The Effectiveness of Interactive e-Module for Natural Science subject at Equality Education Program

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Abstrak

Penelitian ini bertujuan untuk (1) mengembangkan e-modul interaktif pada mata pelajaran IPA kelas VII paket B di pendidikan kesetaraan SKB Kota Semarang yang layak dan baik digunakan, (2) mengetahui langkah pembuatan e-modul meng-gunakan software Adobe In design dan (3) mengetahui kelayakan dari pengem-bangan e-modul inter-aktif mata pelajaran IPA paket B materi klasifikasi makhluk hidup. Model pengembangan e-modul pada penelitian ini adalah model ADDIE. E-modul interaktif untuk mata pelajaran IPA ini dinyatakan layak untuk diguna-kan dalam pembelajaran dengan skor kelayakan dari ahli materi sebanyak 3,73, ahli media sebanyak 3,78 dan respons warga belajar sebanyak 3,43. Berdasarkan ahli materi, ahli media, dan respons warga belajar, maka e-modul interaktif mata pelajaran IPA pada materi klasifikasi makhluk hidup sangat baik dan layak digu-nakan untuk mendukung kegiatan belajar warga belajar kelas VII di pendidikan kesetaraan khususnya SKB Kota Semarang.

Abstract

This study aims to (1) develop an interactive e-module in science subjects class VII package B in SKB Kota Semarang equivalency education that is feasible and good to use, (2) know the steps for making e-modules using Adobe In design software, and (3) knowing the feasibility of developing an interactive e-module for science subjects package B for the classification of living things. The e-module development model in this study is the ADDIE model. This interactive e-module for science subjects was declared feasible to be used in learning with a feasibility score of 3.73 from material experts, 3.78 from media experts, and 3.43 student responses. Based on material experts, media experts, and student responses, interactive e-modules for science subjects on living things classification material are very good and appropriate to be used to support learning activities for class VII learning citizens in equality educa-tion, especially for the SKB Kota Semarang.

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INTRODUCTION

The development of information and communication technology (ICT) has caused quite significant changes, especially in the current learning models and patterns, so that the current generation requires digitization of learning through visual representations of data that are useful for attracting students' attention in their learning process (Alrwele, 2017). The use of paperless and mobile such as e-learning, video conferencing, electronic books and the like is an introduction to the development of information and communication technology that is happening (Wirasasmita & Uska, 2017).

The module is one of the teaching materials that is packaged as a whole and systematically which contains a set of planned learning experiences. By using the module, students can measure their own level of mastery of the material discussed in each module unit and if students have not been able to master it, then these students will be asked to repeat and study again (Hananingsih & Saputra, 2019). Generally, modules are made in printed form which has several weaknesses, namely in terms of appearance it is still limited because it is only in the form of text and pictures, its distribution also requires costs because it has to be printed many times or photocopied (Asyhar et al., 2015). With the development of technology, modules are currently not only available in printed form but are also available in digital form which are commonly called electronic modules (e-modules).

E-modules are module formats in electronic form that can be read via a computer or smartphone, usually e-modules are adapted versions of printed modules. E-modules have several advantages such as adding video, audio, animation, text, links, and images as well as their interactive nature to facilitate navigation which can be activated by readers via touch clicks such as visual presentations, instructions to guide readers' thoughts or hyperlinks in content, which is useful (Sugihartini & Jayanta, 2017)

The correct use of modules or electronic books that are inserted with interactive multimedia features can enrich the experience of reading books as well as being a good alternative that can contribute to increasing reading comprehension and reading interest (Winatha, 2018). This is in line with the meta-analysis research conducted by Clinton-Lisell et al. (2021) towards interactive e-text indicating that interactive features have a positive and beneficial impact on individuals, especially in reading performance and can help readers or students by providing background knowledge to build a situation model, in their research Sommers et al. (2019) and Weng et al. (2018) suggest how the interactive features of digital text can affect reading comprehension and overcome screen inferiority.

Science is a concept of learning with nature and has a very broad relationship with human life. Science learning in Equality Education package B is not only seen as transferring knowledge and skills to students, but also building analytical, synthetic, critical, creative and innovative thinking skills through scientific work (Curriculum and Bookkeeping Center, 2019). Biology is one of the sub-subjects of Natural Sciences which aims to convey information, thoughts and values that contain facts, concepts and processes that occur in nature so that students are able to understand the natural world around them. But even so in the process of learning biology, there are still students who experience difficulties, especially in understanding the terms and processes contained in biology material (Permana et al., 2021). Therefore, it is necessary to use strategies and materials that can support learning and help students to understand biology material.

Semarang City learning activity center (Sanggar Kegiatan Belajar, SKB) of is an equality educational institution which in its learning process still tends to be conventional and does not utilize technology so that it only relies on what is in the module. The use of e-modules in learning activities at SKB Semarang City has been implemented since the Covid-19 outbreak, where learning activities must be carried out online. The e-module that is currently used by the SKB Semarang city in Science Package B biology is a module issued by the directorate of fostering literacy and equality education. Where there are still some deficiencies such as: (1) it is only a conversion from printed books into digital format without any modifications, (2) there is no multimedia content so that it is less interactive and provides an experience for readers,

In addition to the deficiencies in the e-module used by the SKB Semarang city, based on the observations that have been made there are also several other factors that become a problem in the science learning process so that it is less than optimal as there are still many learning residents who are lazy and less motivated to learn so that being able to achieve KKM (KKM stand for Kriteria Ketuntasan Minimum, in English: the minimum standard of academic achievement) on natural science material for the classification of living things is only 70%, then the limited internet quota owned by learning residents to access online learning resources

and the limitations of educators in making interesting and innovative teaching materials or learning media. In addition, the results of the questionnaire on the needs and characteristics of learning residents that have been distributed show the potential that 96% want additional, more interactive teaching materials that do not only contain pictures. but also includes moving pictures and sound. Based on the results of observations by researchers at the SKB Semarang City, 84% of residents studying SKB have smartphones, tablets and gadgets, 64% of the average resident chooses to study using a smartphone for more than two hours a day, so that it has the potential to be able to learn using the developed e-module.

Improvements both in terms of teaching and in the use of media or teaching materials need to be done because the use of media and sources of teaching materials is part of the components that influence learning (Pratama et al., 2018). E-modules can explain abstract science material so that the material is easily understood by students, e-modules are interesting learning materials and can increase students' interest and motivation in learning, especially when studying biology material (Asyhar et al., 2015). In this development, the E-module is used as an interactive teaching material that contains infographics. Infographics are a combination of info and graphics which is an approach to presenting information in visual and graphical form (Alrwele, 2017; Dunlap & Lowenthal, 2016). Infographics can be adopted as learning media that are efficient and minimally explained (Wulandari et al., 2019).

In concept, infographics play an important role in simplifying information, especially long text, images and significant figures and improving processing for readers so that it is faster and easier to understand (Damyanov & Tsankov, 2018; Ozdamli et al., 2016). Apart from that, from the point of view of learning science, infographics are also a cognitive tool for learning, with infographics being able to represent visuals and ideas to build knowledge and facilitate the reader's understanding of a phenomenon (Gebre, 2018).

The use of infographics is very helpful in the process of learning activities, especially in independent learning activities, besides that infographics can strengthen students' cognitive abilities, this can be seen from Wulandari's et al. (2019) research related to the development of infographic e-book learning media to improve students' cognitive, that the cognitive level of students in understanding a material is still lacking,

so that with the development of learning media in the form of infographic e-books students are easier to understand abstract concepts from a learning material .

Science subject is one of the learning materials that has a broad scope and with limited amount of time provided and the conditions of each student in SKB Semarang City are different. Students are required to be able to understand concepts and master the material that has been studied so that they need references to appropriate learning materials, especially on biological material that requires more visualization. In reviewing these problems, there is a need for innovation by providing learning materials that can be used as independent learning resources that are easy to use, save internet quota and are presented in an attractive form, namely in the form of e-modules that are designed and developed using technology with an attractive appearance, more innovative so that facilitate the understanding of learners.

According to the previous research on learning media based on internet this research aims to develop e-module for equality education program, especially in Biology subject (the topic is living things classification). Since there were only few research who focus on this topic and context, this research offers a novel contribution to the field of educational technology, especially for non-formal education context. This research will proof that educational technology as a field of studies and practices is not only aligned with formal educational practices, but also encompasses the so-called as non-formal or alternative education by providing useful learning media to support the learning processes.

METHOD

This research focuses on developing e-module for equality educational program, especially in Biology subjects with the topic of living things classification. It is a mandatory topic for VII grade students. The method used is research and development (R&D) with the development model applied is the ADDIE model. The ADDIE model consists of five stages of development, namely: (1) analysis, (2) design, (3) development, (4) implementation and (5) evaluation.

The first stage, analyzing the needs and characteristics of the target, namely students, is a step of gathering information in the form of problems related to learning activities, as well as an analysis of the e-module teaching materials used by teachers and students in SKB. *The sec-*

Table 1 Convert Values into Categories

No	Interval Score	Qualitative Category
1	$X \geq (\bar{x} + 1.SBi)$	Very Good
2	$(\bar{x}\ 1.SBi) > X \geq \bar{x}$	Good
3	$\bar{x} \geq X \geq (\bar{x} - 1.SBi)$	Not Bad
4	$X < (\bar{x} - 1.SBi)$	Bad

ond stage is to design the e-module product that will be developed, such as designing the concept sketch of the cover, presenting material content, designing infographics to the navigation buttons, then establishing an outline of the contents of the e-module and compiling a framework or structure of the e-module.

The third stage is the development stage after finishing designing the concept of the e-module, at this stage the development carried out by researchers is: (1) installing the required programs such as Adobe in design, (2) collecting material along with supporting components such as images and videos, (3) digitally create images and backgrounds, (4) design e-module sheets using Adobe in design (5) insert material that already contains content along with practice questions, (6) publish e-modules in epub3 format, and (7) validate e-module products that have been developed to media experts and material experts. Validation is carried out to determine the level of product feasibility through assessment and advice from a team of experts.

The fourth stage is implementation, the product that has been developed and has undergone several revisions is tested on class VII Semarang City SKB students in the form of small groups or limited testing. Learning residents who carry out trials will test the feasibility of the e-module products developed through the questionnaire provided. *The fifth stage* is evaluation, this evaluation is carried out by revising the product based on the assessment and suggestions from the expert team, the tutor's assessment, and the responses of the learning residents who test the feasibility of the product.

This research was conducted on class VII package B students at the SKB Semarang City Road. Sumurrejo, Mount Pati, Semarang City, Central Java. The e-module product is validated by one material expert and two media experts. The technique used in product validation is by distributing closed questionnaires to material experts and media experts. The questionnaire instrument for material experts consisted of 26 statement items and the instrument for media experts consisted of 30 statement items.

The research subjects or trials consisted of: (1) material experts as people who were competent in science learning, namely science subject teachers for class VII at SKB, (2) media experts as people who were competent in the media field, and (3) a sample of learning citizens class VII at SKB Semarang City as a small group trial with a total of 12 learning residents, because according to Arikunto (2006) the test subjects in small groups were 4-14 people or respondents and for large groups between 15-50 people or respondents.

The data analysis technique used in this research is descriptive analysis technique. The data analyzed consisted of an analysis of the feasibility of the e-module based on the results of completing a questionnaire by media experts, material experts and the response of the learning community to the e-module. The results of the analysis data obtained from the questionnaire are qualitative data, which are then converted into quantitative data using a Likert scale. The Likert scale used is a scale of four with a maximum ideal score of four to an ideal minimum score of one.

After being converted into the weighted level of the ideal value score of 4,3,2,1, then calculating the total average score of each aspect of the assessment by all assessors using the average formula, then the average value obtained is converted into a qualitative value of four category scale using reference from Mardapi (2008)Conversion of values into categories can be seen in table 1

Notes: **X**= average number of values obtained from research; $\bar{x}$ = the average number of ideal scores; **SB**= standard deviation of the ideal score, with a coefficient of 1

RESULT AND DISCUSSION

We have divided this section into three sub-sections. First, we explain the developmental process of the e-module, followed by the second part that depicts the results of the e-module. Finally, in the third sub-section, we discuss the implementation of the e-module. More detailed results and discussion are provided below.

A. Making E-modules with Adobe Indesign

According to the ADDIE instructional design model, in this sub-section we combined the analysis and design processes into a single part as

Figure 1 Steps to edit video picture 4 steps to export e-module exported
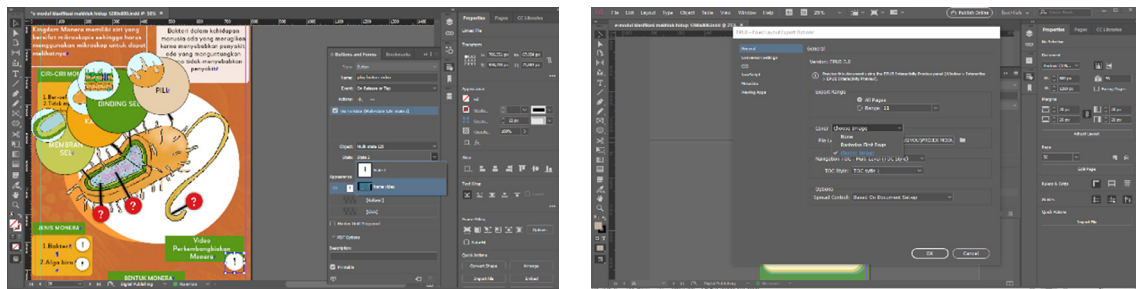
an effort to simplify it, as follows.

1. Steps for Making Interactive E-Modules using Adobe Indesign

Firstly, we analyse the need of the school toward a more interesting and useful learning media that could potentially support the students' learning processes, especially for Biology subject. In this regard, we found that interactive e- module will has more potential to be used by the students. Firstly, the e-module offers more interactive learning activities that could encourage students' engagement toward their learning activities. Secondly, the e-module also provide a clearer visual appearance of the topic for students. According to these main considerations we decided to develop an e-module. Afterwards, we designed the initial draft of the e-module and analysed its possibilities to be developed for several times before actually produce it.

In the next process the researchers made interactive e-modules by incorporating infographic design elements using Adobe InDesign layout software. They utilized available features such as buttons and form feature to display or create text popups, used object states in videos, and created exercises or multiple-choice quizzes. The first step in making an interactive e-module is to set the document format used, such as setting the worksheet to A4 portrait by selecting the number of worksheets needed, then the second step is to insert the cover that was made earlier using Medibang and Adobe Photoshop software.

The third step is the stage of entering, creating and editing parts of the e-module such as the introduction, content and closing by inserting illustrations, images, videos and creating text popups with the buttons and forms feature. The fourth step is to create and edit quizzes using the object state feature. The fifth step is to export the finished e-module file into an e-module format with the extension epub3 (editor publisher 3) which is the latest epub format with interactive support, html5 and css, more sophisticated metadata and fixed layout format support (Kudler, 2018).

2. E-Module Final Product ReviewB. Justification for Developing Contents on Climate Smart Agriculture

The product produced in this research and development is an interactive e-module for class VII science subjects, especially on the material Classification of living things which contains elements of infographic design. Products are produced using Adobe Indesign software as layout, Adobe Photoshop and Medibang to create background designs and illustrations.

The e-module created by the researcher has the extension epub3 which can be operated using either a smartphone or personal computer with the help of a third-party application, namely the epub reader. The Epub reader which is a recommendation for rating Windows systems on PC devices in school and private laboratories is Thorium Reader, while the Epub Read which is a recommendation for Android systems to open e-modules being developed is Reasily. The two applications are recommended by researchers because they are able to read the latest epub version, namely epub3 with the advantage of being able to read interactive multimedia content, and not change the layout of the pages that have previously been compiled.

The resulted e-module product takes five and a half months to complete starting from the analysis, design, development, implementation and evaluation stages. The subject e-module on the classification of living things consists of four units of learning activities such as getting to know living things and non-living things, dichotomous classification and key determination, classification of living things and microscopes and how to use them. Each material in each learning activity is presented with an infographic display as well as support and interactive multimedia features so as to be able to attract learning residents to learn. At the end of each learning activity there are exercises and assignments to measure understanding of the material.

Table 2 Material Expert Validation Results

No	Assessment Aspect	Average Rating Score for Each Aspect	Category
1	Content	3,76	Very Good
2	Language	3,66	Very Good
3	Display	3,71	Very Good
Average Overall Rating Score		3,73	Very Good

Table 4 Results of assessment of student responses to the e-module

No	Assessment Aspect	Average Rating Score for Each Aspect	Category
1	Presentation of Material (Content)	3.50	Very good
2	Language	3,40	Very good
3	Benefit	3,36	Very good
4	Chart	3,44	Very good
Average Overall Rating Score		3,43	**Very good**

Table 3 Media Expert Validation Result

No	Assessment Aspect	Average Rating Score for Each Aspect	Category
1	Screen Design Display	3,64	Very Good
2	Feasibility	3,85	Very Good
3	Consistency	4,00	Very Good
4	Usefulness	3,85	Very Good
5	Graphic	3,64	Very Good
Average Overall Rating Score		3,78	**Very Good**

The e-module product developed aims to make it easy for users to learn anywhere and anytime and provide different and varied learning experiences independently. The e-module product being developed has a size of 88.2 MB and can be operated offline or online. As another alternative, researchers also export e-module files in the form of links that don't need to be downloaded first so they can be accessed directly using a PC or smartphone browser by pressing the link.https://tinyurl.com/revisimodul, but the e-module in the form of this link can only be accessed online.

B. E-module Development Results

This interactive e-module product contains infographic elements developed using the ADDIE model. It contains content material for classification of living things which is composed of four sub-materials or learning sub-units including material about knowing living things and non-living things, dichotomous classification and key determinations, classification of living things. as well as a microscope and how to use it. This interactive e-module containing infographic design elements combines the module structure format from Andi Prastowo with the Directorate of Literacy and Equality Education which consists of an introductory section containing a foreword, table of contents, short description, KI/KD, concept maps, objectives and instructions for using the e- module.

The material section consists of descriptions of material explanations, independent exercises and assignments. While the closing section consists of a summary, answer keys, glossary, bibliography, and about the author.

The results of the validation test by material experts covering aspects of content, language aspects, and presentation aspects, obtained an overall average score of 3.73 out of a maximum score of 4.00. Based on the criteria of the reference eligibility level (Mardapi, 2008), it can be explained that interactive e-modules that contain elements of infographic design for science subjects are in a very good category and are suitable for use in the learning process. Suggestions from material experts, namely: Improvements to the module title.

Then, the results of validation tests by media experts covering aspects of screen design display, ease of use aspects, consistency aspects, usability aspects and graphical aspects, obtained an overall average rating score of 3.78 out of a maximum score of 4.00. Based on eligibility criteria (Mardapi, 2008), it can be explained that interactive e-modules that contain elements of infographic design for science subjects are in the very good category and are appropriate for use in the learning process. Suggestions from media experts, namely: improving the position of the development name layout with the supervisor, improving the size of the background image on the footer, the background image on the dichotomy classification material page closing the content of the material, repairing the back cover so that the text of the essence of the material is added.

After the e-module has been validated by experts by making existing improvements, then

Figure 2 The results of the development processes

the e-module is tested on 12 students or small groups of class VII package B students at SKB Semarang City. Citizens as respondents respond to assessments of e-modules based on several aspects including: aspects of material presentation, linguistic aspects, usability aspects and graphical aspects. The results of the assessment of student responses in small groups of 12 people, obtained an average overall score of 3.43 from the maximum score of 4.00. Based on eligibility criteria (Mardapi, 2008), it can be explained that the interactive e-module which contains elements of infographic design for science lessons is in a very good category so that it can be used as an alternative teaching material in science learning activities, especially material for classification of living things.

C. Analysis of Feasibility Data and Student Responses

The interactive e-module for science class VII subject on the Classification of Living Things has been tested for its feasibility in terms of material and media by one material expert and two media experts. The results of the analysis of the e-module assessment by one material expert,

namely the VIIth grade science teacher, found an overall average rating score of 3.73 which is included in the very good product category based on reference from Mardapi (2008). The results of the average score of the assessment indicate that the material in the e-module that has been developed meets the eligibility requirements for learning materials in accordance with the provisions of Core Competency, Basic Competence and Main Material for Class VII Classification of Living Things that apply to non-formal education in City SKB Semarang.

The results of the analysis of the e-module assessment by two media expert lecturers, the overall average rating score obtained was 3.78 in the very good product category. The average result on this score indicates that the e-module that has been developed meets the eligibility requirements of learning media as teaching materials for students and teachers. Material and media assessment shows very good or decent results while continuing to make improvements to the product according to the input or suggestions that have been given by each material expert and media expert.

The feasibility of the interactive e-module

material for classification of living things was also tested on class VII students at the SKB, the trial entered the implementation stage of the development model. The trial was carried out in a small group of 12 people during limited face-to-face meetings at the SKB Semarang city. Students are the main target of the e-module after going through the validation stage carried out by material experts and media experts. The results of the e-module feasibility test based on the responses of the learning residents from the questionnaire that has been given show that the interactive e-module of classification of living things containing infographics is declared feasible as teaching material in learning activities. The results obtained from the assessment of learning residents is an overall average score of 3.43 in the very good category.

Based on observations made by researchers, many learning residents gave positive responses when learning activities using e-modules that had been developed took place. Learning residents looked more independent, enthusiastic and did not look bored when reading material, this was also supported by several impressions of messages from residents. Learning states that the presentation of colourful designs and the many illustrations available make learning and reading more enjoyable.

Based on this description, the results of the interactive e-module feasibility test for science class VII subjects on the classification of living things by containing infographic elements by material experts, media experts, as well as the responses of learning residents to the use of e-module products are included in the very good category which is appropriate with the aim of due diligence on the guide to writing teaching materials from Ministry of National Education (2008) and Supriadi (2000). With interactive multimedia features contained in the developed e-module, it can help and enrich the experience of learning citizens in understanding learning material independently. This is in line with research and opinions conducted by Asyhar et al. (2015) that good e-modules or media will be able to increase students' interest, motivation and basic skills in learning.

One component that makes science learning activities successful is the presence of learning resources. Learning resources are an important choice to be able to help the process of learning activities. E-modules are sources and teaching materials that can teach citizens to learn independently due to their self-instructional nature with the advantage of being able to innovate according to the needs of both tutors and learning residents. E-modules that are innovated by containing interactive multimedia will provide more and enrich the reading and learning experience of its users, besides that it will also increase the high value of communication because the information in it can not only be seen as static print but can also inspire enthusiasm.

CONCLUSION

According to the research processes and results, this research combined the ADDIE stages into more small and simple steps in order to develop the e-module for Biology subject. After several stages of development processes the e-module has been sent to the implementation stage. In this step we gather several data to assess the quality of the e-module to support Biology subject. Regarding the statistic calculation it shows that the interactive e-module for science subjects on Classification of Living Things that has been developed is good and suitable for use as teaching materials or learning media for teachers and students in the process of learning activities. The description of the product that is suitable for use is based on the acquisition of an overall average aspect score by material experts of 3.73 in the very good category, the average overall aspect score by media experts is 3.78 in the very good category, and the overall average score aspects by student responses to the e-module of 3.43 with a very good category.

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