DEVELOPMENT OF LEARNING INTERACTIVE MEDIA GAS TURBINE ENGINE ON AIRFRAME AND POWERPLANT FOR GRADE XI AT SMK NEGERI 12 BANDUNG

Faqih Pratama L[1] Irawan Afrianto[2]

[1,2]Teknik Informatika – Universitas Komputer Indonesia
Jl. Dipatiukur 112-114 Bandung
E-mail : lazugreen@gmail.com[1] irawan.afrianto@email.unikom.ac.id[2]

ABSTRACT

In the airframe and powerplant program at SMKN 12 Bandung, There is maintenance of gas turbin engine subject for grade XI. According to the interviews, as the teachers of gas turbine engine said in the process of learning theory, the illustrations of the material are not well illustrated. Because the props are limited and off so that the students have trouble in the theory class and practice class. This research to help to produce interactive multimedia applications gas turbine engine that can visualize the working principle of gas turbine engine, overcome props that the students have trouble in the theory class and practice class to learning process, And can be a help students to learn gas turbine engine.

The method of development that used is Sutopo's multimedia development method, also equipped with CAI (Computer Assisted Instruction) interactive learning methods, and CAI Model used consists Tutorial, Simulation, and Drills and Practice. While to know the success, conducting interviews to teachers of gas turbine engine and doing pretest and posttest to students.

Based on the results of interviews with teachers of gas turbine engine declare that the applications built to help teachers to visualize gas turbine engine works and overcome the limitations of props. Then from the pretest and posttest on the 60 students of grade XI getting the pretest and posttest with the results of the percentage increase in the average value of 13.70%, It can be concluded that application helps to improve students' understanding.

Keywords: Learning Interactive Multimedia, Gas Turbine Engine. CAI(Computer Assisted Interaction), Simulation, Airframe and Powerplant.

1. PRELIMINARY

1.1 Background

Vocational Secondary School of State 12 (SMK N 12) Bandung is intermediate school which educates its students to have competence in the field of manufacturing an aircraft that has been accredited by A National Accreditation Body by school/Madrasa. One of the courses offered at this school is a Department of Airframe and Powerplant. On the Airframe and Powerplant vocational, there is a Gas Turbine Engine subjects studied for Class XI. Based on the results of the interview with Mr. Drs. Isbandono as the head of the vocational section of Airframe and Powerplant at the same time as the teacher of a gas turbine engine subjects of Class XI AP says that the learning process in the Department of Airframe and Powerplant has a the two processes of learning theory and practical work, i.e. done in the workshop. On the process of learning theory, the teacher explains to the students about the existing theories in the book include giving illustrations or description. While the study of practices in the workshops of the State of the tools provided and could not be used. Due to the way the teaching of teachers who are still hard so that students understand the conventional subject matter of gas turbine engines. As for the State of the tool can not be used because of the limited props and die so that students often encounter difficulties when conducting practical theory of Gas Turbine Engine at once.

This one way to help teachers in the delivery of this material can be done with memanfaaatkan interactive multimedia technology on Gas Turbine Engine materials. Seen from the percentage value of the students do not meet the criteria of a minimum set by ketuntansan school that is 77. For Class XI AP 1 of 32 students for 3 semesters of 56.3% and 53.1% of 4 semester grades of knowledge/theory is not complete and Class XI AP 2 of 32 students for 3 semesters of 53.1% and 4 semesters of 59.4% the value of knowledge/theory is not complete. Based on the results of respondents percentage of grade XI AP with sample 2 class as much as 67.9% of 60 students having difficulty in understanding the

material of Gas Turbine engines. From previous research regarding Multimedia interactive learning Application-based Autoplay Media Studio 8 at the material a water turbine is very effective for improving student learning outcomes of 85.62% [1]. Computer Learning Media Development (Computer Assisted Instruction) Basic Chinese Grammar (Hanyu Yǔfǎ) for Students of class X in the Madrasah Aliyah Sidoarjo State to address student learning outcomes in the use of basic Chinese grammar, in order to knowing the effectiveness of media CAI basic Chinese grammar, learning outcomes students use learning media with media CAI showed the results of process improvement study of 88.63% [2]. Judging from the results of quisioner on a solution of the media as a means of learning as much as 66.3% of the 60 students need multimedia as learning materials. Starting from the problem above became the basis the author implement interactive learning top Gas Turbine Engine subjects focused on interactive multimedia technology that could provide a new way in the process of teaching and learning. Therefore required more advanced technology to produce an interactive learning process. One of the interaktifnya multimedia technologies give 3D simulation for gas turbine engine subjects.

Solutions that can overcome these problems by using a multimedia interactive learning that can display a picture or illustration regarding the gas turbine engine. Therefore it will be done the research thesis under the title "Development of learning interactive Gas Turbine Engines in the Majors Airframes and Powerplant for Class XI in SMK Negeri Bandung 12".

1.2 Purpose

Based on the problems studied, the purpose of this thesis research is to build development of learning interactive media gas turbine engine on airframe and powerplant for class XI case study at SMK Negeri 12 Bandung.

1.3 Objectives

The objectives to be achieved in this research are:

1. Helped to improve students in understand the working mechanism matter turbine gas engine
2. Helped to the limitations of practical activities to especially tool on the tools practical with visualizing tools.
3. Helped to assist students in increasing the value of the KKM is applied in all schools

2. RESEARCH CONTENTS

2.1 Multimedia

Theory associated with the construction of multimedia learning media of gas turbine engine that is multimedia. Multimedia is the use of computers to present and combine text, sound, images, animation, audio and video with tools and links so users can navigate, interact, work and communicate. Multimedia is often used in the world of informatics. Apart from the world of informatics, multimedia is also adopted by the gaming world, and also to create websites.

Multimedia is also used in education and business. In the world of education, multimedia is used as a medium of instruction, either in the classroom or individually or self-taught. In the business world, multimedia is used as a media company profile, product profile, even as a media kiosk of information and training in e-learning systems [3].

2.2 Learning Media

Theory associated with the development of instructional media gas turbine engine learning media. Learning media is a tool that serves to convey a message. Learning is a process of communication between learners, educators and teaching materials. Communications will not work without the help of messaging or media suggestions. Learning media is physically known as hardware or hardware, which in this case is defined as an object that can be seen, heard or touched with the five senses of man. In non-physical, learning media is known as software or software that the content of messages contained in the hardware is the content delivered to students.

2.3 Analysis of the Problem

In this section will be explained about the problems that arise at the time of research at SMKN 12 Bandung, before building the application of learning media gas turbine engine. Based on the background that has been discussed, there are several problems:

1. Students difficult to understand subject matter of gas turbine engine due to the method of the teacher just gave a little picture or illustration.
2. State of the tool can not be used to result in difficult students in understanding the workings of a gas turbine engine the subject matter.
3. Shiva is still not a lot to reach the value of minimum graduation criteria (KKM) applied by the school.

2.4 Analysis of Its Ongoing

The analysis of procedures is an activity of analyzing the work steps and the documents that run in the steps. Based on the analysis conducted there are three procedures relating to this instructional media that is the learning implementation procedures, the procedures for the implementation of the practicum, and evaluation implementation procedures.

2.4.1 Learning procedures

Learning procedures that run the learning described in the form of BPMN diagram in Figure 1. The learning procedures include:

1. The initial activity the teacher provides information on the objectives to be achieved in the implementation of learning.
2. Students pay attention, respond to, and asked about the objectives to be achieved.
3. If there are no questions, the teacher gives apersepsi and questions to measure the student's knowledge of the material to be delivered.
4. Students answer the questions provided by the teacher.
5. After that go to the core activities, the teacher delivering the material to the students in the class.
6. At the time of the material presented, students are allowed to ask.
7. If none of these questions, then the teacher continued delivery of material to completion.
8. Once the material is completed then go to the end of the activities in which teachers will develop exercises in accordance with the material being taught.
9. Then the teacher holding exercises by appointing some students directly and asking questions.
10. Students answer the questions correctly then the teacher will assess the students.
11. If students have not quite understand, the teacher will explain the material back.
12. Learning is completed.

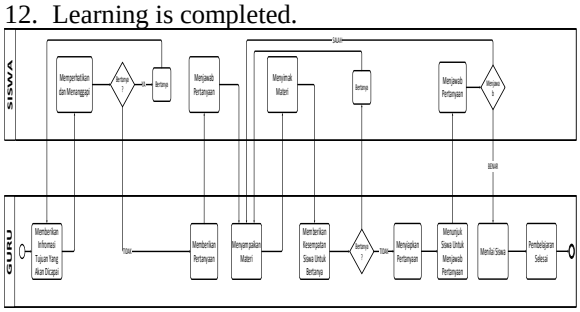


Figure 1 BPMN Learning Procedure

2.4.2 Practical Implementation Procedures

After students understand the subject matter then the students will continue the learning by doing the lab. The procedure practicum activities described on the BPMN diagram in Figure 2. Activities undertaken in the procedure of practicum activities are:

1. Teachers divide students into groups with random methods.
2. Then the teacher gives the jobheet that will be done by the student, and explain the jobheet.
3. Then give the opportunity to ask the students, if there is no question then the teacher guides students to carry out practicum activities.
4. Students carry out practicum activities according to the given jobheet.
5. After all students finish the practicum then the students make a report of the results of practice and give a report practicum to the teacher.
6. The teacher makes the final conclusion of the lesson.
7. The teacher then scores the student practicum report and records the score, combining the value with the value of another practicum.

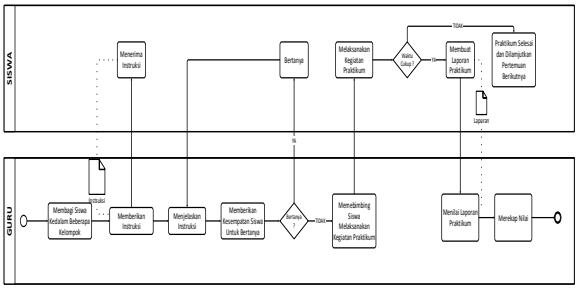


Figure 2 BPMN Diagram Practical Implementation Procedures

2.4.3 Evaluation Procedures

Implementation procedures that run the evaluation described in the form of BPMN diagram in Figure 3. The evaluation procedures include:

1. After the material and the time of learning is complete the teacher will give an evaluation to the students to know the ability of students.
2. Students do the evaluation questions given by teacher s.
3. After answering all the questions the students give answers from the question of evaluation to the teacher.
4 . The teacher conducts the examination and gives the value to the answers given by the students from the evaluation question.
5. After checking the answers of the students, the teacher returns the student answers to the students.
6. Student evaluation result sheets are stored to be combined with other evaluation results.

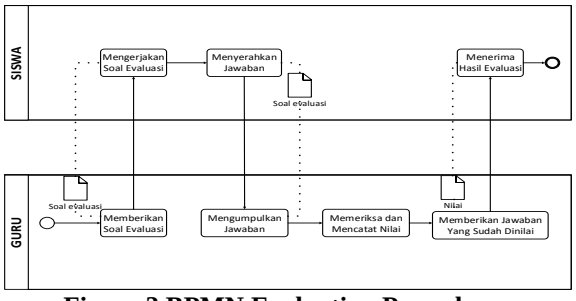


Figure 3 BPMN Evaluation Procedures

2.5 Analysis Of The Business Model After The Application Was Built

Analysis of the business model after the application is built is the analysis of new procedures that will be implemented when the learning media

applications already built and applied SMKN 12 Bandung. Analysis of the application after the procedure then generates the learning steps recently, evaluation procedures, diataranya procedures, practical and procedural learning.

2.5.1 Learning procedures After The Application Was Built

The learning procedure after the application is built in the shape of BPMN is depicted in Figure 4. Activities conducted at the learning procedure covers.

1. Initial Activities teachers instruct students to open the application.
2. Students open media applications of learning.
3. Student Learning and understanding the materials provided on the application.
4. The teacher gives the opportunity to the rest of the question.
5. When no one asked, then teachers finish learning.

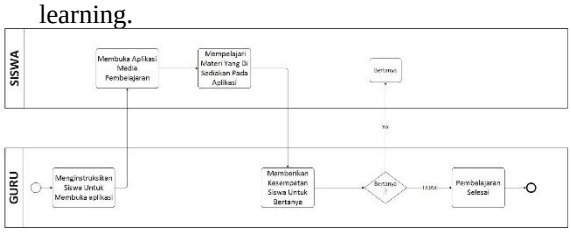


Figure 4 Learning Procedure After The Application Was Built

2.5.2 Practical Implementation Procedures After The Application Was Built

Practical procedure after the application is built in the shape of BPMN are depicted in Figure 5. Activities performed include teaching on the procedures.

1. Initial Activities teachers instruct students to open the application.
2. Students open media applications of learning.
3. Teachers instruct students to learn learning material.
4. The teacher guides the students to perform the simulation.
5. Students doing the simulation on medium of instruction.
6. Learning is complete.

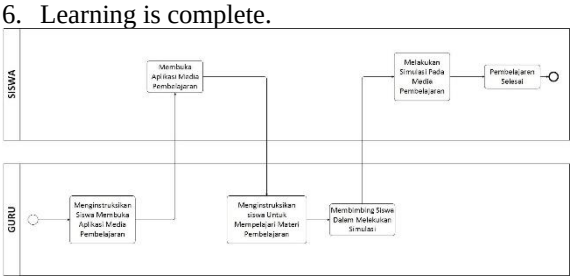


Figure 5 Practical Procedure After The Application Was Built

2.5.3 Evaluation Procedures After The Application Was Built

Evaluation procedure after the application is built in the shape of BPMN is described in Figure 6. Activities conducted at the learning procedure covers.

1. Initial teacher megarahkan Activities students select evaluation.
2. Students working on an evaluation that has been provided in the application of learning media.
3. Students submit evaluation results to the teacher through the application.
4. Teachers receive the results of the evaluation of the students who have been diselsaikan.
5. The Data values will be saved automatically secar out into the database master.

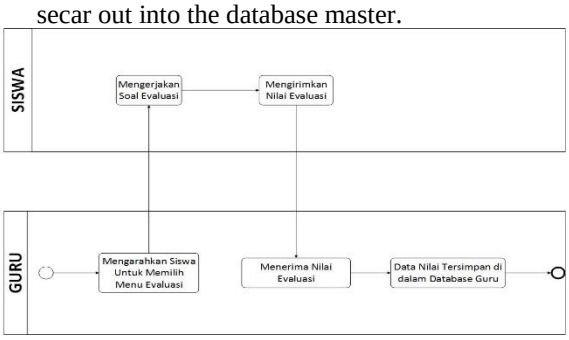


Figure 6 Evaluation Procedure After The Application Was Built

2.6 Analysis of Application of Learning Built

Analysis of learning media that is built is a learning medium that contains learning materials gas class XI SMKN 12 Bandung. The main purpose of this learning media is to assist students in understanding the components and the working principles of gas turbine engine, parts of gas turbine engine, gas turbine engine and the mechanism of operation of auxiliary power units.

The built system has two applications: frontend and backend. Here is an overview of the application system of instructional media gas turbine engine to be built.

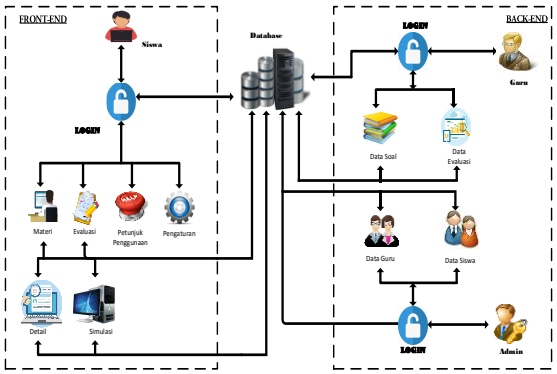


Figure 4 General Architecture Application

2.7 Description Learning Media gas turbine engine

Interactive multimedia multimedia application of XI SMKN 12 Bandung is a desktop-based learning media, describing the components

and working principles ranging from charging system, ignition system, lighting system, to starter system in accordance with the technical curriculum of SMKN 12 Bandung.

There are four main parts of this application: material, evaluation, user manual and settings:

1. Material delivered is the material the working principle of gas turbine engine, Engine Performance, parts of gas turbine engines, Bearings and Seals, Engine Indication/tools indicators, Mechanisms of Gas turbine engines, Auxiliary Power units, Powerplant Installation, Engine Storage and Preservation, Maintenance and Turbine engines. The material selected will display a form of simulation exercises and simulation of gas turbine engine working principle, parts of gas turbine engine, gas turbine engine and the mechanism of operation of auxiliary power units.
2. Evaluation that is built is the exercise questions of the material and simulation given.
3. Instructions for use of the application.
4. Application settings are the settings to adjust the sound and screen size of multimedia applications.

2.8 Analysis of Interactive Learning Method

The learning method used can affect the success of the learning process, of course, need to be supported using appropriate media so that learning objectives can be achieved. The learning method used in the development of this application is a method of CAI (Computer Assisted Instruction). The concept used in gas turbine engine instructional media is the concept Tutorial, Simulation, and Drill and practice.

2.8.1 Tutorial Model

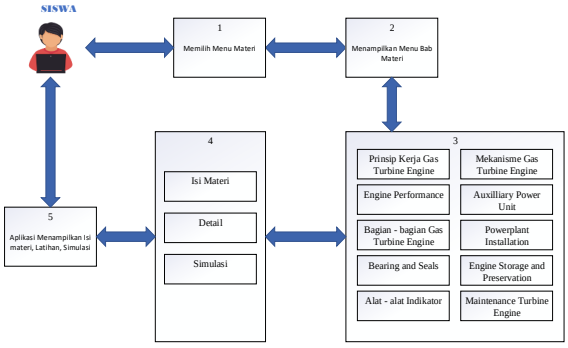


Figure 5 Tutorial Model

From the picture above, the flow of material delivery of instructional media application that was built is as follows:

1. In the multimedia applications of gas turbine engine students select menu material.
2. The application will display a menu chapter 10 that the material the working principle of gas turbine engines, Engine parts, Performance of gas turbine engines, Bearings and Seals, Engine Indication/tools indicators, Mechanisms of Gas turbine engines, Auxiliary Power units, the Powerplant Installation, Engine Storage and Preservation, Maintenance and Turbine engines.
3. Then students choose one of the chapters of the material.
4. The application displays a sub menu explanations, component, video, and simulation. Sub-menu explanation chapter contains explanations material according to previously selected material in the form of text, images and animations. Sub menu component corresponding chapter contains an explanation of components previously selected material in the form of images and text. Sub menu video contains video material related to the previously selected chapter. Sub menu simulation simulation according chapters contain material previously selected. Then students choose one of the sub menus.
5. The application will display the contents of the selected sub-menu.

2.8.2 Simulation Model

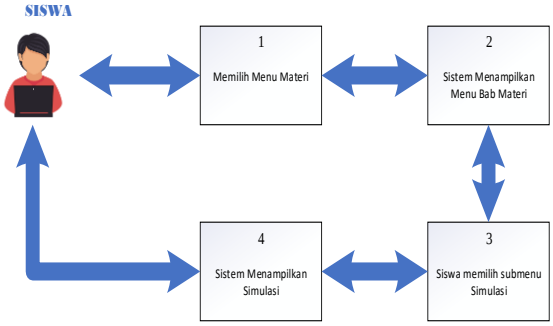


Figure 6 Simulation Model

From the picture above, the flow simulation of instructional media application that was built is as follows:

1. In the multimedia applications of gas turbine engine students select menu material.
2. The application will display a menu chapter 4 that the material the working principle of gas turbine engines, parts of gas turbine engine, gas turbine engine and auxiliary power unit pengoperasioan. Then students choose one of the chapters of the material.
3. Then students select a sub menu simulation.
4. The application will display a simulation to simulation concepts are described in the storyboard.

2.8.3 Drill and Practice Model

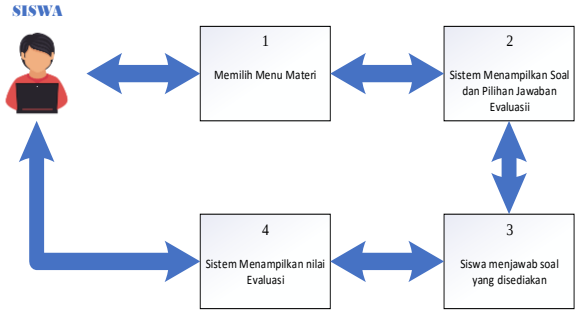


Figure 7 Drill and Practice Model

From the picture above, the grooves evaluation of instructional media application that was built is as follows:

1. In the multimedia applications of gas turbine engine students select menu evaluation.
2. Report on the application and evaluation of answer options in the form of *multiple choice* (multiple choice).
3. Then students answer all evaluation questions given.
4. If the students answer all evaluation questions, this application will give a response to the actions of the students in the evaluation. Rate shaped values will appear after answering the questions provided. If the results of the evaluation of students is less than KKM is specified, then the student is allowed to repeat to exceed the specified KKM.

2.9 Use Case Diagram

Use case diagram illustrates the process of each running procedure contained in the application of learning media gas turbine engine. Use case diagram application of instructional media of gas turbine engine, can be seen in Figure 8.

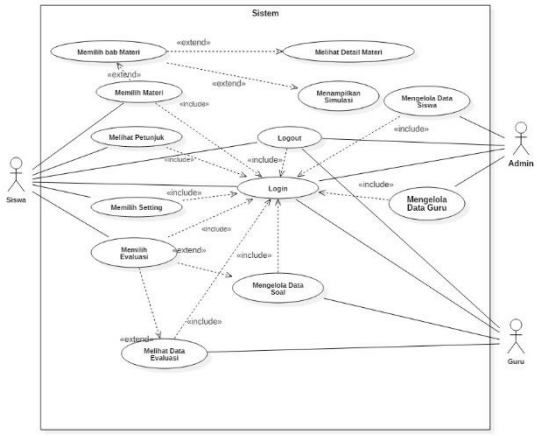


Figure 8 Use Case Diagram Frontend

2.10 System Testing

System testing is the most important thing to do to find flaws and errors in the software being tested. The test is intended to determine the software that created already meet the appropriate criteria.

In this study the tests performed on the system that is testing alpha(blackbox) and beta (questionnaires, interviews, posttest and pretest).

2.10.1 Blackbox Testing

Cases and test results contain the exposure of test plans that were prepared in the test scenario. The test is performed by *blackbox* by only taking into account input into the application and the output of the feedback. Based on the test plan, it can be tested *blackbox* on the application as follows:

Table 1 Blackbox Test Frontend

No	Data Masukan	Hasil yang Diharapkan	Pengamatan	Hasil Pengujian
1	**Login Siswa**			
	Data Benar NIS : 20167673 Kata Sandi : 20167673	*Field* data NIS dan Kata sandi dapat diisi	*Field* data NIS dan Kata sandi dapat diisi	[√]Diterima [ ]Ditolak
	Data Salah NIS : (kosong) Kata Sandi : (kosong)	Menampilkan pesan NIS atau Kata sandi salah	Menampilkan pesan NIS atau Kata sandi salah	[√]Diterima [ ]Ditolak

Table 2 Pengujian Blackbox Backend

No	Data Masukan	Hasil yang Diharapkan	Pengamatan	Hasil Pengujian
1	**Melakukan login**			
	Data Benar *Username* : admin *Password* : admin	*Field* data *username* dan *password* dapat diisi	*Field* data *username* dan *password* dapat diisi	[√]Diterima [ ]Ditolak
	Data Salah *Username* : (kosong) *Password* : (kosong)	Menampilkan pesan username atau password salah	Menampilkan pesan username atau password salah	[√]Diterima [ ]Ditolak
2	**Halaman tambah data siswa**			
	Data Benar NIS : 20167673 Nama : Akbar ramadhan *Password* : 20167673 Kelas : XI AP 1	Data siswa berhasil ditambah. Menampilkan pesan "Data siswa berhasil ditambah".	Menampilkan pesan berhasil	[√]Diterima [ ]Ditolak
	Data Salah NIS : (kosong) Nama : (kosong) *Password* : (kosong) Kelas : (kosong)	Data siswa gagal ditambah. Menampilkan pesan "Data siswa gagal ditambah"	Menampilkan pesan gagal	[√]Diterima [ ]Ditolak
	Memilih tombol cancel	Menampilkan menu data siswa	Menampilkan menu data siswa	[√]Diterima [ ]Ditolak
3	**Halaman tambah data soal**			
	Data Benar Soal : Termasuk	Data soal berhasil ditambah.	Menampilkan pesan berhasil	[√]Diterima [ ]Ditolak

No	Data Masukan	Hasil yang Diharapkan	Pengamatan	Hasil Pengujian
	Jenis Motor Turbin apakah gambar dibawah ? Gambar : turbin.jpg Opsi a : Motor TurboJet Opsi b : Motor Rotor Turbin Opsi c : Motor Turbio Propeller Opsi d : Motor Turbo Fan. Opsi e : Motor Turbo Shaft mesin. Jawaban : C	Menampilkan pesan "Data soal berhasil ditambah".		
	Data Salah Soal : (kosong) Gambar : (kosong) Opsi a : (kosong) Opsi b : (kosong) Opsi c : (kosong) Opsi d : (kosong) Opsi e : (kosong) Jawaban : (kosong)	Data soal gagal ditambah. Menampilkan pesan "Data soal gagal ditambah"	Menampilkan pesan gagal	[√]Diterima [ ]Ditolak
	Memilih tombol cancel	Menampilkan menu data soal	Menampilkan menu data soal	[√]Diterima [ ]Ditolak

Conclusion oftesting *alpha (blackbox)* conducted on application gas turbine engine learning to class XI found that interactive learning application that is built has been running as expected both in terms of *alpha* testing.

2.10.2 Testing With Questionnaire

Questionnaires were given to 60 students as frontend application users. Data from the questionnaire will be processed by using Likert scale. Here is the scale of the assessment of the answers of each question given to students of gas turbine engine SMKN 12 Bandung by using Likert scale can be seen in Table 1.

Table 3 Questionnaire Answer Scale

Answer	Score
Strongly Agree	5
Agreed	4
Simply Agree	3
Less Agree	2
Disagree	1

The following are the questions asked to the respondent:

1. Is the presentation of images, animation and video on this application can already visualize the gas turbine engine compared with the book?
2. Is the narrative of the delivery of the material sounded clear?
3. Does the simulation in this application make you understand gas turbine engine system?
4. Is the simulation contained in this application is in accordance with the actual situation?
5. Do the instructions provided facilitate the use of the application?
6. Is the use of language in this application easy to understand?
7. Is navigation or button placement in this application easy to understand and use?
8. Is the application display design, letter selection, and color clear and appropriate?

Here are the individual results of the calculation of the answers that have been calculated.

Table 4 Questioner Results

Pertanyaan	Persentase
1	83.67 %
2	85.33 %
3	78.67 %
4	83.67 %
5	91.33 %
6	81.33 %
7	78.33 %
8	77.67 %

2.10.3 Testing With Interviews

Interviews conducted by SMKN 12 Bandung teachers Drs. Isbandono, ST regarding the results and observations on the application of interactive learning media gas turbine engine, resulting in the following interview:

1. What are the application of gas turbine engines it can enhance understanding of students against material gas turbine engine?
   Answer: Simulations made have been represented as props and simulation on gas turbine engine subjects in class.
2. What media interactive learning gas turbine engine in accordance with the taught?
   Answer: is in compliance with, having been taught include aspects of the matter of gas turbine engines.
3. Is the gas turbine engine learning media it can already visualize the working principle of gas turbine engine?
4. Answer: gas turbine engine learning Media is appropriate and can already visualize the working principles of gas turbine engines, as

it already covers aspects – aspects of the existing system of gas turbine engines.

5. Is the gas turbine engine learning media is able to overcome the limited props on learning theory?
   Answer: the simulation is made can help overcome the limitations of the props, the props are there dead and limited by the existence of this simulation can help learning theory and can represent the props are limited, so that students can understand about the working principle of gas turbine engines.
6. Is the application of gas turbine engine interactive learning can be media aid student learning and increase student interest?
   Answer: this Media is very helpful against the interest of the students, because students are now more able to understand when learning digitally and automatically increase also helped the students to be more interested in learning more about gas turbine engines.

2.10.4 Pretest and Posttest

Pretest and posttest is a test given to students of class X SMK International craft to measure the success of media that is built in to help students to improve understanding of the material presented. Samples taken as many as 60 people from two class. In testing the pretest and posttest.

Here are the results from the increase in the value of pretest and posttest can be seen in Table 5.

Table 5 Hasil Pretest dan Posttest

Materi	Rata-rata *pretest*	Rata-rata *posttest*	Hasil Nilai	Hasil (%)
System *Gas turbine engine*	74.17	84.33	10	13.70%

Conclusion of the test results beta (questionnaires, interviews, *pretest* and *posttest)* are performed on the gas turbine engine learning application for grade XI found that interactive learning application that is built has been running as expected both in terms of beta testing.

3. CLOSING

3.1 Conclusions

Based on the results of the implementation and testing system performed, then the conclusion of the final project entitled "Development of Learning Interactive Media Gas Turbine Engine on Airframe and Powerplant for Students Class XI At SMKN 12 Bandung" is as follows:

1. Multimedia Applications as a medium for gas turbine engine Learning that has been developed to simulate the engine turbines and turbine components into digital form to help students.
2. Multimedia Applications as a medium for gas turbine engine Learning which has been built up can overcome problems that limited props and died by the time the learning process theory while simultaneously teaching to reduce the difficulty students in understanding how gas turbine engine materials work.
3. Make gas turbine engine multimedia applications as tools the students of Class XI in increasing understanding of the subject matter of a gas turbine engine. It is inferred based on the results of a pretest and posttest given to 60 students with the results of the percentage increase in the average value of 13.70%.

3.2 Advice

In the development of learning interactive media gas turbine engine on airframe and powerplant for class XI students at SMKN 12 Bandung there are some shortcomings. Suggestions for the development of this learning media interactive for the future are as follows:

1. Interactive multimedia application this gas turbine engine could be developed again so that the teacher may revise its way of delivering material by uploading material in the form of a video.
2. Simulation on this application can be added to the evaluation.
3. In the section on evaluation can be used problem-problem-solving or problem solving.

BIBLIOGRAPHY

[1] Moh. Latif Risyda Shubhi1, Widiyanti, dan Yoto, “Pengembangan Media Pembelajaran Interaktif Berbasis Aplikasi Autoplay Media Studio 8 Pada Materi Turbin Air Program Keahlian Teknik Pemesinan Kelas X di SMK Nasional Malang," Jurnal Pendidikan Profesional, vol.4, 2015.

[2] I. Sofyana dan Dr. B. S. Bachri, M.Pd, "Pengembangan Media Komputer Pembelajaran (Computer Assisted Instruction) Tata Bahasa Mandarin Dasar (Hanyu Yǔfǎ) Untuk Siswa Kelas X Di Madrasah Aliyah Negeri Sidoarjo," Jurnal Pendidikan, vol. 1, 2014.

[3] Ariesto Hadi Sutopo, Multimedia Interaktif dengan Flash. Yogyakarta: Graha Ilmu, 2003.