
Development of an Interactive E-Module Based On Flipbook Protista Material To Improve Student Biology Learning Outcomes

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Article History:

Received date: May 4 2024

Received in revised from: May 28 2024

Accepted date: June 5 2024

Available online: June 14 2024

Citation:

Iwan, Sirait, S.H.K., & Fahmi, D. 2024. Development of an interactive e-module based on flipbook protista material to improve student biology learning outcomes. *JUPI (Jurnal IPA dan Pembelajaran IPA)*, 8(2):131-142.

Abstract. The development of a flipbook-based interactive e-module is an innovative step in increasing the effectiveness of biology learning, especially Protista material. Protista is a group of eukaryotic organisms that includes various microorganisms such as protozoa, unicellular algae, and others. This research aims to develop an interactive e-module based on flipbook material on protists that is valid, practical and effective. The research method refers to the analysis, design, development, implementation, and evaluation development model. The subjects of this research were class X students at Oikomene Manokwari High School, consisting of 24 students. Data collection procedures in the form of a questionnaire to determine validator and student responses to interactive e-modules as well as providing multiple choice questions to measure learning outcomes. Descriptive data analysis technique by calculating validation results and student learning outcomes. The research results showed that the media and material expert validation test results obtained a percentage of 96.67% with a very valid category. The results of the assessment of student responses in large group trials obtained an average percentage of 83.61% in the very practical category. The test results show that the average student learning outcome is 82.21 in the very high category. This research can be concluded that the flipbook-based interactive e-module on protist material meets the criteria of being valid, practical and effective in improving student learning outcomes.

Keywords: Development, E-module, Flipbook, Protista, Learning outcomes

Introduction

The use of technology in the learning process allows students to access the information they need to help find knowledge and learning activities. The development of technology and science is now driving the use of technological results in the world of education. Technological developments are now increasingly sophisticated, various information in digital form is easily accessible, the acquisition of knowledge is one of them, in this case the acquisition of information for students does not only depend on teachers and teachers printed books but can also be done electronically (Fauziah & Wulandari, 2022).

Learning media is a useful tool in learning activities. Apart from being useful for helping educators, learning media also provides assistance to students so they can understand more deeply the material to achieve learning goals. At least, the role of this media is able to have an impact on student learning outcomes because it contains material

that will later be explained during learning. The form of teaching materials is for example print and digital media. Learning media is considered to be very helpful for teachers in the classroom (Muthoharoh & Sakti, 2021). During the learning process, media has the function of conveying information from teachers to students. At school, students during learning are facilitated with learning resources, namely books. These sources provide knowledge, understanding and skills to students (Fauziah & Wulandari, 2022).

One of the learning media in the form of electronic media is an e-book in the form of a Flipbook. Flipbook is a form of the result of the development of e-books. Flipbooks are a category of teaching materials in the form of electronic media. Access can be via cellphone, laptop and others. The advantages are that it is able to load animated images and videos, has template designs, and is facilitated by features that can facilitate the use of this flipbook (Febrianti et al., 2022). This innovation allows students to easily digest learning material or provide a realistic learning perspective. The choice to develop flipbooks was based on the basis of being an independent and practical learning resource. The Flipbook-Based module is an electronic book application that is equipped with pictures, sound and video which can make readers more involved in their reading and can be carried anywhere with an android cellphone (Mahendri et al., 2023).

Flipbook media has advantages compared to other learning media because flipbook media not only presents a combination of text but also tries to include animation, video, sound, and so on. Flipbooks also have the advantage of being able to provide a flip effect module (pages that can be turned over). Apart from that, flipbooks are also very easy to make, and the display module is not only in the form of text and images but can also be supported. Via video, audio supporting materials (Ula et al., 2023). Flipbooks also help improve student mastery/learning outcomes regarding abstract things or events that cannot be presented in class (Elvianasti et al., 2023). Learning outcomes are abilities obtained by students after carrying out the learning process. Learning can be said to be successful if the learning objectives can be achieved. One of the successes of student learning is cognitively regarding the subject matter taught by the teacher. Learning outcomes are the main factor in learning. Student success in learning is an indicator of a teacher's success in implementing learning (Virdarani, 2023). Learning using flipbook e-modules can provide a difference in value, even though it is not significant (Masito et al., 2024). Research by (Aswanti & Isnaeni, 2023) states that the level of achievement of students' cognitive learning outcomes using interactive flipbooks is in the good category

Based on the results of observations made at SMA Oikomene Manokwari class X, information was obtained that the use of flipbook-based modules/media had never been used, especially for protist material. This has an impact on low student learning outcomes and some students also do not meet the minimum completeness criteria. Protista is a group of eukaryotic organisms that includes various microorganisms such as protozoa, unicellular algae, and others. Therefore, this material requires an attractive digital book form such as a flipbook which allows users to add effects in the form of video, images, audio, hyperlinks and multimedia objects to the page so that it looks like a 3D book. Research conducted by (Virdarani, 2023) shows that the use of flipbooks can improve high school students' biology learning outcomes. This is in line with research conducted by (Yanti et al., 2023) showing that using flipbook media can improve junior high school students' learning outcomes. In line with research conducted by (Prasetyono & Hariyono, 2020) regarding Development of Flipbook using Web Learning to Improve Logical Thinking Ability in Logic Gate, it shows that the development of flipbook-assisted learning can improve students' thinking abilities, one of which is their learning outcomes.

Based on this background, the aim of this research is to develop and produce flipbook-based interactive e-module products to improve student learning outcomes at Oikomene Manokwari High School, West Papua.

Methods

The procedure for developing flipbook-based interactive e-module media on Protista material in high school uses the ADDIE model which consists of five stages, namely analyze, design, development, implementation, and evaluation including (1) analyze stage. Protista material is one of the learning materials in class the media used is still limited to visual (image) and audio-visual (video) media. Never before has a flipbook-based interactive e-module been used. The use of flipbook-based interactive e-modules on protista material is expected to improve students' ability to compare the structure of protista similar to fungi, plants or animals (2) Design Stage. One of the Indicators of competency achievement in protista material is to summarize the general characteristics, basis of grouping and the role of protista in life. Face-to-face learning is carried out with the help of flipbook-based interactive e-modules on Protista material which presents interactive digital modules that are able to accommodate responses from students. The e-module is designed in the form of a flipbook, a three-dimensional digital book which can contain text, images, videos, music or songs, and moving animations. Assessment of students' cognitive abilities uses a formative test in the form of a post test using AI-based media (Quiziz, google form). (3) development stage. After becoming a prototype, the flipbook-based interactive e-module on protista material in high school will be validated by experts/media experts and material experts. (4) implementation stage. Real steps to implement flipbook-based interactive e-modules on Protista material and instruments that have been created. At this stage everything that has been developed will be tested in actual conditions. In the trial phase, a flipbook-based interactive e-module was obtained from observing the implementation of the e-module. (5) evaluation stage. Evaluation will be carried out at the end of each Analyze, Design, Development and Implementation stage. Furthermore, at the end of the stage, a summative evaluation will be carried out to see the success of developing flipbook-based interactive e-module products on protista material in high school.

A questionnaire/questionnaire is a number of written questions addressed to respondents to obtain information about the respondent themselves or other things known to the respondent The questionnaire was used to determine the responses of validators and students to the interactive e-module. The questionnaire for expert validation uses a 4-point response format from a Likert scale. The answer to each item of the development instrument has a gradation of (1) not very good, (2) not good, (3) good, and (4) very good. The final test (post test) is used to determine the extent of students' understanding of the lesson material provided, and is carried out by students individually. The test questions used are multiple choice questions.

Analysis of research data is grouped into two, namely validity and practicality. Calculate the validity of learning media using the following formula:

$$\text{Eligibility (\%)} = \frac{\text{obtained item score}}{\text{maximum scorekor}} \times 100$$

The table shows the category of learning device validity based on the final score attained on a scale (0-100).

Table 1. Categories of Learning Media Validity

Interval (%)	Category
81-100	Completely Valid
61-80	Valid
41-60	Less valid
21-40	Invalid
0 - 20	Completely Invalid

Products are tested to see student responses. The interactive e-module will then be analyzed using student response data. Calculate responses to interactive e-modules using the formula:

$$\text{Eligibility (\%)} = \frac{\text{obtained item score}}{\text{maximum score}} \times 100$$

Student response criteria to see the practicality of interactive e-modules can be seen in Table 2

Table 2. Response Questionnaire Criteria

Interval (%)	Category
81-100	Very Good
61-80	Good
41-60	Good enough
21-40	Not good
0- 20	Not very good

Results and Discussion

The results of research and development refer to the ADDIE model consisting of 5 stages (analyze, design, develop, implementation and evaluation). Presentation of research and development data: Analyze stages. For this analysis stage, an analysis of the needs for interactive teaching modules was carried out to identify the problems that exist at the SMA Oikomene Manokwari High School and find solutions to solve the problems faced. In a survey conducted discussions and interviews with biology teachers at SMA Oikomene High School. The teaching modules that teachers use are still limited to books that have been provided by the school without being developed by the teachers themselves according to learning needs. In particular, the protista material which emphasizes the characteristics, nature and reproduction of living things which requires pictures and interactive forms in learning has never been developed independently and applied by teachers. Teaching modules in the form of interactive modules have never been implemented, while currently students need to be prepared to face 21st century learning which emphasizes high-level thinking skills and the use of technology in learning.

Protista material is one of the learning materials in class the media used is still limited to visual (image) and audio-visual (video) media. Never before has a flipbook-based interactive e-module been used. The use of flipbook-based interactive e-modules on protista material is expected to improve students' ability to compare the structure of protista similar to fungi, plants or animals. Based on this needs analysis, it was deemed necessary to develop an interactive e-module on protista material so that students were motivated in learning and could improve their learning outcomes.

Design stage. One of the indicators of competency achievement in protista material is to summarize the general characteristics, basis of grouping and the role of protista in life. Face-to-face learning is carried out with the help of flipbook-based interactive e-

modules on protista material which presents interactive digital modules that are able to accommodate responses from students. The e-module is designed in the form of a flipbook, a three-dimensional digital book which can contain text, images, videos, music or songs, and moving animations. Assessment of students' cognitive abilities uses formative tests in the form of post tests utilizing AI-based media (Quizizz). The following is an example of a design drawing that has been designed

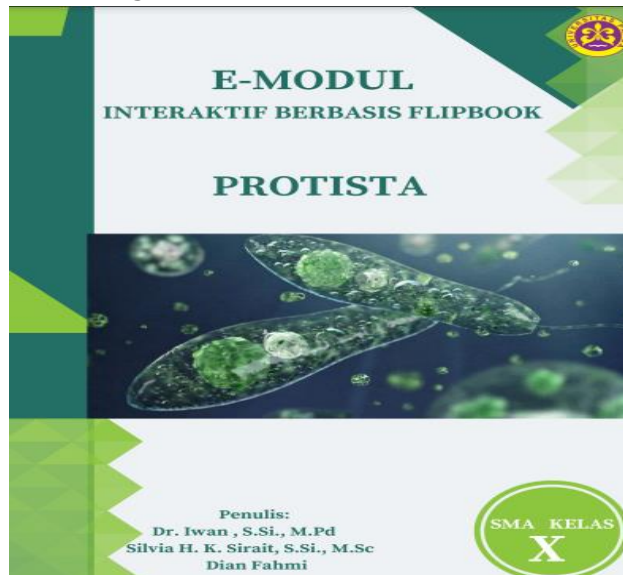


Figure 1. Interactive E-Module Based Product Design

Development Stage. This development stage contains product design realization activities in terms of Flipbook-based interactive e-modules. After becoming a prototype, the flipbook-based interactive e-module on Protista material in high school was validated by learning media experts and material experts on the interactive e-module from biology education study program lecturers. The following are the results of material and learning media expert validation presented in Table 3.

Table 3. Results of Material and Media Expert Assessment

No	Statement	Validator 1	Validator 2	Total
1	Cover, concept map, introduction and instructions for using interactive e-modules based on Flipbook are available	5	5	10
2	Suitability of material in flipbook-based interactive e-modules with learning indicators	4	5	9
3	The general design of this flipbook based interactive e-module is quite interesting	5	5	10

4	Flipbook-based interactive e-module material is appropriate to students' level of thinking development	5	5	10
5	The flow and structure of flipbook-based interactive e-modules arouse students' motivation to read them	5	5	10
6	Visual elements (images, graphs, videos) support students' understanding of protist material	5	5	10
7	Make it easy for students to understand material concepts in flipbook-based interactive e-modules	5	5	10
8	The explanations in this flipbook e-module are easy for students to understand	4	5	9
9	The language used is appropriate to the student's level of understanding	4	4	8
10	Interactive features (LKPD, Quiz, assignments, etc. help improve student understanding	5	5	10
11	The flipbook e-module is an interactive learning resource to support students in learning	5	5	10
12	Practice questions/cases in this flipbook e-module support the material and are in line with the learning objectives	5	5	10
Total				116
Percentage				96.67

In Table 3, the validation test results of flipbook learning materials and media show that 96.67% are in the very valid category.

Implementation stage. At this stage, real steps are implemented to implement a flipbook-based interactive e-module on the Protista material and the instruments that have been created. At this stage everything that has been developed will be tested in actual conditions. The trial phase was carried out through 2 limited trial stages and a real class trial obtained a flipbook-based interactive e-module from observing the implementation of the e-module.

Evaluation Stage. Evaluation will be carried out at the end of each analyze, design, development and implementation stage. Furthermore, at the end of the

stage, a summative evaluation will be carried out to see the success of developing flipbook-based interactive e-module products on protista material in high school.

Table 4. Results of student learning outcomes

No	Respondents	Learning Outcomes	Category
1	R1	95	Very high
2	R2	95	Very high
3	R3	95	Very high
4	R4	86	Very high
5	R5	86	Very high
6	R6	86	Very high
7	R7	95	Very high
8	R8	86	Very high
9	R9	67	Medium
10	R10	87	Very high
11	R11	87	Very high
12	R12	87	Very high
13	R13	67	Medium
14	R14	67	Medium
15	R15	67	Medium
16	R16	87	Very high
17	R17	77	high
18	R18	77	high
19	R19	77	high
20	R20	77	high
21	R21	77	high
22	R22	86	Very high
23	R23	95	Very high
24	R24	67	Medium
Average		82.21	Very high

Table 4 shows that the average student learning outcome is 82.21, which is included in the very high category.

Furthermore, student responses to the flipbook e-module are presented in Table 5 below:

Table 5. Respondents' Assessment Results

No	Respondents	Score (%)	Category
1	R1	83.33	Very good
2	R2	70.00	Very good
3	R3	81.67	Very good
4	R4	85.00	Very good
5	R5	85.00	Very good
6	R6	80.00	Very good
7	R7	76.67	Good
8	R8	80.00	Very good
9	R9	76.67	Good
10	R10	93.33	Very good
11	R11	80.00	Very good
12	R12	68.33	Good
13	R13	73.33	Good
14	R14	78.33	Good
15	R15	91.67	Very good
16	R16	91.67	Very good
17	R17	80.00	Very good
18	R18	90.00	Very good
19	R19	90.00	Very good
20	R20	96.67	Very good
21	R21	85.00	Very good
22	R22	91.67	Very good
23	R23	91.67	Very good
24	R24	86.67	Very good
Average Number Percentage		83.61	Very good

Table 5. Average student response results are 83.61%, which shows that student responses to the Flipbook e-module are in the very good category.

In general, the results of research on the development of interactive e-modules based on flipbooks on Protista class X Oikomene Manokwari High School show results that are very valid, practical and effective for use in learning. Based on the validation test results, a percentage of 96.67% was found to be in the Very Valid category. This is in line with research conducted by Wicaksono & Kuswanti (2022) regarding the development of flipbook material on the excretion system which was stated to be very valid and practical for use in the learning process. The same research also conducted by (Andi et al., 2023) shows that flipbook-based learning media products meet the criteria of being very valid and very practical to use in the learning process. Flipbook is an electronic media which in its use is able to display interactivity, with a combination of animation, text, video, images, audio, and also navigation which can encourage students to be more interactive, so that learning becomes more interesting (Masithoh, 2022). Research by (Agustina et al., 2023) shows that the development of flipbook media produces products that are very valid for use in the learning process

Likewise, students' responses to the use of flipbook material on protists were very high with a student response percentage of 83.61. This can happen because the use of learning media that is interesting and involves students in the teaching and learning process allows students to become more enthusiastic, interested and enthusiastic in participating in learning activities. Flipbook-based learning media influences students' activeness in learning (Nuraini et al., 2022). This can happen because flipbooks have the advantage that flipbooks contain a series of images which, when opened from one page to the next, will show that the content contains material or images that seem to move like opening a printed book. E-modules also have various types, one of which is interactive. Interactive e-modules in the form of flipbooks are learning materials that contain materials, methods, limitations and ways of evaluating that are designed systematically and interestingly (Mulyono & Elly, 2023). The use of digital books packaged in flipbook form has a positive impact on improving the quality of student learning processes and outcomes (Roemintoyo & Budiarto, 2021). Flipbook-based interactive e-modules can improve student Learning outcomes where interactive and interesting learning activities determine the success of achieving student learning outcomes in class (Hasibuan et al., 2023).

The use of flipbook-based media on protist material can improve student learning outcomes. The average student learning outcome reached 82, 21 which is in the very high category. This can happen because through this media, students are invited to read and understand learning material which is expected to increase learning motivation and interest in reading subject matter which has an impact on improving biology learning outcomes. Cognitive learning outcomes consist of remembering, understanding, applying, analyzing, evaluating and creating (Güven & Selvi, 2021). The application of flipbook learning media can improve students' biology learning outcomes (Virdarani, 2023). This flipbook is a medium that should be a reference for teachers and educational practitioners to support and fulfill teaching and learning skills, besides that this digital flipbook can improve student learning outcomes in understanding the material presented by teachers or educators (Yulianti et al., 2023). Research conducted by (Putra et al., 2023) states that Flipbook-based teaching materials can increase effectiveness in the learning process. Cognitive learning outcomes are students' skills after gaining knowledge. Cognitive learning outcomes are also skills that students acquire after carrying out learning activities. Usually, learning success is assessed based on the achievement of learning objectives. Therefore, cognitive learning outcomes have an important role in the education system, considering that the main portion of learning activities involves thinking and remembering exercises

(Sudiarti et al., 2023). This is relevant to research conducted by (Yuliani & Setiawan, 2023) regarding the development of flipbook-based digital comics to improve learning outcomes on simple comic material, showing that flipbook development is effective and can improve student learning outcomes.

Conclusion

Research on the development of an interactive e-module based on flipbook material on protists was declared feasible and practical for use in biology learning. This flipbook e-module product was responded very well by students. Therefore, it is very important to develop and apply other biological material in learning so that it can improve cognitive learning outcomes as well as higher level thinking skills and digital literacy in the future.

Acknowledgement

The researcher would like to thank the principal and biology teacher at Oikomene Manokwari High School and the validators who have facilitated and assisted the author in carrying out the research.

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