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E-Module Validation Based on Contextual Teaching and Learning for High School Optical Instruments

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ABSTRACT
In this technological era, innovation is needed to improve the quality of education. Teachers are required to be able to integrate information and communication technology to produce teaching materials since the form of print media have gradually shifted to electronic media. The purpose of this research is to develop an e-module based on contextual teaching and learning which is valid for high school optical instruments. In this study, validation was carried out by 3 experts consisting of material experts, media experts and linguists. The data collection technique was carried out by providing a validation questionnaire in the form of a checklist. The data were analyzed using descriptive analysis by calculating the average of each indicator used to determine the validity of the developed e-module. The results of the study provide information that the e-module based on contextual teaching and learning on the material for optical high school instruments developed is valid with valid. The average score of the validation results obtained ranges from 3.00-4.00 so e-module belongs to valid. It means e-module has been successfully developed and it can be used in learning to enhance better teaching and learning process.

Keywords: *e-module, contextual teaching and learning, optical instruments, validation*

INTRODUCTION

The 21st century is known as the technology century (Yen et al., 2018). Information and communication technology that is developing rapidly has a wide impact on aspects of education, including in the field of physics (Rahayu et al., 2020). The demands and challenges in this technological age require innovation to improve the quality of education (Rani et al., 2019). This is in accordance with the standard process of the 2013 curriculum where the learning process needs to be carried out interactively, inspiring, challenging and fun (Inriani et al., 2021). So that students are motivated to actively participate and provide sufficient space for innovation, creativity and student independence (Suastika & Tri Wahyuningtyas, 2018).

Physics as one of the sciences that plays an important role in technological progress is seen as a process as well as a product so that in learning (Azhar, 2008), it must consider effective and efficient learning strategies or approaches (Aripin et al., 2021). But in reality, current learning in schools is still student-oriented (Revi Syahfira et al., 2021) and also still oriented towards testing students' memory so that learning physics is less attractive to students (Dewi & Primayana, 2019). Based on questionnaire analysis from several schools, it was found that in physics learning teachers still use powerpoint in learning and there is no guide for students to do practical work on making simple physics products in accordance with the demands of basic competencies, especially in this optical instrument material. In addition, the material presented by the teacher in the teaching materials used is still abstract and complicated also still separated between students' formal knowledge and their daily experiences (Aprianti et al., 2015).

Efforts that can be made to overcome the problems above are through the development of teaching materials (Azhar et al., 2021). With teaching materials students can learn more directed and systematic (Mahardika et al., 2020). At this time materials that used to teaching has been gradually shifting to electronic media (Chiappe & Lee, 2017). In order for information and communication technology to play an effective role in learning, it is necessary to have a mechanism that supports interactive dialogue between teachers and students (Arenas, 2015). With the technology used by teachers in learning, it will further develop the skills acquired by students (Neville & Heavin, 2013). One of the teaching materials that can be developed is e-module. This is the form of modules packaged electronically. Users will more interactive (Komikesari et al., 2020). One of the programs that we can used is Flip PDF Professional. This program can combine images, animations and learning videos which is still rarely used in physics learning (Rindaryati, 2021). Only by drag, drop or click, the animated media can be inserted into the flipbook (Febrianti, 2021).

There have been several previous studies on e-modules based on contextual teaching and learning (Uslima et al., 2018), as well as e-modules using the Flip PDF Professional application (Komikesari et al., 2020), but no one has yet developed an e-module based on contextual teaching and learning using the Flip PDF Professional application. So i combined them all and i choose the material for optical instruments. Meanwhile, optical tools study real objects in students' daily lives (Zulkifli et al., 2022 and (Irawan et al., 2010) and optical is one of the abstract concept (Khusnul et al., 2022).

METHODOLOGY

This research is a development research using the 4D model proposed by Thiagarajan et al (Lawhon, 1976) which includes the define, design and develop stages. At the define level is set the description of learning that is considered ideal, which consists of an front-end analysis (basic problems faced by students), learner analysis, concept analysis, task analysis and specifying instructional objectives. After finished the first stage, e-module planning is done that will be developed, including media selection, format selection and making initial plans. Then at the development stage, an expert assessment is done followed by a revision based on input from experts.

This research has only reached the develop stage because the purpose of this research is to develop e-modules based on contextual teaching and learning that are valid for high school optical instruments. The research was carried out at the Secretariat of the Master of Physics Education, Riau University. The research implementation time is in the even semester of the 2021/2022 academic year.

The types of data in this study are qualitative data and quantitative data. Qualitative data obtained from suggestions for improvement during validation and validation results. While the quantitative data obtained from the assessment score by the validator. The instrument used is a questionnaire in the form of a checklist.

The data collection technique uses validation techniques by experts to measure the feasibility of the developed e-module. Experts consist of material experts, media experts and linguists. In the first validation, the experts provided input for the developed e-module. Then in the second validation, the experts assess with a checklist.

The data were analyzed using descriptive analysis. The score is a number on a *Likert* scale with the highest score of 4 (strongly agree) and the lowest value of 1 (strongly disagree) (Sugiyono, 2013). The interpretation of the average validation score can be seen in Table 1.

Table 1. Criteria for Validation Score

Score Range	Classification
$4{,}00 \geq \bar{x} > 3{,}25$	Valid (Strong)
$3{,}25 \geq \bar{x} > 2{,}50$	Valid
$2{,}50 \geq \bar{x} > 1{,}75$	Valid (Weak)
$1{,}75 \geq \bar{x} \geq 1{,}00$	Invalid

(Riduwan dan Sunarto, 2013)

RESULT AND DISCUSSION

In the define stage, it was found from the results of observations through questionnaires that the problems faced by students on the subject of optical instruments were that in learning the teacher still used powerpoint media and there was no guide for students to experiment with making simple physics products in accordance with the demands of the basic competencies on the material of optical instruments. At this stage, the subject matter of the discussion of optical instruments based on KD 3.11 and 4.11 is also determined, namely eyes and glasses, loupe and microscope as well as binoculars and cameras. After that, the learning objectives are formulated. Based on the learning indicators, six learning objectives are formulated, namely: 1) Students can explain the parts of the eye, eye accommodation power and eye disorders, 2) Students can understand the use of glasses for eye defects, image formation and magnification of glasses, 3) Students can explain the principle of image formation and magnification on loupe and microscope, 4) Students can make simple loupe in groups, 5) Students can explain the principle of image formation and magnification on binoculars and cameras, 6) Students can make simple binoculars in groups.

Then at the design stage, the design of the learning device is determined. At this stage, the selection of the media to be developed is carried out, how the format is and what model to use. The selected media is an e-module using the Flip PDF Professional application. The e-module was developed based on a simple framework containing cover, table of contents, glossary, introduction containing basic competencies and indicators of competency achievement to material maps, learning activities, evaluations, bibliography and attachments (if any) (Kemdikbud, 2018). The framework of the e-module can be seen in Figure 1.

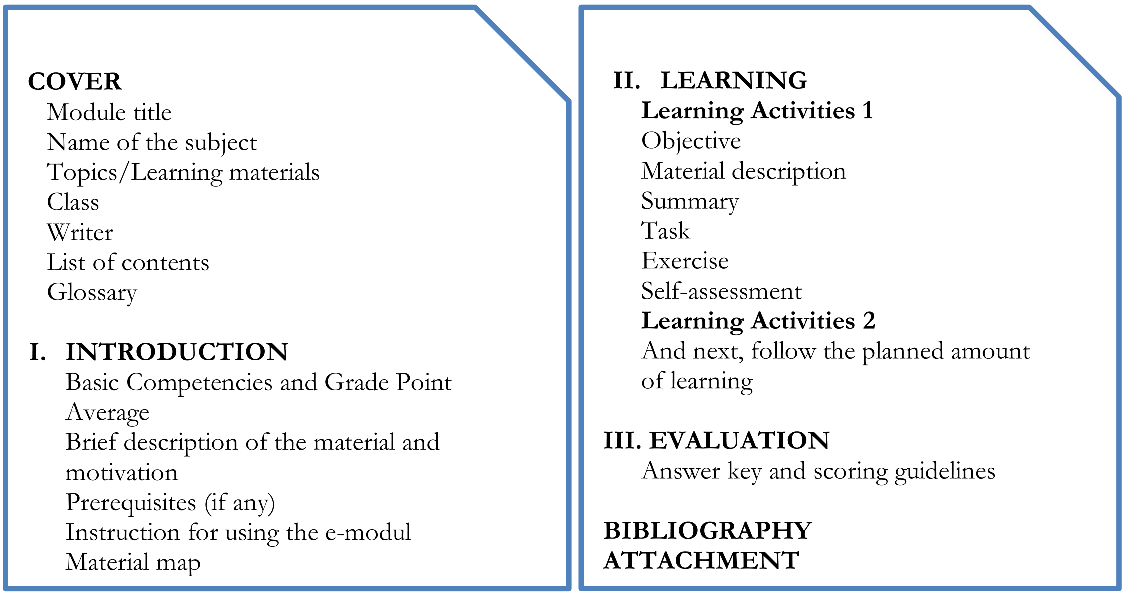

Figure 1. E-modul Framework (Kemdikbud, 2018)

The e-modul framework generally consists of a cover containing module title, name of the subject, topics, class and writer. Then there is the table of contents, glossary and an introduction to a brief description of the lesson. After that there is a series of learning activities arranged from beginning to an end to the assessment stage. It ends with attachments if any.

The model chosen is contextual teaching and learning (CTL). CTL has seven components namely constructivism, questioning, inquiry, learning community, modelling, reflection and authentic assessment (Yolanda, 2020). The e-module was developed by incorporating these seven CTL components.

The cover section contains the module title, subject name, topic/learning material, class and author.

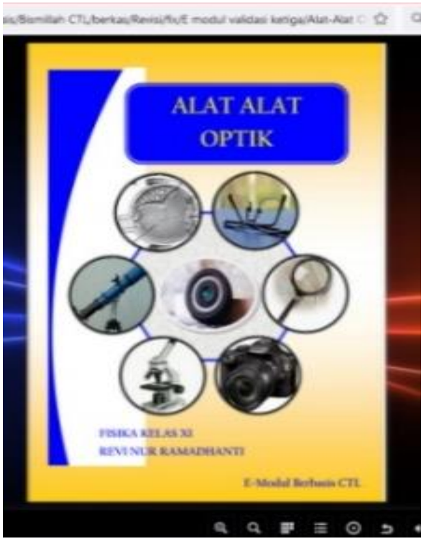

Figure 2. E-modul Cover

The e-module contains instructions on how to use it as in Figure 3.

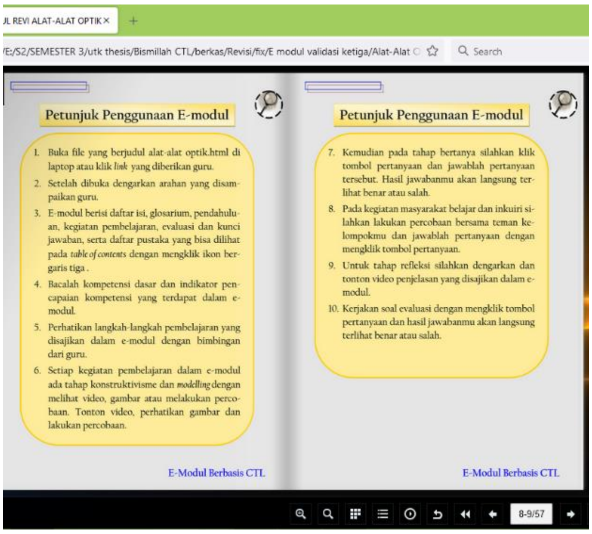

Figure 3. Instructions for Using the E-module

In the constructivism section, illustrations/pictures, videos or experiments are given and then answer questions based on the constructivism activities.

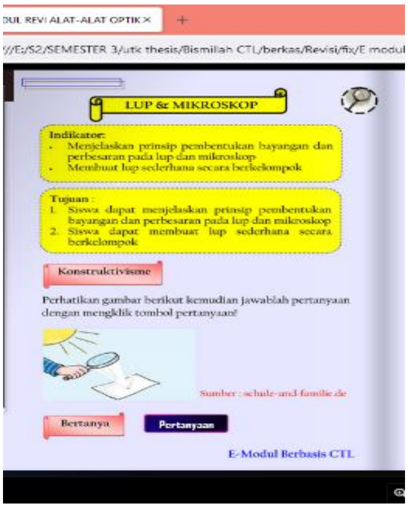

Figure 4. Constructivism and Asking Questions

In this section, students carry out the experiments presented in the e-module with their groups as shown in Figure 5.

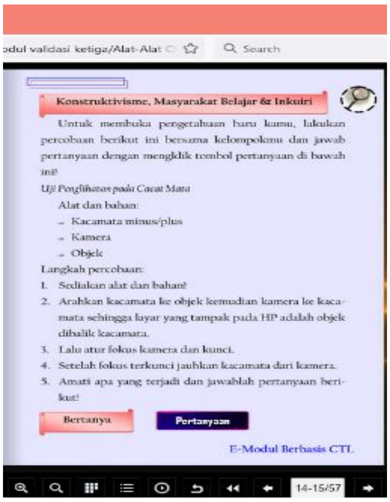

Figure 5. The Learning Community and Inquiry

In this section, students listen to the teacher's explanation of the material by clicking on the sound icon or by watching a video as shown in Figure 6.

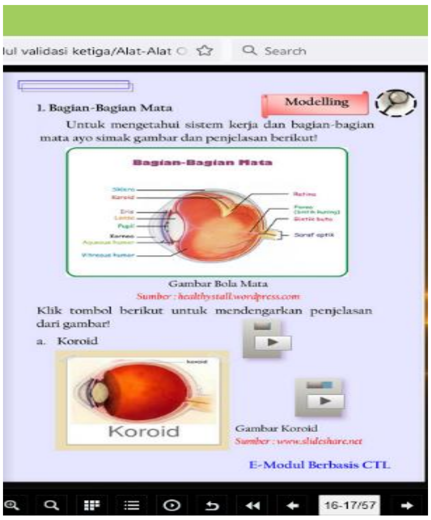

Figure 6. Modelling

Students review the material they have learned at the reflection stage by watching videos or listening to sounds as shown in Figure 7.

Figure 7. Reflection

Then in the authentic assessment students are given questions related to the material by clicking the question button on the e-module and the student's answer score will be immediately visible.

Figure 8. Authentic Assessment

Then at the develop stage, an e-module validation test is carried out by experts consisting of material experts, media experts and linguists. Validation was carried out twice. In the first validation the experts gave suggestions for revision. The suggestions from the experts are: fix the location of the instructions for using the e-module, fix the validation item, fix the video, enlarge the text on the e-module, change the sound icon, enlarge the question button and change the background, and change the color for the CTL component. After the e-modul was repaired, a second validation was carried out, namely an assessment by experts. There are 3 aspects that are assessed, namely aspects of appearance, aspects of material content and aspects of language. Data validation results are as follows:

E-module display aspect

In the display aspect, an average validation score of 3.33-4.00 is obtained as shown in Table 2. So that the e-module belongs to the very valid validation criteria.

Table 2. Validation Result of E-module Display Aspect

Aspect to-	Experts			Σ	$\bar{x}$	Validation Criteria
	1	2	3			
1	4	3	3	10	3,33	SV

Aspect to-	Experts			Σ	$\overline{x}$	Validation Criteria
	1	2	3			
2	4	4	3	11	3,67	SV
3	4	3	4	11	3,67	SV
4	4	4	3	11	3,67	SV
5	4	4	4	12	4,00	SV
6	4	3	3	10	3,33	SV

Note: SV= Sangat Valid

Content aspect

For the aspect of material content, the results of the e-module are valid with valid and very valid categories. The average score range obtained is 3.00-4.00 as shown in Table 3.

Table 3. Validation Results of E-module Content Aspect

Aspect to-	Experts			Σ	$\overline{x}$	Validation Criteria
	1	2	3			
7	4	4	4	12	4,00	SV
8	4	4	4	12	4,00	SV
9	4	4	4	12	4,00	SV
10	3	3	3	9	3,00	V
11	3	4	4	11	3,67	SV
12	4	4	4	12	4,00	SV
13	4	4	4	12	4,00	SV
14	4	4	4	12	4,00	SV
15	3	4	3	10	3,33	SV

Note: SV= Sangat Valid, V=Valid

Language aspect

In the language aspect, an average score of 3.00-4.00 was obtained so that the e-module developed was valid with valid and very valid categories as shown in Table 4.

Table 4. Validation Results of E-module Language Aspect

Aspect to-	Experts			Σ	$\overline{x}$	Validation Criteria
	1	2	3			
16	4	4	4	12	4,00	SV
17	4	4	4	12	4,00	SV
18	4	4	4	12	4,00	SV
19	4	3	3	10	3,33	SV
20	3	3	3	9	3,00	V
21	3	3	3	9	3,00	V

Aspect to-	Experts			Σ	$\overline{x}$	Validation Criteria
	1	2	3			
22	4	3	3	10	3,33	SV
23	3	4	4	11	3,67	SV
24	4	4	3	11	3,67	SV

Note: SV= Sangat Valid, V=Valid

From Table 2, Table 3 and Table 4, it can be concluded that the e-module based on contextual teaching and learning on the optical instruments developed is valid in terms of appearance, content and language.

The development of this e-module is based on stage 4D. In the first stage which is called define, it is obtained from the results of the questionnaire that during the learning process students tend to listen more to explanations and have not yet experimented with making simple physics products. Beside that the students' physics scores obtained from the scores in the previous learning were still relatively low.

Then proceed to the second stage called design, where the e-module is developed here using the flip pdf professional application by incorporating the seven CTL components. At this stage, questions are also formulated in the form of essays in accordance with the material for optical instruments.

Then move on to the third stage which is called develop. At this stage material, media and language experts give value to the validity of the e-module. For the material aspect it was found that the formula used in the e-module was correct as well as the symbols used. The questions are also in accordance with the material. There is also a practicum for students to make simple physics products related to their lives so that from the aspect of the materials of the e-module is valid. From the media aspect, it was found that the developed e-module created a fun and interesting atmosphere to be used as a lesson. The color composition is matched and well formatted. Images and videos are clear and easy to play. Finally on the aspect of language, it shows that the sentence used does not cause double meanings and has a clear structure.

From the results it can be said that the developed e-module is well organized with material content that is relevant to students' daily lives and the use of language that is appropriate to the child's maturity level. For the weakness of this research, it can't be accessed offline on students' cellphones. Besides that the time to develop this e-module takes quite a long time. This research can be continued up to the disseminate stage, namely the stages to apply the developed media to classroom learning. The results serve to determine whether the media developed is effective or not.

CONCLUSION

An e-module based on *contextual teaching and learning* on optical instruments using the *Flip PDF Professional* application has been successfully developed and is valid in terms of appearance, content and language based on the average score of validation results from experts. It means that e-module can be used in the learning process to support better learning activities according to the demands of this technological era. For the advantages of e-module based on CTL using the Flip PDF Professional aplication is easy to operate both laptops and cellphones, students can also access them offline on their laptops. In addition, students also feel the sensation like reading a textual book because there is a sound effect of opening the book when the e-module is moved through the pages. Temporary for the weakness is e-module can't be accessed offline on student cellphones.

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