DEVELOPMENT OF MULTIMEDIA APPLICATION AS A LEARNING MEDIA OF TRAIN BOGIE (CASE STUDY IN EDUCATION AND TRAINING CENTER PT KERETA API INDONESIA)

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ABSTRACT

This research was conducted at the PT Kereta Api Indonesia Center for Education and Training Center concerning the construction of a train bogie multimedia application that aims to build interactive learning media for educators and participants in education and training. The research methodology consists of 5 (five) stages namely problem identification, data collection (interview, observation, literature review), analysis (problem analysis, material analysis, LMS analysis, database analysis), the software development uses Luther Sutopo's Multimedia Development Life Cycle method and conclusions. Applications built on these contain learning material, exercise, simulations and evaluations which include basic knowledge of bogies, bogie components, maintenance and tendance of train bogies. Exercise and Evaluation are given in order to know the participant understanding of bogie learning material. Based on the results of testing the multimedia application of the train bogie, it was concluded that the application built could be a learning aid, help in finding additional resources and to maximize the education and training time. Moreover with the application being built can reduce the risk of damage to train bogie components such as gear boxes and axle boxes during practicum if not handled in accordance with the guidebook.

Keywords : *Media, Application, Multimedia, Train Bogie, PT Kereta Api Indone*sia.

1. PREMILINARY

PT Kereta Api Indonesia is a State-Owned Enterprise (BUMN) which provides, arranges and manages railway transportation services in Indonesia under the supervision of the Ministry of Transportation of the Republic of Indonesia [1]. PT Kereta Api Indonesia has a train expertise school, SATKA (Railway Engineer School), but with the change in the form of the company to PT Kereta Api (Persero) in 1999, SATKA was closed and the PUSDIKLAT (Railway Training and Education Center) was established [2]. Education and Training has five types of fields including Traction Engineering Training Center (BPTT) located in Yogyakarta, Railway Engineering Training Center (BPTP) located in Bekasi, Telecommunication Signal Engineering Training Center (BPTST) located in Laswi [2]. The Operations and Marketing Training Center (BPLOPSAR) is located in Dago and Sriwijaya Training Center (BPS) in Palembang [2].

In 2017, there were 10,181 employees who attended education and training at the Education and Training Center Ir. H. Djuanda this number consists of new employees and old employees. The data has been confirmed through direct interviews with Mr. Tiven as Manager of E-Learning and Mr. Iwa Kartiwa as employees at the Center for Education and Training at Ir. H. Dujanda. From the results of the interviews on the implementation of education and training, there are still some obstacles, including the number of bogie instructor who are not comparable, namely 6 people so that it is not enough to accommodate the number of 921 students (in 2018) the comparison is 1 (one) teacher must educate and train around 153 people in one training. Media for bogie learning used in the Education and Training Center still uses text or picture learning contained in the book resulting in participants having difficulty learning about train bogies because they have to come directly to the Traction Engineering Training Center (BPTT) located in Yogyakarta.

The allocation of time given from instructor for understanding the maintenance procedures for train bogies is deficient can be seen in the written syllabus for only 225 minutes. Meanwhile, to understand the maintenance procedures which contain practical material, it takes a long time, namely for the dismantling of bogies, it takes 4 hours and for the maintenance process after dismantling, it takes 1 day to cover the immersion process and washing the train bogie unit. During practicum, equipment such as gear boxes and axle boxes are often damaged. It can be seen in the bogie damage check sheet, the total damage for the damaged gear box is 6 units and 4 units axle box from January to December 2016 as for the causal factors, namely the occurrence of collisions with hard objects when conducting bogie trial experiments and error in the installation of training participants so that the gear box and axle box cannot be reused and must be made new with a

manufacturing process that takes a long time and costs around 30-40 million rupiah resulting in many material that is not explained by peractic.

Based on the constraints experienced, PT Kereta Api Indonesia Center for Education and Training Center needs a Multimedia application as a train bogie learning media that is able to provide information and support the development of training through E-learning.

The purpose of developing the Multimedia application as a train bogie learning media at the PT Kereta Api Indonesia Education and Training Center is as follows:

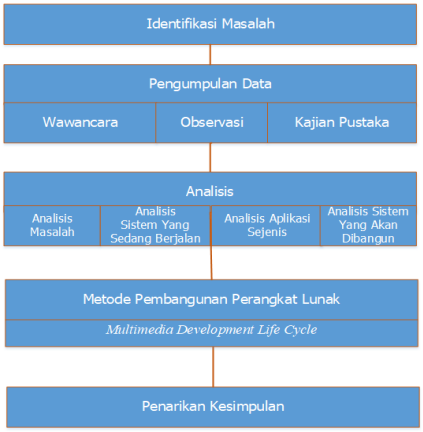
1. Assisting Teachers in overcoming the number of training participants who are not comparable in one bogie training, namely 1: 153 with interactive multimedia learning media as learning aids.
2. Helping Teachers in making learning media about train bogies so that training participants can easily find learning media about train bogies.
3. Helping the teacher maximize the training time which is as much as 225 minutes for train bogie practice activities will be very sufficient because it is assisted by simulations that exist in interactive learning media.
4. Helps reduce the risk of damage to gear boxes and axle boxes during the loading and unloading of train bogie components if they are not handled according to the ones in the book will be damaged.

2. CONTENTS OF RESEARCH

The following is an explanation of the research content from the development of a Multimedia application as a train bogie learning media at the PT Kereta Api Indonesia Education and Training Center.

2.1 Research Methodology

In conducting research on the development of multimedia applications as Bogie Train learning media, concrete data are needed to support the research. These data are obtained by various methods. The purpose is to do and to solve a problem to support the implementation of a study. The research methodology stages are shown in Figure 2.1-1.



Gambar 2.1-1 Research Methodology

2.2 Theoretical Basis

The theoretical basis is an explanation of theories related to the development of a Multimedia application as a train bogie learning media at PT Kereta Api Indonesia Education and Training Center.

2.2.1 Application

The application is computer-aided software that utilizes the ability of the computer directly to perform a task or processing that the user wants [3]. The application classification in this study is included in the educational software class which contains content about train bogie learning [3].

2.2.2 *Multimedia*

The definition of multimedia in general is the use of more than one type of media to present an information [4]. Multimedia comes from the Latin language that is nonus which has the meaning of many or various and mediums that have the meaning of intermediaries or something that is used to convey [4]. Multimedia as a collection of computer-based media and communication systems that have a role to build, store, deliver, and receive information in the form of video, text, audio, and animation [4].

2.2.3 Learning Media

Learning media is a message delivery tool in various forms to stimulate students' thinking power to achieve learning goals [5]. The success of the use of media in the learning process is based on how the media is conceptualized and designed, good media is a medium that can improve participants' understanding of training and improve learning outcomes of training participants [5].

2.2.4 *Bogie*

Bogie or also called *truck* is a supporting part of the railroad body that invites the railway body to move on the tracks following the locomotive [6]. One train body has two or more wheels which are combined by a frame and equipped with a heating system, braking system and as a whole functions as a

support for the basic frame of the railway facilities [6]. Based on the definition of the attached bogie, the intent and purpose of installing bogies in the railway facilities is to overcome the problem of the length of the railway facilities, the carrying capacity (weight) of the railway facilities, then through the bend, speed, and running qualities [6].

This type of bogie has 2 (two) types, consisting of bogies on the train having several types, namely bogie pensylvania (k2), bogie cradle: k3, bogie nt 504 (sig): k4, bogie 11 (nipon trail 11): k5, bogie sgp ferrostahl: k6, gorlitz bogie: k7, nipon trail bogie 60 (nt 60), trail bogie 398 (tb 398), bogie k9 (reenginering) and bogie carriage type, namely bogie rigid frame (braid) and not rigid frame bogie (piece) [6]. Bogie has 7 (seven) main components, namely: bogie frame, wheel device, axle box housing and bearing, axle box housing and bearing, swing bolster, swing bolster guide, suspension system (primary spring and secondary spring) [6]. The process of maintenance and maintenance of bogies is carried out in stages, namely daily maintenance, one-month care, three-month care, six-month care and one-year care [6].

2.3 System Analysis and Design

System analysis and design is a stage to examine the problem and then compile problem solving and make system specifications which will be applied to train bogie learning media applications.

2.3.1 Problem Analysis

Analysis of problems in the development of multimedia applications as a train bogie learning media to identify problems or find out the constraints experienced in the implementation of education and training at the Center for Education and Training Ir. H. Djuanda. The problem analysis of the system being experienced is as follows:

1. Teachers cannot handle the number of training participants who are not comparable in one bogie training, namely 1: 153 so that they do not meet the ideal standard ratio of 1:30 based on the circular letter of the Minister of Technology Research and Higher Education Number 105 / M / VI / 2015.
2. When studying train bogies at the Education and Training Center Ir. H. Djuanda, the learning media used still uses text or picture learning media contained in books that have several weaknesses or disadvantages, including the difficulty of understanding the depiction of bogie forms and how bogies work.
3. In the learning process practicum carried out at BPTT Yogyakarta Allocation of education and training time for train bogies that was given as much as 225 minutes is still not enough because in the course of bogie demolition it takes 4 hours and for the maintenance process after demolition takes 1 day covering the immersion process and washing the train bogie unit.
4. In the practical learning process supporting equipment such as gear boxes and axle boxes often experience damage seen in the January to December 2016 cheek sheet the number of damaged gear boxes is 6 units and 4 unit axle boxes with a note of the causative factor that is the occurrence of collisions with hard objects when conducting experiments bogie testing and error in the installation of training participants so that they cannot be reused and new equipment must be made so that the manufacturing process takes a long time and costs a large amount of 30-40 million rupiah.

2.3.2 Current System Analysis

The current system analysis is a series of activities and documents involved in the process of analyzing procedures for the provision of train bogie materials, procedures for training train bogie learning materials, train bogie learning practicum procedures, train learning management system (LMS) analysis and analysis. database learning management system (LMS).

2.3.3 Similar Application Analysis

Similar application analysis is an analysis of other applications that become a reference in the development of multimedia applications as a medium for train bogie learning. As for what is discussed in this analysis phase, which is about how to use the application, the components that exist in the application and features that exist.

2.3.4 Analysis of the system to be built

In the development of multimedia applications as learning media for Bogie Train at the Education and Training Center Ir. H. Djuanda was built using multimedia learning with the Computer Assisted Intructional (CAI) method, a multimedia program with a model of tutorials, simulations, exercises and computer-aided games.

2.3.4.1 Tutorial Model

The tutorial model presented in the form of train *bogies* in accordance with the syllabus at the Railway Training and Education Center Ir. H. Djuanda. The details of the material are the recitation, the type of train bogie, the train bogie component and the maintenance of the train bogie by being presented using visual information such as vdeo, text, images, audio and others.

2.3.4.2 Simulation Model

The simulation model is an illustration of the practicum process that is made like the actual form in the form of an imitation by involving training participants. The simulation used is the installation of wheel devices, installation of swing bolsters,

installation of axle boxes, installation of shock absorber, and installation of padestal bases.

2.3.4.3 Exercise Model

This training model is given to train training participants to have skills or strengthen a concept by means of an application providing a series of questions or questions that are randomly displayed in a combination of different questions. The provisions for the processing time of each exercise per chapter are 15 minutes and if the training in the previous chapter has not reached a minimum score of 70% then it cannot proceed to the next chapter and must complete and repeat it again. train bogies for the construction of evaluation questions that are 45 minutes.

2.3.4.4 Game Model

The game model in the application is built in the form of a form of material processing time and practice questions that have been determined so that if the training participants go through a predetermined time it will be declared "Not Pass" and cannot continue the next chapter.

2.3.5 Material Analysis

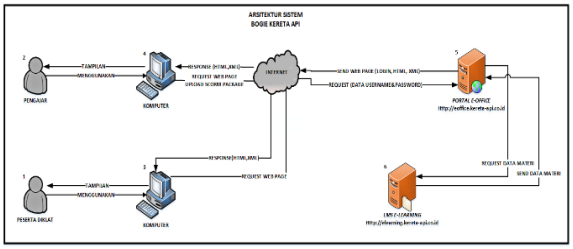
The material and questions given were obtained from all the material and questions that had been studied previously. The material used in the Multimedia Application as a Train Bogie Learning Media refers to the syllabus at the Education and Training Center Ir. H. Djuanda. Material analysis of Multimedia Applications as a Train Bogie Learning Media can be seen in table 2.3-1.

Tabel 2.33-1 Material Analysis

Material	Category	Material Group
Chapter 1 Material 1 Introduction	The material is presented using text	Tutorial and Problem Training
Chapter 1 Material 2 Bogie Function	The material presented is in the form of text and animation.	Tutorial and Problem Training
Chapter 1 Material 3 Confirmation on Bogie	The material presented is in the form of text and animation.	Tutorial and Problem Training
Chapter 1 Material 4 Bogie Types	The material presented is in the form of text.	Tutorial and Problem Training
Chapter 2 Material 1 Theory of Vibration and Damping	The material presented is in the form of text and animation.	Tutorials and Exercises
Chapter 2 Material 2 Bogie Technical Knowledge TB-398	The material presented is in the form of text.	Tutorials and Exercises
Chapter 2 Material 3 Bogie Components	The material presented is in the form of text and animation.	Tutorial, Exercise and Simulation
Chapter 3 Train Material Maintenance and Maintenance	The material presented is in the form of text, animation and video.	Tutorials and Exercises

2.3.6 Learning System Architecture

System architecture used in the Learning Management System (LMS) that has been used in the Education and Training Center Ir. H. Djuanda. The system architecture can be seen in Figure 2.3-1.



Gambar 2.3-1 System Architecture

2.3.7 Non Functional Needs Analysis

Non-functional needs analysis is a process of describing the boundaries of the system into more detailed needs based on the facts and needs that exist. The purpose of these non-functional needs is certainly to suit the needs of users and systems.

2.3.7.1 Hardware

Based on the results of interviews with Mr. Tiven and observation within the Education and Training Center, Ir. H. Djuanda obtained specifications in the computer laboratory which can be seen in table 2.3-2.

Tabel 2.3-2 Hardware Requirements

No	Hardware	Specifications
1	*Prosesor*	*Core i3 2.8Ghz*
2	*Monitor*	*14" Resolution 1366 x 768 Landscape*
3	*Keyboard dan Mouse*	*Standart*
4	*Hardisk*	*1 TB*
5	*VGA*	*128MB*
6	*RAM*	*4GB*

2.3.7.2 Software

The software used in a system is commands related to the hardware used and both interact with each other. Based on observations at the computer laboratory, the Railway Training and Education Center, Ir. H. Djuanda, the available software can be seen in table 2.3-3.

Tabel 2.33-3 Software Requirement

No	Software	Specifications
1	*Operating System*	*Microsoft Windows 7*
2	*Compilator*	*Adobe Flash Player 13 ActiveX*
3	*Web server*	*Xampp 5.6.21*
4	*Web browser*	*Mozilla Firefox and Chrome*

2.3.7.3 Brainware

User needs analysis (brainware) is an analysis of users who will use the train bogie learning media application system. Analysis of user needs can be seen in table 2.3-4.

Tabel 2.3-4 User Needs

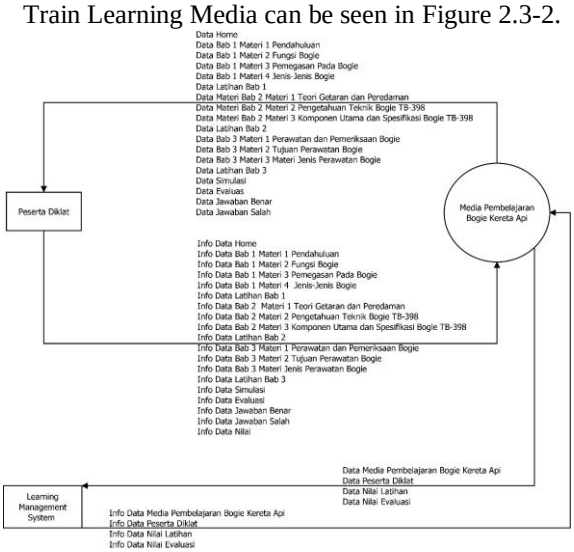
User	Access rights	Ownership
instructor	1. login as instructor. 2. Providing train bogie learning material. 3. Providing train bogie learning simulation. 4. Provide training on train bogie learning. 5. Provide evaluation of train bogie learning. 6. View Application Information 7. Can process value data. 8. Can add material. 9. Can edit material.	1. Can operate a computer. 2. Can run computer applications. 3. Can process data
Training participants	1. Log in as a training participant. 2. See material and learn about train bogies. 3. Exercise the material provided by the teacher. 4. Simulation of material provided by the teacher. 5. Conduct evaluation of all train bogie learning.	1. Can operate a computer. 2. Can run computer applications.

2.3.8 Functional Needs Analysis

Functional needs analysis is the process of describing the system needs that will be built on the Development of Multimedia Applications as Train Bogie Learning Media. The functional requirements for learning multimedia applications that are built using Data Flow Diagram (DFD) system modeling.

2.3.8.1 Context Diagram

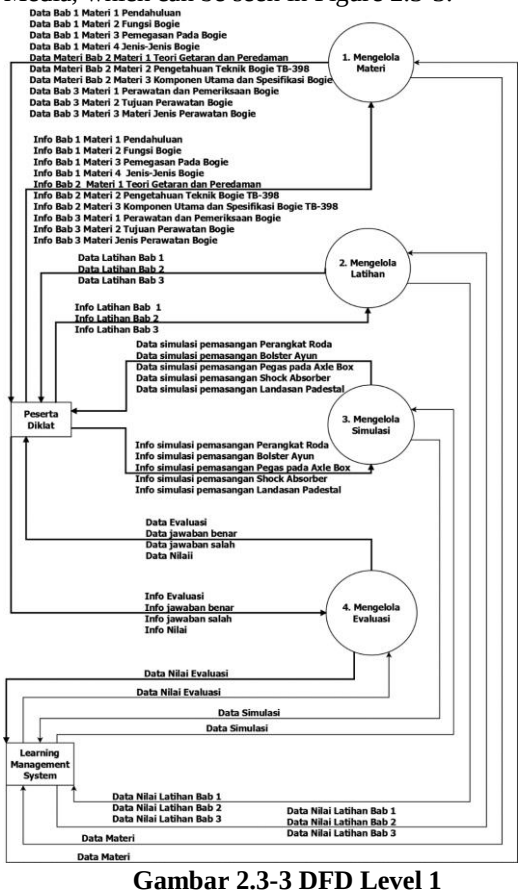
Context Diagram is a diagram that describes input, process and output on a software system that is built. The following context diagram of Multimedia Application Development as Bogie Train Learning Media can be seen in Figure 2.3-2.



Gambar 2.3-2 Diagram Konteks

2.3.8.2 DFD Level 1

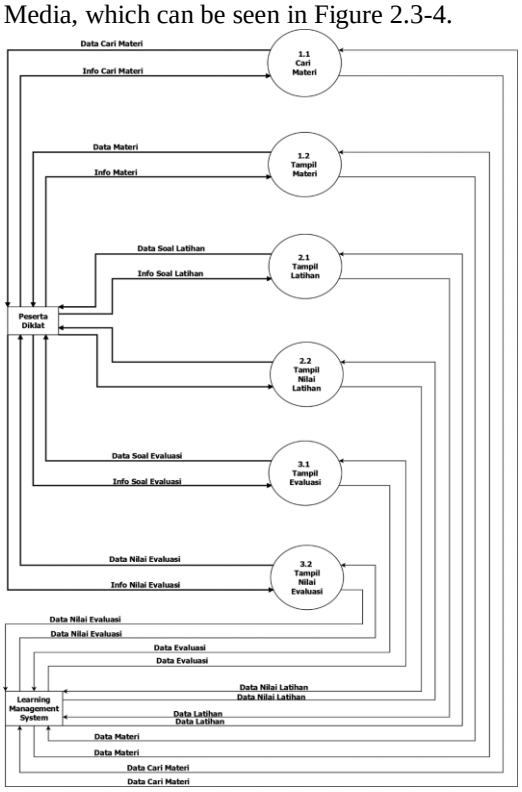
Data Flow Diagram (DFD) level 1 explain all the functionality that can be done in the Development of Multimedia Applications as Train Bogie Learning Media, which can be seen in Figure 2.3-3.



Gambar 2.3-3 DFD Level 1

2.3.8.3 DFD Level 2

Data Flow Diagram (DFD) level 2 explain the material selection process in the Development of Multimedia Applications as Train Bogie Learning Media, which can be seen in Figure 2.3-4.



Gambar 2.3-4 DFD Level 2

2.4 Testing

In the development of multimedia applications as learning media for Bogie Train at the Education and Training Center Ir. H. Djuanda uses the two testing processes and their explanations.

2.4.1 Blackbox Testing

Blackbox testing is a test conducted on the functionality contained in multimedia applications as a medium for train bogie learning. The purpose is to find malfunctions in the software that has been built.

2.4.1.1 Blackbox Testing Scenario

The test scenario of the system built can be seen in table 2.4-1.

Tabel 2.4- 1 Blackbox Testing Scenario

No	Test Material	Test Details
1	Material Search	Enter material, training, simulation, and evaluation data that will be searched in the search form or click on the material menu option.
2	Show Material Chapter 1 Bogie's Basic Knowledge	a. Showing the material in CHAPTER 1 Bogie's Basic Knowledge a. Click the

No	Test Material	Test Details
		"Continue" button for proceed to the next material. b. Click the "Back" button to return to the previous Practice Problem.
3	Shown Exercise Chapter 1	Displaying the Problem of Exercise Chapter 1 a. Click the "Continue" button to proceed to the next Practice Problem. b. Click the "Back" button to return to the Practice Problem. Enter the answer data for the problem. a. Click the "Submit All" button to send all answers.
4	Appear Practice Questions Chapter 3	Displaying the Problem of Exercise Chapter 1 a. Click the "Continue" button to proceed to the Practice Problem next. b. Click the "Back" button to return to the previous Practice Problem. Enter the answer data for the problem. a. Click the "Submit All" button to send all answers.

2.4.1.2 Conclusion of Blackbox Testing

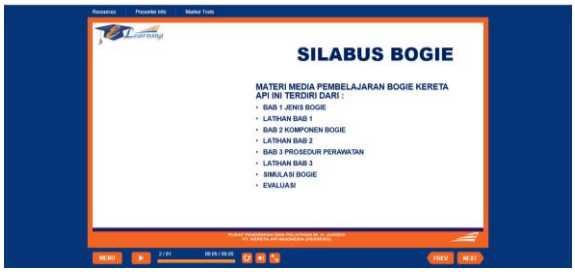
Based on the results of blackbox testing that has been carried out, it can be concluded that multimedia applications as a medium of train bogie learning that are built functionally produce output that is in line with the expected results and has been running well. Of all that has been done in this test, it is hoped that it can represent the testing of other functions in the system being built.

2.4.2 System Implementation

System implementation is the stage of the system design that is approved and approves, installs and uses it and tests the feasibility of the system that has been made.



Gambar 2.5-1 Main Page Interface



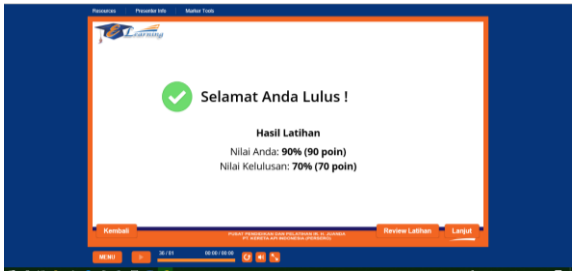
Gambar 2.4-2 Interface of the Bogie Railway Syllabus



Gambar 2.4-3 Display Interface Contents Material Sub Chapter 1 Bogie Basic Knowledge



Gambar 2.4-4 Problem Display Interface Sub Chapter 1 Bogie Basic Knowledge



Gambar 2.4-5 Display Interface Value> 70% Sub Chapter 1 Bogie Basic Knowledge



Gambar 2.45-2 Display Interface Value> 70% Sub Chapter 1 Bogie Basic Knowledge



Gambar 2.45-3 Axlebox Simulation Display Interface

3 FINALE

This is an explanation of the conclusions that contain the results obtained after the analysis, design and implementation stage of the development of multimedia applications as a medium for train bogie learning. and there are some suggestions for further research.

3.1 Conclusion

Based on the results of the tests that have been carried out in the preparation of this final project and referring to the research objectives that have been made, it can be concluded that :

1. Multimedia application as a learning media on train bogies can be an additional tool for learning to overcome the number of teachers and training participants who are not comparable in the H Djuanda IR Education and Training Center.
2. Multimedia application as a learning media on train bogies can be an additional reference in limited bogie learning at the H Djuanda IR Education and Training Center.
3. Multimedia applications as learning media about train bogies can help maximize training time with the simulation process presented in the application.
4. Multimedia applications as learning media about train bogies can reduce the risk of damage to train bogie components such as gear boxes and axle boxes during practicum if not handled according to the guidebook because with this application training participants can do the bogie component installation process indirectly using bogie component installation simulation.

3.4 Suggestions

The suggestions that can be used as references for the development of Multimedia Applications as Learning Media regarding train bogies in the future are as follows:

1. LMS E-Learning in PT Kereta Api Indonesia is expected to be developed especially on features to manage material, manage practice questions and evaluation.
2. E-Learning LMS in PT Kereta Api Indonesia is expected to have a large capacity for material storage to accommodate large material files.

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