

Development of E-Module Biology Based on Modified Free Inquiry on Invertebrate Materials as Independent Teaching Material

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Abstract: This research aims to develop biology E-Module Based Modified Free Inquiry on Invertebrate Main Subject as independent teaching materials and measure E-Modul quality. This reaserch is determined as a Research and Development (R&D) method by applying ADDIE procedure which is focused on the level of Analysis, Design, Development and Evaluation phases. It employs questionnaire as a research instrument. Biology E-Modul quality is assesed by some respondents involving in this research. They are, one subject expert, one media professional, three peer reviewers, three biology teachers, and fifteen students' responses of X MIPA MA WI Kebarongan Banyumas. The data obtained from the research is analized by implementing qualitative and quantitaive decriptive method. Biology E-Module product based modified free inquiry is developed using ADDIE model on main subject's sub material about Invertebrate for students in the first year of X MIPA MA WI Kebarongan Banyumas. The result of this research shows that e-modul product has a great quality with a percentage of 81,67% (one subject expert), 92,27% (one media professional), 87,36% (peer reviewers), 89,92% (three biology teachers) and 93,52 % (fifteen students' responses). Thus, it can be concluded that Biology E-module has a great quality to be used as independent teaching materials to the students of X MIPA MA WI Kebarongan Banyumas.

Keywords: Teaching Material, E-Module, Invertebrate, Modified Free Inquiry.

Introduction

The year of 2020 was the tough year as Indonesia was hit by the covid-19 pandemic. The first case was detected on March 2 2020, after two people were confirmed infected from Japanese citizens. The Covid-19 is a new type of corona virus that was discovered in Wuhan, China in 2019 (Ilmiyah, 2020: Hui, et al., 2020). Covid-19 is an infectious disease that leads to a world health crisis caused by acute respiratory syndrome corona virus 2 (Server Acute Respiratory Syndrome Coronavirus 2 or SARSCoV-2). This virus is a family of corona viruses that can attack both animals and humans. On one hand, the Covid-19 pandemic has affected all education systems from pre-primary schools, secondary schools, to tertiary institutions. Based on the ABC News report March 7 2020, schools and

colleges had been shut down due to the Covid-19 pandemic in more than dozens of countries (Purwanto, et al., 2020). As a result of the Covid-19 pandemic situation, the Indonesian government had implemented physical distancing for its citizens.

The applied physical distancing causes the learning process of students in the classroom to change its method from face-to-face learning to learning from home or online-based learning (Herliandry, et al., 2020). Online-based learning is a type of learning that uses an internet network with accessibility, connectivity, flexibility, and the ability to bring up various learning interactions. One of the affected schools was MA WI Kebarongan Banyumas. The online learning process during the pandemic at MA WI

Kebarongan Banyumas was carried out through Zoom Online Meeting application, Whatsapp and Google Classroom. In this case, students were required to use their time at home by studying, discussing, doing assignments independently with online media (Safitri, et al., 2020).

Based on the results of interviews that had been conducted by researchers with the students of class X MIPA MA WI Kebarongan Banyumas regarding online learning that made full use of Google Classroom media, the teacher usually provided materials in the form of PPT (presentation slides) for teaching materials which is uploaded on Google Classroom. However, during the online learning process some students experienced difficulties with the material delivered by the teacher because there was no independent teaching material that facilitated students in the online learning process. In line with these conditions, based on the additional data from interviews with the Biology teachers at MA WI Kebarongan Banyumas, the learning process suffered constraints such as the limited Biology learning hours. This was because online learning has special challenges including internet connection and different living locations of the teachers and students, therefore the implementation of learning was not yet effective and the teacher could not fully supervise learning directly. Furthermore, the teacher had implemented several learning models in class, such as the discovery learning model by utilizing Power Point media and also giving assignments. Based on the results of students' scores on invertebrate material which were still below the KKM (minimum score) of 75, the use of this model did not seem to show maximum outcomes due to the limited teaching materials. Students were only relied on Student Worksheets (LKS) as teaching materials. The limited carrying capacity of teaching materials had an impact on the learning process. Another problem was related to student learning outcomes, in which the teachers had emphasized that during the online learning period students were expected to learn more independently at home, and therefore, there was no direct control and guarantees from the teachers that students really understand the material presented. Moreover, many students had less focus during the online learning process and as a result,

student learning outcomes on a particular Biology topic, invertebrate lesson, were not optimal.

Invertebrate material of the animalia sub-chapter is one of the biology materials taught in class X SMA/MA. This material has a lot of discussion while the time allocation is not sufficient to discuss all the Phyla. Invertebrate material is classified as very broad and uses a lot of scientific language. On the other hand, many species are further classified into other Phylum. Each example of species in the Phylum has many similarities and differences, this makes students think that Invertebrate material is quite difficult. It caused the expected student learning outcomes were not satisfactory. Based on the results of the material difficulty questionnaire that was distributed to students, it showed that 50% of students had difficulty with invertebrate material. Simultaneously, the test for understanding the invertebrate material tested by the researchers showed an average score of 62.52 from the Minimum Completeness Criteria (KKM), which was 75.

This condition showed that the learning process was still lacking and students had not acquired in-depth knowledge. Considering these conditions, practical teaching materials are needed to enable students to study independently outside of school hours. One of them is with electronic modules. Electronic modules (e-modules) are learning materials that are designed systematically based on a certain curriculum and are packaged in the form of the smallest learning units and allow them to be studied independently within a certain time unit. The goal is that students can master the competencies taught in learning activities as well as possible (Purwanto, 2007). E-modules that are arranged in electronic form can save the use of stationery such as papers so that it will indirectly help reducing paper waste. In addition, e-modules are electronic teaching materials in which animation, audio, navigation and video can be added to help visualize the process, making it more interactive and interesting.

Based on students' needs for independent teaching materials that were not yet optimal, the researchers innovated to develop teaching materials in the form of modified free inquiry-based Biology e-modules to support the use of e-

modules so that students are able to improve the quality of learning. The characteristic of the developed E-module is it can be run offline and online. For the offline type, it is a Windows application that has an executable format (exe) and can be opened via laptop or PC with a capacity of ± 20 MB. As for the HTML format, it can be performed directly via online with a link and is already connected to the internet.

Materials and Methods

The type of research was structured based on Research and Development (R&D) method. It is a method used to produce certain products, and test the effectiveness of these products (Sugiyono, 2015: 297). This study used the ADDIE model which was limited to the Analysis, Design, Development and Evaluation (ADDE) stages only. However, this research was conducted without an implementation stage. The research site was MA WI Kebarongan Banyumas. The test subjects for this study were class X MIPA MA WI Kebarongan Banyumas. Data collection techniques were carried out by distributing student needs questionnaires and teacher interviews, assessments by the material experts, media experts, peer reviewers, Biology teachers and limited testing to 15 students.

Results and Discussion

This development research produced a product in the form of a modified free inquiry-based Biology e-module with Invertebrates material for class X SMA/MA students. The e-module had been tested for validity, both content validity and validity construction so that it is declared feasible by material experts, media experts and peer reviewers, and had gone through a limited response test from students and biology teachers who had used it. The development of e-modules in this study has its own characteristics. The e-module developed in electronic form contains the Modified Free Inquiry (MFI) learning model on Invertebrate material. Product preparation referred

to Core Competencies (KI) and Basic Competencies (KD) in the 2013 curriculum.

The quality of the product in the form of e-Module based on Modified Free Inquiry (MFI) on invertebrate material was tested using data analysis obtained from 1 material expert, 1 media expert, 3 peer reviewers and 3 Biology teachers and a limited test of 15 students of MA WI Kebarongan Banyumas. The assessment criteria were summarized in a questionnaire submitted to the reviewer. The performed stages of data analysis was changing the qualitative data obtained from the reviewers into quantitative data, then calculated using the relative frequency distribution formula, and hence the results obtained were qualitative data based on ideal assessment categories. The following table shows the results of the overall e-module assessment by the reviewers:

Table 1.1 Overall e-modul assessment result data by reviewers

No	Reviewer	Score		Average	Ideal Percentage	Quality
		Max	Min			
1	Material expert	120	24	99	81,67%	Very good
	Media Expert	75	15	70	92,27%	Very good
3	Peer Reviewers	135	27	121	87,36%	Very good
4	Biology Teachers	135	27	113	81,875%	Very good
	Total	465	93	403	85,79%	Very good

Based on table 1.1. the average score obtained from the material expert's assessment was 99 and then converted to the ideal percentage obtained by a value of 81.67% which according to the quality percentage scale is included in the very good criteria. The average score obtained from the media expert's assessment was 70 and then converted to the ideal percentage, a value of 92.27% was obtained, which according to the quality percentage scale, was included in the very good criteria. Furthermore, the average score obtained from the peer reviewer's assessment was 121 and then converted to an ideal percentage, a value of 87.36% was obtained which according to the quality percentage scale was included in the very good criteria. As for the latter, the average score obtained from the Biology teachers' assessment was 113, and then converted to an ideal percentage obtained by 81.875% which according to the quality percentage scale was included in the very

good criteria. Overall, the average percentage of ideality obtained was 85.79%. The number showed that the quality of e-module Biology product is in the very good category.

The following is a more detailed description of the assessment of each reviewer:

Table 1.2. Data from e-module assessment results by the material expert

No	Assessment Aspects	Max. Score	Min. Score	Average	Ideal Percentage	Quality
1	Content/Material Feasibility	60	12	51	85%	Very good
2	Presentation	40	8	32	80%	Good
3	Language	20	4	16	80%	Good
	Total	120	24	99	81,67%	Very good

Based on table 1.2. the assessment given by the material expert above showed that the e-module has very good quality with an ideal percentage of 81.67%. The result of the highest assessment was in the feasibility aspect of the content/material with an ideal percentage of 85% and the lowest score was in the presentation and language aspects with an ideal percentage of 80%.

Table 1.3. Data from e-module assessment results by the media expert

No	Aspect	Max. Score	Min. Score	Average	Ideal Percentage	Quality
1	Presentation	55	11	52	94,54%	Very good
2	Language	20	4	18	90%	Very good
	Total	75	15	70	92,27%	Very good

Based on table 1.3. the assessment given by the media expert above demonstrated that the e-module has very good quality with an ideal percentage of 92.27%. The highest rating result was in the presentation aspect with an ideal percentage of 94.54% and the lowest score was in the language aspect with an ideal percentage of 90%.

Table 1.4. Data from e-module assessment results by the peer reviewers

No	Aspect	Max. Score	Min. Score	Average	Ideal Percentage	Quality
1	Content/Material Feasibility	60	12	55,3	92,2%	Very good
2	Modified free inquiry	15	3	11,7	78%	Good
3	Presentation	40	8	36,3	90,75%	Very good
4	Language	20	4	17,7	88,5%	Very good
	Total	135	27	121	87,36%	Very good

Based on the rating of table 1.4. given by peer reviewers above, it illustrated that the e-module has very good quality with an ideal percentage of 87.36%. The highest rating results were found in the feasibility aspect of the content/material with

an ideal percentage of 92.2% and the lowest score was in the modified free inquiry (MFI) aspect with an ideal percentage of 78%.

Table 1.5. Data from e-module assessment results by the Biology teachers

No	Aspect	Max. Score	Min. Score	Average	Ideal Percentage	Quality
1	Content/Material Feasibility	60	12	52,5	87,5%	Very good
2	Modified free inquiry	15	3	13,5	90%	Very good
3	Presentation	40	8	34	85%	Very good
4	Language	20	4	13	65%	Good
	Total	135	27	113	81,875%	Very good

Based on table 1.5. about the assessment given by the biology teacher above, it showed that the e-module has very good quality with an ideal percentage of 81.875%. The highest rating result was obtained in the modified free inquiry (MFI) aspect with an ideal percentage of 90% and the lowest score was in the language aspect with an ideal percentage of 65%.

Table 1.6. Data from students' responses results towards the product

No	Aspek	Skor max	Skor min	Rata-rata	Presentase keidealan	kualitas
1	Material Coverage	15	3	13	86,66%	Very good
2	Interest	10	2	8,3	83%	Very good
3	Interface	5	1	4,4	88%	Very good
4	Language	5	1	4,5	90%	Very good
5	Images, videos/animations	30	6	26	86,66%	Very good
6	Learning independence	20	4	17,3	86,5%	Very good
7	Presentation	35	7	30,3	85,71%	Very good
8	Appearance	5	1	4,5	90%	Very good
	Total	125	25	116,9	93,52%	Very good

Data on table 1.6 were collected from 15 class X MA WI Kebarongan Banyumas students who responded to the product of Biology e-module. Students stated that the quality of the products produced in this study was very good, with the ideal percentage of each aspect ranging from 83% to 90% in which the highest ideal percentage was in the language and appearance aspects with an ideal percentage of 90% and the lowest score was in the interest aspect with an ideal percentage of 83%. As for the overall students' responses to the quality of the e-module, an average percentage of 93.52% was obtained with a very good category. This denoted that the quality of the e-module was very good so that the e-module is feasible if it is used to support the learning process.

Based on the overall results of the assessment given by reviewers (material expert, media expert,

peer reviewers, and biology teachers), an ideal percentage of 85.79% was obtained or was included in the *Very Good* category. Meanwhile, the results of the readability test for 15 students at MA WI Kebarongan Banyumas obtained an ideal percentage of 93.52% or was included in the *Very Good* category. Therefore, it can be summarized that the product in the form of a modified free inquiry-based (mfi) Biology e-module with invertebrate material is suitable to use as teaching material on invertebrate material for students of class X at MA WI Kebarongan Banyumas. The result in this research is in accordance with Sawitri's research, et al (2014: 412) which stated that quality and appropriate learning e-modules are e-modules that have met the validity standards assessed by experts.

The advantage of this biology e-module product is that there is Interactive Publishing which appears not only in the text form but it can also be images, videos, music/voice, hyperlinks and others. This e-module is in the form of a flipbook that can be opened in the form of sheets like a real book, therefore students can be more interested in and understand the material they are studying. It also allows the e-module to be interactive with users. With this e-module, students can have a variety of learning experiences and it can reduce student boredom because the media used is more varied. Additionally, this e-module is very recommended to use in order to increase students' understanding in the learning process.

The product output is in the form of a *Flip PDF builder* with extensions including HTML 5, EXE, ZIP and APP. The e-module was packaged in Android form so that users are more practical to use it anywhere and anytime. However, the e-module developed using the Flip PDF Builder application has several drawbacks. The e-module that was processed in the software can only be input from PDF format. If there are changes to the main file, the users have to create a new project. Then, the file size is quite large because the content is full of videos and images. It will have an impact when opening this e-module product on a smartphone, which requires a large enough memory space to open it. This is likely to be one of

the reviewers' considerations in assessing the quality of the Biology e-module.

Conclusions

Based on the conducted research, the following conclusions have been obtained: Invertebrate e-module product based on modified free inquiry for class X MA WI Kebarongan had been successfully developed using the Corel Draw X7 application and Flip PDF builder. The quality of the e-module received the *Very Good* category (SB) from the material expert with an ideal percentage of 81.67%, the assessment from media expert obtained the *Very Good* category (SB) with an ideal percentage of 92.27%, the assessment from peer reviewers obtained the *Very Good* category with an ideal percentage of 87.36%, and the assessment from the Biology teachers obtained a *Very Good* category (SB) with an ideal percentage of 87.92%. Furthermore, students' responses to the developed e-module obtained a *Very Good* (SB) category with an ideal percentage of 93.52%. Therefore, the e-module based on modified free inquiry is considered suitable as teaching material for class X SMA/MA with invertebrate material.

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