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ELECTRONIC SPARK ADVANCE IGNITION SYSTEM SIMULATOR AS INSTRUCTIONAL MEDIA FOR ASSISTING ELECTRICAL PRACTICES ON AUTOMOTIVE FIELD

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ABSTRACT

This paper discusses the development of simulators as instructional media for learning Electronic Spark Advance System in vehicle technology and its advisability. Simulators were developed to assist students in learning the skills and practical knowledge of the electronic ignition system in vehicle engine. The simulator was developed by applying 10 development stages. Development stages included: analyzing the problems, needs analysis, product design, design implementation, expert assessment, limited testing (small classes), product revisions, large usage / class testing, product revisions, and get suitable product. The development result was a replica of ESA system separated from vehicle system. The ignition system components were arranged on the acrylic board, so it can be used by the students safely and easily for: (1) identifying components, (2) inspect components, (3) inspect ignition circuit, (4) conducting ignition system adjusting, and (5) simulating ignition system. Based on the material and learning media aspects with the results of limited trials as well as usage trials show that the developed ESA's electronic ignition system simulator was suitable to use, so it can help students to learn and practice skills related to maintenance jobs and repair ESA's electronic ignition system more easily.

Keywords: *Simulator, ESA Electronic Ignition System.*

INTRODUCTION

The need for manpower in the automotive field is still high which can be reflected from the population of vehicles in Indonesia until 2016 reaches more than 10 million units (Ministry of Industry Republic of Indonesia, 2017). This is evidence that the vast market becomes a great opportunity for vocational high school graduates for those who are really competent. However, the lack of local manpower skills compared to foreign workers is an issue that needs to be considered. In accordance with the Ministry of Industry of the Republic of Indonesia (2017), it is stated that the automotive service sector still has a lot of homework to meet the needs, where it is stated that many foreign workers are more qualified than the local workforce.

The establishment of a professional human resources is supported by the provision of quality vocational education. But the development of technology in the automotive field that seemed not to stop being a difficulty in itself. The dominant application of electronics systems in the automotive field is a challenge for many learners. In an electronic spark advance (ESA) ignition system for example, a computer control system is used to adjust the accuracy of its work that is integrated with other engine control systems. In fact, understanding ESA's electronic ignition system is not easy because of the complexity of the electrical system.

Many efforts can be made to improve the effectiveness of learning. One of them is the use of media products / visual aids that can help the learning process. Smaldino, et al (1999) states that: "*the purpose of media is to facilitate communication and learning*". Thus, the media is very important in the learning process. Media can facilitate the communication of learners, both with the teacher and the source of learning. Judging from the benefits, Sukiman (2012) suggests some practical benefits of using instructional media such as: (a) media can clarify the presentation of messages and information so as to facilitate and improve learning process and outcomes; (b) learning media can improve and direct the attention of children so it can lead to learning motivation, more direct interaction between learners and the environment, and the likelihood of learners to learn independently according to their abilities and interests, and (c) learning media can overcome the limitations of the senses, space and time. With the benefits of this medium, the difficulty in accessing and understanding ESA's electronic ignition systems on vehicles can be helped with appropriate media.

Appropriate learning media needs to be used to study electronic systems in vehicles that do not look as if they are abstract. In accordance with Smaldino's opinion, et al (1999: 9-10): "*Instructional media that incorporate concrete experience help students integrate prior experience and thus facilitate*

learning of abstract concepts". The nature of electrical systems in ESA electronic ignition systems are complex and abstract can be assisted by the media learning so that it can look more concrete. This opinion is also based on the opinion of Blank (1982: 195) which states that: through learning tools, it can help learning more effectively through the provision of variations of learning resources and activities such as books, learning media, or practices appropriate to the task or work. The components of the ignition system that are difficult to observe need to be shown in a more accessible place. In addition, the ignition system circuit needs to be set up so it can be easily observed.

In addition to being a mediator between lecturers and learners, practice media can be used as a learning resource for learners, so it must meet media eligibility criteria. Arsyad (2006: 75-76) states that some of the criteria of appropriate learning media include: (a) the media used must be in accordance with the results to be achieved, referring to instructional objectives, (b) the content of the media should be appropriate to support the subject matter, in order (d) easy to use, (e) according to the target group to be taught, (f) meeting the technical requirements. With some of these criteria, then the aspects that determine the feasibility of the media is the aspect of media and content / substance aspects. With decent media, then it will be very helpful to achieve the effectiveness of learning. Evident from research conducted by Suyitno et al. (2018) that the results of the development of learning media that are declared feasible and applied to the 2-step gasoline lecture course, it is quite effective to improve student learning outcomes.

According to the above conditions, learners need a learning medium that allows separating the ESA ignition system circuit with other electrical systems. Therefore, this study aims to:

1. Produce a simulator product as a learning media to membelajarkan ESA electronic ignition system.
2. Knowing the eligibility of ESA's electronic ignition system simulator developed

METHODOLOGY

Research and development methods are used to develop ESA's electronic ignition system simulators. Steps taken in accordance with Sugiyono (2011) include: (1) problem analysis and potential developed, where the problem is the need for simulators that can simulate the work of ESA's electronic ignition system. In the second stage (2), needs analysis; with the existing demands, the simulator should meet the elements of security, convenience, and accommodate practical activities. Third step (3), designing the simulator; Simulator design is done with the help of computer program to design the layout (layout) component, size, and completeness of simulator will be made. Design results are then subsequently

consulted to the expert. The design image of the ESA ignition system simulator can be seen in Figure 1.

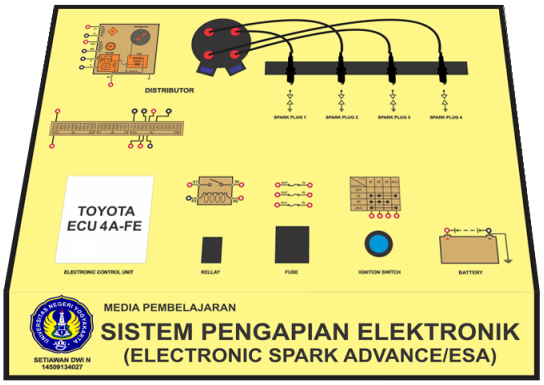

Figure 1. ESA Simulator design

The fourth step (4), the manufacture of real products. After the simulator product is created, the fifth step (5) is validating the simulator by the learning expert and the material expert about the product being created. The sixth stage (6) is a limited trial. Tests are performed on small groups of users. The seventh stage (7) is a revision based on the test response. Revision is done by cleaning the simulator made so it looks clean and bright.

After the revision, the eighth step (8) is testing the use of / final product in the large class on the respondent class practice as much as 16 people. Input for the simulator made in this usage test is related to the ease of storage. So to improve the simulator made, made the rail holder to facilitate the storage. After the revision is done, the next stage is the implementation stage, where the simulator product can be used to assist in learning the practice of Electrical and Electronics Automotive.

The research data was taken by questionnaire method for material experts, media experts, and product users. Data were analyzed to determine the feasibility of media through quantitative descriptive analysis.

RESULTS AND DISCUSSION

1. The result of the simulator product as a learning media to learn ESA electronic ignition system

The result of problem analysis on electronic ignition system learning lies in the difficulty of understanding the abstract electrical character and access of complex system components. With the potential that exists, then made an educational display of ESA electronic ignition system simulator to support the needs of practice. With the stages of development research conducted simulator products produced can be seen in Figure 2. Simulator is made of acrylic material which is an electrical insulator material, which is placed on the metal frame.

Figure 2. Results of ESA's electronic ignition system simulator product

According to the Figure 2, it can be seen that the components of the electronic ignition system are mounted on the display panel accompanied by its component symbols. Thus, learners can learn the physical components and symbols. Simulation of this simulator is done by connecting the components with the connecting cable in accordance with the scheme diagram of ESA electronic pengapia system.

2. The eligibility of developed ESA's electronic ignition system simulator

The simulator feasibility results that have been developed can be seen from the validation data by media experts and material experts, limited trial data, and trial test data to assess the developed product. Validation results by media experts and experts are shown by table 1. Scores of 1.00 - 2.75: Not worth, Score 2.76 - 4.50: Less than decent, Score of 4.51 - 6.25: Eligible, Score 6, 26 - 8.00: Very decent.

Table 1. Simulator validation results

Aspects	Score Rate (Ignition System Simulator)
Content	7,71
Media	7,18
Average	7,45
Category	Very decent
Suggestion	a. The use of DC motors is more practical for resources and practicality. b. Component symbols need to be clarified to support group learning

Based on the results of validation of media experts and material experts above, it can be seen that the developed product is feasible to use. The feasibility of developed simulators is also based on the results of limited trials. Tests are performed on small groups of users. The results of the test can be seen in table 2.

Table 2. The test results are limited to the feasibility of the simulator

Aspects	Average Simulator score
Content	6,5
Media	6,1
Max value	8
Average	6,3
Interpretation	Very decent

Based on the results of feasibility tests against the limited class above, it can be seen that both from the media aspect and the simulator material aspects made to get a positive response from the respondents. The developed simulator is well worth using. Although the lowest score on the media aspect lies in the color combination is still less than optimal.

The feasibility of the product made can also be known from the results of the trial of the use of large classes on the respondent's class practice as much as 16 people. The results of the test can be seen in table 3.

Table 3. Results of trial usage

Aspects	Average Simulator score
Content	6,5
Media	6,3
Max value	8
Average	6,4
Interpretation	Very decent

Based on the results of the above test results, it can be seen that ESA electronic

ignition system simulator is very feasible to be used as a medium of practice learning.

The developed simulator has been feasible to be used to support the learning of automotive electrical systems. The results of the simulator development have been declared feasible in terms of content / material and aspects of instructional media. From the material aspect, the simulator meets the needs of ESA's ignition system practice materials, among others: (1) identifying components, (2) checking the components, (3) checking the circuit, (4) adjusting, and (5) doing the ignition system simulation. Viewed from the media aspect, the simulator has an attractive appearance, layout, size requirements, ease of use, ease of storage, financing, and functional aspects work well.

This simulator is a replica of ESA's electronic ignition system on a vehicle, with the same set of components and circuits as the vehicle. With ease of access to component, provided component terminals in accordance with the code in the manual, then the simulator can also help learning to assemble. In addition simulators can be used to simulate jobs on maintenance and repair of ignition systems as well as on real vehicles. Rai, et al (2014), states that: *Simulation is the imitation of the operation of a real world process or system over time. The act of simulating something first requires that a model be developed; this model represents the key characteristics or behaviors of the selected physical or abstract system or process*." With this ESA electronic ignition system simulator model, the difficulties encountered by learners in learning abstract electronic ESA ignition system electronics, it will be easier. Students do not directly learn the circuit of ignition systems on the vehicle because it will encounter difficulties caused by the complexity of the electrical circuit on the vehicle. However, with this separate simulator, learners are more focused and the ignition system's electrical circuit looks simpler. In accordance with the statement of Barjis J, et al (2012), that: "*For technically and engineering oriented fields, simulation is a prominent way of teaching, experimenting, and dealing with complex systems*".

Naz A.A. & Akbar R.A. (2008) states "*The instructional-aids assist educators to transmit the knowledge in an impressive way of giving diversity to classroom teaching and making learning more effective*". Thus, the model / simulator made and declared feasible will be able to improve the effectiveness of ESA's electronic ignition system learning practice. The resulting model acts as an educational tool that can help the learning process. As well as other car system displays such as starter system developed by Anton Mujahid and Adhetya Kurniawan (2015), where the media-based learning can be used as a supporter to improve student achievement of basic competence of electricity. In addition, with the right media, it can motivate learners because it can encourage

multisensory interest, move the imagination, thinking process, and reasonable ability of learners (Naz A.A. & Akbar R.A., 2008). Thus, the difficulties that exist in the ESA's ignition system power learning can be overcome.

CONCLUSIONS

There are two important points from the results of the above research. First, the result of the development of ESA's electronic ignition system practice technique is an ignition system simulator which is a replica of the ESA's system of ignition system components in the vehicle. This simulator can separate the ignition system components from other vehicle systems. Components are arranged on an acrylic board so it is safe and facilitates access to enable learners to learn: (1) identify components, (2) check components, (3) check the circuit, (4) make adjustments, and (5) ignition.

Secondly, the ESA's electronic ignition system simulator developed is feasible for use based on the assessment of material experts and media experts. In addition, judging from the results of limited trials and usage, obtained the average feasibility score for the limited trial is 6.3 while the average usage test score is 6.4 in the category is very feasible.

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