DEVELOPMENT OF INTERACTIVE APPLICATIONS SIMULATION OF CHEMICAL PRACTICE OF SENIOR HIGHT SCHOOL (CASE STUDY IN SMA NEGERI 6 TASIKMALAYA)

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ABSTRACT

SMA Negeri 6 Tasikmalaya is one of the Senior High School in Tasikmalaya city which is located at street Cibungkul, Sukamaju Kaler Village, Indihiang Sub-district, Tasikmalaya City, West Java Province. Problems experienced by the school students are difficult to understand the material practicum especially chemistry lesson so that the value obtained under the minimum passing criteria (KKM), chemical labolatorium experiencing the limitations of tools and materials practicum so it can not carry out all teaching materials and students often make mistakes in the procedure practice.
The solution of the problems that happened in the chemistry lesson in SMA Negeri 6 Tasikmalaya, especially the practice that is by Computer Assisted Instruction (CAI) method which aims to help the learning process of students become more easily understood, can carry out the practicum material that is not implemented because of the limited tools and materials of practicum and Minimize procedural errors in the lab.
Based on the results of testing black box and beta testing can be concluded that with the application of this chemistry practicum simulation, can make the learning process students become more easily understood, help students implement the material that is not practicum implemented and can minimize errors in the lab so that time is used effectively.

Keywords : Application of simulation, simulation, chemistry practice.

1. Introduction

1.1. Background of the problem

SMA Negeri 6 Tasikmalaya is one of the Senior High School from 10 (ten) SMA Negeri located in Tasikmalaya city which is located at Jl.Cibungkul, Sukamaju Kaler Village, Indihiang Sub-district, Tasikmalaya City, West Java Province. Same with senior high school in Indonesia the school education period in this school is taken within three years of lessons, ranging from Class X (ten) to class XII (twelve). SMA Negeri 6 Tasikmlaya was officially established on March 11, 1991 previously as a class far from SMA Negeri 2 Tasikmalaya.

Chemistry is one of the core subjects in the current educational curriculum. Studying chemistry subjects should be fun and easy, because from these subjects students can gain knowledge about various chemistry. Chemical practice is part of the teaching of chemistry that aims to enable students to have an opportunity to test and execute in the real state of what is obtained in theory. In the chemistry lab students will learn how the chemical reaction takes place directly and manifestly. Chemical practice is indispensable for students because many chemical reactions are difficult to explain just by words alone.

Based on interview with mother Dra. Mumun Munawaroh as a chemistry teacher and father Arip Rusmana as a laboratory of SMA Negeri 6 Tasikmalaya, many students have difficulties in understanding the practicum material that will be implemented, it is seen from the number of students who do not know what to do in implementing the practicum procedure. This leads to the value of practicum obtained by many students under minimal mastery criteria (KKM). From the data obtained can be concluded that the overall average value is 71.88 while the completeness standard (KKM) chemical subjects is 75. Thus the daily test value is still below the expected standard. This shows that the students still lack understanding on the material that has been taught.

Practical materials are teaching materials that are realized with established procedures, but the limitations of existing tools and materials make not all teaching materials in practice. Some tools and materials that are not available in the lab of SMA Negeri 6 Tasikmalaya include analytical balance, boiling rock, electron microscope, distillation device, rotary evaporator, ozone generator, bomb calorimeter, solution calorimeter, separating funnel, Argenti Nitrate (AgNO3), Thephyllinum (C7H8N4O2) , Sorbitol (C6H14O6) and Iron III Chloride hexahydrate (FeCl3 * 6H2O) so that there are not teaching materials that are practiced, such as atomic structure, periodic table, molecular form and inter-molecular force and chemical equilibrium.

The time available for a 2 hour teaching period (45 minutes) so the time available for a 90 minute practicum. Whereas to conduct a one-time trial takes

± 15 minutes per 1 person in a group consisting of 5 people and each group member should carry out the lab, it does not include errors that occur when the lab work takes. Reinforced by the data of questionnaires conducted on the students of class XI IPA 1, 30 students from 38 students stated that the practical material is difficult to understand and the lack of time needed to do this practice because 1 times the practicum is implemented by every student in In the group had to do practicum, while the number of students in the group an average of 5 students and each person takes at least 15 minutes and the average procedural error of each student 2 times in 1 experiment, while the time provided to carry out practicum only 90 minutes.

Learning media help many teaching and learning process so that the learning process becomes more effective and provide benefits for teachers as teachers and students. The advantage gained from the utilization of media as a learning tool will facilitate the students to receive the material so that students quickly understand and understand the material presented and on the side of the profits gained that can deliver the material well and easily. For the material pratikum can be simulated so that students can experiment repeatedly until students are familiar with the material and procedures practicum that will be implemented.

1.2. Identification of problems

Based on the above background exposure can be formulated the problem, among others

1. Students have difficulties to understand the practicum material so that the value earned is below the minimum passing criteria (KKM).
2. Chemistry Laboratory of SMA Negeri 6 Tasikmalaya has limited equipment and practicum materials so that it can not carry out all teaching materials.
3. Students often make mistakes in the lab so that the time available for the teaching and learning process is not sufficient.

1.3. Purpose and Objectives

Based on the problems studied, the purpose of this thesis is to build an interactive application of chemistry chemistry lab simulation 6 Tasikmalaya Senior High School. While the objectives to be achieved in this research are:

1. Developing chemistry lab applications to make learning easier.
2. Developing a chemical practicum application so that students can carry out practicum materials that are not implemented because of the limited tools and practicum materials.
3. Build a chemical practicum application so as to minimize errors in the lab so that time is used effectively.

1.4. Research methods

The research methodology is anything related to the methods used in doing this research by approaching the methods that have been there. The method itself is a way done in the research and preparation of this thesis. The author uses the methods described in Figure 1.

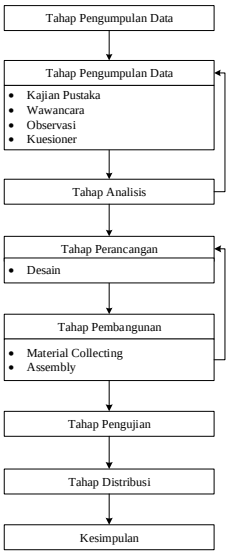


Figure 1 Research Metedology

1.4.1. Method of collecting data

The data collection stage is the means used to obtain data penujang for research. The data collection techniques used consist of four ways of collecting data, namely:

1. Literature review
   Learn the theoretical basis of various literatures on programming language html5, java script, php, CI framework, learning media and teaching materials that are in use in SMA Negeri 6 Tasikmalaya. Searching information in the form of references from the internet, books, scientific journals, can be articles and discussions in the forum related to this final task, and discuss with the parties berkompetensi.
2. Interview
   Data collection by means of direct question and answer with mother Dra. Mumun Munawaroh as a chemistry teacher and father of Arip Rusmana as a laboratory Senior High School 6 Tasikmalaya about matters relating to the problem under study.
3. Observation
   Collecting data on chemistry chemistry learning material in SMA Negeri 6 Tasikmalaya in accordance with the curriculum textbook that is used the curriculum 2013, and directly into the environment of SMA Negeri 6 Tasikmalaya.
4. Questionnaire
   Collecting data is done by giving a set of written questions to students of SMA Negeri 6 Tasikmalaya especially IPA class to get data response from students.

1.4.2. Method of Software Development

What is meant by methodology is the procedure that determines what process will be used. In multimedia, there are many methodologies used to develop multimedia. A product can be created with various methodologies by the developer organization.

According to Luther (1994), multimedia development methodology consists Concept (pengonsepan), Design (designing), collecting material (material collection), Assembly (manufacture), Testing (testing), Distribution (distribution).

These six stages are not necessarily sequential in practice, they can be exchanged positions. Even so, the concept stage must be the first thing to be done.

Sutopo (2003) adopted Luther's methodology with modifications, as shown in Figure 2.

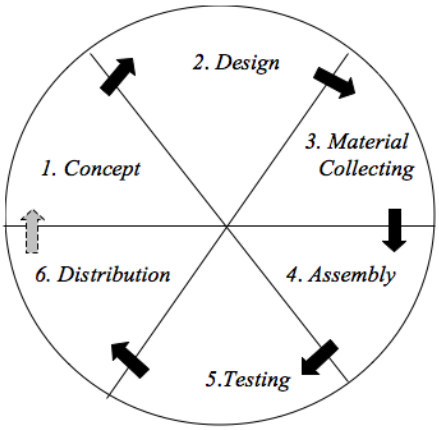


Figure 2 Luther Sutopo software development model [1]

1. Concept

   Stage concept (pengonsepan) is the stage of determining objectives and who the users of the program (identification hearings). The purpose and the end users affect the feel of a multimedia program as a reflection of the identity of the organization who want information to the end user. User characteristics include the ability of users also need to be considered because it can affect the design.

   In addition, this phase will also determine the type of application (presentations, interactive, and others). Basic rules for design are also determined at this stage, such as the size of the application, the target, and others. The output of this stage is usually a narrative document to reveal the project objectives to be achieved.

2. Design

   Design(Design) is a specification of the manufacturing phase of the program architecture, style, appearance, and material requirements / materials for the program. Specifications are made as specific as possible so that the next phase of collecting materials and assembly, the new decision making is no longer needed, simply use decisions that have been determined at this point. However, in practice, the project at the initial stage they will often have additional ingredients or the reduction of parts of the application, or other changes.

   This stage typically use storyboards to illustrate the description of each scene, to include all the multimedia objects and links to other scenes and parts flow (flowchart) to describe the flow from one scene to another scene.

   Storyboard creation can use the storyboard creation film / animation, or can use the storyboard creation in multimedia. which only uses text only.

   In the flow can be seen components contained in a scene with the necessary explanation.

3. Material Collecting

   *Material*Collecting is a stage of collecting material that fits the needs done. These materials, such as clip art images, photographs, animations, video, audio, and others that can be obtained free of charge or with reservations to other parties in accordance with the design. This stage can be done in parallel with the assembly stage. However, in some cases, the stage of collecting materials and assembly phase will be done in a linear and not parallel.

4. Assembly

   Assembly stage is the stage of making all objects or multimedia materials. Making an application based on a design stage, such as storyboards, flowcharts, and / or navigation structure.

   This stage typically use authoring software, such as Macromedia Director. In addition, Macromedia Flash or a free open source product, Sophie that can run on Linux as well as in Mac OS X can also be used.

5. Testing

   Stage Testing (testing) is performed after completing the stage of manufacture (assembly) to run applications / programs and see if there is a mistake or not. The first stage in this phase is called the alpha testing stage (alpha test) the testing done by the manufacturer or the manufacturer's own environment. Having escaped from alpha testing, beta testing involving end users will do.

6. Distribution

   At this stage, the application will be stored in a storage medium. If the storage media is not sufficient to accommodate the application, compression of the application will be performed.

2. RESEARCH CONTENTS

2.1 Theory

2.1.1 Media of Learning

The word media derived from the Latin is a plural of the word medium which etymologically means "middle", the introduction or the intermediary. In a communication activity, the media is an intermediary or sender of messages from the sender to the recipient

of the message. While in the learning activities, the media tends to be defined as anything that can be used to deliver the message (message), stimulate the mind, feelings, concerns, and the willingness of students so as to encourage learning [2].

Association of Education and Communication Technology (AECT) memberikan batasan tentang media sebagai segala bentuk dan saluran yang digunakan orang untuk menyalurkan pesan atau informasi.

Association of Education and Communication Technology (AECT) imposes limits on media as all forms and channels that people use to distribute a message or information.

The use of media in the learning process aims to make the lesson material delivered by the teacher can be more easily accepted and understood by the students, so that the learning activities can take place effectively, communication and interaction between teachers and students can take place effectively and efficiently [3].

By virtue of all the understanding or limitation of the media focused on the educational media or better known by the media learning. Learning media is all the physical tools used to present the message in teaching and learning activities in order to stimulate students to learn [4].

Physical learning media is known as hadware or hardware, which in this case is defined as an object that can be seen, heard, or touched with the five senses of man. While non-physical, learning media is known as software or software that contains the message contained in the hardware that is the content to be conveyed to students.

2.1.2 Benefits of Learning Media

Basically the learning media can support the learning process which in turn is expected to enhance understanding and achievement of student achievement. By using learning media, subject matter can be delivered more clearly and not verbalistic (in the form of written or mere words), but it also can overcome the limitations of space, time, and sense power.

The use of instructional media can also help overly complex objects (eg machines) using models or diagrams, whereas to explain overly broad concepts (eg volcanoes, earthquakes, climates etc.) can be written in the form of films, frames, And image [4].

Learning media when used appropriately and varied, can also overcome the passive attitude of students. In this case its use can be useful to cause student enthusiasm in learning, student will be more excited and motivated to keep on learning until finish. In addition the students solely not only sit in class with attention to teacher explanation and record learning materials, but also actively to do more learning activities such as observing, performing, or demonstrating.

Tunagrahita children who incidentally has a unique nature, among students with one another have heterogeneous characteristics. Coupled with intelligence factors that are limited to abstract things and narrow experience, on the other hand the curriculum and educational materials are determined equally for each student, consequently the teacher will have many difficulties. With regard to it learning media play a role in:

1. Giving students motivation in learning
2. More realizing the abstract things become concrete
3. Assist teachers in the delivery of material so as not to be verbal
4. Providing a meaningful and meaningful learning experience

2.1.3 Learning Media Cationfication

In the classification of learning media there are three groups of media commonly used are:

1. Audio media

Media belonging to this group can only produce sound / sound only. Example: cassette, radio, and tape recorder.

2. Visual media

Visual media is a medium that can only show the form and shape. The media is divided into two parts namely two-dimensional visual media and three-dimensional visual media.

a. Two-dimensional visual media, divided into two namely:
    1. Two-dimensional visual media, divided into two namely:
    2. Two-dimensional visual media, divided into two namely:
b. Two-dimensional visual media, divided into two namely:

3. Audio visual media

Audio-visual media are tools / media that can produce visuals and sound in a single unit, for example: TV, Sound film, interactive edutainment, and video.

2.1.4 Computer Assisted Learning

The development of computers in the field of education, especially in learning is actually a link from the history of learning technology. The history of learning technology itself is the creation of various experts in related fields, who basically want to strive in realizing practical ideas in applying didactic principles, namely learning that emphasizes individual differences in both ability and speed.

Psychological theories of schooling associated with complete learning *(mastery learning)* with characters such as John B. Carroll, Jerome S. Bruner and Benjamin S. Bloom also very influential on the development of learning technologies. In addition, the framework of reference related to the design or design of learning also helped enliven the development of learning technology which is further used as a reference in the preparation of the frame in developing computer-based learning.

The historical perspective of computer-based learning begins with the emergence of ideas for creating an applied technology tool that enables one to conduct individual learning by applying such didactic principles. In the history of learning technologies we find that the work of Sydney L. Pressey to create or *teaching machine* teaching machine could be recorded as a pioneer in the use of technology in learning.

Pressey considers that this test machine can be used also in teaching and by slightly changing the destination, from the purpose of examining the purpose of teaching the instrument eventually diguankan as well as teaching machines. Unlike the audio-visual media, the computer is an interactive medium, where students have the opportunity to interact in the form of influencing or changing the order presented. As it is the case with the use of audio-visual resources that can enhance motivation and the initiative and present information through visual and audio stimuli, the computer has more value because it can give students kinesthetic experience through the use *of computer keyboards.*

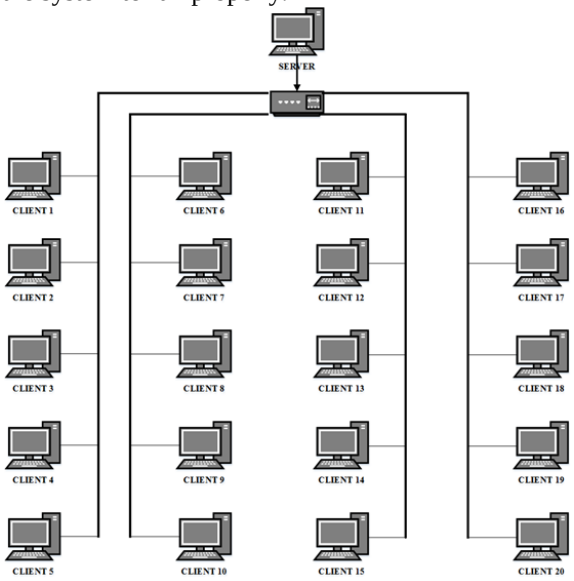
There are three forms of computer use in the classroom, namely:

a. To teach the students be able to read computer or computer literate
b. To teach the basics pemprogramam and computer problem solving, and
c. To serve students as a learning tool.

2.2 Analysis System

2.2.1 Network Architecture

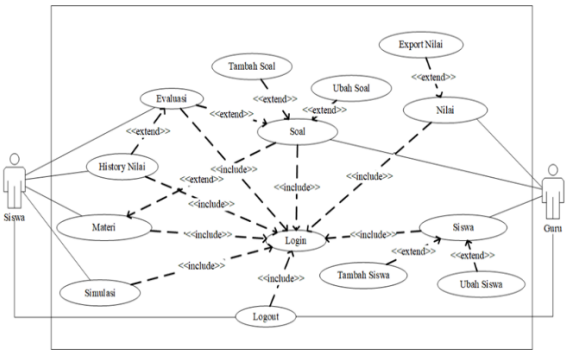
Here is a network architecture that will be built for the system to run properly.



Picture 3 Network Architecture

2.2.2 *Use Case Diagram*

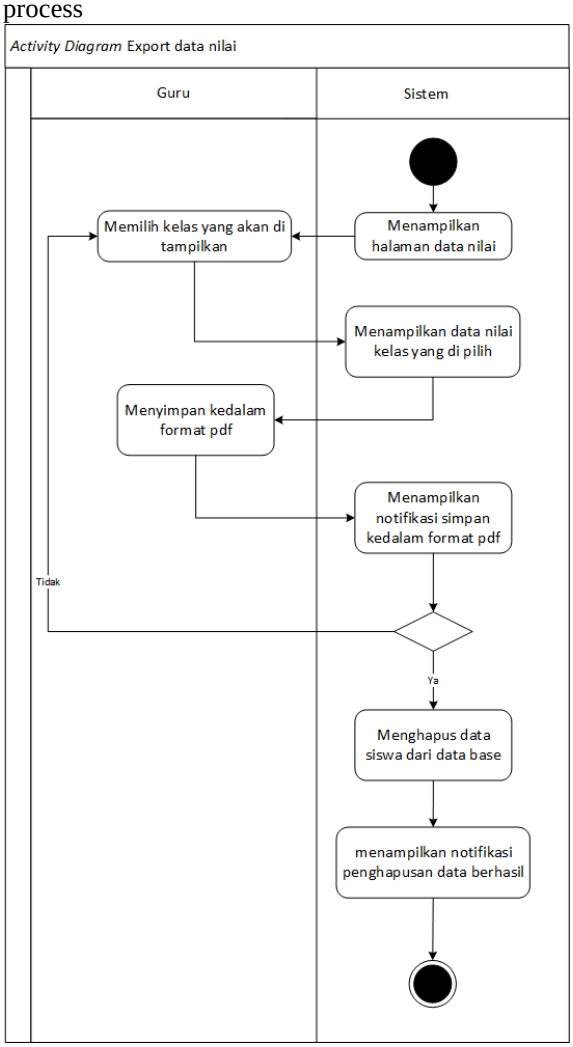
*Use case*or use case diagram is modeling for system behavior to be made. Use case describes an interaction between one or more actors with the information system will be made



Picture 4 Use Case Diagram

2.2.3 *Activity Diagram*

Activity diagram or activity diagram illustrates the workflow or activity of a system or business process



Picture 5 Activity Diagram Export value data

2.2.4 *sequence Diagram*

sequence Diagram, Describing the behavior of objects in use case by describing the life time of the object and the message that is sent and received between objects.

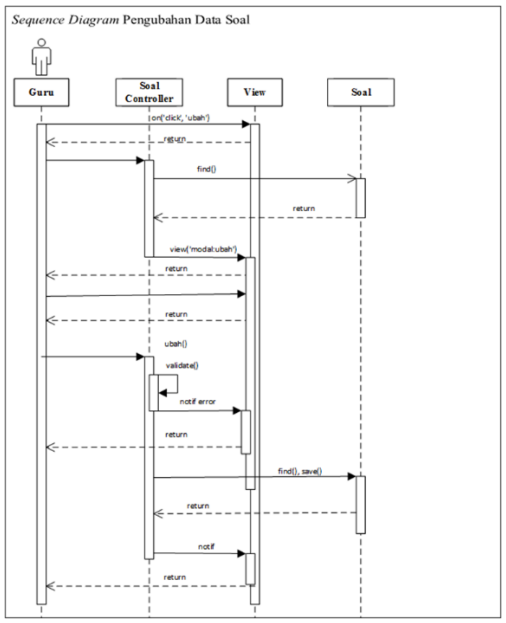


Figure 6 Sequence Diagram Edit the question data

2.2.5 Class Diagram

The class diagram or class diagram illustrates the structure of the system in terms of defining the class - a class that will be created to build the system.

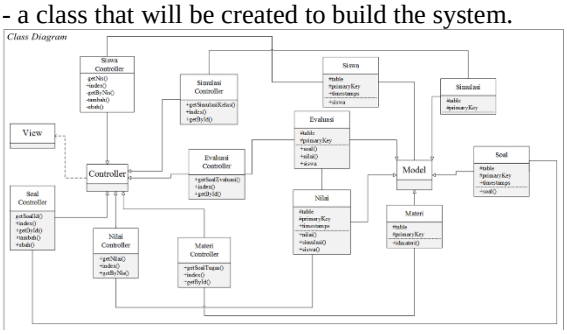


Figure 7 Class Diagram

2.3 Peranca Designing ngan

2.2.6 Struktur Menu

Menu structure is a description of the application usage flow. The design of the menu structure of the application of chemical practicum simulations to be built Teacher Menu Structure

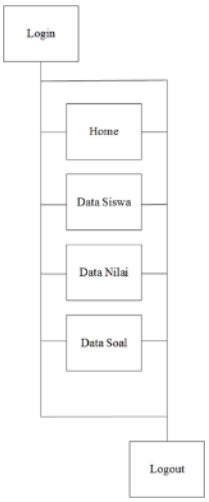


Figure 8 Menu Structure Students

1. Menu Structure Students

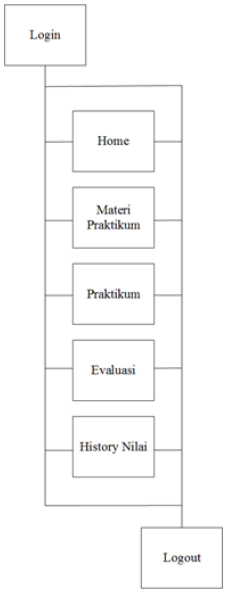


Figure 9 Structure of Student Menu

2.2.7 Diagram Relasi

Relationship diagram is a diagram that explains the realization between tables or entities.

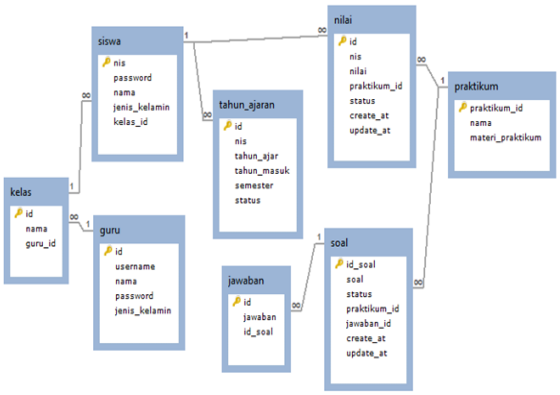


Figure 10 Relationship Diagram

2.2.8 Semantic Network

Semantic network is a picture of graphic knowledge that shows the interrelated relationship between various objects. Here is a semantic network on interface design.

1. Jaringan Semantik Guru

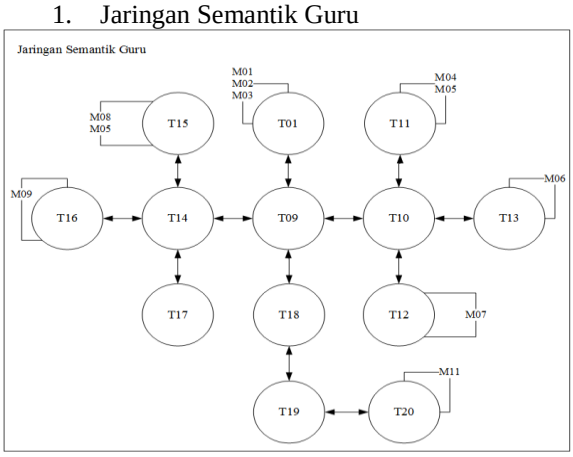


Figure 11 Teacher Semantic Network

2. Students Semantic Network

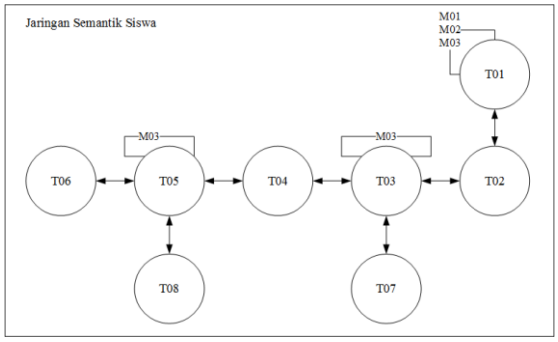


Figure 12 Students Semantic Network

2.4 Implementasi

2.4.1 Screenshot Program

Here are some screenshots taken from programs that have been running.

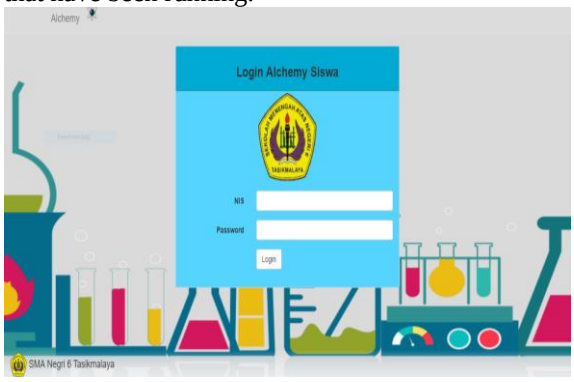


Figure 13 Login Page

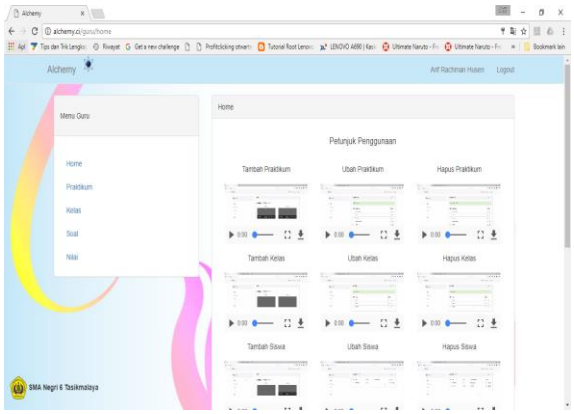


Figure 14 Home Page

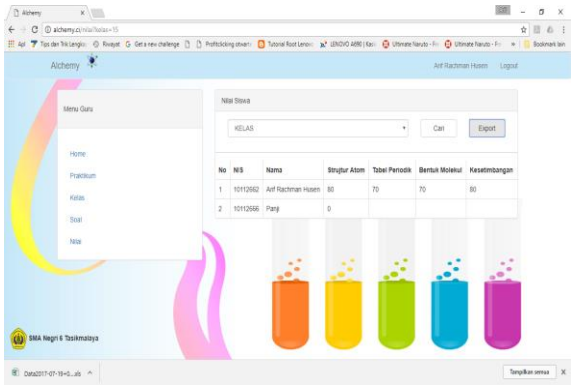


Figure 15 Student Score

2.4.2 Students Semantic Network

Testing the system is the most important thing that aims to find errors or deficiencies in the system being tested. Testing intends to know the system is made to meet the performance in accordance with the design objectives. Testing the system uses black box testing. Black box testing focuses on the functional requirements of the software. Test plan will do is to test the system built by Black Box and Beta

Table 1 Black Box Testing Scenario

No.	Components Tested	Scenario	Type of Testing
1	Login	Enter your username and password	*Black Box*
2	Practicum Material	Select the Practicum Material button	*Black Box*
3	Simulation	Select the Simulation button	*Black Box*
4	Evaluation	Select Evaluation button	*Black Box*
5	Score	Select Score button	*Black Box*
6	Student	Selecting Student button	*Black Box*
7	Add Student	Select add student button	*Black Box*
8	Edit Student	Select edit student button	*Black Box*
9	Question	Select question button	*Black Box*
10	Add Question	Select add question button	*Black Box*
11	Edit Question	Select edit question button	*Black Box*
12	Score	Selecting the score button	*Black Box*
13	Export Score	Memilih tombol Export Nilai	*Black Box*

14	Logout	Select the Logout button	*Black Box*

3. COVER

3.1 Conclusion

Based on the results of research, analysis, system design, implementation and testing, we conclude that the chemistry lab simulation application development are as follows

1. Chemistry lab applications can make the learning process easier to understand.
2. Chemistry lab application can help students take a practical matter that is not implemented.
3. Chemical practicum applications can minimize errors in the lab so that time is used effectively.

3.2 Suggestion

Based on the results of the research, the suggestions that can be put forward for future improvement and consideration are as follows:

1. The addition of simulated lab material..
2. Adding animations and interesting features into the app to make students more interested in learning.
3. Make the simulation a 3 Dimensional view.

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