

Development of e-module integrated QR code in a lesson of Air Conditioner (AC) to support paperless

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Abstracts. This was Research and Development. This research aimed to develop an integrated QR-code e-module to support the paperless movement in the air conditioner (AC) course, and to find out the feasibility of media e-modules and the response of students of Mechanical Engineering Education. The results of this study were: 1) the integrated QR-code e-module product to support the paperless movement in the air conditioner (AC) course, 2) the air conditioner e-module was declared feasible by experts with a percentage of feasibility by material experts of 100%, from the results e-modules worthy of product testing. In the product trial, the results of the readability of e-module media in 20 students obtained an overall score of 1767 indicating "very feasible" with a percentage of 88.35%. In testing the use of the results of the readability of e-module media; 50 students obtained an overall score of 4128 indicating "feasible" with a percentage of 82.56%, so it could be said that the e-module developed was feasible to be used as a learning media for the manufacture of AC and accessories.

Keywords: development, integrated e-module qr-code, paperless movement

Introduction

Teaching materials are one of the important elements in learning. The definition of teaching material is widely expressed by experts, one of which is Finch and Crunkilton (1999: 208) which suggests that, "teaching materials are sources that can help teachers in bringing desired behavior changes in individual students".

The definition above illustrates that a teaching material should be designed and written with instructional rules because it will be used by the teacher to help and support the learning process. Bahan ajar merupakan salah satu unsur penting dalam suatu pembelajaran. Definisi bahan ajar banyak dikemukakan oleh para pakar, salah satunya adalah Finch dan Crunkilton (1999:208) yang mengemukakan bahwa, "bahan ajar yaitu sumber-sumber yang dapat membantu pengajar dalam membawa perubahan perilaku yang diinginkan dalam individu para siswa".

The learning process requires components so that learning activities run well and directed, one of which is the presence of teaching

materials that can be used as learning guidelines for both students and lecturers. As a subject that is classified as old but requires the development of teaching materials that can be used as learning guidelines.

According to Hamalik Oemar (2014: 36) Definition of learning is a process, an activity and not a result or goal. Learning is not only inviting, but wider than that, namely experiencing. Learning outcomes are not a mastery of the results of training, but changes in behavior.

Learning resources are one component of learning activities that enable students to gain knowledge, abilities, attitudes, beliefs, emotions, and feelings. Learning resources can provide learning experiences and without learning resources it is impossible to carry out the learning process well.

Learning can be done anywhere and at any time, with today's technological goals students learn can be helped by teaching materials for e-modules that are easy to use, students do not have to use books or pens, using mobile phones

students can learn anywhere and are practically brought.

According to Prastowo (2011: 45) "Interactive e-module teaching material is one whose publishing process in digital form consists of text, images or a combination of both. E-module is an electronic module which is a teaching material that is presented systematically so that users can learn independently or without a facilitator or teacher ". Whereas according to Asyhar (2012: 105) "One of the criteria of the interactive e-module is self instructional which makes the teaching material able to teach students independently".

E-learning modules are teaching materials that are arranged in a systematic manner, methods and evaluations that can be used independently, according to the speed of learning of each individual effectively and efficiently. Teaching e-modules is an individual teaching process that allows students to master teaching materials.

Air Conditioner (AC)

Air conditioner (AC) or air conditioning is a modification of the development of cooling engine technology. This tool is used to aim to provide cool air and provide water vapor needed for the body. AC users are often found in tropical regions which are famous for summer. High temperatures during summer can cause dehydration of body fluids which can lead to death.

In addition, the air conditioner is used as a convenience provider. In the AC workplace environment is also used as a way to increase work productivity. Because in some cases humans need a comfortable air environment to be able to work optimally. The comfort level of a space is also determined by temperature, humidity, circulation and the level of cleanliness of the air.

Inside the Air Conditioner is divided into two rooms. Inside and outside space, in the air inside the room is cold because there is a cooling process. The outside is used to release heat into the surrounding air.

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One of the learning materials in the Mechanical Engineering Education Study Program at the University of Sarjanawiyata Tamansiswa is AC and Accessories. Air Conditioners are given with the aim that students have the skills and skills in practice. In the practice of Air Conditioning (AC) requires neatness, accuracy, and creativity in conducting learning, this is a difficulty for students, as evidenced during the practice students do not follow the steps in accordance with the procedure in conducting learning in the workshop.

To overcome these problems the lecturer must be able to present the media in learning that can better generate interest in student learning, one alternative is to use learning media that can improve the learning process of Air Conditioning (AC). Learning media that can be used are electronic modules.

Electronic modules are media that can facilitate learning, clarify presentation, overcome limitations, time, to help students be more motivated and subject matter can be better understood. The electronic module made with the language that is easy for students to understand, is given an overview and work steps, at the end of the learning activity also given mastery for students.

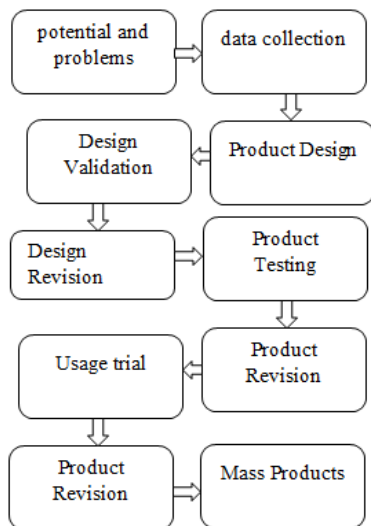
The success of learning with an electronic module system is expected to be able to foster neatness, accuracy, and creativity in the learning process of Air Conditioner (AC), besides creating effectiveness and efficiency in the learning process. By mastering Air Conditioner (AC) material, students are expected to have good and more creative AC skills and accessories competencies in the practice of Air Conditioner.

Metode

Research on the development of e-module Air Conditioner (AC) in the AC and Accessories courses at the Mechanical Engineering Education Study Program at the University of Srajanawiyata Tamansiswa is a type of research and development (Research and development / R & D), namely research methods used to produce certain products and test the feasibility of the product. According to Sugiyono, (2017: 407) "Research and development methods or in English Research and Development is a research method used to produce certain products, and test the effectiveness of these products".

In this case the development procedure will explain several procedures or steps that must be taken when developing and making e-modules. The development procedure in the research on the development of e-module Air Conditioner (AC) in the AC and Accessories courses for semester IV students, especially in the field of automotive experts, Sarjanawiyata Tamansiswa Mechanical Engineering Education Study Program uses development research procedures according to Sugiyono (2017: 409)

Development research according to Sugiyono (2017: 409) "there are ten steps namely potential and problems, data collection, product design, design validation, design revision, product testing, product revision, usage testing, product revision and mass products". The steps of research and development are shown in the figure.



Gambar 1. Steps to use the Research and Development Method

The subjects in this study were fourth semester students of the Mechanical Engineering Education Program, especially in the field of automotive experts, Sarjanawiyata Tamansiswa University. The subject of this research is product testing which is only for fourth semester students majoring in automotive in the Air Conditioner and Accessories courses. The object of this research is an integrated e-module QR code to support the paperless movement on the subject of Air Conditioning (AC) Study Program of Mechanical Engineering Education at Sarjanawiyata Tamansiswa University.

The results of student assessment of this e-module are aspects of readability. By analyzing the description, the research can look for the magnitude of the score or mean (mean) and standard deviation (SDI). After all data has been collected, then the data is then analyzed.

Mean

$$Me = \frac{\sum x_i}{n}$$

Which one :

- Me = mean (average)
- Xi = value x to I to n
- n = individual total

Standar deviasi

$$S = \sqrt{\frac{\sum(x_1 - x_2)^2}{(n-1)}}$$

Which one :

- $(x_1 - x_2)^2$ = deviation
- S = standard deviation of samples
- n = number of samples

The clarification is based on a normal curriculum by using ideal scores obtained from the instrument. For the assessment of categories strongly agree interpreted to be very feasible to use, the assessment of agreed categories is interpreted to be feasible to use, the assessment of the category is not feasible, interpreted to be less well used, while the assessment does not agree, interpreted to be unfit to be used as learning media Air Conditioner.

Tabel 1. Clarification of criteria for evaluating the feasibility of e-modules by students

Assessment category	Value	Value interval
Very accepted	4	$(S \text{ min} + 3p) \leq S \leq S \text{ max}$
Accepted	3	$(S \text{ min} + 2p) \leq S \leq (S \text{ min} + 3 p-1)$
Less accepted	2	$(S \text{ min} + p) \leq S \leq (S \text{ min} + 2 p-1)$
Not accepted	1	$S \text{ min} \leq S \leq (S \text{ min} + p-1)$

Which one :

- S = score of respondents
- S min = lowest respondent score
- S max = highest respondent score
- p = length of class interval

Results and Discussion

This study developed an application that uses QR code to support paperless movements in the Air Conditioner (AC) course which is presented in the form of applications, lecturers and students can install it through the application address and open it via mobile / cellphone. The results of the development products can be published through Google Drive.

1. Appearance_AC that has been downloaded on a smart phone

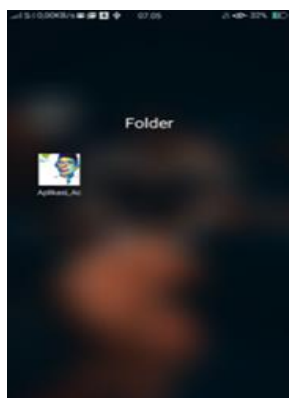


Figure 4. Display of AC Applications (Source : Rahmatia Joisangadji, 2018)

2. Screen 1, the initial display on the application_AC which consists of: background AC, start button, profile button and button to upload the barcode.

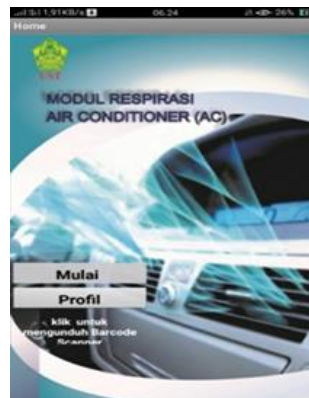


Figure 5. Initial view of the AC Application (Source: Rahmatia Joisangadji, 2018)

3. Screen 2, the display scans the barcode. How to scan a barcode by placing a barcode pattern in the box to scan.



Figure 6. Display Menscan Barcode (Source: Rahmatia Joisangadji, 2018)

4. Screen 3, module page display consisting of introduction button, button (KP, RPS, SAP), meeting button 1 to meeting 14, and evaluation button

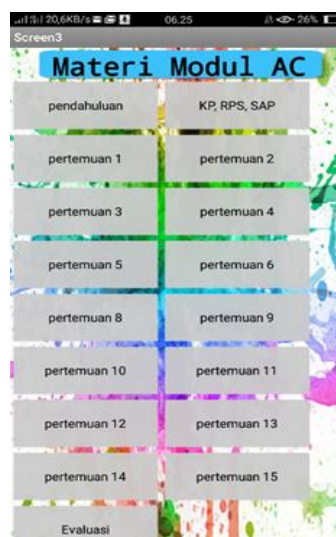


Figure7. Module Page Views (Source: Rahmatia Joisangadji, 2018)

5. Screen 6, displays the meeting page 1 which contains basic concept material from air temperature and coolant



Figure 8. Display of Meeting Page 1 (Source: Rahmatia Joisangadji, 2018)

6. Screen 20. Displays a page about the evaluation



Figure 9. Display of evaluation questions page (Source: Rahmatia Joisangadji, 2018)

The feasibility of e-modules validated by material experts was measured using an alternative "Worthy" with a score of 1 and "Not feasible" with a score of 0. The number of questions consisted of 11 items with respondents 2 people. The results of the assessment obtained a maximum score of $1 \times 22 = 22$, the minimum score of $22 \times 0 = 0$ the number of classes is 2, the length of the class interval (p) $22: 2 = 11$. The results criteria for e-module material experts can be seen in the table:

Table 2. Criteria for Results of e-module Validation by Material

Value	Assessment categories	Value interval	Score
1	Feasible	$(S \text{ min} + p) \leq S \leq S \text{ max}$	$14 \leq S \leq 28$
0	Not feasible	$S \text{ min} \leq S \leq (S \text{ min} + p - 1)$	$0 \leq S \leq 13$

The feasibility of e-modules that are validated by media experts is measured using an alternative "Worthy" with a score of 1 and "Not feasible" with a score of 0. The number of questions consists of 14 items with respondents 2 people. The results of the assessment obtained a maximum score of $1 \times 28 = 28$, the minimum score of $0 \times 28 = 0$ the number of classes is 2, the length of class intervals (p) $28: 2 = 14$. The results of e-modules by material experts can be seen in table 3.

Table 3. Criteria for Results of e-module Validation by Media Experts

Value	Assessment categories	Interval value	Score
1	Feasible	$(S \text{ min} + p) \leq S \leq S \text{ max}$	$11 \leq S \leq 22$
0	Not feasible	$S \text{ min} \leq S \leq (S \text{ min} + p - 1)$	$0 \leq S \leq 10$

Details of the results of the readability of students on e-modules from 20 respondents stated a score of 260 (54.20%) Very Acceptable, score 228 (45.40%) Ditrima, score 4 (0.40%) Less Acceptable and Score 0 (0%) Not Accepted. For more details, can be seen in the table about the presentation of student reading results on e-modules in product trials.

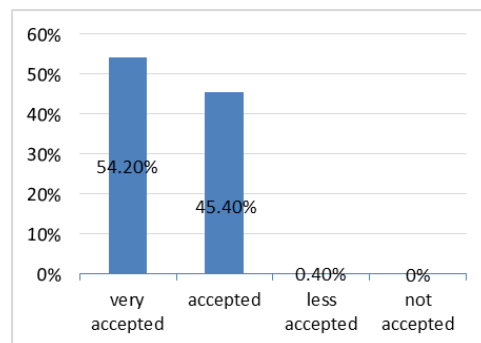


Figure 2. Test Result Histogram of E-module Products

Details of the results of the readability of students on e-modules from 50 respondents stated a score of 442 (32.32%) Very Acceptable, a score of 782 (65.60%) Received, a score of 26 (2.08%) Less Received and a score of 0 (0%) Not Accepted. For more details, it can be seen in the student reading results table for e-modules in the usage trial.

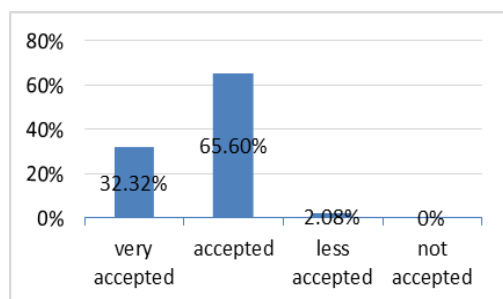


Figure 3. Test Result Histograms Using E-modules

This development aims to produce an e-module Air Conditioner using the apk application and design e-module Air Conditioner (AC) stored in PDF format in accordance with the provisions.

Conclusion

E-module Air Conditioners are declared as "feasible" products for mass testing based on validation results from material experts and media experts.

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