Jurnal Taman Vokasi
Vol.7, Issue (1) 2019 (pp. 24-30)
p-ISSN: 2338-1825; e-ISSN: 2579-4159
http://jurnal.ustjogja.ac.id/index.php/tamanvokasi

Developing Distributorless Ignition System Learning Media for Automotive Engineering Students

Sudarwanto[1], Tafakur[2]
[1,2]Universitas Negeri Yogyakarta, Yogyakarta, Indonesia
E-mail: [1]sudarwanto@uny.ac.id, [2]tafakur@uny.ac.id

Abstracts. This study aims to: (1) develop a learning media for practicing Distributorless Ignition (DLI) system for automotive engineering students and (2) identify the feasibility of the learning media for practical purpose in the classroom activities. The procedures of this research and development (RnD) study refers to the steps of product development by Borg and Gall (2007). A questionnaire was utilized to measure the learning media feasibility. Furthermore, there were media experts, content experts, and students as the user participated to evaluate and give feedback for the learning media improvement during the product development. The results reveal that (1) the distributorless ignition system learning media displays a systematic arrangement of the DLI components on acrylic boards accompanied by symbols of electrical components and (2) the product developed was suitable to facilitate students' learning activity. The content and media experts scored the learning media as very feasible (7.59 & 7.06), the average score of the response of small class users was 6.14 (feasible), and the scores of large class respondents were 6.80 (very decent). It can be concluded that the DLI learning media can be used to support the instructional activity for ignition system.

Keywords: Instructional media, Distributorless Ignition (DLI) System.

Introduction

The reality in the 21st century shows many changes in various fields of life. Technology is so rapidly developing that easy demands adaptation. Advances in electronic and computer technology have penetrated all lines of life. Technology that is supposed to help human life, on the other hand, can be a problem when humans do not master it. One area affected by rapid technological development is the transportation sector. Where in Indonesia alone, the number of vehicles always increases every year. As reported: Another consequence that must be faced is the opening of competition between countries globally. The open competition includes when the era of the Asean Economic Community (MEA) came into effect. There is no other way to maintain regional and international existence for the Indonesian nation, except by strengthening its Human Resources (HR). Competitive HR is the basic capital of the workforce to be able to compete in the workforce in regional and international areas. The formation of competitiveness can be started from the role of the education and training sectors that form graduates who are competent in their respective fields.

The challenges of globalization, as well as the rapid advancement of technology, are the triggers of education and training institutions to build graduate competencies that are adaptive and predictive of the needs of the community. However, the reality on the ground is very difficult to realize. For example, in the automotive sector, the application of electronic systems and controls, which are other disciplines, has been applied in vehicles. Consequently, the education curriculum for educating students mastering the technology of electronic control systems requires more complex learning. One small field that must be mastered by students is about the material of ignition system Distributorless ignition (DLI) which is currently used in almost all cars with gasoline motor drives. The complexity of the material began to be felt when the ignition system that was applied now was integrated with other systems. This ignition system does not use distributors to distribute sparks produced by the ignition coil. However, this system uses an electronic control unit (ECU)

that controls several coils to regulate the ignition of each cylinder.

Another difficulty that arises in the learning of the DLI ignition system is that the nature of the electronic system is very abstract, it does not appear to work, but it can feel the effect of its performance. The challenge itself for educators to concretize abstract material into material that can be understood by students. One way that can be used by educators is to use appropriate learning media. As stated by [1] that: "Instructional media that incorporates concrete experience helps students integrate prior experience and thus facilitate the learning of abstract concepts." Thus, the use of appropriate learning media can help understanding students who were originally abstract into the concrete.

Learning media are classified into various types. According to [2] the grouping of learning media is made into four groups, namely: a) media produced by print technology, b) media produced by audio-visual technology, c) media resulting from technology based on computers, d) media combined with print technology and computers. Classify types of learning media, namely: a) text, b) audio media, c) visual media, d) motion projection media, e) artificial objects/miniatures, f) Humans [3]. These media are used by the characteristics of the material, as well as students who learn. Because in principle, the media must help the learning process. With the learning characteristics of the DLI ignition system practice direct skills, the media in the form of artificial or miniature objects are the best choices to develop. "The purpose of media is to facilitate communication and learning" [1]. Media is a bridge of communication and learning for students towards educators and other learning resources. Therefore, the right learning media can be used to help teach the practice of the DLI ignition system.

The obstacle in the learning process of the DLI ignition system is not only the abstract matter of the work system and its sequence. However, another aspect that needs to be considered is that the risk of studying this highly sensitive system can cause damage to components. Potentially damaged components not only on the ignition system itself but other systems that are also integrated with the DLI ignition system. Also, the DLI ignition system that is fully installed in the actual vehicle is difficult to observe, the electrical circuit is considered too complex, the components are difficult to reach, and it takes a lot of time and money to train all the skills demanded. Learning about the DLI system is not easy. Based on the observations and results of student practice, students are still having difficulty understanding this material. Also, practical activities cannot be carried out properly because some work cannot be done and cannot be accessed because it uses direct vehicles.

In addition to the media learning role to concretize objects that were originally abstract, the right learning media also has several benefits. Explains some practical benefits of using learning media, among others: (a) the media can clarify the presentation of messages and information so as to facilitate and improve learning processes and outcomes, (b) learning media can increase and direct children's attention so that they can cause motivation to learn, more direct interaction between students and their environment, and the possibility of students to learn on their own according to their abilities and interests, and (c) learning media can overcome sensory limitations, space and time [4]. Thus, the proper use of media can assist in the implementation of the DLI ignition system. Previously, once stated that: through learning tools, it can help to learn more effectively through the provision of variations in learning resources and activities such as books, learning media, or practices that are appropriate to the task or work.

Learning media for the practice of DLI ignition systems need to be developed based on needs. Learning media in the form of models or visuals is a suitable tool for learning competence in DLI ignition systems. The education exhibitors developed must be suitable for use. States that some criteria for proper 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 must be appropriate to support the subject matter, in order to help the effective learning process, (c) the content should be practical, flexible, easy to use, and durable/reliable, (d) easy to use, (e) in accordance with the target group to be taught, (f) meet technical requirements. With some of these criteria, the aspects that determine the feasibility of media are aspects of the media

and aspects of content/substance [5]. Thus, in this study, we will discuss: The results of the development of DLI ignition education systems in the Department of Automotive Engineering Education, Faculty of Engineering, Universitas Negeri Yogyakarta and the feasibility of DLI ignition education system developed at the Department of Automotive Engineering Faculty of Engineering, Universitas Negeri Yogyakarta.

Research Methods

This research uses research and development methods to develop learning media in the form of educational visuals for the practice of DLI ignition systems in the automotive field. The development model carried out adopted the steps of research and development from Borg and Gall (2007). Declare that "The major step in R & D cycle used for research is following: Research and information collecting, Planning, Developing preliminary forms of products, Preliminary field testing, Main product revision, Main field testing, Operational product revision, Operational fields, Final product revision, Dissemination and implementation" [6]. Therefore, adapting to these steps, the development of educational displays for the practice of the DLI ignition system includes steps: (1) searching and collecting data, (2) planning, (3) initial product development or product design, (4) initial field trials, (5) revisions based on the results of the initial trials, (6) large class trials, (7) revisions to the results of the trials, (8) usage trials, (9) final revisions, and (10) implementation of development results. In the search and data collection phase, it is carried out

In addition to the step of the development process carried out to produce the product, at the development stage an assessment of the feasibility of the education display made was carried out which was accommodated in the initial field testing step. The assessment was carried out by material experts to validate the media in terms of material content, learning media experts to validate learning media developed in terms of media aspects. Users consist of users in small classes and groups of users from large class groups. Data from respondents were excavated by questionnaire/questionnaire instruments with semantic measuring scale. The scale used consists of choices of answers from score 1 to score 8. Score 1 is the most negative response, while score eight is chosen when the respondent gives the most positive response. The results of the recapitulation of the next value are compared with the standard normative reference table to determine the assessment category. Based on the continuum scale, a standard norm reference table is obtained in table 1.

Table 1. Product eligibility criteria

Number	Score	Feasibility Category
1	1,00 – 2,50	Very inappropriate
2	2,51 – 5,00	Less Worthy
3	5,01 – 6,50	Worthy
4	6,51 – 8,00	Very Worthy

Result and Discussion

The development carried out has got the results according to the target. In accordance with its objectives, this research has produced a development product in the form of a visual aids as well as producing the results of a media feasibility test developed. The results of the study can be explained below.

The results of the development of educational equipment for DLI electronic ignition systems

The development of educational display products is carried out by the stages planned. As a result, educational display products can be realized according to the design made. The design is made by the characteristic needs of students, in this case, students, as well as the characteristics of the material studied with this display. The layout design of the development of learning media in the form of educational displays for DLI ignition systems can be seen in figure 1.

This educational exhibit displays components of the DLI ignition system that are

placed on an acrylic board. The education of the DLI ignition system developed can be seen in Figure 2.

The components are arranged systematically by the work order of the ignition system. To facilitate understanding, this ignition system has been separated from other vehicle systems. The ignition system component is installed with an easy-to-reach arrangement and placement to help students access the forms of construction, composition, and characteristics of the components. Also, the exhibitor presents electrical component symbols to make it easier for students to understand the circuit symbols and schemes. Thus, in the learning process, students can easily synchronize between the electrical circuit scheme and the visual object.

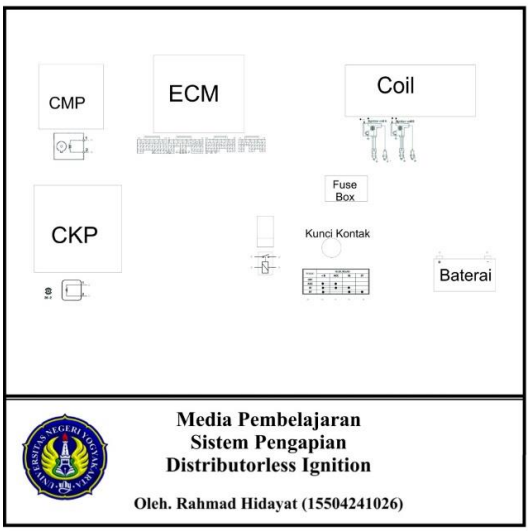

Figure 1. Design layout for media development

Figure 2. The results of the development of an educational display

The components of the DLI ignition system that are installed are given a terminal that can be connected with a cable that is easily installed and removed. That is to facilitate storage and facilitate learning how to assemble the components of the ignition system into a series of ignition systems as a whole. In terms of material, the display is made from the main acrylic material mounted on an iron frame, so that besides having good aesthetic value, it also acts as an electrical insulator to support security aspects of the media. The acrylic board is placed on an iron frame that is formed firmly and with dimensions that allow students to learn comfortably in groups. The size of the media is adjusted to the learning needs, which is accessed on a work desk.

Judging from the aspect of its function, this display allows a simulation of the work of the DLI ignition system as this system works in vehicles. Simulation can be done after the components are assembled with a connecting cable according to the DLI ignition system circuit scheme. After that, students can simulate their work by operating the control pedal. When the simulation is run, the sensors will work and provide input to the Electronic Control Unit (ECU). After that, the ECU will calculate the input given to determine the output of the ignition system in the form of sparks on the spark plug that is easily seen. Also, to monitor the rotation as in a real vehicle, the display is equipped with a round gauge that is displayed on the dashboard.

The results of the feasibility study media for DLI ignition systems

This research is targeted to produce products that are truly feasible to use by the specified feasibility indicators. The feasibility test of the educational exhibitor was developed based on the responses and opinions of media experts who assessed the product based on the learning media aspects, material experts who assessed the product from the point of view of substance/content, and the opinions of users in this matter were students of Automotive Engineering Education FT UNY. By the stages of development, users are classified into small groups and large groups. The response data regarding the media products developed

obtained by questionnaires for expert respondents can be seen in table 2.

Table 2. Recapitulation of media feasibility questionnaires by learning media experts and material experts

Item	Media expert	Information	Material expert	Information
mean	7,59	Very decent	7,06	Very decent
The highest score	8		8	
Lowest value	7		6	

Based on the table above, according to media experts and material experts it can be seen that overall the average score obtained is in the high region. Likewise, the lowest score and the highest score of each item are in a high area. This value is then compared with the criteria table in table 1. Based on the criteria table shown in table 1, according to media experts and material experts, the media developed can be said to be feasible to use, even if there is a score that is not optimal. Judging from the advice given by experts, several experts have provided suggestions for the improvement of the educational exhibitors developed. These suggestions were discussed by the research team to decide what corrective actions needed to be taken. Recapitulation of suggestions and improvements made that can be seen in table 3.

Table 3. Recapitulation of suggestions and input from media experts on the learning media developed.

Number	Repair suggestions	Improvements made
1	Need to add gas pedal operation information	Provided operating instructions on education display
2	It is necessary to include a picture of the ignition system circuit in the panel / included when practicing	Add a DLI ignition system circuit to a separate sheet and to the jobsheet
3	Need to add security to the spark plugs	Added acrylic safety

With the revision of learning media developed, the media products developed have been sufficiently feasible to be tested on small groups of users. Data from trial results of small groups of users can be seen in table 4.

Table 4. Data on limited trial results on media feasibility

Item	Highest score	Lowest score	average	Category
Display	8	2	5,86	worthy
Ease of use	8	4	6,13	worthy
Functional	8	5	6,26	worthy
Security	8	5	6,6	Very decent
Mean			6,14	worthy

Based on the data in table 4 above, it appears that in general, the average score obtained is quite high, which is 6.14. Based on the criteria table in table 1, according to the group of respondents in the small class, the media made can be said to be worthy of use. More details, judging by the feasibility indicators, the display aspect gets the lowest score with an average score of 5.86. However, this value is still in the feasible category. On the contrary, the feasibility indicator that gets the highest score is on the security aspect, where a mean score of 6.6 is obtained. Thus, the security aspect can be categorized as very feasible.

Table 5. Advice and input from small class respondents, along with improvements made.

Number	Suggestion	Corrective action
1	The letters are too small, the colors are less attractive	Clean the media to taste
2	The ECU code is unclear	Provide a clear code on the usage guide diagram / electrical diagram of the DLI ignition system made
3	The condition of the media looks dirty	Clean the media to taste

Indicators of media feasibility with a feasibility score that is not optimal are clearly known. For the sake of improving the media, input and suggestions from respondents were

also explored. The respondents' suggestions were then discussed by the research team to determine the improvement decisions that needed to be made. After discussion, the revisions / revisions made can be seen in table 5 above.

With the revision carried out, the learning media that were developed were then tested on large classes. In this case there are 20 practice classes. The results of responses from users in the large classes obtained can be seen in table 6.

Table 6. Results of the user's response to the learning media of the DLI ignition system

	Highest score	**Lowest score**	**Average**	**Category**
Display	8	4	6,68	Very decent
Ease of use	8	4	6,69	Very decent
Fungctional	8	4	6,99	Very decent
Security	8	3	6,90	Very decent
Mean			6,80	Very decent

Based on the media feasibility questionnaire data given to the user respondents, it appears that the average score of feasibility is 6.80. The media in the form of educational exhibitors developed are very feasible to use. More details of each of the feasibility indicators, the media developed get an average score above 6.51 (minimum criteria value), so that it can be assumed that from all aspects of the media it can be said to be very feasible. However, from the lowest score data, each aspect, there are questions that get scores of 3 and 4. The security aspect gets the lowest score of 3, while the other aspects 4. Thus, it needs to be explored further, related to suggestions and comments from users who obtained as a basis for improvement. Suggestions/input from users and efforts to improve the media can be seen in table 7.

Table 7. Recapitulation of suggestions and input from user respondents along with media improvements.

No.	**Suggestion**	**Corrective action**
1	Add component name information	Use the manual to access component names
2	Add a place for batteries	-
3	Add an electric shock warning to the spark plug component	Give a warning on the instructions for use

After repairing the product based on suggestions and input from users, the learning media developed can be said to be feasible to use. The product of the DLI ignition system can be used for learning media in learning theory and practice of electricity and automotive electronics, especially in the matter of DLI ignition systems.

The learning media of the DLI ignition system is designed to be able to support the learning and training of various competencies that must be mastered by students. The learning media developed is an educational display that can show the system and simulation of the work of the DLI ignition system. The exhibition consists of DLI ignition system components arranged in such a way that it is easy to identify, inspect, and assemble according to the DLI ignition system scheme. Also, with the need for a safe, educational display, the media materials are considered using those related to electricity, namely acrylic as an electrical insulator.

Based on the results of the analysis of media feasibility data, the learning media of the DLI ignition system has been declared suitable for use. Expert opinions and users have stated that the display that is loaded is appropriate to use. Can also be interpreted that the media which has fulfilled the elements of media feasibility. It is evident from each indicator that comprehensively requires that the exhibitor developed is suitable for use. The learning media of the DLI ignition system will support the achievement of student competencies. As explained earlier, the demand for mastery of students' competencies in the field of vocational education must refer to the current and future needs of the industry.

Learning DLI ignition systems which were initially difficult to practice various skills because of the characteristics of the material that is difficult to access and too risky to practice indirect objects can now be facilitated by the existence of appropriate media. With the media being developed, it is expected to contribute to the increasing quality of learning. Material demands such as identifying components, carrying out component checks,

checking the DLI ignition system, assembling, and testing the DLI ignition system can be supported by the presence of this educational display.

The DLI ignition system which was originally difficult to understand, too risky, and too abstract to learn, with the presence of this educational display, the practice of the DLI ignition system can be done to achieve the competency of students. The DLI ignition system can be trained concretely with the presence of this learning media. As stated by [1] that: "Instructional media that incorporates concrete experience helps students integrate prior experience and thus facilitate the learning of abstract concepts."

This education visualizer is an important component in the learning process of the DLI ignition system. Learning media has many benefits to support an effective learning process, directed at the goals set. With its function, the education educator of the DLI ignition system will also help the communication of students. As with the opinion of [1] who said that: "the purpose of media is to facilitate communication and learning." With the achievement of student competencies due to the contribution of these educational presenters, then other materials with characteristics similar to those of the DLI ignition system can also be developed by visual artists with the same concept. The impact, student competency can reach according to the expected criteria. The long-term impact is that students can compete in the era of globalization with strong competency and competitiveness.

Conclusion

Based on the results of the research on the development of the DLI ignition system, it can be summarized as follows: (1) The results of the development of DLI ignition system learning media in the form of an ignition education system in the form of simulators by displaying ignition system components arranged in such a way as to form ignition system that can be affected to work. (2) The learning media of the DLI ignition system developed can be said to be suitable for use. It is evident from the value of media feasibility by material experts in the very feasible category with a mean score of 7.06, media experts in the very feasible category with a mean score of 7.59, and the results of trials for users in the very feasible category with a mean score of 6.80.

References

[1] S. E. Smaldino, Instructional technology and media for learning. Upper saddle river: Pearson, 1999.

[2] B. B. Seels and Richey, Instructional Technology: the Definitions and Domains of the Field. Whashington DC: AECT, 1994.

[3] D. R. Heinich, Molenda., and E. Smaldino, Instructional Technology and Media for Learning. Columbus, Ohio: Pearson Merrill Prentice Hall. Upper Saddle River, 2005.

[4] Sukiman, Pengembangan Media Pembelajaran. Yogyakarta: Pedagogia, 2012.

[5] A. Azhar, Media Pembelajaran. Jakarta: Rajawali Pers, 2014.

[6] M. D. Gall and W. R. Borg, Educational Research: An Introduction., 7th ed. New York: Longman, 2003.