



## DEVELOPMENT OF TEACHING MATERIALS BASED ON E-MODULE CLASS X INFORMATICS SUBJECTS

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### ABSTRACT

*The era of globalization and technological developments proves that the world has entered the industrial era of 4.0. The existence of this human activity is easier to get information. Not only information, but in the world of education it also makes it easier for teachers and students to carry out teaching and learning activities. State Vocational High School (SMK) 1 Tulungagung still uses teaching materials that are PDF text. With the lack of variety of teaching materials, students feel quickly bored and bored in the learning process. Less attractive teaching materials make students lazy to learn. In addition, it also affects the value of Student Completeness Criteria (KKM). So the development of e-module-based teaching materials can provide student enthusiasm and motivation in the learning process. This research aims to arouse students' enthusiasm for learning by using e-module-based teaching materials that are interactive and facilitate students in learning. This research method is Lee and Owens (2004). This research uses R&D (Research and Development) development research, this research produces a product, and tests the effectiveness of the resulting product. In this study, researchers used the Lee and Owens (2004) development model consisting of five stages, namely Assessment, Design, Development, Implementation, and Evaluation. The eligibility results of media experts get a percentage of 100%, material experts get a percentage of 100%, small group trials get a percentage of 97.6%, and large group trials get a percentage of 92.6%. Based on the average results of the four percentage data, the percentage of products is 97.3% and is included in the "Very Decent" category based on the rating scale table. So this study concludes that the development of e-module-based teaching materials in informatics subjects is very suitable for grade X students of SMK Negeri 1 Tulungagung.*

**Keywords:** teaching materials, e-module, informatics

### I. INTRODUCTION

**A**t The era of globalization and technological developments proves that the world has entered the industrial era 4.0. The existence of this human activity is easier to get information. Not only information, but in the world of education it also makes it easier for teachers and students to carry out teaching and learning activities. The use of technology in education will make students more interested and the learning process can be carried out independently [1]. Active and creative learning provides student enthusiasm and motivation in the learning process [2]. Informatics subjects in the independent curriculum are subjects that must be understood by all Vocational High Schools (SMK) 2 in Tulungagung. This is because students do not only know the development of technology through mobile digital devices. However, technological developments also include those in laptop and computer devices. Informatics subjects in the independent curriculum also make students, not gaptek (technology stuttering).

In this informatics subject for all Sschool Intermediate Kvocational is in the Independent Curriculum. The Ministry of Education, Culture, Research, and Technology (Kemendikbud-Ristek) issued the latest learning process policy in Indonesia called the Merdeka Curriculum. The Merdeka Curriculum is one of the evaluations of the previous curriculum, the 2013 Curriculum. The advantages of using the Independent Curriculum include: the learning process uses simple media and it is expected that the learning process is by student development achievements. Before implementing the Independent Curriculum in schools, two-dimensional learning media facilities such as LKS (Student Worksheets) were provided. The LKS contains little material so the learning media used when implementing the 2013 Curriculum is inadequate [3]. The existence of the Independent Curriculum helps teachers

and students in the learning process by using e-modules so it requires the role of technology that is developing today.

E-module-based teaching materials aim for students to be easier to understand the material and students more active in independent learning. This e-module-based teaching material requires Android as a medium so that 3 students can access the e-module. Android users at SMK Negeri 1 Tulungagung 98% of students actively use Android, so the e-module-based teaching materials, it is very suitable for use in learning activities every day. In addition, the facilities and infrastructure at SMK Negeri 1 Tulungagung are adequate to support the learning process such as computers, WiFi internet networks, and other learning media tools. So that it can be used in teaching and learning activities. The situation of teachers at SMK Negeri 1 Tulungagung is quite understanding of the use of technology in the learning process but still has limitations in using teaching materials. For example, e-module materials in the form of PDF text and sent via class WhatsApp grub so that teachers have not used other learning application developers. With this problem, teaching material developers must overcome existing problems and introduce teaching material developer applications that are easy to use. E-modules also affect the value of Student Completeness Criteria (KKM). This was proven by previous researchers who developed E-Module-Based Teaching Materials in the subject of momentum matter physics whose products are very suitable for use by students so that they get a percentage of grades of 98.7% [4].

## II. LITERATURE REVIEW

### A. Teaching Materials

#### 1) Understanding Teaching Materials

Teaching materials must be made and written by instructional rules, the existence of teaching materials will help teachers support the learning process takes place.

#### 2) Functions of Teaching Materials

The function of teaching materials is to make it easier for teachers to carry out the learning process, in addition to teachers teaching materials function for students as guidelines in the learning process by the curriculum. Based on these functions, other functions of teaching materials can be grouped into three parts, including (1) Classically teaching materials function as controllers and sources of information for students; (2) Individually, teaching materials function as the main medium in learning and as a tool that conveys information in supervision to students, and (3) In groups, teaching materials function as tools or supporting learning materials that are prioritized.

#### 3) Types of Teaching Materials

According to Heinrich et al., (1996) [5] types of teaching materials can be grouped into 5 parts, including:

(1) Audio teaching materials, (2) Video teaching materials, (3) Media teaching materials, (4) Teaching materials in the form of flat objects, (5) Teaching materials that can be displayed.

### B. Mygo

#### 1) Understanding Modul

The module is one of the teaching materials in the form of a written book to make it easier for students to learn independently. The module contains material from the curriculum used today (Nurdyansyah & Mutala'iah, 2018) [6].

#### 2) E-Module

The material packaged in digital learning media is called an e-module. E-Modules are teaching materials that are in digital format and use an Android device or computer so that it is structured according to the curriculum used today (Lestari & Parmiti, 2020) [7]. So the teaching materials in the form of e-modules will make it easier for students and students to learn independently.

### C. Android

#### 1) Understanding Android

Android is a Linux-based operating system used for *mobile devices*. Android or commonly referred to as a smartphone is an operating system that has an *open source* nature because, in this Android or smartphone, there are application features that already exist so that Android or *smartphone* provides a place for users who will Develop applications from the android.

#### 2) Development of Multiple Android Versions

In the development of this teaching material so that it can be accessed with a smartphone or Android, there is a quality, namely by using a mobile version of at least Android version 10 (Android Q). According

to (Handoyono & Mahmud, 2020) [8] Android has several versions ranging from the oldest version to the latest version, here are some versions of Android, namely:

TABLE 1  
ANDROID VERSIONS

No.	Verses	Tahun Release
1	Android 1.5 Cupcake	The Android version of Cupcake was released in 2009
2	Android 1.6 Donut	Android version of Donut released in 2009
3	Android 2.0/2.1 Lightning	The Android version of Eclair was released in 2009
4	Android 2.2 Froyo	Froyo's version of Android was released in 2010
5	Android 4.1/4.3 Jelly Bean	Android Jelly Bean version was released in 2013
6	Android 4.4 KitKat	Android KitKat version was released in 2013
7	Android 5.0/5.1 Lollipop	The Lollipop version of Android was released in 2014
8	Android 6.0 Marshmallow	Android version 6.0 Marshmallow was released in 2015
9	Android 7.0/7.1 Nougat	Android version 7.0/7.1 Nougat released in 2016
10	Android 8.0/8.1 Oreo	Android version 8.0/8.1 Oreo released in 2017
11	Android 9.0 Pie	Android version 9.0 Pie was released in 2017
12	Android 10 (Android Q)	Android version 10 (Android Q) was released in 2019
13	Android 11	Android version 11 released in 2020

#### D. Andromo

##### 1) Understanding Andromo

Andromo is a software used to develop Android-based applications.

- 2) *The advantages of andromo:* 1) It can be used by everyone and the way it is used does not use programming languages or code; (2) Have a variety of template designs; (3) The application can be used for free or paid; (4) There are 3 languages to create applications, namely: Indonesian, English, and Arabic and (5) There is a tutorial on how to use andromo when starting a new *project*.
- 3) *Disadvantages of Andromo:* (1) Applications that are used for free only have limited features; (2) Lack of language selection in the andromo app because andromo only provides three languages; (4) There are very few promo users and no everyone uses it yet.

#### E. Informatics Subjects

*Informatics subjects consist of several materials including Local Networks and Internet Networks, Data Communication, Data Protection, and Internet History.*

### III. RESEARCH METHODOLOGY

#### A. Research Model

The research method used by researchers is a type of research and development often referred to as R & D (Research and Development). R & D is a research method that produces a particular product and tests the effectiveness of the resulting product (Hidayatullah, 2022) [9]. The method applied in this study uses the development method of Lee & Owens (2004). The reason for using this research method is that Lee & Owens' research method is by the development of interactive media (Pratama et al., 2021) [10].

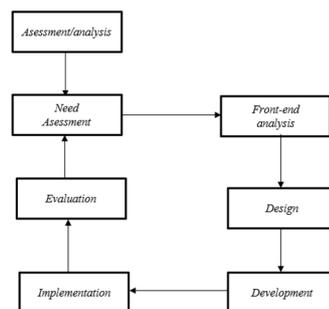


Figure 1 Model Research Development William W. Lee & Owens

#### B. Research Procedure

In this research, there are 5 stages in the development model of Lee and Owens including:

1) *Stages of Analysis Assessment*

At this stage, there are two stages including: *need assessment* and *front-end analysis*. This analysis stage made observations at SMK Negeri 1 Tulungagung school and observations of informatics subject teachers. The assessment stage of this need found several problems including: (1) teaching materials are still PDF text, (2) teaching materials are only sent via class WhatsApp grub and (3) students feel bored quickly. While the early-end analysis stage (front-end analysis) there are several stages including student analysis, technology analysis, situation analysis, goal analysis, and media analysis.

2) *Design Stages*

This design stage displays products that have been made that are by the initial design model which aims to make it easier for users to operate products that have been developed.

3) *Development Stages*

In this stage of development, researchers use Romo as a developer of teaching materials to be made that are already by the design. The next stage is product feasibility testing of media experts and material experts. Media experts named Okta Purnawirawan, M.Pd., and the material expert is Fita Lestarifa, S.Kom.

4) *Implementation Stages*

This implementation stage of the product is aimed at grade X students of SMK Negeri 1 Tulungagung in class ATPH 1. This stage aims to allow students to provide feedback to researchers.

5) *Evaluation Stages*

This evaluation stage aims to improve products that are less than perfect, with this evaluation, researchers revise products that have been evaluated so that the product is suitable for use.

C. *Product Trials*

Here is a summary of the trials conducted by researchers:

1) *Test Drive Design*

The product will be tested in stages, starting with individual trials, then continuing with trials in small groups and large groups. In the initial phase, engagement will focus on specific individuals, such as material and media experts.

2) *Test Subjects*

In the trial of e-module-based teaching materials, the subjects involved consisted of three stages. In the individual trial stage, it involves two experts who have special roles. The first is an informatics teacher from class X at SMK Negeri 1 Tulungagung, who acts as a material expert. Then, there is a lecturer from Bhinneka University PGRI who acts as a media expert. The next stage is a small group trial, involving 10 learners from class X as group representatives of the study. Finally, in the large group trial stage, it was carried out in class X ATPH 1 involving 37 students. This process allows testing e-module-based teaching materials to obtain a wide range of views from expert individuals as well as involving several participants covering a representative sample of the wider population.

3) *Data Type*

This study collected the following three types of data: a) Material Data: Material data were obtained through interviews with material experts, namely a chemistry teacher from SMK Negeri 1 Tulungagung. b) Application Design Model Data: Application design model data is obtained from a media expert, who is a lecturer at Bhinneka PGRI Tulungagung University. c) Needs Conformity Data: Needs suitability data is obtained from application users, namely students from class X at SMK Negeri 1 Tulungagung. By collecting these three types of data, the study can investigate different and relevant aspects to test the application under development.

4) *Instrument and Data Collection Techniques*

In this study, the data collection techniques used include a) Observation: Conducted on grade X students at SMK Negeri 1 Tulungagung to identify problems that may arise during learning activities. b) Interview: Conducted with the subject teacher as a resource person, where specific questions are asked to obtain relevant information c) Documentation: Involves the analysis of data from relevant documents and supports the research. d) Questionnaire: Used as a data collection technique by providing written questions to respondents, in this case, learners, to obtain their responses related to certain aspects. By combining these various data collection techniques, the study was able to gather comprehensive and in-depth information about the learning problems faced by grade X learners at SMK Negeri 1 Tulungagung as well as perspectives from teachers and relevant documents.

5) *Data Analysis Techniques*

The results of the questionnaire data came from three groups of respondents: media experts, material experts, and class X students. Before the questionnaire data were obtained, the scoring criteria were filled in by respondents by the table guidelines that had been prepared. The criteria for scoring questionnaires for media experts, material experts, and students in this development research refer to the table that has been compiled.

TABLE II  
CRITERIA FOR SCORING QUESTIONNAIRES OF MEDIA EXPERTS, MATERIAL EXPERTS, AND STUDENTS

Category	Percentage	Qualification
SS(5)	80%-100%	Very Worth It
S (4)	60%-79%	Proper
N (3)	40% - 59%	Neutral
TS (2)	20% - 39%	Less Decent
STS (1)	0% - 19%	Not Worth It

To obtain the feasibility level of the product to be developed, the results of quantitative data are converted into descriptive data using data and qualitative analysis techniques. The following is the formula used for qualitative data analysis techniques.

$$\text{Hasil} = \frac{\text{Jumlah skor yang diperoleh}}{\text{Jumlah skor Maksimal}} \times 100\%$$

#### IV. DISCUSSION

##### A. Data Presentation, Results of Problem and Needs Analysis

###### 1) Analysis

The results of the analysis were obtained from observations at SMK Negeri 1 Tulungagung and interviews with informatics subjects. The problem found is that teaching materials are still PDF, teaching materials are only sent to the class's WhatsApp GRub, and students tend to get bored during the learning process.

##### Presentation of Data and Results of Product Development Analysis

###### a. Design

At the design stage, page views and objects in learning media products are created using the Canva application. As for building the product itself, the Andromo application is used. Figure 4.1 shows the display design of the product that has been created using the application.

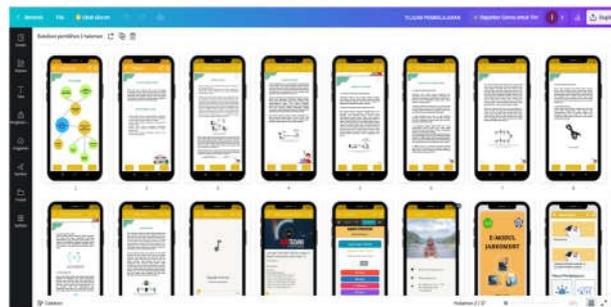


FIGURE 4. 1 CANVA DESIGN VIEW

###### a. Media expert test results

The feasibility test of media experts was conducted by Okta Purnawirawan, M.Pd. as a lecturer in Technology and Information Education at Bhinneka University PGRI. The results obtained from the media expert questionnaire are shown in Table III

TABLE III  
RESULTS OF PRODUCT FEASIBILITY TEST QUESTIONNAIRE SCORES BY MEDIA EXPERTS

No.	Aspects	Assessment Indicators	Shoes	Max Score
1.	Learning Media	The application can be <i>installed</i> on Android	5	5
2.		The application does not experience errors	5	5
3.		Buttons on the app are working normally	5	5
4.		The application can be operated on Android	5	5
5.		Application loading learning resources	5	5
6.		The application contains teaching materials that have been arranged systematically	5	5
7.		Easy-to-operate application	5	5

8.		Practical application and easy to carry anywhere	5	5
9.	Multimedia	Inside the application there are images	5	5
10.		The presented images correspond to the material Computer Network and the Internet	5	5
11.		Inside the application, there is video and audio	5	5
12.		The video presented can be seen clearly	5	5
13.		Videos can play smoothly	5	5
14.		Videos containing Computer Network and Internet materials	5	5
15.		There is text on the application	5	5
16.		The font used is clear and easy to read	5	5
17.		Text is easy to understand	5	5
18.		The colors on the <i>e-module</i> correspond to the level of the student	5	5
19.	Distribution	Application format in the form of apk	5	5
Total number			95	95

$$\begin{aligned}
 \text{Hasil (\%)} &= \frac{\text{Jumlah skor yang diperoleh}}{\text{Jumlah skor maksimal}} \\
 &= \frac{50}{50} \times 100\% \\
 &= 100\%
 \end{aligned}$$

Based on the results of the media expert questionnaire above, the product received a percentage value of 100% with the criteria of "Very Feasible" ase-module-based teaching materials.

b. *Material expert test results*

The feasibility test of products from material experts was carried out by informatics subject teachers at SMK Negeri 1 Tulungagung, namely Mrs. Fita Lestarifa S.Kom. The results obtained from the material test refer to Table 4.4

TABLE IV  
RESULTS OF PRODUCT FEASIBILITY TEST QUESTIONNAIRE SCORES BY MATERIAL EXPERTS

No.	Aspects	Assessment Indicators	Shoes	Max Score
1.	Content	The material in the <i>e-module</i> is by the Learning Outcomes	5	5
2		The material in m <i>e-module</i> is on the Learning Objectives of informatics	5	5
3		The <i>e-module</i> contains material on local networks and internet networks	5	5
4		The <i>e-module</i> contains about wired and wireless computer network connectivity.	5	5
5		The <i>e-module</i> contains data communication with mobile phones.	5	5
6		The <i>e-module</i> contains material containing data protection with the internet.	5	5
7		The material in the <i>e-module</i> is easy to understand	5	5
8		The material presented in the <i>e-module</i> is arranged systematically	5	5
9	Evaluation	There are tests or practice questions	5	5
10		Tests or questions are arranged according to the order of sub-material	5	5
11		There is feedback from the test results	5	5
The overall number of scores			55	55

$$\begin{aligned}
 \text{Hasil (\%)} &= \frac{\text{Jumlah skor yang diperoleh}}{\text{Jumlah skor maksimal}} \\
 &= \frac{50}{50} \times 100\% \\
 &= 100\%
 \end{aligned}$$

Based on the results of the material expert questionnaire above, the product received a percentage value of 100% with the criteria of "Very Feasible" ase-module-based teaching materials.

B. *Data Presentation and Product Trial Analysis*

1) *Implementation*

a. *Small group test results*

Small group tests were conducted in class X ATPH 1 using a sample of 10 students. Small group test results refer to Table 4.5.

TABLE V  
SMALL GROUP TRIALS

No.	Aspects	Assessment Indicators	Shoes	Max Score
1	Learning Media	The application can be <i>installed</i> on Android	48	50
		The app doesn't hang	49	50
		The application can be operated on Android	48	50
		The application has no bugs	49	50
		The buttons on the app work fine and normally	47	50
		The application contains teaching materials that have been arranged systematically	46	50
		Application loading learning resources	49	50
		Practical application and easy to carry anywhere	49	50
		Easy application to operate	50	50
2	Multimedia	Inside the application there are images	49	50
		The presented images correspond to the material Computer Network and the Internet	50	50
		Inside the application, there is video and audio	49	50
		The video presented can be seen clearly	49	50
		Videos can play smoothly	48	50
		Videos can be played with a resolution of at least 360p	49	50
		Videos containing Computer Network and Internet materials	49	50
		The audio presented is heard clearly	48	50
		Audio can be turned on and off manually	49	50
		There is text on the application	49	50
		The font used is clear and easy to read	49	50
		Text is easy to understand	49	50
		The text contains computer network and internet material	48	50
3	Distribution	Application format in the form of apk	49	50
4	Material	The material in the application is by the Learning Objectives Flow	50	50
		The material in the application is by the Learning Outcomes	50	50
		There are learning objectives	49	50
		In the application, there is material on understanding computer networks and the internet that can be read clearly	48	50
		The material presented is easy to understand	49	50
		The material presented is arranged systematically	50	50
5	Evaluation	There are quizzes	50	50
		The quizzes presented can be read clearly	50	50
		Inside the quiz, there are test results or grades	50	50
Total number			1565	1600

$$\begin{aligned}
 \text{Hasil (\%)} &= \frac{\text{Jumlah skor yang diperoleh}}{\text{Jumlah skor maksimal}} \\
 &= \frac{1565}{1600} \times 100\% \\
 &= 97,8\%
 \end{aligned}$$

Based on the results of small group trial questionnaires, it was found that the percentage of product feasibility was 97.8% so the "Very Feasible" product was used as e-module-based teaching materials.

b. *Large group test results*

Large group tests were conducted in class X ATPH 1 with a total of 37 students. Small group test results refer to Table 4.6.

TABLE VI  
LARGE GROUP TRIALS

No.	Aspects	Assessment Indicators	Shoes	Max Score
1	Learning Media	The application can be <i>installed</i> on Android	172	185
		The app doesn't hang	173	185
		The application can be operated on Android	167	185
		The application has no bugs	173	185
		The buttons on the app work fine and normally	169	185
		The application contains teaching materials that have been arranged systematically	169	185
		Application loading learning resources	171	185
		Practical application and easy to carry anywhere	170	185
		Easy application to operate	173	185
		2	Multimedia	Inside the application there are images
The images presented are by the material Computer networks and the internet	167			185
Inside the application, there is video and audio	168			185
The video presented can be seen clearly	172			185
Videos can play smoothly	167			185
Videos can be played with a resolution of at least 360p	173			185
Videos containing Computer Network and Internet materials	172			185
The audio presented is heard clearly	169			185
Audio can be turned on and off manually	169			185
There is text on the application	172			185
The font used is clear and easy to read	170			185
Text is easy to understand	175			185
The text contains computer network and internet material	172			185
3	Distribution			Application format in the form of apk
4	Material	The material in the application is by the Learning Objectives Flow	172	185
		The material in the application is by the Learning Outcomes	171	185
		There are learning objectives	172	185
		In the application, there is material on understanding computer networks and the internet that can be read clearly	168	185
		The material presented is easy to understand	174	185
		The material presented is arranged in a manner	170	185
5	Evaluation	There are quizzes	168	185
		The quizzes presented can be read clearly	185	185
		Inside the quiz, there are test results or grades	185	185
Total number			5490	5920

$$\begin{aligned}
 \text{Hasil (\%)} &= \frac{\text{Jumlah skor yang diperoleh}}{\text{Jumlah skor maksimal}} \\
 &= \frac{5490}{5920} \times 100\% \\
 &= 92,7\%
 \end{aligned}$$

Based on the results of small group trial questionnaires, it was found that the percentage of product feasibility was 92.7 % so the "Very Feasible" product was used as e-module-based teaching materials.

## V. CONCLUSION

### A. Conclusion

Based on the results of development research conducted for 6 months, researchers have developed teaching materials that are PDF text into e-module-based teaching materials in class X informatics subjects of SMK Negeri 1 Tulungagung. This product development research uses the Lee and Owens (2004) development model which has several stages, namely: *Analysis / Assessment, Need Assessment, Front-end Analysis (early-end analysis), Design, Development, Implementation, and Evaluation* (Evaluation). This product can be declared "Very Feasible" to use after going through the feasibility test stage of media

experts, material experts, and trials with students. The results of the feasibility test for media experts get a percentage value of 100% with very feasible criteria, material tests get a percentage value of 100% with very feasible criteria, small group trials get a percentage value of 92.7% and large group trials get a value of 92.3% with very feasible criteria. Based on the average results of the four product percentage data of 97.3 so that e-module-based teaching material products obtained the criteria of "Very Feasible".

### B. Suggestion

Based on the results of this study, researchers provide several suggestions to various parties, including:

- 1) For other researchers, it is advisable to look for the main problem as a basis for research and find the right solution. If you want to use the Andromo application, you should study the various menus, features, disadvantages, and advantages of the application.
- 2) For students, it is recommended to utilize teaching materials based on e-modules of computer networks and the internet as additional learning resources.
- 3) For teachers, e-module-based teaching materials in informatics subjects can be used as a tool in chemistry learning activities that are more interactive and interesting.
- 4) For schools, it is advisable to develop and produce similar applications that suit learning needs. Thus, it can improve the quality of learning and provide more options for learners in other subjects.

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