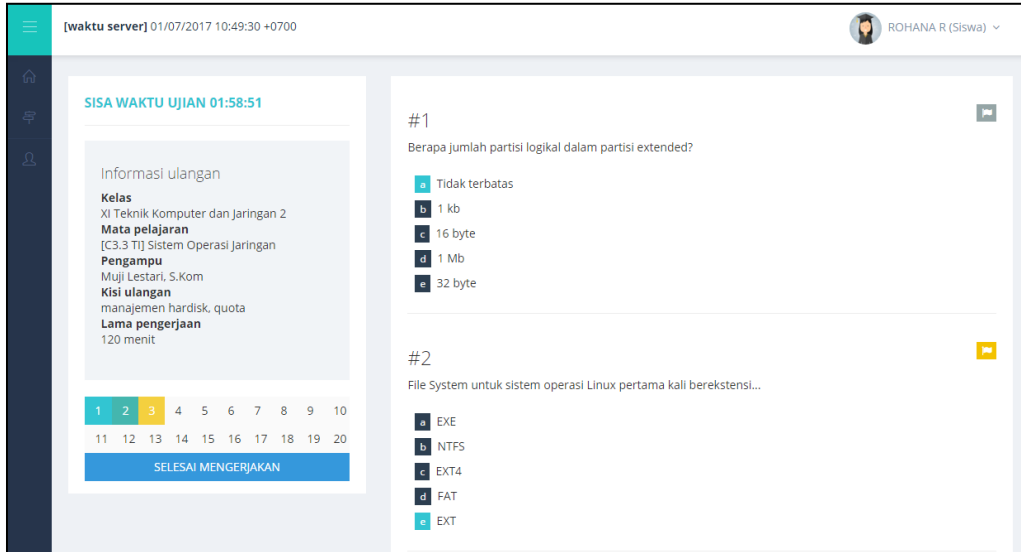


Figure 9. Student Take the Examination

### Discussion

Based on data analysis obtained during CBT system testing using technology acceptance model (TAM) instrument, the CBT system feasibility chart of all users viewed from the perception of usability and perception of ease of use can be seen in figure 10 below.

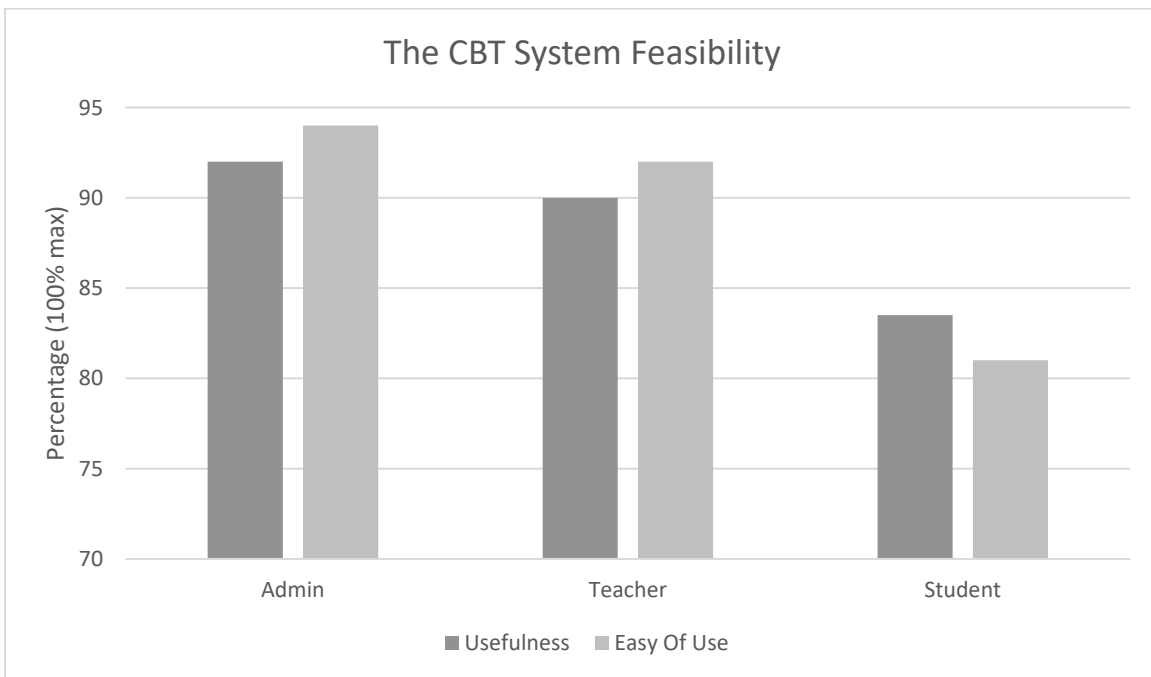


Figure 10. The Chart of CBT system's feasibility with TAM instrument

Then, the average analysis result of each user feasibility is compared with the table of feasibility criteria belonging Riduwan (2013) as in table 7. From the comparison results can be concluded that the developed CBT system is very feasible to use in all Indonesian school in general.

**Table 5. Comparison of feasibility criteria for CBT system (Riduwan, 2013)**

Percentage (%)	Rating Criteria	CBT System result (%)
<b>81 – 100</b>	<b>Very feasible</b>	<b>93; 91; 82,25</b>
61 – 80	Feasible	
41 – 60	Enough	
21 – 40	not feasible	
0 – 20	Very unfeasible	

## Conclusion

In this research, a CBT system was developed and intended for schools in Indonesia. Many of the advantages of implementing an online exam system include saving on paper printing costs, saving time, fast assessment process and reducing fraud because the question will be randomized by the system. In addition, the advantages of this developed CBT system are classroom management processes suitable for classroom needs in Indonesia, grouping the question into course and competencies, flexible testing process (start and stop student's examination process) that can be arranged by the teacher and the registration process for the new academic calendar in school was made easy.

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