THE MULTIMEDIA APPLICATION OF 3D SIMULATION FOR HANDLING ENGINE AND INJECTION SYSTEM PROBLEMS OF AUTOMATIC MOTORCYCLE LNS125

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ABSTRAK

Research that conducted at T-Rexton Motomodification Shop workshop is about the multimedia application of 3D simulation for handling engine and injection system problems of automatic motocycle LNS125 aims as an auxiliary medium for mechanics and mechanical candidates to obtain information about the engine and injection system of automatic LNS125 motorcycle. The research methodology consisted of 5 stages, that are problem identification, data collection (interview, observation, questionnaire, and literature review), data analysis, software development using the Luther Sutopo Multimedia Development Life Cycle method, and Application Testing. The application that built contains material, simulations, and practice questions about dismantling machines, component material, and damage codes. In addition there's also an evaluation of this application to find out whether the mechanic understands what has been explained in the application or not. Based on the results of testing the multimedia application of 3d simulation for handling engine and injection system problems of automatic motocycle LNS125, it was concluded that the applications which was built can be easily understood by mechanics and mechanical candidates, the applications also help provide references in remembering the stages of dismantling machine and injection system of LNS125 automatic motorbike.

Keywords : *Application, Multimedia, Injection System, LNS125 automatic motorcycle, 3D simulation*

1. INTRODUCTION

One of the general workshops located on Bojong Koneng Street, West Bandung Regency is the T-Rexton Motomodification Shop Workshop. T-Rexton Motomodification Shop is a business engaged in the automotive motorbike industry that sells goods and services. Based on the results of an interview with the owner of the T-Rexton Motomodification Shop, Mr. Asep Rahmat stated that the motor vehicle service needs will continue to increase because the number of motor vehicles from year to year has increased. However, there are problems that are found and are not in line with the increase in motorcycle sales, that is the brand holder sole agent (ATPM) as a motorcycle seller currently does not provide training on injection motors for general workshops, such as the LNS125 automatic motorcycle engine which is the basis of modern injection machines nowadays that have complete sensors.

Based on the questionnaire that has been distributed to all respondents in the workshop, that are mechanics and mechanical candidates, there are several problems for mechanics and mechanical candidates, that are 90% of mechanics and mechanical candidates have never attended training and training to get information about the automatic motorcycle injection system LNS125. 50% of mechanical candidates find it difficult to understand information from the manual book and do not have other media to find information about the LNS125 automatic motorcycle injection system. 70% of mechanics often feel hampered if they forget the procedures for handling a motorcycle. 52.5% of mechanics often pass the duration of dismantling time that has been determined by the owner of the workshop, which is 60 minutes. 70% of the mechanics feel that the sensor in the LNS125 automatic motorcycle injection system is very easily damaged if it is not handled according to the one in the manual and if the component is damaged it takes a long time to procure or replace the damaged component.

3-dimensional learning media in general can be interpreted as a tool for teaching and learning processes or anything that can be used to stimulate the mind, feelings, attention and abilities or skills of the learning participants so that it can encourage the learning process with 3-dimensional form. Based on previous research, research conducted by Muhammad Haris Batubara et al with the title "Application of Learning Techniques of Light Vehicle Automotive Machines With Methods of Computer Assisted Instruction (Case Study: Smk Private Educator Works)" [1] and research by Sukoco et al entitled "Media Development Computer-Based Interactive Learning For Students of Light Vehicle Engineering Subjects [2] states that interactive learning media is very helpful in the learning process.

From the problems that have been explained, we need an auxiliary media for mechanics and mechanical candidates to get good information about the handling of injection motorcycles, a media that supports 3D Simulation Multimedia Application Handling Problems on the Engine and Injection System of the LNS125 Motorcycle.

2. CONTENTS OF RESEARCH

2.1 Learning

Learning is a process of creating a conducive situation so that teaching and learning interactions occur between teachers, students, and other learning components to achieve a goal [4].

2.2 Learning Based by Multimedia

Multimedia-based learning is a learning media that is built to improve the learning motivation of students. The provision of learning material to students is made creatively and innovatively so as to increase the attractiveness of students in understanding the learning material. In learning, there are several multimedia objects, that are text, images, audio, and video.

2.3 Types of Computer Assisted Learning

a. CAI Method (Computer Assisted Intructional)

CAI (Computer Assisted Instruction) is a computer role as an additional helper in the learning process, its use in the form of presenting information on the contents of the subject matter, training, or even both. CAI supports learning and training, but not in the main delivery of subject matter.

Learning interaction forms can be applied in designing an interactive media. The format or form of interaction is in the form of practice and training (drill and practice), tutorials, games (games), simulation (simulation), discovery (discovery), and problem solving [5].

b. CAL Method (Computer Asisted Learning)

CAL is a teaching and learning method using Computer assistance. CAL can also be said to be the progress of learning methods via computer. In the CAL method, users (Users) can more easily and quickly understand and apply the information they learn through the appearance of an attractive image (Audio Visual) of the Application.

2.4 Object Oriented Analysis and Design

The OOAD concept consists of analysis and design of a system with object approach, that is object-oriented analysis (OOA) and object-oriented design (OOD) [7]. OOA is an analytical method that checks the requirements (requirements/ requirements) that must be met by a system from the point of view of the classes and objects found in the scope of the company [7]. While OOD is a method for directing software architecture based on manipulation of system objects or subsystems [7].

2.4.1 Modeling

Modeling is a depiction of a simple reality and outlined in the form of mapping with certain rules [7]. Modeling is also a process of designing software before coding. Software models can be analogous to make blueprints on motorcycle designs.

The success of a software modeling is determined by three elements, which are then known as the triangle for success [8]. The three elements are the method of modeling (notation), process (process) and tools used [8].

2.4.2 Unified Modeling Languange (UML)

UML in a language functions to determine visualization, construction, and document the artifacts of software systems, to model businesses, and other non-software systems [9]. Artifact is a piece of information used or produced in a software engineering process [9]. Artifact can be in the form of a model, description, or in the form of software [9].

2.4.3 Diagram Use Case

The use case diagram is a model for the system behavior that will be created. Use Case describes an interaction between one or more actors with the system to be created [8]. Use Case is used to find out the functions that exist in a system and who have the right to use these systems. For one use case only one sequence diagram is needed, if there are several scenarios in the use case it can be illustrated as a fragment in the sequence diagram [10].

2.4.4 Activity Diagram

Activity Diagram describes the work flow or activity of a system or business process contained in the software [7]. Activity diagrams provide analysis with the ability to model processes in a system. Activity diagrams can be used for workflow models, individual use cases, or decision logic contained in individual methods.

2.4.5 Class Diagram

Class Diagram describes the structure of the system in terms of defining the classes that will be created to build the system [7]. The class diagram has attributes and methods or operations. Attributes are variables that are owned by a class, while operations or methods are functions that are owned by a class [7].

2.4.6 Sequence Diagram

Sequence diagrams focus on behavior in the system, illustrating how objects interact with other objects. In the sequence diagram there is an object

and message sent between objects. Usually sequence diagrams are used to describe the interaction of objects that occur in a use case. For one use case only one sequence diagram is needed, if there are several scenarios in the use case it can be illustrated as a fragment in the sequence diagram.

2.5 System Testing Method

System testing methods are carried out in order to find out the effectiveness of a software that is being used. Testing can also provide an opportunity for users to use software and check software. System testing method in this study uses Black Box and User Acceptance Testing testing.

2.5.1 Blackbox Testing

Black box testing only observes the results of execution of a function by entering test data and checking the functionalities of the software. This test is analogous to seeing a black box that can only be seen from its outer appearance, without knowing what is behind the black wrapper. Black box testing uses evaluation to find an error inside:

a. *The function is running incorrectly or is missing.*
b. *Errors that occur in the interface or interface.*
c. *Errors that occur within the data structure.*
d. *Performance or behavior errors and initialization and termination errors.*

2.5.2 User Acceptance Testing

User acceptance testing testing in this application aims to obtain information about the responses and assessments of users of software or applications that have been made using a questionnaire, then the calculation of the user's answers using a Likert scale is carried out, that is, the data is calculated on average from the answers given by the user based on the score of each answer and then added up.

2.5.2.1 Measurement Scale

Measurement Scale Measurement scale is an agreement that is used as a reference to determine the interval interval in a scale or measuring instrument, so that the scale or measuring instrument when used in the measurement will produce quantitative data. The measurement scale used in this study is the Likert Scale. Likert scale can be used to measure attitudes, opinions, and receptions of a person or group of people about a social phenomenon. In this study, social phenomena have been specifically determined by researchers, hereinafter referred to as research variables. Example :

Table 1. *Table of Likert Scale Value Index*

No	*Preference*	*Preference*	*Preference*
1	*Very agree*	*Agree*	*Very positive*
2	*Agree*	*Often*	*Positive*
3	*Doubtful*	*Sometime*	*Neutral*
4	*Disagree*	*Almost never*	*Negative*
5	*Very disagree*	*Never*	*Very Negative*

The Likert scale shows the agreement or disagreement on every statement that contained in the instrument. Each response is given a numerical score, then the score can indicate the category of favourableness or unfavourableness, after that the score is summed to measure the attitude of the respondent. In other words, the overall value is the respondent in the continuum position favourableness or unfavourableness of the problem. Likert scale can be seen in Figure 1.

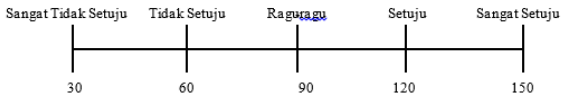

Figure 1. *Likert Scale*

Explanation:
30 × 5 = 150 Most favorable response
30 × 3 = 90 Neutral attitude
30 × 1 = 30 Most unfavorable attitude.

3. RESEARCH METHOD

The research methodology that used as a guide in conducting research so that the results achieved do not deviate from the objectives carried out, research methods can also be used to solve a problem. In this study the methodology used has stages that can be seen in Figure 2

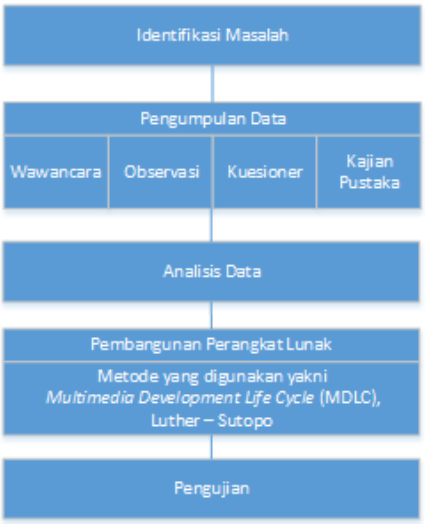

Figure 2. *Research Methodology*

3.1 Problem Identification

Problem identification is the stage to find problems that occur in the research place, nthat is T-Rexton Motomodification Shop workshop. So that from the existing problems will be determined what applications are needed by the T-Rexton Motomodification Shop workshop.

3.2 Collecting Data Method

Data collection techniques that used in this study are interviews with the owners of the T-Rexton Motivation shop, observation by collecting data about the engine and injection system from manuals, questionnaires, and literature reviews from previous researchers.

3.3 Data Analysis

At this stage data analysis is carried out from the problems obtained from the data identification stage and from the data collection stage to build learning media for the T-Rexton Motomodification Shop workshop.

3.4 Software Development

The software development method used is the Multimedia Development Life Cycle application development method, Luther - Sutopo [3]. The device development method takes the process systematically and sequentially, each process is carried out one by one, if it will do the next process then the previous process must be completed first. The process series of software development methods carried out can be seen in Figure 3.

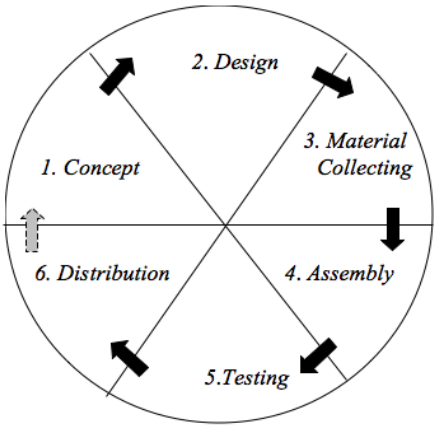

Figure 3. *Multimedia Luther-Sutopo Application Development Method*

3.5 Testing Stage

The testing phase is the testing stage in the learning media application that has been built. Tests that will be carried out for learning media applications aim to test applications that are built and observe whether or not there are deficiencies in the application. System testing method uses the BlackBox approach and User Acceptance Testing.

4. RESULT AND ANALYSIS

4.1 Collecting Data Method

The first problem is the mechanics and candidates for general workshop mechanics find it difficult to find learning media about the machine and the automatic motorcycle injection system LNS125. This was caused by the lack of learning facilities in the general workshop regarding injection machines for LNS125 motorbikes.

The next problem is that mechanics often feel that they do not work optimally or do not meet the target because in a day they can only complete motorbike services of less than 8 units. In a day, the mechanic works for 8 hours, and the time determined by the workshop owner to service 1 unit of motorcycle is 60 minutes or 1 hour, so that in one day the mechanic is targeted to service 8 units of motorbikes, but the average mechanic cannot fulfill that target. This is because mechanics sometimes have difficulty or even do not know how to properly disassemble LNS125 injection motorcycles so they have to open the manual first and seek information to dismantle the LNS125 injection motorbike which takes a long time.

The last problem is the injection sensor on the LNS motorbike is very easily damaged if the demolition and handling are not in accordance with the procedures listed in the manual, and if the injection sensor is damaged, the time needed to procure the components is long enough.

4.2 Architectural Analysis

Architecture analysis on the system built can be seen in Figure 4.

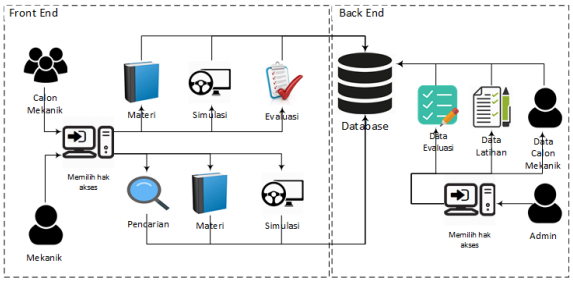

Figure 4. *System Architecture*

This application uses a database, 3D objects and the information is stored on local storage, this application is offline that does not use an internet connection in its use.

In using learning media users can interact with objects in the application and users can also take action on objects displayed to facilitate users in using multimedia applications 3D simulation of handling problems on the engine and LNS125 automatic motorcycle injection system.

4.3 System Modeling

4.3.1 Non-Functional Needs Analysis

This non-functional needs analysis describes the needs of the system which focuses on the behavior properties possessed by the system, including the needs of users, hardware, and software as material for analysis of deficiencies and needs that must be met in the system design that will be implemented.

4.3.2 Functional Needs Analysis

Functional needs analysis is the process of describing the activities needed by a system so that the system that is built goes well and in accordance with the needs. System modeling is modeled with use case diagrams and class diagrams.

4.3.2.1 Use Case Diagram

The interaction between one or more with the system to be built can be seen in Figure 5 below.

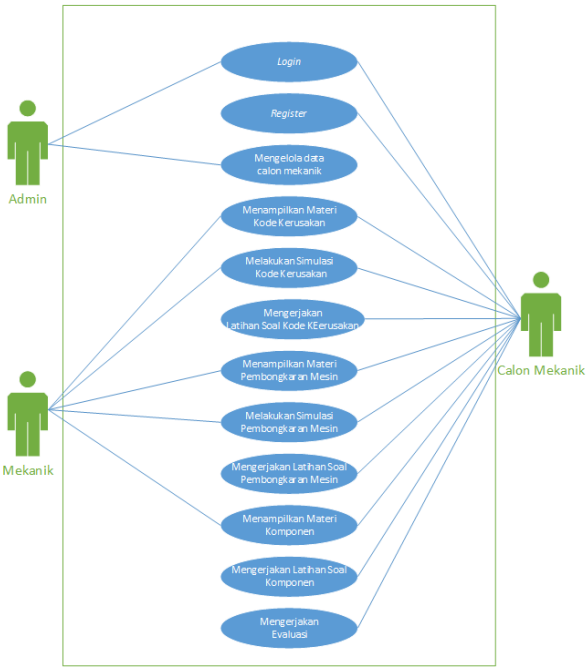

Figure 5. *Use Case Diagram*

4.3.2.2 Actor Definition

The following are the actors found in the system to be built.

Table 2. *Actor Definition*

No	*Actor*	*Description*
1	*Mechanics*	*Is a user of the application to be built, namely a mechanic in the T-Rexton Motomodification Shop workshop who will use multimedia applications 3D simulation of handling problems on the engine and the LNS125 automatic motorcycle injection system as a supporting medium in activities.*
2	*Mechanical Candidate*	*Is a user of the application that will be built, namely a mechanical candidate who is in the T-Rexton Motomodification Shop workshop who will use 3D multimedia simulation application handling problems on the engine and LNS125 automatic motorcycle injection system as a learning media about LNS125 motorbike.*
3	*Admin*	*Is a user of the application that will be built, to manage candidate mechanical data including value data, training data, and evaluation data in the 3D multimedia simulation application handling problems on the engine and LNS125 automatic motorcycle injection system as learning media about LNS125 motorbike.*

4.3.2.3 Use Case Definition

The following is the use case definition found in the system to be built.

Table 2. *Use Case Definition*

No	*Use Case*	*Description*
1	*Login*	*Is a process to login*
2	*Register*	*Is a process for registering users.*
3	*Managing Mechanical Candidate Data*	*The process for managing candidate mechanical data, value data, training data, and evaluating data.*
4	*Displays the Damage Code Material*	*The process for displaying damage code material*
5	*Display Machine Dismantling Material*	*The process for displaying machine disassembly material*
6	*Display Component Material*	*The process for displaying component material*
7	*Perform Damage Code Simulation*	*The process for simulating the damage code*
8	*Performing a Machine Demolition Simulation*	*The process for dismantling the engine*
9	*Doing Damage Code Problem Exercises*	*The process for displaying the training phase about the damage code*
10	*Working on the Machine Demolition*	*The process for displaying the training phase of the problem*

No	Use Case	Description
	Exercise	*regarding machine dismantling*
11	*Doing Component Problem Exercises*	*The process for displaying the training questions about the Component code*
12	*Do Evaluation*	*The process for displaying the evaluation questions*

4.4 Design and Implementation

4.4.1 Interface Design

The following is the design of a mechanical menu interface can be seen in Figure 6.

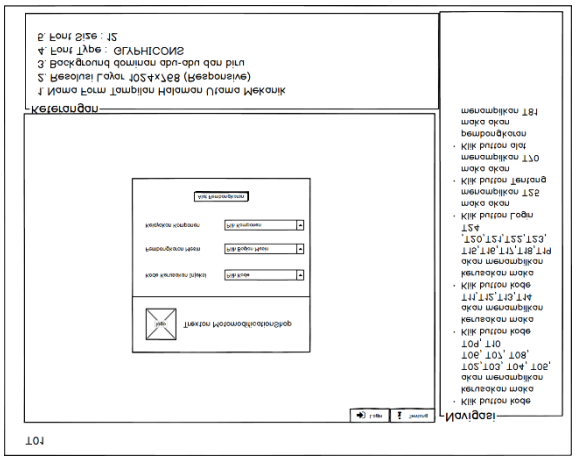

***Figure 6.** Mechanic Interface Design Menu Mekanik*

The following is the design of the mechanical candidate menu interface can be seen in Figure 7

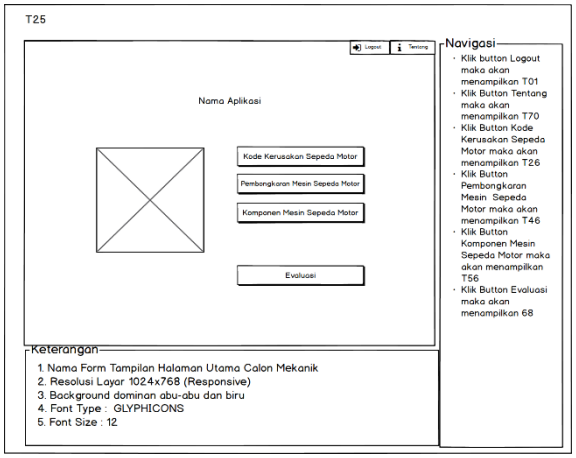

***Figure 7.** Mechanic Candidate Interface Design*

The following is the design of the admin menu interface can be seen in Figure 8.

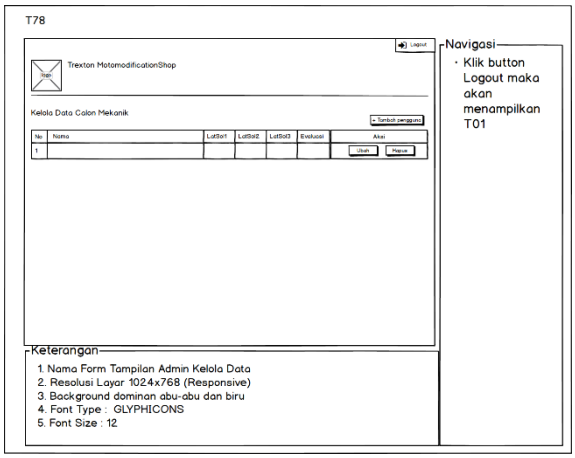

***Figure 8.** Admin Interface Design Menu*

4.4.2 Menu Structure Design

The following is the design of a mechanical menu structure can be seen in Figure 9.

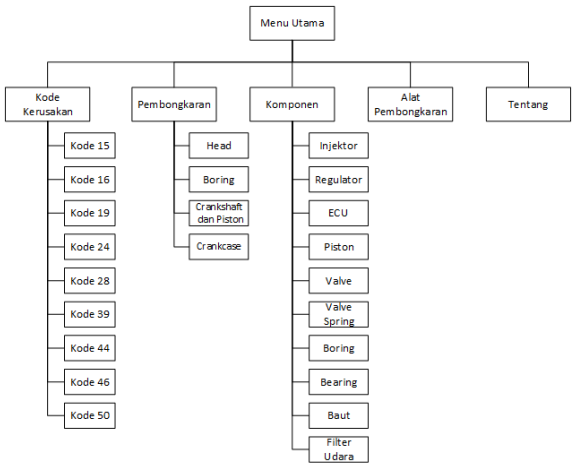

***Figure 9.** Mechanic Menu Structure Design*

The following is the design of the mechanical candidate menu structure can be seen in Figure 10.

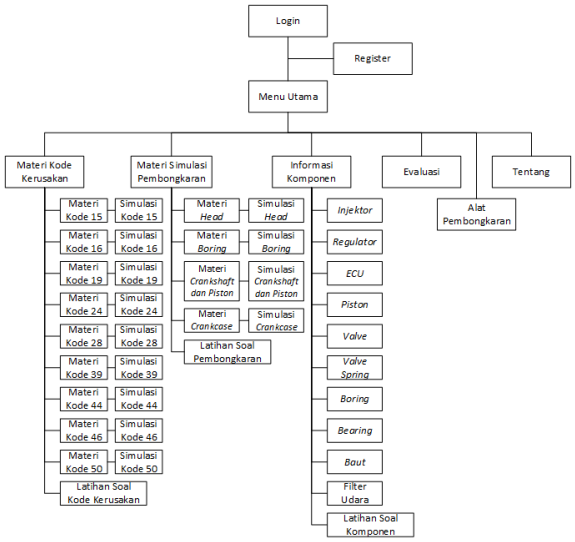

***Figure 10.** Mechanic Candidate Menu Structure Design*

The following is the design of the admin menu structure can be seen in Figure 11.

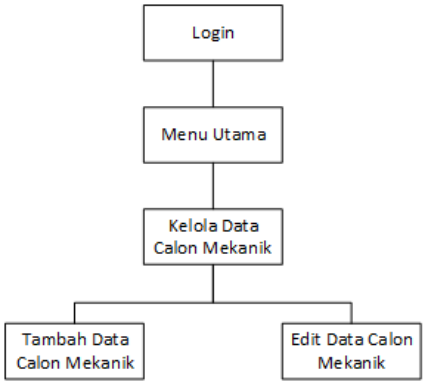

Figure 11. *Admin Menu Structure Design*

4.5 Tests and Test Results

4.5.1 Blackbox Testing

Blackbox testing focuses on the functional requirements of the software being built. The stages of a functional test carried out include blackbox testing scenarios, cases, and test results.

4.5.1.1 Blackbox Test Results

The results of blackbox testing that have been carried out can draw a conclusion that the system built has run as expected or not. Of all the tests that have been carried out this is expected to represent the testing of other functions in the system being built.

4.5.2 User Acceptance Testing

The test of user acceptance testing is an objective test where this test is carried out directly in the workshop of the T-Rexton Motivation Shop, this test aims to determine the quality of the system in the learning application built. User acceptance testing is done by researching application users to determine the user's assessment of the application.

4.5.2.1 User acceptance Testing Test Result

User acceptance testing test results conducted with observation questionnaires can be concluded in 3D multimedia applications simulation handling problems on the engine and automatic motorcycle injection system LNS125 can help and make it easier for mechanics and mechanical candidates to understand the material and carry out simulations using interactive multimedia.

4,5,3 Interview

The interview is carried out directly at the T-Rexton Motomodification Shop workshop for the user who is called the admin user (Service Advisor). The interview was conducted to Mr. Taufik which aimed to find out how far the quality of the system in the learning application was built

4.5.3.2. Interview Result

The results of the interviews conducted to Mr. Taufik as a service advisor, can be concluded that this application can help and facilitate learning activities regarding damage codes, engine demolition, component feasibility information on automatic injection LNS125 motorcycles because it has a very attractive and interactive appearance. But there are few difficulties in using the application, because it takes time for users to adapt to the application. The use of images and animation is very helpful for users to better understand the material presented, because it can be used as a substitute for props in a limited and incomplete workshop.

5. CONCLUSION

Based on the test results obtained from the research conducted in the preparation of this thesis and referring to the research objectives that have been made, it can be concluded that multimedia applications about the machine and the automatic motorcycle injection system of LNS125 can be easily understood by mechanics, can help the mechanics dismantling the engine and LNS125 automatic motorcycle injection system with the help of demolition simulation, the mechanic is easier to remember the demolition stage, and can help the mechanic in dismantling the injection system. The mechanical simulation does not cause damage to the sensor of the injection motorcycle which is very easily damaged if it is not handled according to the one in the manual and if it is damaged.

Based on all the results that have been achieved in the preparation of this thesis, the suggestions that can be used as a reference for the development of 3D Simulation Multimedia Applications in Handling Problems in the LNS125 Motorcycle Motorbike Injection Systems and Systems in the future are expected to be developed into online learning media. So it can be used anytime and anywhere.

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