EDUCATION GAME OF CAR TRANSMISSION BASED ON ANDROID FOR MECHANICAL ENGINEERING COLLEGE STUDENT

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ABSTRACT

One of the method that can be used in car maintenance is Jishu Hozen that demands the driver to be able not only riding the vehicle but able to maintain it. In order to increase people understanding to Jishu Hozen method especially engineering vocational student we could use Jishu Hozen method to more enjoyable form which is in form of android-based educational game. Game can implemented android application that mostly people and college student has android mobile phone. The purpose of this research focus on to create a method in transmition maintenance using Jizhu Hosen method that implemented android-based game. To fulfil this research purpose we use Information Gathering, designing Jishu Hozen method into android base application to test it. To test the game we spread a questionnaire to 30 engineering college student. The result validity and reliability show that the game is appropriate. The result from questionnaire show that the students' level of satisfaction upon the game is higher. Besides that, there are differences on students' knowledge before and after using the education game that tested using paired sample t-test.

Keywords: Android, Game, Jishuhozen, Maintenance, Transmission

INTRODUCTION

The development of science and technology has an impact on increasingly complex human needs where automotive technology and maintenance are the most important topics in its development [1]. However, not everyone understands the maintenance system that must be done so that the vehicle such as the car, functions optimally. Maintenance activities are ignored in various studies where machines are assumed to always be used well on their planning horizons [2]. In fact, vehicles like cars, are potentially damaged. Damage to a machine is a common thing and needs serious maintenance [3]. The operation of the car is obtained from the engine as the main driver. The power produced by the engine transformed first by the transmission system. Therefore, maintenance of transmission systems plays an important role in the car.

An understanding of the transmission system maintenance is not easy and requires adequate skills, perseverance and media practice [4]. Gopalakrishnan, et al. (2015) stated that improving the performance of a facility can be achieved through maintenance activities. The main goal of treatment is to get a reliable system and minimize maintenance costs [5]. Understanding and skills in maintaining transmission systems is very important [4]. The development of a new treatment method that is often implemented is autonomous with Jishu Hozen [6]. Jishu hozen is an operator's behavior in carrying out maintenance activities with the aim of creating zero breakdown [7]. The principles of the Jishu Hozen method require that an operator / driver besides being able to

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operate the equipment can also maintenance. It aims to increase life span engine, reduce damage, and minimize maintenance and damage costs.

Fulfillment of understanding and skills maintenance of transmission systems by the public in general and Diploma of Mechanical Engineering students in particular, can be done by formulating the Jishu Hozen method which is interactively packaged. So far there have been no studies that discuss the method of car transmission that is packaged interactively. Besides being able to operate vehicles, drivers are required to be able to maintain their vehicles independently in the event of damage. The teaching methods that have been used so far have not been accommodated, resulting in the understanding of the material not being intact [8]. In the teaching and learning process in the classroom not a few have difficulty understanding and applying the material taught by the teacher [9]. Humans can essentially receive 90% of lessons determined from what is done and said [10]. The many interactive media owned by a university's laboratory are teaching aids is so limited, the cost of making is quite high, requiring routine maintenance costs, and limited practice time allocation. This resulted in learning activities and practices not being maximal, understanding decreased because not all students could practice well.

Interactive learning media such as Android-based educational games are still rarely used in learning. The combination of text, images, animation, audio, procedural instructions, and video images can be presented through the game application. The game application for education is at a new stage and few studies have focused on

the effectiveness of increasing learning output [11]. The nature of the game is challenging and fun providing opportunities as an educational medium. Meanwhile, according to Simkova (2014) the application of games in supporting education has good potential. Ekaterina, et al (2015) produced research on educational games for polytechnic students. Seng & Yatim (2014) conducted research on computer games as a medium of learning and teaching for university students where games improve student skills and knowledge more efficiently than traditional teaching methods (without simulation media). Gabor & Arki (2017) concluded in his research that educational games affect the structure of student mindsets. Students who get traditional learning methods (without games) lack a structured mindset and experience many difficulties in solving problems systematically [12].

Based on this background, this study aims to formulate a car transmission maintenance method using the principle of Jishu Hozen which is packaged in an android-based game application. The proposed method is expected to be used as a new method in maintaining a car transmission system where the driver is able to perform maintenance independently. This method will provide convenience for users because it is packaged in game applications that have educative properties, are entertaining, and can be easily understood by all groups. In addition, the effectiveness of the delivery of learning materials to students and the improvement of the quality of students will be created both from the aspect of thinking ability (cognitive), attitudes (affective), and skills (psychomotor). Students will be able

to receive complete information not only from others, but based on their own experience through games. Students can practice and understand how the transmission and maintenance system works easily and everywhere [13].

State of the Art

Interactive learning media such as Android-based educational games are still very rarely used in learning. The game application for education is at a new stage and few studies have focused on the effectiveness of increasing learning output [10]. The nature of the game is challenging and fun providing opportunities as an educational medium. The combination of text, images, animation, audio, procedural instructions, and video images can be presented through the game application. Meanwhile, according to Simkova (2014) the application of games in supporting education has good potential. Ekaterina, et al (2015) produced research on educational games for polytechnic students. Seng & Yatim (2014) conducted research on computer games as a medium of learning and teaching for university students where games improve student skills and knowledge more efficiently than traditional teaching methods (without simulation media). Gabor & Arki (2017) concluded in his research that educational games affect the structure of student mindsets. Students who get traditional learning methods (without games) lack a structured mindset and experience many difficulties in solving problems systematically [12].

RESEARCH METHODS

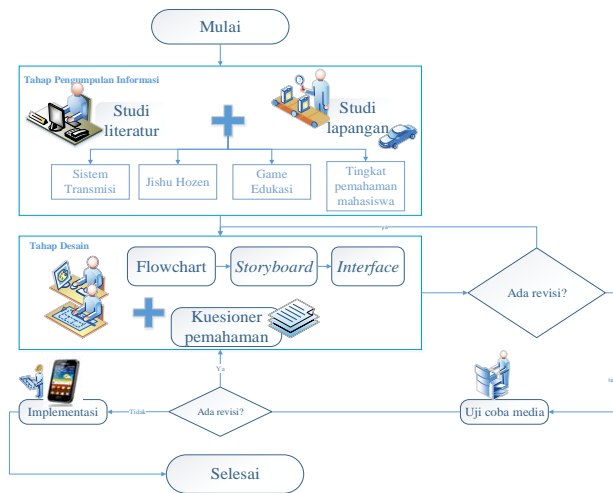The steps to be taken in this study can be seen in Figure 1 below.

Fig 1. Research Steps

Information collected at this stage comes from literature studies and field studies. Information collected from literature studies on car transmission systems, Jishu Hozen treatment methods, and educational games.

1.1. Information Collection

Information collected at this stage comes from literature studies and field studies. Information collected from literature studies on car transmission systems, Jishu Hozen treatment methods, and educational games.

Fig 2. Transmission system maintenance practicum in Laboratory Engine Maintenance and Repair Study Program Polytechnic of Kediri

Field studies are needed to determine the level of student understanding of the transmission maintenance material

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provided by lecturers during classroom learning and practice. Before dismantling the car transmission system, students carry out basic maintenance of the transmission system with the trainers owned by the laboratory. . Figure 2 shows that there is ineffectiveness in delivering transmission maintenance practices where there are limitations to trainers and practicum time so that not all students have the opportunity to dismantle pairs of trainers. Meanwhile, the target students in this study were students of the D3 Polytechnic Engine Maintenance and Repair Study Program whose address was at Jln. Mayor Bismo no. 27 Kediri.

1.2. Design

The design stage is used to compile the Development of Learning Methods for Transmission and Transmission Maintenance Systems with Educational Games. At this stage, it is divided into two sub-stages, namely the design of educational games and questionnaires, the level of students' understanding of the transmission material when using educational game applications and not.

1.3 Designing Educational Games

The design of the educational game is divided into three stages, namely making flowcharts, story boards, and interfaces. This educational game consists of material and three levels of the game. The material summarized in this game is about car transmission systems, jishu hozen maintenance, and troble shooting transmission systems. Meanwhile, the first level game contains questions relating to the test of students' understanding regarding the material presented.

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At the first level, users can choose to study material first or directly test understanding. The value of this understanding test will be recorded if the user answers all questions at the first level. Users will not be limited by time in completing the game at the first level. If the first level has been completed, then the user can proceed to the next level. At level two the user will play and learn about what equipment is needed in maintaining and repairing the vehicle transmission system. At this level users will be given various kinds of images and words. The user's task is to match the words and images that correspond to the limited time. The third level of the game aims to make users understand how to take maintenance of vehicles on the principle of Jishu Hozen. At this level users will be presented with case studies and asked to take action in resolving

the case. Users will have limited time in completing this level. This educational game provides question and case banks. So when the user wants to repeat the game again, the user will not get a similar question and case. The following is a flowchart used in preparing educational games.

In the start menu, the "loading" opening page will appear where the user will be directed to the main menu. The main menu contains play options (material or test), exit, and settings. In the play option the user can choose material or tests where there will be three discussions, namely the transmission system, jishu hozen, and troble shooting. Furthermore, in the design stage of the educational game design, later the display of games for level two and three will be arranged, so that it can be applied to the android system.
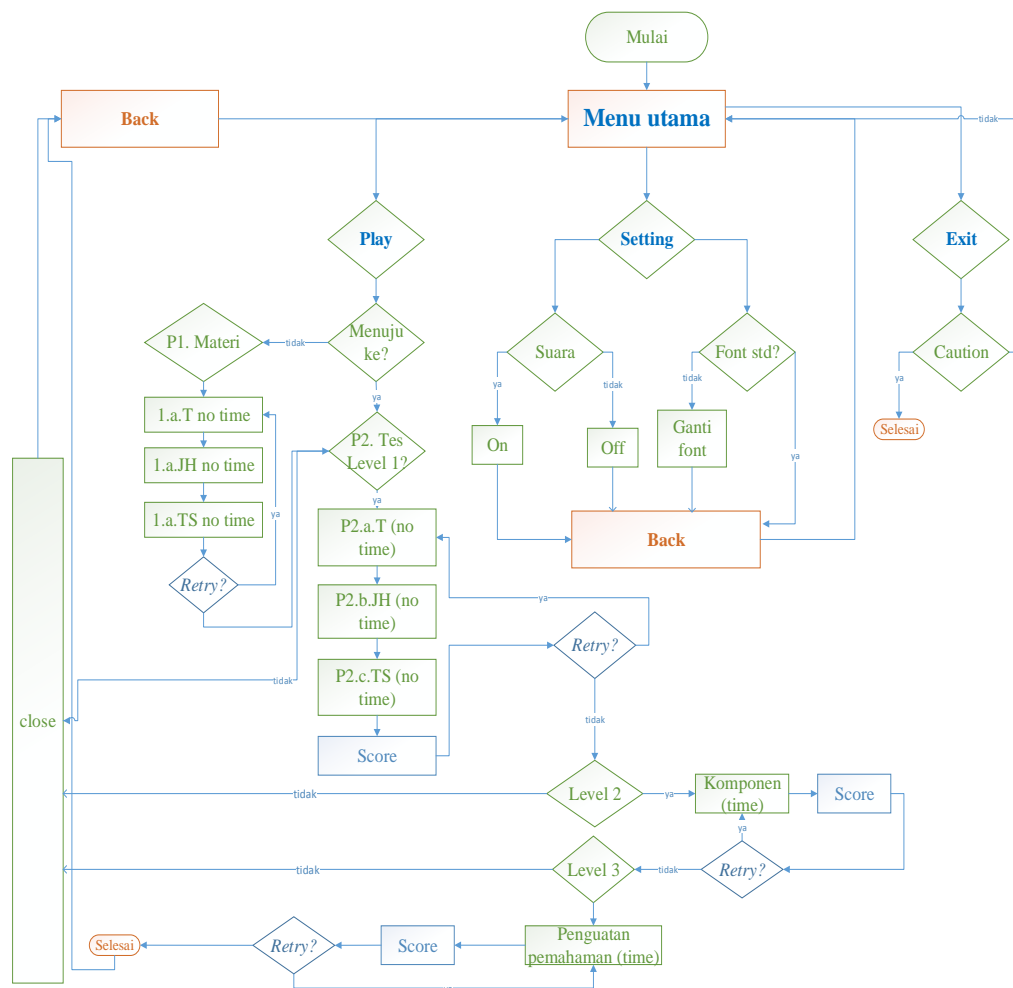

Fig 3. Flow process educational game Jishu hozen maintenance system transmission

1.4. Media Test

Educational games that have been designed are tested to find out whether the game is in accordance with the design or not. If it is not suitable, then redesign is done. In addition, this media trial also considers the results of the understanding questionnaire. If the results of the questionnaire indicate that the educational game helps in understanding students, the educational method is feasible to be applied as a new method in teaching and learning transmission systems. If it does not help understanding, it is necessary to redesign.

1.5. Implementation

Implementation aims to apply game learning media to students in order to develop learning media. The purpose of implementing this learning media is so that student achievement increases both from cognitive and affective and psychomotor aspects.

RESULTS AND DISCUSSION

From this research, an android based game application containing material and tests was produced regarding the transmission of cars and their maintenance. The educational game consists of three levels of tests, first containing questions relating to the transmission system, Jishu Hozen maintenance, and trouble shooting. The second level in this game contains an introduction to the components of the transmission system and the third level of the game about strengthening student understanding. Each level has a different turnaround time. The value range for each level in this game is 1-100. In this game supported by fonts and music that supports a relaxed atmosphere for players. The application is formed through a psudocode program created in such a way.

2.1. Interface

The results of the interface display of the educational game are as follows:
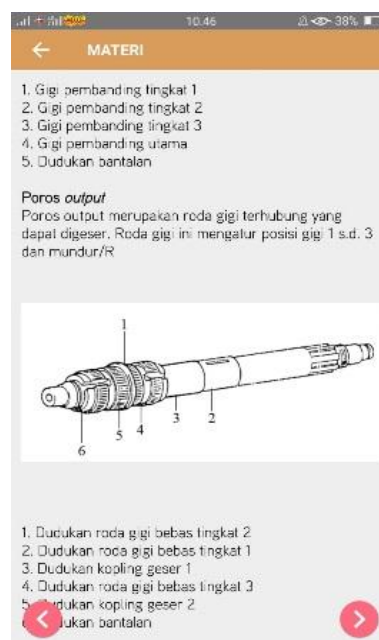
Fig 4. a Front Page   b. Material page   c. Test Page

2.2. Psudocode

```
1.  DBHelper.java
    package com.android.educationgameoto.database;

    /**
     * Created by KF on 7/30/2018.
     */

    import java.util.ArrayList;
    import java.util.List;
    import android.content.ContentValues;
    import android.content.Context;
    import android.database.Cursor;
    import android.database.sqlite.SQLiteDatabase;
    import android.database.sqlite.SQLiteOpenHelper;

    import com.android.educationgameoto.tes.Question;

    import static com.android.educationgameoto.database.GameContract.DataEntry.KEY_ANSWER;
    import static com.android.educationgameoto.database.GameContract.DataEntry.KEY_ID;
    import static com.android.educationgameoto.database.GameContract.DataEntry.KEY_ID_ANSWER;
    import static com.android.educationgameoto.database.GameContract.DataEntry.KEY_IMG;
    import static com.android.educationgameoto.database.GameContract.DataEntry.KEY_LEVEL;
    import static com.android.educationgameoto.database.GameContract.DataEntry.KEY_MATERI;
    import static com.android.educationgameoto.database.GameContract.DataEntry.KEY_OPTA;
    import static com.android.educationgameoto.database.GameContract.DataEntry.KEY_OPTB;
    import static com.android.educationgameoto.database.GameContract.DataEntry.KEY_OPTC;
    import static com.android.educationgameoto.database.GameContract.DataEntry.KEY_OPTD;
    import static com.android.educationgameoto.database.GameContract.DataEntry.KEY_QUES;
    import static com.android.educationgameoto.database.GameContract.DataEntry.TABLE_ANSWER;
    import static com.android.educationgameoto.database.GameContract.DataEntry.TABLE_QUEST;
```

Fig 5. Pseducode database

2.3. Value of Student Understanding

At this stage students solve questions related to manual car transmission and maintenance. Students are given two treatments, the first treatment is the pre test where students answer questions before students use the educational game. Next, re-examine the level of student understanding of manual car transmissions and maintenance after students use the educational game. The results of testing students' understanding before and after using this educational game are as follows.

Table 1. Value college student before and after using educational game

Respondent	Before	After	Respondent	Before	After
1	58	74	16	20	74
2	42	60	17	54	66
3	60	66	18	74	84
4	40	64	19	62	80
5	18	64	20	46	66
6	42	66	21	56	64
7	32	64	22	58	76
8	46	66	23	64	74
9	52	76	24	76	76
10	48	70	25	70	76
11	74	81	26	68	76
12	58	70	27	50	62
13	52	70	28	42	66
14	42	62	29	48	76
15	66	66	30	64	70

Based on the table, 30 students were obtained with the acquisition of scores for two treatments, namely before and after using the educational game as a learning medium for the car transmission system and maintaining it in the form of an Android-based game application. Before using the educational game, the frequency of the scores obtained were 3 students getting E scores, 10 students getting D scores, 8 students getting C values, and 4

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students getting C + scores, 2 students getting B values, and 3 students getting B + scores. Meanwhile, the results of the assessment of 30 students who have used educational games as a means of learning manual car transmissions and their maintenance are 1 student gets a C score, 6 students get a C + score, 11 students get a B score, 10 students get a B + score, and 2 students get a score A. From the results of the table above, it is entered into a table
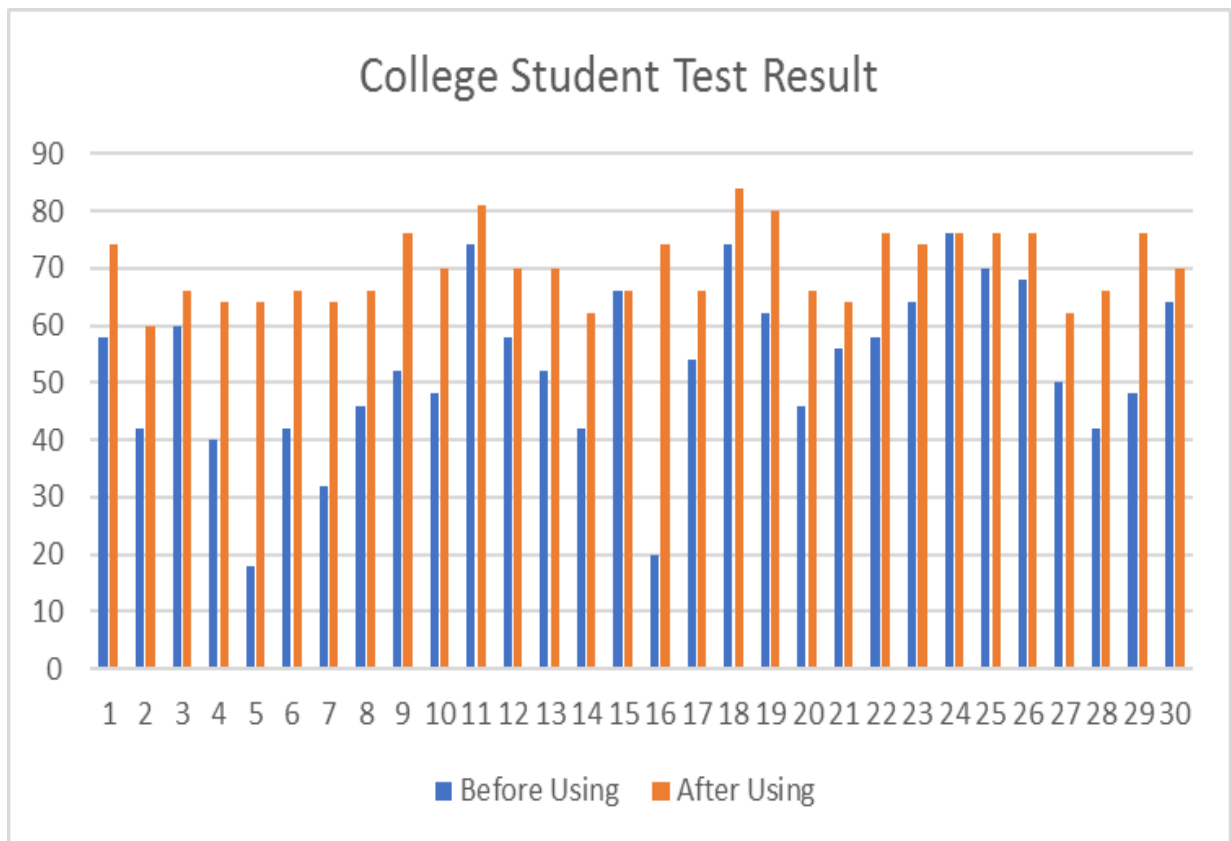

Fig 6. College Student Assessment Before and After Using Educational Game Result

CONCLUSION

With the creation of an android-based educational game about the car transmission system and how to maintain it, it can be applied to students as a learning tool that is expected to help students or the community of car drivers in performing independent maintenance on the transmission system.

Assessment of the feasibility of this educational game media with a media questionnaire distributed to 30 students. Validation and reliability test results show that it is valid and reliable so that it can be used as a reference to test the feasibility of the educational game developed. Respondents who filled out the questionnaire were students who had received Basic and Automotive Maintenance and Repair Engineering courses. The results of testing with the questionnaire stated that student satisfaction was higher when using

educational games. In addition, there are differences in student grades before and after using the game. The difference was tested by the value of the different test paired sample t-test variables from the media, media attractiveness, and the ability of students respectively, namely -28,656; -77.06; -62,885. This is supported by student exam results before and after using educational games as learning media.

REFERENCES

Ansori N., & Mustajib I. (2014). Sistem Perawatan Terpadu, Yogyakarta: Graha Ilmu.

Aqib Z. (2015). Model-model Media dan Strategi Pembelajaran Konstektual (Inovatif), Bandung: Yrama Widya.

Asmeati & Abbas H. (2015). "Analisis Total Preventive Maintenance dalam Minimasi DOwntime Tools Kritis dan Menngkatkan Reliability pada Mesin," in *Rekayasa Material, Sistem Manufaktur dan Energi*, Makasar.

Azipurua J. (2017) "Supporting Group Maintenance Through Prognostics Enhanced Dynamic Dependability Prediction," *Reliability ENgineering and System Safety*.

Fawaid, M., Nurhaji, S., Nurtanto, M., & Ramdani, S. D. (2017). Perancangan Media Pembelajaran Sistem Kelistrikan Luar Mobil. *VANOS Journal of Mechanical Engineering Education*, *2*(1). https://doi.org/10.30870/vanos.v2i1.1965

Firmansyah, A. (2008). "Studi Kasus dan Troble Shooting Gangguan Sistem Transmisi," Universitas Mercubuana, Jakarta.

Gabor & Arki Z., (2017). "The Influence of Game-Based Programming Education on the Algoritmic Thinking," in *Procedia Social and Behavioral Sciences*, Slovakia.

Ginting S., (2007). "Usulan Perbaikan terhadap Manajemen Perawatan," Universitas Gunadarma, Bekasi.

Kusumaningrum T., (2016) "Pengembangan Game Edukasi Berbasis Android untuk Belajar Kosakata," UNY, Yogyakarta.

Novriza (2012). Memperbaiki Transmisi, Medan: Creatacom.

Nugraha, B. M. S., & Wijaya, M. B. R. (2016). Penerapan Model Problem Based Learning Berbantuan Education Games Untuk Meningkatkan Hasil Belajar Siswa Kelas X TKR Materi Hand Tools Dan Power Tools. *VANOS Journal of Mechanical Engineering Education*, *1*(1)

Nurizha (2016). "Trobleshooting Sistem Transmisi Otomatis pada Sepeda Motor Yamaha Mio," Universitas Muhammadiya , Yogyakarta.

Nurtanto, M., Fawaid, M., & Nurhaji, S. (2018). Application of Cluth Educational Teaching Aid As an Effort to Improve Metacognitive Knowledge, *161*, 4.

Pourabdollahian B., Taisch, M. & Kerga E. (2012). "Serious Games in Manufacturing Education: Evaluation of Learners' Engagement," *Procedia Computer Science*, pp. 256-265.

Pradipta, G, (2013). "*Perancangan Game Edukasi Row The Automotive Menggunakan Adobe Flash CS5*" STMIK Amikom, Yogyakarta.

Rifai, W. A., (2015). "Pengembangan Game Edukasi Lingkungan Berbasis Android," Fakultas Teknik Universitas Negeri Yogyakarta, Yogyakarta.

Setiadi, B. R., & Nurtanto, M. (2018). Installation of Closed Circuit Television to Produce a Quality Assessment Process in Vocational Learning, *161*, 4.

Seng W. Y., & Yatim M. H. M. (2014). "Computer Game as Learning Tool for Object Oriented Programming in Higher Education Institution," *Procedia Social and Behavioral Science*, pp. 215-224.

Simkova M. (2014). "Using of Computer Games in Supporting Education," *Procedia - Social and Behavioral Sciences*, vol. 141, pp. 1224-1227.

Sri K. & Suriadi I. (2014) "Geometric Progression Application in Design Transmission Gear Ratio," *Suistanable Technology Development*,

Sudrajat A., (2010). Manajemen Perawatan, Bandung: Politeknik Negeri Bandung.

Supandi (1999). Manajemen Perawatan Industri, Bandung: Ganeca Exact.

Suriadi I., & Atmika K. A., (2016), "Perancangan Rasio Sistem Transmisi Kendaraan Penggerak Roda Belakang untuk Meningkatkan Kinerja Traksi," *Energi dan Manufaktur*, pp. 44-48.

Yusuf, F., (2016). "Pengembangan Multimedia Pembelajaran IPA Meningkatkan Hasil Belajar," in *Inovasi Pendidikan di Era Big Data dan Aspek Psikolognya*, Malang.

Zandieh M., Khatami A., & Rahmati S. H. (2017). "Flexible Job Shop Scheduling under Condition Based Maintenance Improved Version of Imperialist Competitive Algorithm," *Applied Soft Computing,* vol. 58, pp. 499-464.