# INTERACTIVE MULTIMEDIA HOW TO INSTALLING PROPELLER SHAFT AND DIFFERENTIAL ON CAR TYPES KIJANG 5K

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**ABSTRACT**

SMK Bintara Rancaekek has a prepared skill in *Teknik Kendaraan Ringan (TKR).* The method of teaching that used for it is divided into two. There are theories and practical works. Based on the interview, questionnaire, and observation, it is found that in class XI, the difficulties to understand the material of practical work about energy transfer system due to lack of visual form to explain it. Besides that, the lack of space and the availability of tools which are limited made the learning process is not optimal. The tools which are needed to be in the workshop are *propeller shaft* and *differential,* so that the students need an application which can solve the problem. The application that should be made has to be in the form of interactive multimedia that utilizing computer laboratory to explain and to visualize the form of *propeller shaft* and *differential* into the 3D object so that the students can be more understand about these two components. The existence of simulation features can help the students and the teachers in explaining the method of installing these components. From the test, the results of the test and the questionnaires shared to the students who used the application show that the application can help the students in understanding the material. Besides that, the results of the interviews to the teachers on duty clarify that the teachers believe that the application help them a lot in explaining the material.

Keywords : *Teknik Kendaran Ringan, Propeller Shaft, Differential, Multimedia, 3D, Simulation.*

## 1. INTRODUCTION

SMK Bintara Rancaekek is a school that has four majors an having an A for the accreditation score. One of the major that has the most interested for the students is teknik kendaraan ringan (TKR). In the TKR, there are a lot of subjects and one of them is about the transferring energy system.

The transferring car energy system with back wheel of the car (*front engine rear drive*) is a subject that is going to be learned by the students start from class of X, XI, and XII. The most important thing is this subject has a purpose in explaining the procedures on how the energy produced by the machine (*engine*) can be transferred to the activator of the wheel so that the back wheel can be revolve.

The components that can be mixed up into the process of transferring energy from *engine* to the wheels, the components are called *propeller shaft* and *differential.*

*Propeller shaft* has a function to transfer the energy from the transmission to the differential part, *propeller shaft* is made of steel pipe that is made in such a manner in order to transfer the energy softly without any influence of the changes of position of the *differential* towards the transmission, therefore, in every corner of the *propeller shaft,* the *universal joint* is being installed to absorb the changes of angle from suspension [1].

However, the *differential* has a function to adjust the rotation of the left-wheel and right-wheel (activator wheel) at the moment the car is taking a turn or if the left-wheel and right-wheel is in the unstable condition, for example when one of the revolving wheel is in a muddy road. If the left-wheel and right-wheel are rotating with the same rotation when the car is taking a turn, or in the muddy road, one of the wheel is going to be slip, and can affect the wheel that can quickly worn-out[1].

In this subject of transferring energy system, the students are expected to understand the theories and can be applied when there is a practical work. It starts from the work principle, functions, and the procedures in installing and uninstalling each component.

Based on the interview with Mister Asep Rusli, S.Pd as a Head of TKR program in SMK

Bintara Rancaekek, he stated that the learning process of this subject is still using the module, pictures, and *power point* to convey the material. Next, after the students have receive all of the theories and understand enough in understanding the theories, there are going to be a practical work in the workshop, to found out whether the students are truly understand the material or not. Due to the limited of space and the tools of the practical work used by the students, the teacher is dividing the students into group of four to enter the workshop. The students who are less understand the material, when they are doing the practical work, they join and create another group and has a long time in taking his/her turn in doing a practical work, This thing made the time is not efficient, and also made the components in a damaged condition because one of the procedure in installing the application is not properly done and students tend not to give attention to the teacher when the teacher is explaining the material.

Based on the results of the observation, SMK Bintara Rancaekek has a computer laboratory that can be used as a tool in delivering the material in the more interactive way, so that the students can be more understand and finding out the shape of the components that is in the workshop. Besides that, it can be optimize the time because the students that have not get their turn to enter the workshop for the practical work can learn the components using the computer before the practical work is done so that the students can be more understand in comprehending the material that is going to be done.

Based on the questionnaire given to the 30 students of class XI, it showed that 50% of students are having difficulties in receiving the introduction to the components due to the module as a media of teaching. It is also because the students are having difficulties in describing the shape of the components based on only pictures and 55,3% of the students are expecting a different media in delivering the material so that the method of teaching can be more interesting and hopefully can help the students in understanding the material given by the teachers.

Therefore, the solution in solving these problem is to make an application of interactive multimedia with a simulation application that can describe the procedures of installing the component in a very obvious way as if it is a real things or components with the most easiest way in delivering the theories so that it can be more effective and more interactive. The application is expected to have helped the students in understanding the theories and solving the problem that can be happening in practical work and hopefully can helped the teachers in delivering the theories and also help the students in understanding the theories in the more effective and interactive way in the shape of 3D components so that it can motivate the students in learning process and minimalize the damaged that can be happening in the workshop before they do the practical work in the workshop.

## 2. CONTENT

### 2.1 The analysis of problem in the research location

The teaching method in SMK Bintara Rancaekek is using two kind of method namely theories and practical works, the teachers teach the theories for students in class using modules, pictures, and *power point* slide to deliver the learning material to the students. In the case of delivering the material, teachers are tend to speak in front of the class, writing the material on the blackboard while for the practical work, the material that is given in the class can be implemented directly to the devices or tools. However, because of the limited space and limited tools in the workshop, the practical work process is still not optimal. For example, on the tool called *propeller shaft* and *differential*/ The school has only one tool for it and the students seem to have difficulties in visualizing the components of *propeller shaft* and *differential* by seeing the pictures from modules only, this can be effected the student entirely due to the lack of understanding the procedures of the tools. The identification of the problem can be seen as follows:

a. The students are having difficulties in understanding the material which are given by the teachers through only modules, pictures, and power point slide.
b. The lack of space and tools or devices made it difficult to have learning process done so well.

### 2.2 The analysis of the Data in making the application.

The data analysis in this process can be describe by what kind of data can be used in making this application. The data used are the results of the collection of the data that has been done before by collecting some literature studies, observation, interviews, and questionnaires. The following are the dara that

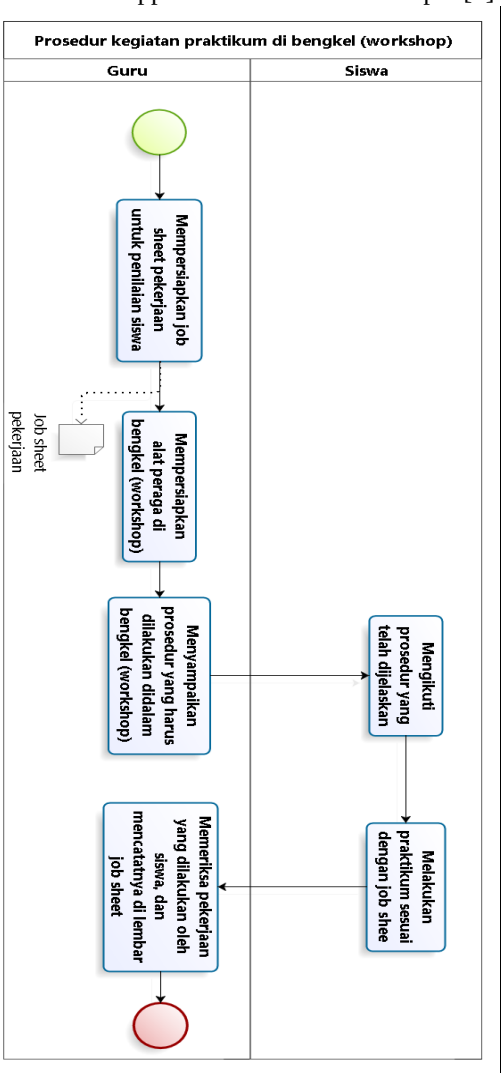
has been collected as a reference in making the application that can be seen in table 1.

**Table 1 The Data analysis in making the application**

| No | Sources | The Data collection |
|---|---|---|
| 1 | Observation | **Determining the type of application that would be made.** The application that would be made is based on the desktop because the results of the observation is a supporting factor that is exist in SMK Bintara Rancaekek which means that the school has the computer laboratory that can be used in the learning process by using computer. |
| 2 | Interviews | **Determining the problem that is happening through the research.** From the results of interviews with the teachers and the students, the researchers got the problem which is happening in the location and searching for the solution to solve the problem. |
| 3 | Questionnaire | **Consolidating the problem happening in the location of the research and using it as a test process.** The Data from the questionnaire used to consolidate the problem that is happening while doing the interview, after that, the researcher took the data that is going to be processed using statistical feature by using likert scale to find out whether the application is working or not. |
| 4 | Study Of Literature | **The materials used in making the application. What materials are used in application development.** Studying the theories used in making the application that would be made while the determining process can be a solution in learning process. |

## 2.3 The Procedures Analysis that is happening in the research location

The activities of practical work in SMK Bintara Rancaekek were made and became an *Notasi* called BPMN (*Business Process Modeling Notasi*) to facilitate the business processed happens in the workshop [2].




**Picture 1 the plot of BPMN activities in the workshop**

The detail explanation on the plot of BPMN in practical works activities in a workshop:

- The teacher was preparing the job sheet that should be done by the students as a assessment while doing the practical work.
- The teacher is using the devices that is going to be used by the students in the workshop.
- The teacher is explaining the procedures that should be done in the workshop.
- The students are following the procedures.
- The students are doing the practical work based on their job sheet.
- The teacher is investigating the students work on the job sheet.

**2.4 The supporting factors that would be made**

The supporting factor is done by using the interactive multimedia in SMK Bintara Rancaekek in implementing the application later. SMK Bintara Rancaekek has 27 unit of computer in computer laboratory with enough specification of hardware so that it can be used in learning process which needs computer support.

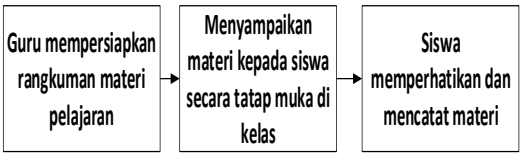
**2.5 The demotivating application that would be made**

The demotivating factor in using interactive multimedia in SMK Bintara Rancaekek is the readiness of the teacher in using the multimedia-based application and also the readiness of the students in receiving the learning process by using multimedia-based application. It is happening because the teacher is not familiar with the technology using multimedia-based application.

**2.6 The analysis of Tutorial mode on the application that would be made**

This model is an interaction form that has the purpose to deliver information which is done by using tutorial mode by giving information as a concept served as texts, pictures, videos, or animation.

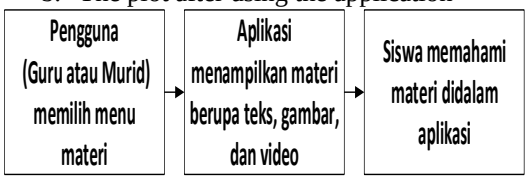
a. The plot in learning process before using the application




**Picture 2 The plot of delivering the material before using the application**

- The teacher is preparing the summary from the book and internet, and served it in the form of power point slide.
- The teacher is delivering the material to the students in front of the class.
- The teacher is giving attention and taking notes of the material for practical work material.

b. The plot after using the application



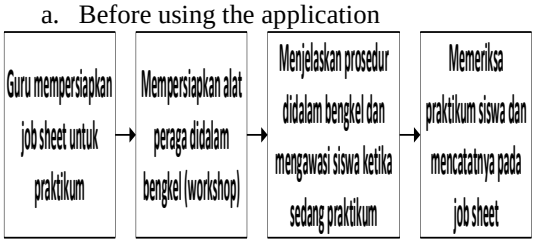

**Picture 3 The plot in delivering the material after using the application**

- The teacher is giving instruction to the students in using computer-based application in computer laboratory. Besides that, the teacher can explain the material in front of the class using the application.
- The application is showing the material in the form of texts, pictures, and video.
- The user comprehends the material served in the application, the teacher as an instructor and the students can follow the material explained by the teacher.

**2.7 The analysis of simulation model on the application that would be made**

This model aims to give the experiences for the used to do the research about the activities in the real world which is formed in the form of simulation. It made the users experiences more before they are experiencing the real world [3].

a. Before using the application

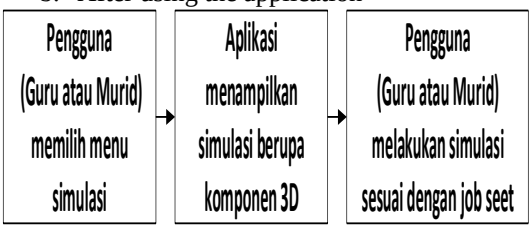



**Picture 4 The plot of practical work before using application**

- The teacher is preparing the job sheet in the practical activities to take notes the students who can do the practical work or not.

- The teacher is preparing the tools or devices used for the practical work.
- The teacher explains the procedures that should be followed by the students in the workshop and giving attention while the practical work is still going.
- When the time for the practical work finished, the teacher checked the results of the practical works and make sure whether the practical work is similar with the job sheet or not.

b. After using the application



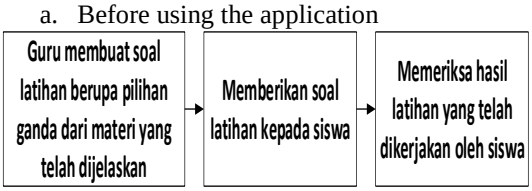

**Picture 5 The plot of practical work after using the application**

- The teacher is directing the students in using computer-based application in the computer laboratory.
- The application shows the simulation in the form of 3D component.
- The user is doing the simulation with following the procedures and steps served in the application.

### 2.8 The Analysis of Drill Model and Practical work

This model aims to test the users so that they would be more understand the material delivered with the collection of questions for exercise that should be answered by the users to measure the comprehension about the material explained to the students[3].

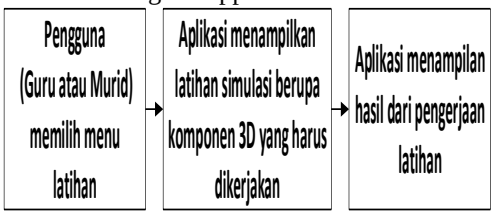
a. Before using the application




**Picture 6 the plot of exercising before using the application**

- The teacher made questions for exercising in the form of multiple-choice question from the material explained either in the class or in the workshop.
- The teacher is giving the questions to the students in from of the class to be done by the students.
- The teacher is investigating the results of the test and giving scores to the students and giving the questions again to the students.

b. After using the application




**Picture 7 The plot of exercising after using the application**

- The teacher directs the students to use the computer-based application in the computer laboratory.
- The application shows the simulation exercise in the form of 3D component that should be done by the students.
- The application shows the results of the exercise and the results of the exercise can be used by the teacher to give scores to the students.

### 2.9 The Analysis of requirements of the hardware

The analysis of the requirements of the hardware aims to check the application so that the application can be done in the hardware which are appropriate for the learning process.

**Table 2 The specification of hardware in Computer laboratory in SMK Bintara Rancaekek**

| Number | Hardware | Specification |
|---|---|---|
| 1 | Processor | AMD A-4 6300 APU 3.7GHz |
| 2 | Screen | LG with 1366 x 768 resolution |
| 3 | Graphic Card | 1 GB |
| 4 | Hard disk | 160 GB |
| 5 | Memory | 2 GB |
| 6 | Mouse | Standard |
| 7 | Keyboard | Standard |

**Table 3 The minimum specification of the hardware**

| No | Hardware | Specification |
|---|---|---|
| 1 | Processor | Intel Core 2 duo E4400 |
| 2 | Screen | Standard with 1280 x 720 resolution |
| 3 | Graphic Card | 1 GB |
| 4 | Hard disk | 40 GB |
| 5 | Storage | Free Space (2 GB) |
| 6 | Memory | 512 MB |
| 7 | Mouse | Standard |
| 8 | Keyboard | Standard |

### 2.10 The analysis of requirements of the software

The analysis of requirements of the software aims to support the application when it is working. The software is going to interact with the hardware so that the analysis of the software is done in order to support the application later.

**Table 4 The software of the computer in SMK Bintara Rancaekek laboratory**

| No | Software | Program |
|---|---|---|
| 1 | Operating System (OS) | Windows 7 |
| 2 | Processing data Program | MS. OFFICE |
| 3 | Tools for Multimedia Program | Flash Player |
| 4 | Tools for PDF file readers | Adobe Reader |

**Table 5 the minimum requirements of the software**

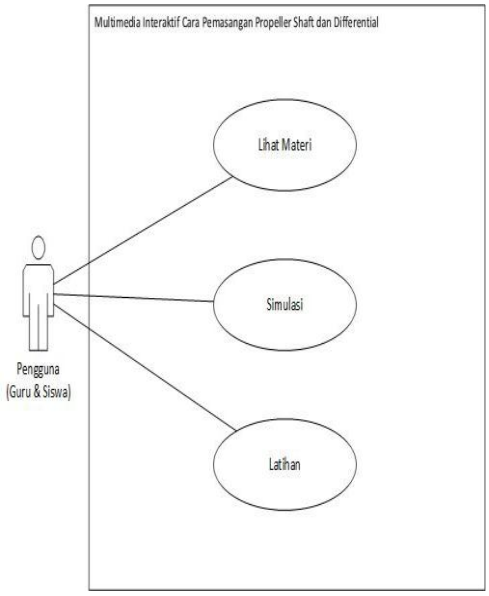
| No | Software | Program |
|---|---|---|
| 1 | Operating System (OS) | 1. Windows XP<br>2. Windows 7 |

**Table 6 the software for making the application**

| No | Software | Program |
|---|---|---|
| 1 | Operating System (OS) | Microsoft Windows 7 |
| 2 | The program for making the application | Unity3D 5.3.1 |
| 3 | The program for making the 3D objects | Solidworks 2013 |
| 4 | The Program for making the BPMN model | Bizagi Modeler 3.1 |
| 5 | The program for making the UML model | Visio 2013 |

### 2.11 The use of Case Diagram

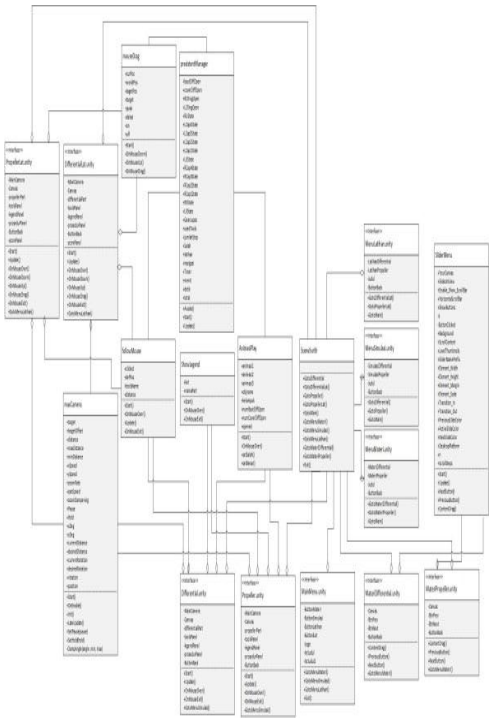
The use of case diagram aims to explain the interaction that happened between the actor with the system and to see the functions served in the system. Use case describes the typical interaction between the users of the system with the system itself, with giving the narration on how the system is going to be used [4].




**Picture 8 Use Case Diagram application that would be made**

### 2.12 The use of Class Diagram

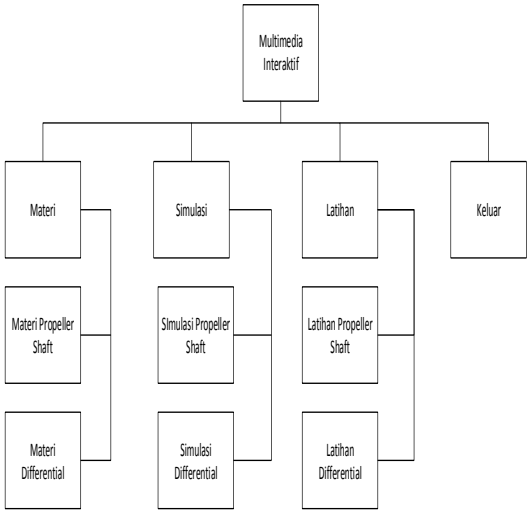
The use of class diagram aims to describe the genre of the objects in the system and the variety of static relationship that is happening between them. The Class diagram is also shows the property and the operation of a class and the limitation that is exist in the relationship of the objects [4].



**Picture 9 Class Diagram**

### 2.13 The Navigation structure of the Menu

The structure of the navigation of the menu is a plan from some different areas and it can explain the plot of the activities in the application.




**Picture 10 the navigation structure of the Menu**

### 2.14 The Implementation of Interface

This step is results of the design interface made in the previous design of interface, then this step implemented into the application that would be made with a purpose to give the whole information about the application.

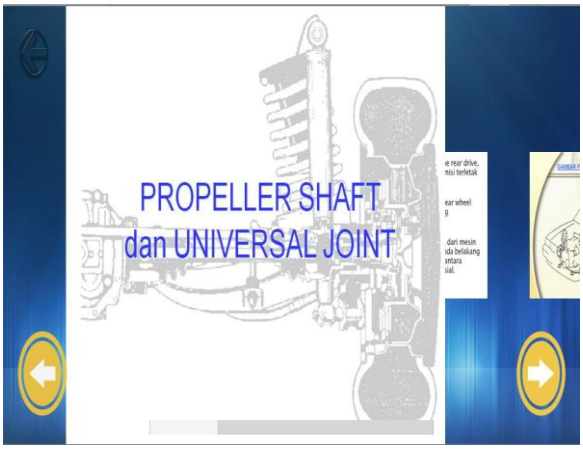
a. The Interface on the main menu




**Picture 11 The Interface on the main menu**

In this interface, there are 3 main menu used to move into other pages namely *materi*, *simulasi*, and *latihan* menu. In the menu *materi*, there is explanation about the *propeller shaft* and *differential*. In the *simulasi* menu, the users are going to see the components that contain of 3D objects with the explanation of the name and the steps to open the objects. In the *latihan* menu, the users are going to be given the exercise on how the components that are still not installed yet and should be rightly installed but when they got it wrong, it would cut down the score.

b. The interface of *materi* menu



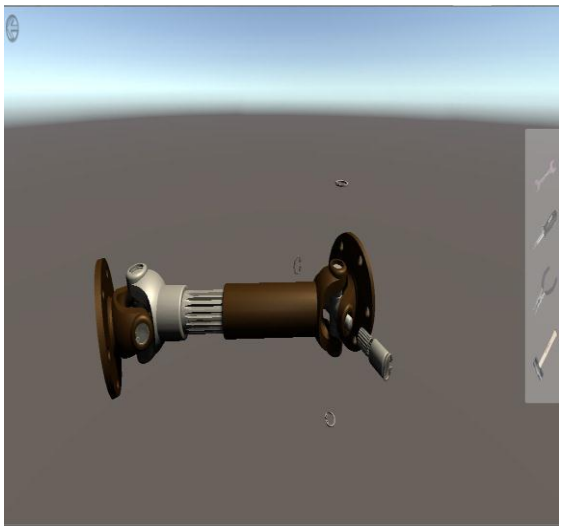

**Picture 12 the interface on the menu *Propeller Shaft***



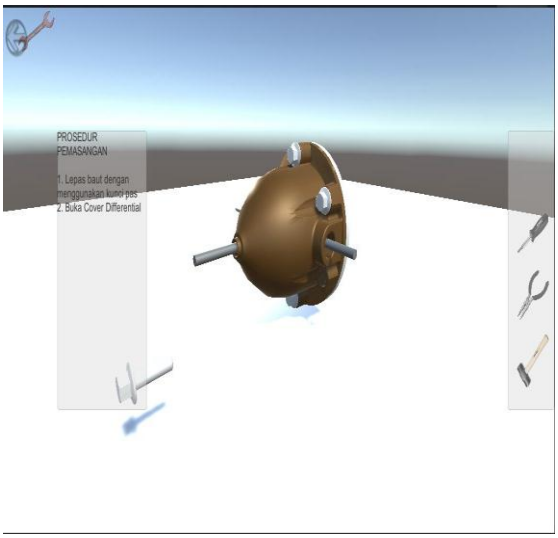

**Picture 13 the interface on the *materi Differential* menu**

On this interface, the users can diligently study the material served in the application that is going to be used later on the *simulasi* menu to be practiced from the comprehension of the material. It contains the information in the form of texts, pictures, and videos. This menu aims to give information to the users about *propeller shaft* and *diferential*, the name of each components, the function, the procedures in installing the components, and the maintenance of each components.

c. The interface on the *simulasi* menu



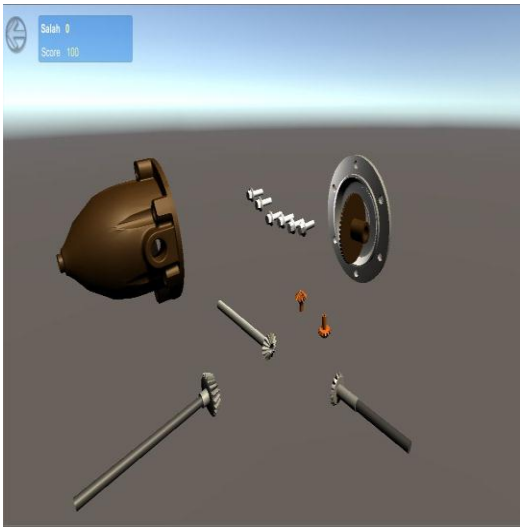
**Picture 14 the interface on the *simulasi Propeller Shaft* menu**



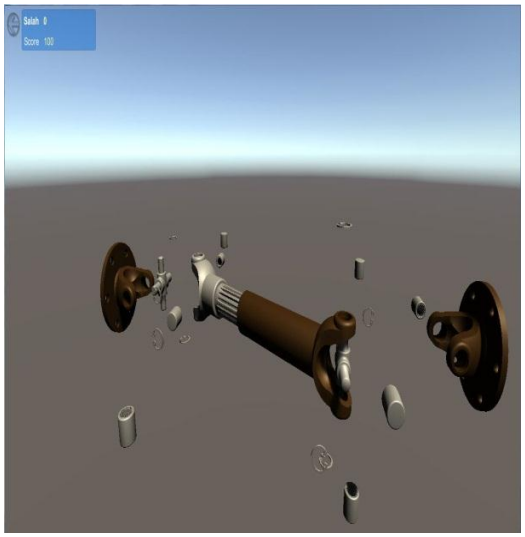

**Picture 15 the interface on the *Simulasi Differential* menu**

On this interface, the users do the simulation on releasing the component using the tools that are available, if the tools used are wrong, then the components cannot be opened. The 3D objects appears in the interface has been programmed concerning on the name of each components and also giving instructions on which tools can be used to open each components. This menu aims to give a picture to the users on the shape of the components and the procedures of installing the components before they do the practical work in the workshop so that it would minimalize the damage on the tools that might happen during the practical work.

d. The interface on the *latihan* menu




**Picture 16 the interface on the *latihan Differential* menu**




**Picture 17 the interface on latihan *Propeller Shaft* menu**

In this interface, it contains the score display and also it shows how many times the students have done wrong in installing each component. The user has to install each component correctly, and if they done wrong, then the score would be decreasing according to how many times they got it wrong.

### 2.15 The trial of the system

This step where the application would be examined to find out the functionality of the system whether it is working or not, besides that, this trial of the system has to be done to find out the mistakes when the application is still on going. This trial aims to find out that the application has been correctly made and match with the aims of the design of the system.

In this research, the examination used towards the application is alpha and beta. The method used in the examination of alpha is *black box* trial that examine the functionality of the application. As for the beta, it used the likert scale to measure the behavior or the opinion by the users that has tried the application through questionnaires and interviews.

#### 2.16.1 The test on the *Black Box*

The test on the *Black box* is done with testing the compatibility of the function that is in the tested application. The test on the *black box* consists of the scenario of the application test and the results of the test towards the application. [5].

The test scenario is done to map out what kind of functionality that would be tested The test scenario on the application can be seen at table 8.

**Table 8 the test scenario on the *Black Box***

| No | The test components | The test scenario | The type of the test |
|---|---|---|---|
| 1 | Main Page | Choosing *materi* menu | *Black box* |
| | | Choosing *simulasi* menu | *Black box* |
| | | Choosing *latihan* menu | *Black box* |
| | | Choosing the exit from the application | *Black box* |
| 2 | *Materi* Page | Choosing *Propeller Shaft* menu | *Black box* |
| | | Choosing *Differential* menu | *Black box* |
| | | Back button | *Black box* |
| 3 | The material on *Propeller Shaft* | Next button | *Black box* |
| | | Prev button | *Black box* |
| | | Back button | *Black box* |
| 4 | The material on *Differential* | Next button | *Black box* |
| | | Prev button | *Black box* |
| | | Back button | *Black box* |
| 5 | *Simulasi* Page | Choosing *Propeller Shaft* menu | *Black box* |
| | | Choosing *Differential* menu | *Black box* |
| | | Back button | *Black box* |
| 6 | The simulation on *Propeller Shaft* | Doing the simulation | *Black box* |
| | | Back button | *Black box* |
| 7 | The simulation on *Differential* | Doing the simulation | *Black box* |
| | | Back button | *Black box* |
| 8 | *Latihan* page | Choosing *Propeller* | *Black box* |

| No | The test components | The test scenario | The type of the test |
|---|---|---|---|
| | | *Shaft* menu | |
| | | Choosing *Differential* menu | *Black box* |
| | | Back button | *Black box* |
| 9 | The exercise on *Propeller Shaft* | Doing the exercise | *Black box* |
| 10 | The exercise on *Differential* | Doing the exercise | *Black box* |

### 2.16.2 The Trial of Beta

The trial of beta is an objective examination to find out the opinion of the users towards the application. This test is done with the users use the application first then the researcher is giving the questionnaires and doing an interview to find out their opinion.

The questionnaires are distributed to 22 students of class XI, and the interviews are done to the teachers. The questionnaires consist of 5 questions with the score system using the measurement based on Likert scale.

Likert scale is the measurement scale used to measure the behavior of people with choosing their behavior into the scale and having the continuum feeling from the "very positive" response to "very negative response toward something (Physiological aspect)[6].

**Table 7 The score on Likert scale**

Sources : *Aplikasi Statistika Dalam Penelitian*[6]

| Option | Score |
|---|---|
| Very agree (SS) | 5 |
| Agree (S) | 4 |
| Hesitant (R) | 3 |
| Disagree (TS) | 2 |
| Very disagree (STS) | 1 |

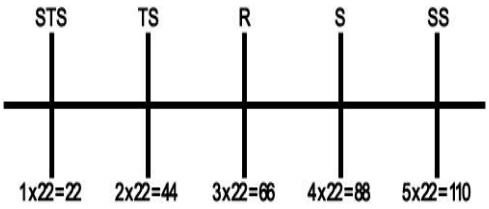
It is known that:

- The amount of sample are 22 students
- The amount of criterion score
  = The score × the amount of sample
- The level of agreement (TP)
  $= \frac{HS}{ST} \times 100\%$
  where,
  TP : The level of agreement
  HS : The results of the amount of scoring
  ST : the highest criterion score.

Thus:

- The highest criterion score
  = The highest score × the amount of sample
  = 5 × 22
  = 110
- The lowest criterion score
  = The lowest score × the amount of sample
  = 1 × 22
  = 22

It can be describe continuously on the picture 18.




**Picture 18 the continuum score**

## CONCLUSION

### 3.1 Conclusion

Based on the results of the research, analysis, the design of the system, the implementation, and the examination, it can be concluded that:

a. This application can help the students and the teachers in giving a picture about the material explained when the learning process is still going.
b. This application can be a supporting tools for the learning process because it can give the simulation before the students do it on their practical work, so that it would minimalize the damaged on the tools on the workshop.

### 3.2 Suggestions

The installment of this application is still far from perfection and still lack in most of the aspects. Therefore, it needs to have more developing process for perfection, in the further research, the researcher hope that the users of the application will be increased and the application will be develop for the better system and application. Thus, there are many

suggestions for the development of this multimedia application is open in the future.

The suggestion that the researchers give to develop the application is to complete the shortcoming of the application to had an access (*login*) for the students and the teacher, adding some network architecture is also possible so that the results of the exercise and the score from the exercise can be found out directly to the students and the teacher. Lastly, the simulation part can be develop so that the system can be more specific and detail.

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