

# E-Module: Improving Biomedical II Study Results for STIKes Nurul Hasanah Kutacane Students

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**Abstract:** This research is motivated by a lack of learning resources about Biomedical II courses and learning media that are still not effective in improving learning outcomes. The purpose of this study was to produce a feasible and effective E-module in improving student learning outcomes in the Biomedical II course at Stikes Nurul Hasanah Kutacane. The development procedure used in this study is the development model from Borg and Gall and the instructional design step from Dick and Carey which is divided into 4 stages: the needs analysis stage, the product design stage, the validation and evaluation stage, and the final product stage. To see the effectiveness of the E-module, it can be analyzed through the normality test, homogeneity test, and hypothesis testing. Product validation results show a score percentage of 87% for media expert validation, 93% for material expert validation, and 96.18% for student response results. The results of the normality and homogeneity tests show that the research data has been declared normal and homogeneous. The results of the hypothesis test show that the value of t count is 3.03 and the value of t table is 1.66, where t count > t table. The results of this study indicate that the E-module is effective in improving student learning outcomes in Biomedical II at Stikes Nurul Hasanah Kutacane.

**Keywords:** e-module; biomedicine; learning media

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## 1. INTRODUCTION

The development of information and communication technology (ICT) has changed the paradigm and transformed the world of education in terms of curriculum, methods, models, strategies, and other teaching materials. Technology changes the use and development of learning media into several parts, namely print-based media, visual-based media, computer-based media, and audio-visual based media. The most sophisticated learning media is media that can convey five forms of information, namely lines, symbols, images, sounds, and movements.

The development of ICT continues to increase along with the increasing human needs in education [1]. Currently, many innovations in the use of electronic technology trends have sprung up, for example, such as e-education, e-learning, and many others, including module innovations using electronics, namely e-modules, which can improve the quality of student learning. The current development of ICT in the development of e-modules seems to have become an option for educators to change conventional learning systems, this is evident from several previous studies in several different places.

The Ministry of National Education [2] defines electronic modules as self-study materials that are systematically arranged and presented in an electronic format. The advantage of electronic modules (e-modules) over printed modules is that they can be inserted with videos, pictures, and interactive questions. Thus, electronic modules (e-modules) are expected to increase students' interest and motivation and provide a pleasant learning experience because teaching materials are not only textual in nature which can cause boredom during the learning process. E-modules are capable of being interactive sources of information because they can present information dynamically with the support of images, videos, and simulations [3]. The characteristics of an effective, practical, easy, and efficient electronic module will be able to present independent learning for students [4].

Biomedical II course is a compulsory basic advanced course for S1 Public Health Study Program, STIKes Nurul Hasanah Kutacane. The Biomedical II course discusses Pathology, Parasitology, and Biochemistry. As a graduate of Public Health STIKes Nurul Hasanah S1 Public Health Study Program who has the main competency objectives, namely being able to communicate effectively, apply legal aspects in the practice of public health science, educate public health, and be able to conduct research, and be able to apply public health management, of course, every course taught teaching must be well planned and well designed.

Biomedical II course is a subject that is expected to support the achievement of student competency as a professional Bachelor of Public Health Sciences graduate. Every undergraduate student in Public Health Sciences is expected to get a learning experience that allows the achievement of learning objectives as a whole and comprehensively, one of which is through the Biomedical II subject. In S1 Public Health Sciences STIKes Nurul Hasanah, the Biomedical II course has a credit load of 3 credits. Biomedical II learning is very important for Undergraduate students in Public Health Sciences so that in the learning process it is not enough just to rely on printed books or modules in pdf format that have not been modified with advances in the technological era as it is today. Learning that is only centered on an educator or what we usually call conventional learning is no longer relevant to be applied in the current era of technological development. We naturally carry out learning modifications so that we can hone creativity and independence which makes S1 Public Health Science students able to learn independently.

### 1.1 Biomedicine II Public Health Sciences

Biomedicine II or also called Basic Biomedicine II is a range of health courses that discuss pathology, parasitology, and biochemistry. In S1 Public Health Sciences STIKes Nurul Hasanah, the Biomedical II course has a credit load of 3 credits.

As a graduate of Public Health STIKes Nurul Hasanah S1 Public Health Study Program who has the main competency objectives, namely being able to communicate effectively, apply legal aspects in the practice of public health science, educate public health, and be able to conduct research, and be able to apply public health management, of course, every course taught teaching must be properly planned and well designed.

Public health science is the science and art of preventing disease, prolonging life, improving physical and mental health, as well as efficiency through organized community efforts to improve environmental sanitation, control infection of the community, educate individuals about individual health, then organize medical services and as well as treatment, for early detection, prevention of disease, development of social aspects, to support every individual in society to have a strong standard of living to maintain their health [5].

The relationship between the Biomedical II course and public health is that biomedicine examines all material that exists in the heavens and on earth, and this shows that aspects of the study of chemistry also depend heavily on humans, because humans are also material aspects that exist on earth. Likewise with public health, where society means a group of people who live in a certain environment. So it is concluded that biomedical science II as well as public health science both have an important role in health, especially in practice and theory.

Learning outcomes are the most important part of learning. According to Sudjana [6], learning outcomes are the abilities possessed by students after they receive their learning experience. Student learning outcomes in the Biomedical II course on Parasitology material are learning activities in the form of knowledge as a result of treatment or learning carried out by students in other words student learning outcomes the in Biomedical II course are what students obtain from Biomedical II learning process in parasitology material.

The expected results in Biomedical II learning on Parasitology material are contained in the assessment indicators for semester 2 students of public health sciences. Students are expected to be able to explain, understand classifying, know nomenclature and also the relationship between parasites and their hosts in Parasitology material so that the objectives of learning Biomedical II for parasitology material are realized, namely, students are expected to be able to develop basic health services according to the local context and face demands for public health problems regarding parasites and parasites. other health.

## 1.2 Learning Media

Gagne [7] said that the media are various types of components that are in the student environment that can stimulate them to learn. Meanwhile, Briggs [8] said that the media are all physical tools that can present messages, and can stimulate students to learn. Meanwhile, the Educational Communication Technology Association in Rahardi [9] said learning media is everything that people use to convey messages. Miarso [10] said learning media is anything that can stimulate students so that the teaching and learning process takes place.

According to Levie and Lentz in Arsyad [11] said that there are 4 functions in learning media, namely: (a) the function of attention that can attract and direct students; (b) the affective function of visual media can be seen from the level of enjoyment of students during the learning process; (c) cognitive function; (d) the compensatory function of learning media

helps students who are weak in reading to organize information in the text and recall it.

The rapid development of science and technology is currently influencing the learning process in schools so the learning media to be used must follow the needs of the learning process. According to Arsyad [12], learning media are grouped into four groups, namely as follows: (a) media produced by printing technology; (b) audio-visual technology media; (c) media produced by computer technology; (d) media combined with printing and computer technology.

According to Munadi [13], the various types of learning media are as follows: (a) audio media, namely radio, recording devices, and audio tapes; (b) visual media, namely magazines, newspapers, modules, comic posters, and atlases; (c) audio-visual media, namely films, television videos. Based on the descriptions of several experts, it can be concluded that learning media can be categorized into four parts, namely visual media, audio media, audiovisual media, and interactive media.

## 1.3 E-Module Flip Pdf Corporate Learning

Electronic modules are a form of presenting independent learning materials that are arranged systematically into certain learning units, which are presented in electronic format, and each learning activity in them is connected with a link as navigation which makes students interactive with the program, equipped with video tutorials, animation, and audio to enrich the learning experience of students [14].

According to Samiasih [15], e-modules are computer-based modules that are also filled with fragments and questions in each fragment which make it easier for users to understand the material. According to Laili [16], E-modules are learning resources that contain material, methods, limitations, as well as ways of evaluating that are designed systematically and attractively to achieve competence according to the curriculum electronically.

According to Irwanyah [17], Flip Pdf Corporate Edition is a Pdf development application that can be accessed online or offline and contains text, audio, video, images, and so on. Electronic modules (e-modules) can be interactive sources of information because they present information dynamically with support from multimedia such as images, videos, and simulations.

According to Susanti, et al. [18] Flip Pdf Corporate is a software that can be used to open the pages of a module like a book. By using Flip PDF Corporate students will be more interested in learning because the appearance of Flip PDF Corporate is attractive.

According to Khoiriyah [19] Flip Pdf Corporate is software used to convert modules in pdf form into flipbooks in html form. The advantage of converting using flip pdf corporate edition is that the module looks more attractive because it can be equipped with images, audio, video, and animation.

According to Fadilah [20] The Flip Pdf Corporate application is an application designed to help create animated e-Modules in the form of flipbooks that are suitable for both display modes, namely desktop and mobile which can help make a good first impression with every opportunity. Flip PDF Corporate has several advantages, namely, it can be used for Windows and Mac users, the registration method is simple

using an e-mail account, the advertisements are small and don't interfere with viewing, it is equipped with several templates that can be used, you can edit existing templates or add PDF files. which has been made together with the relevant components, and can add video and audio to the e-Modules that are made, and can add active links. The output formats provided in this application are HTML, zip, exe, app, and fbr which can be selected according to usage needs.

The advantages of corporate PDF flip, namely: (1) Has an attractive appearance, by adding videos, images, or animations

simultaneously, (2) supports interactive learning, (2) Has a variety of templates, (3) Teaching materials can be supported with text and audio, (4) Easy and accessible to everyone [21].

Based on the descriptions of several experts, it can be concluded that the Flip Pdf Corporate Application is software that has the potential to increase understanding of concepts or learning materials so that teaching materials are not only based on writing but can also be added to the form of images, audio, and video so that they can be implemented effectively. interactive and interesting.

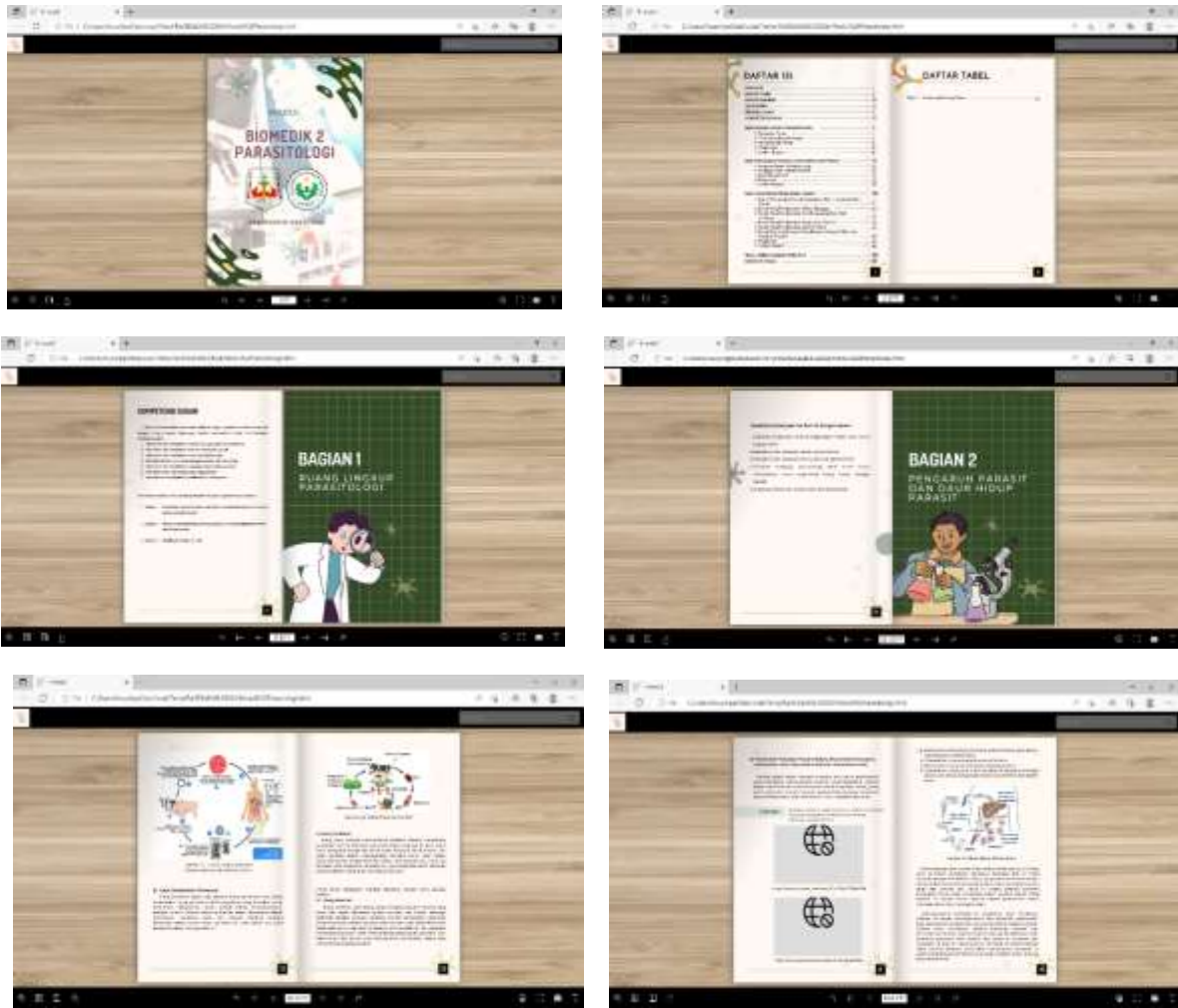


Figure 1. Display of corporate pdf flip e-module



Figure 2. Learning with corporate flip pdf e-module



The research problem is formulated as follows: (1) Are learning media products E-Module Biomedical II appropriate for use in learning for students of the Public Health Study Program?; and (2) Is the learning media product E-Module Biomedical II effectively used to improve learning outcomes for students of the Public Health Study Program?

## 2. METHODS

This type of research is a type of development research commonly called development (Research & Development). Research development is research that aims to produce a product through the development process [22]. According to Sugiyono [23] research and development is research that produces products and also other activities, namely testing the effectiveness of the products to be produced. In order to be able to produce a particular product, namely research that needs analysis in nature and to test the effectiveness of the product so that it can function to a large audience, research must be carried out to test the effectiveness of the product that has been produced. According to Borg and Gall [24], development research is a process used to develop and validate products.

To produce an e-module development product for the Biomedicine II course based on the Flip Pdf Corporate Edition application for Public Health Sciences students at STIKes Nurul Hasanah Kutacane, development steps from Borg and Gall and instructional design from Dick and Carey were used.

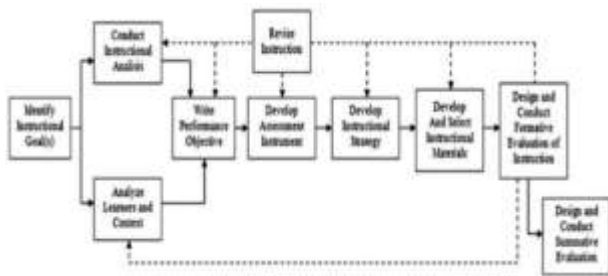


Figure 3. Dick and Carey's Instructional Design Model

This research was conducted at STIKes Nurul Hasanah Kutacane, Undergraduate Public Health Study Program, which was carried out in March 2023. The subject of this research was second-semester students of the STIKes Nurul Hasanah Kutacane Public Health Study Program. The selection of the sample in this study used a purposive sampling technique, namely the determination of the research sample based on the consideration of the researcher who considered the desired research elements already exist in the members of the sample taken and the advice from the lecturer of the Biomedical II course at STIKes Nurul Hasanah Kutacane.

The development procedure used in this study adapts the Dick and Carey instructional development steps and the Borg and Gall product development steps with the following development steps:

1. Needs Analysis Stage. This stage aims to examine the objectives of the product to be developed in the form of e-module learning for the Biomedical II course based on the Flip Pdf Corporate Edition application. Researchers will conduct a curriculum analysis to determine products that are in by demand of the curriculum.
2. Product Design Stage. The results of the needs analysis will then determine the product design to be developed. Product design must be embodied in drawings or charts so that it can be used as a guide for assessing and making it. The

product design stage includes determining the concept of e-module learning for the Biomedicine II course based on the Flip Pdf Corporate Edition application, the concept of delivering and organizing material, evaluation questions, pictures, and e-module storyboards.

3. Validation and Evaluation Stage. This stage is the core stage in the form of a series of product development assessments. Validation of the initial design is carried out by asking experts/experts who have experience in their field to assess the product being designed. The results of the evaluation and expert/expert advice are used to improve and revise the product being developed. The next series of validation and evaluation stages are the product trial stage. Products that have been declared feasible by experts/experts are then tested on Public Health Sciences students at STIKes Nurul Hasanah Kutacane.
4. Final Product Stage. This stage will produce the final product in the form of an e-module that has been revised based on criticism and suggestions from the validation and evaluation stages. The final product is ready to be produced and used as learning media for Biomedical II courses.

Data collection was carried out using a questionnaire distributing questionnaires to the respondents, namely material experts, media experts, design experts, and student responses. The respondents assessed the quality of the corporate flip pdf e-module with the provisions of the research criteria in Table 1 below:

Table 1. Questionnaire Sheet Table

Criteria	Score
Very good	5
Good	4
Enough	3
Not good	2
Very bad	1

((Source: Arikunto [25])

Table 2. Qualification Criteria Assessment Questionnaire Validation Experts, and Student Response Instruments to e-module flip pdf corporate

Percentage of Achievement Level	Eligibility	Description
$80\% \leq X < 100\%$	Very Valid	No Need Revision
$60\% \leq X < 79\%$	Valid	No Need Revision
$40\% \leq X < 59\%$	Valid Partial	Partial Revision
$20\% \leq X < 39\%$	Less Valid	Revision
$0\% \leq X < 19\%$	Very Invalid	Revision

(Source: Arikunto [26])

Based on the quantitative data from the results of the validator by material experts, media experts, and student response questionnaires, the next step is to analyze the data and calculate the percentage level of achievement based on the formula:

$$P = \frac{\sum x}{\sum x_i} \times 100 \%$$

Information:

x : The answer score from the validator

$x_i$  : Score the highest answer

P : Presentation of eligibility level

The feasibility and effectiveness criteria achieved are used in the development of the corporate flip pdf e-module described in the following table.

**Table 3. Criteria for e-module flip pdf corporate**

No	Score in Percentage (%)	Eligibility Category
1	$80 \leq P < 100$	Very Eligible
2	$60 \leq P < 80$	Eligible
3	$40 \leq P < 60$	Adequate
4	$21 \leq P < 40$	Inadequate
5	$0 \leq P < 21$	Very Inadequate

The developed corporate flip pdf e-module learning media gets a positive response from students if the percentage obtained from the student's response questionnaire reaches a score of  $\geq 60\%$ , then the corporate flip pdf e-module learning media is categorized as feasible and effective.

Product Effectiveness Test Data Analysis Techniques. The effectiveness test aims to obtain information about whether or not the product development being tested is effective in the learning process.

Based on the formulation of the first problem, namely whether the developed corporate flip pdf e-module learning media is feasible to use. The corporate flip pdf e-module learning media can be said to be feasible to use based on the results obtained from expert validation regarding suggestions and improvements related to the corporate flip pdf e-module learning media that was developed. The next step was to do an individual trial of 3 students, a small group test of 9 students to find out the response to the e-module flip pdf corporate learning media that was made.

Based on the formulation of the next problem, namely whether the developed corporate flip pdf e-module learning media is effective for improving Biomedical II learning outcomes. Learning is said to be effective if there are significant differences in learning outcomes between classes that are given treatment in classes that are not given treatment. The hypothesis uses the mean difference test or t-test. The t-test is the average difference to find out whether there is a significant difference at the 0.05 significance level with Microsoft Excel 19

The hypothesis formulated is:

$H_0: \mu_1 = \mu_2$  (there is no mean difference between the treated and untreated classes).

$H_a: \mu_1 \neq \mu_2$  (there is an average difference between the treated and untreated classes).

Decision-making  $H_0$  is accepted if the significance is greater than 0.05. The following is the calculation using the 2nd difference test for the population average according to Sudjana [27]:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Where:

$\bar{X}_1$  = total average score of the experimental class sample

$\bar{X}_2$  = total average score of the control class sample

$s$  = standard deviation

### 3. RESULTS AND DISCUSSION

#### 3.1 RESULTS

The results of the assessment by media experts, material experts, individual trials, small group trials, and limited field trials for all aspects of the assessment are determined by the average score. The results of the assessment were then analyzed and determined whether or not it was appropriate to develop corporate learning media on creative economy material. The average percentage of the results of the assessment of media experts, material experts, individual trials, small group trials and field trials is as follows:

**Table 4. The average percentage of the results of the assessment of the e-module flip pdf corporate learning media**

No	Categorization	Percentage of average score %	Criteria
1.	Material Expert Validation	93,00	very feasible
2.	Media Expert Validation	87,00	very feasible
	Learning Design Validation	89,00	very feasible
3.	Individual Trial	95,33	very feasible
4.	Small Group Trial	96,00	very feasible
5.	Field Testing	96,18	very feasible
	The average	93,03	very feasible

Flip corporate pdf e-module learning media shows that: Material Expert Validation is 93.00% very feasible category; Media Expert Validation of 87.00% very feasible category; Learning Design Validation of 89.00% very feasible category; Individual Trial of 95.33% very feasible category, Small Group Trial of 96.00% very feasible category; Field trials of 96.18% very feasible category, an average of 93.03% very feasible category. which means that the use of corporate e-module flip pdf learning media meets the needs of students

Based on student learning outcomes taught using E-modules in the Biomedical II course at Stikes Nurul Hasanah Kutacane, the lowest score was 77.14 and the highest score was 97.14. The mean score is 86.20, the mode is 84.50, the median is 85.50 and the standard deviation is 6.10. To see student scores, interval class is used, namely the score between absolute frequency (the number of students who have learning achievement scores) and relative frequency (the number percent of learning achievement scores). A complete description of learning outcomes using the E-module is shown in Table 5.

**Table 5. Frequency Distribution of Experiment Class Student Learning Outcomes**

Class	Class Intervals	F. Absolute	F. Relative %
1	74 - 77	3	9,38%
2	78 - 81	5	15,62%
3	82 - 85	8	25%
4	86 - 89	7	21,88%
5	90 - 93	5	15,62%
6	94 - 97	4	12,5%
	Total	32	100

Based on the learning outcomes of students taught using printed modules in the Biomedicine II course at Stikes Nurul Hasanah Kutacane, the lowest score was 69 and the highest score was 89. The average score was 72.86, mode 79.50, median 79.19,

and standard deviation 5.80. A complete description of learning outcomes using the print module is shown in Table 6:

**Table 6. Frequency Distribution of Control Class Student Learning Outcomes**

Class	Class Intervals	F. Absolute	F. Relative %
1	69 - 72	4	12.50%
2	73 - 76	6	18.75%
3	77 - 80	9	28.12%
4	81 - 84	8	25%
5	85 - 88	2	6.25%
6	89 - 92	3	9.38%
Total		32	100

The analysis requirements test performed is the normality and homogeneity tests. Testing was carried out using the Liliefors test. A summary of the normality of the two samples can be seen in Table 7 below:

**Table 7. Summary of Data Normality Test with Liliefors**

No .	Data	Class	L <sub>count</sub>	L <sub>table</sub>	Conclusion
1	Pretest	Experiment	0,119	0,157	Normal
2	Pretest	Control	0,096	0,157	Normal
3	Posttest	Experiment	0,112	0,157	Normal
4	Posttest	Control	0,107	0,157	Normal

Based on Table 7, it can be seen that the results of the pretest data normality test in the experimental class obtained  $L_{count} < L_{table}$  ( $0.119 < 0.157$ ), and in the control class also obtained  $L_{count} < L_{table}$  ( $0.096 < 0.157$ ). The same thing also happened to the posttest data normality test results for the experimental class with  $L_{count} < L_{table}$  ( $0.112 < 0.157$ ) and in the control class obtained  $L_{count} < L_{table}$  ( $0.107 < 0.157$ ). Thus, it can be concluded that the pretest and posttest data in the experimental and control classes are normally distributed at the significance level

Homogeneity test analysis using the F test is to prove the largest variance and the smallest variance with the formula:

$$F = \frac{\text{Varian terbesar}}{\text{Varian terkecil}} = \frac{S_1^2}{S_2^2}$$

A summary of the homogeneity of the two samples is seen in Table 8 below:

**Table 8. Summary of Data Homogeneity Test with Fisher's Test**

No.	Data	Class	F <sub>count</sub>	F <sub>table</sub>	Conclusion
1	Pretest	Experiment	1,11	1,83	Homogeneous
2	Pretest	Control			
3	Posttest	Experiment	1,08	1,83	Homogeneous
4	Posttest	Control			

Based on Table 8, it can be seen that the results of the calculation of the pretest data homogeneity test in the experimental class and control class at a significant level  $\alpha = 0.05$  obtained  $F_{count} < F_{table}$  ( $1.11 < 1.83$ ), it can be concluded that the pretest data in the two classes have the same or

homogeneous variance. Then in the posttest data homogeneity test in the experimental class and control class at a significant level  $\alpha = 0.05$  obtained  $F_{count} < F_{table}$  ( $1.08 < 1.83$ ), it can be concluded that the posttest data in the two classes have the same or homogeneous variance.

The following is the formulation of this statistical hypothesis, namely:

$$H_0 : \mu A1 \leq \mu A2$$

$$H_a : \mu A1 > \mu A2$$

Information:

$\mu A1$  : average student learning outcomes taught using learning media e-module flip pdf corporate

$\mu A2$  : average student learning outcomes taught without using corporate flip pdf e-module learning media

The t-test is used as a hypothesis-testing tool because the research data is normally distributed and homogeneous. The hypothesis in the research is:

$H_0$ : Flip pdf corporate e-module learning media is not effective in improving biomedical learning outcomes II.

$H_a$ : Corporate e-module flip pdf learning media is effective in improving biomedical learning outcomes II.

Hypothesis testing in this study was carried out using the t-test formula. The t-test was conducted to find out whether there is a significant difference between learning outcomes in classes taught using e-books (experimental class) and learning outcomes taught using printed books (control class) with the provision that if  $t_{count} > t_{table}$  then  $H_0$  is rejected and  $H_a$  accepted.

The calculation results obtained  $t_{count} = 2.37$  and  $t_{table} = 1.66$  so that  $t_{count} > t_{table}$  at a significant level  $\alpha = 0.05$ . Based on these results, that  $H_0$  is rejected and  $H_a$  is accepted or in other words, there is a significant difference between student learning outcomes in the experimental and control classes at a significance level of 5%. Thus, the learning outcomes of students who are taught using the corporate flip pdf e-module have differences from the learning outcomes of students who are taught with printed books and are declared tested for feasibility.

To test the effectiveness of the developed corporate flip pdf e-module, the following calculations are performed:

$$X = \frac{\text{total score obtained}}{\text{total ideal score of all items}} \times 100\% = \frac{2758}{3208,48} \times 100\% = 88,73\%$$

Adapun nilai keefektifan *e-modul flip pdf corporate* dapat dilihat sebagai berikut:

$$X = \frac{\text{total score obtained}}{\text{total ideal score of all items}} \times 100\% = \frac{2527}{3208,48} \times 100\% = 81,63\%$$

Based on the calculation of the effectiveness test on the two modules, the result is that the learning outcomes of Biomedical II students who are taught with the E-module are higher than the learning outcomes of Biomedical II students with printed modules ( $88.73\% > 81.63\%$ ). Thus it can be concluded that the E-module is more effectively used in the Biomedicine II course

for undergraduate students in the public health study program compared to using the printed module.

### 3.2 DISCUSSION

Based on the results of the validation that has been carried out, the e-module product is declared feasible to continue in field trials. The developed e-module meets standards based on the standard design for the development of learning materials and learning media. For the assessment of learning material experts, a score of 93% was obtained which was categorized as very feasible and an assessment from learning media experts obtained a score of 87% which was categorized as very feasible.

After the experts stated that this e-module product was feasible to be tested in the field, field trials were carried out according to the procedure, namely individual, small group, and field trials. The score of student responses in individual trials was 95.33% (Very Eligible), small group trials were 96% (Very Eligible), and field trials were 96.18% (Very Eligible). Based on the results of the questionnaire, which were validated by material experts, and media experts and then continued with product trials, it can be concluded that the e-module in the Biomedical II course was stated to be very suitable for use as a learning medium for Stikes Nurul Hasanah Kutacane students.

The effectiveness test of the developed e-module was carried out to fulfill the instructional design procedures by Dick and Carey at the summative evaluation stage. The purpose of testing the effectiveness of this product is to determine whether the product needs to be used continuously because it is effective or discontinued. After all, it is not effective.

Testing the effectiveness of the product on the developed e-module has been carried out by comparing the average value of learning outcomes for Biomedical II taught using e-modules with those using printed modules. From the results of research data processing, there were differences in learning outcomes in Biomedical II between students who were taught using e-modules and those who used printed modules (69.06% > 59.58%).

This is in line with Junaedi et al. [28] who specifically conducted a literature study on the effectiveness of using economic learning e-modules at the Faculty of Economics, Sebelas Maret University concluded that the use of problem-based learning (PBL)-based e-modules can be utilized to support the effectiveness of learning so that learning situations become interesting and students are motivated. The use of problem-based learning and economics-based e-module learning media can help achieve maximum learning objectives and learning outcomes.

Furthermore, Suarsana & Mahayukti [29] concluded the same thing in the development of e-modules with a research entitled Development of Problem Solving Oriented E-Modules to Improve Students' Critical Thinking Skills. This research concludes that the quality of the learning modules produced is good, with a percentage of e-module assessment results of 75.5%.

The same thing was also said by Imansari and Suryaningsih [30] who examined the effect of using interactive e-modules on student learning outcomes on occupational health and safety material at the IKIP PGRI Madiun, concluding that student learning outcomes using interactive e-module media were declared complete with grades classical mastery average of

82.22. Student responses to the use of interactive e-module media in the learning process are also in the good category.

According to Arsyad [31], the benefits of using learning media in the teaching and learning process are as follows: (1) Learning media can clarify the presentation of messages and information so that it can expedite and improve learning processes and outcomes. (2) Learning media can increase and direct children's attention so that it can lead to learning motivation, more direct interaction between students and their environment, and the possibility for students to study independently according to their abilities and interests, (3) Learning media can overcome sensory limitations, space, and time, and (4) learning media can provide students with similar experiences about events in their environment.

From Arsyad's explanation [32] about the benefits of media, it can be concluded that e-modules can be called true learning media if these learning media can improve student learning outcomes. The use of e-module media allows students to more easily understand learning and master learning material, therefore this e-module media can improve student learning outcomes.

From the explanation above, it can be concluded that e-module media is feasible and effective for improving learning outcomes in the Biomedical II course for Stikes Nurul Hasanah Kutacane students. In addition, the lecturer's ability to act as a motivator also greatly influences student learning outcomes because students must be motivated to be fully responsible for their learning assignments.

### 4. CONCLUSION

Based on the formulation of the problem, objectives, results, and discussion of the research on the development of e-module learning media previously described, the following conclusions can be drawn:

1. The e-module product developed in the Biomedicine II course for undergraduate students of the Public Health Sciences study program meets the requirements and is suitable for use as a learning medium. This was concluded based on research results from learning material experts (93%), media experts (87%), student responses to individual trials (95.33%), small group trials (96%), field trials (96.18 %) which as a whole stated that the E-module was in the "very good" category.
2. The effectiveness of the e-module in the Biomedical II course that was developed is considered more effective than the printed module. The results of testing the hypothesis prove that there is a significant difference between the learning outcomes of students who are taught using e-modules and the learning outcomes of students who are taught using printed modules. This is indicated by the results of data processing obtained  $t_{count} = 3.03$  and  $t_{table} = 1.66$  so that  $t_{count} > t_{table}$  at a significant level  $\alpha = 0.05$ . So the learning outcomes of students who are taught with e-modules have an effectiveness of 88.73% higher than learning outcomes using printed modules with an effectiveness of 81.63%.

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