The Development of the Modern Physics E-book utilizes Flip PDF Professional to increase student independent

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Abstract: This study aims to develop an e-book on Modern Physics utilizing Flip PDF Professional, which is feasible, practical, effective, and can increase student learning independence. This Modern Physics E-book can make it easier for students to understand the material, attract interest, be practical, and can be used independently. The Modern Physics E-book will consist of audio image text and be made into several formats such as pdf, exe, HTML, and zip. The research was conducted at the State University of Medan Department of Physics in class B stamp 2020 and Class D stamp 2022. This research type uses the Research and Development R & D Borg and Gall model. The researchers used qualitative and quantitative data analysis techniques in this development. The results of the assessment and responses from filling out the questionnaire: (a) the percentage score of the material expert was 84% , and the percentage score of the media expert was 85% (b) the practicality of this media was 85.23% (c) e-book media can increase student independence with the results of 85% (e) from the results of the effectiveness test, it is found that the Modern Physics e-book media has an N-gain score of 0.41 in the medium category and an N-gain score (%) 41 % with a moderate interpretation. It can be concluded that the modern physics e-book media is very feasible, very practical to use and develop.

Keywords: e-book, modern physics, independent

Introduction

The development of information technology is overgrowing. So, it has changed the learning pattern in a more flexible direction. Everyone can take advantage of technological media and learn without being bound by space and time factors (Pribadi, 2017). According to Hamalik (Sukiman 2012: 41-42), the use of instructional media will significantly help the effectiveness of the learning process in delivering and presenting information more attractively and reliably and can increase students' understanding, facilitate the interpretation of data and condense the information to be conveyed.

Modern Physics is a course for fifth-semester students in the Department of Physics. Modern physics studies the behavior of matter and energy at the atomic scale and subatomic particles or waves. Modern Physics was developed in the early 20th century when the formulations in Classical Physics could no longer explain phenomena that occur in tiny matter. The materials studied in modern physics are (a) The special theory of Relativity, including the Galileo transformation, Einstein postulates, Lorentz transformation, Time dilatation and Equivalence of mass and energy, (b) Black body radiation, (c) The photoelectric effect, (d) Compton effect (e) Particle wave dualism (f) Schrodinger equation (g) Atomic models (h) Atoms with many electrons and (i) Molecules.

Based on a survey with students in class Dik B 2018 majoring in Physics at State University of Medan who have taken Modern Physics courses, namely: (a) 50% of students have difficulty studying Modern Physics because it is also difficult to find learning resources such as books (b) 50% of students have difficulty understanding the book/textbook (c) 50% of students need supporting media (d) 50% said the lecturer uses several media to explain Modern Physics. Students giving advice need learning media that can be used independently, such as e-books. 91.7% of students said that lecturers had given E-books, but they were only given in the form of PDF. 91.7% of students said that E-books are suitable for independent use because modern physics is only three credits per week.

At the same time, there is much sub-materials time to study with the lecturer when the lecture is not enough to discuss in detail. Lecturers, as facilitators, are always required to be able to utilize and develop technological products to improve the learning process.

So based on the problem above, a learning media is needed, namely the Modern Physics e-book, which can be studied by students independently. The E-book is one type of media. Electronic books or digital books are electronic versions of books. Many studies have been on the existing Modern Physics E-books, only in PDFs containing text and figures. There is no exist modern physics book consist of text, picture and video to interest student. The E-book will be made into several formats, such as pdf JPEGHTML and OPF (open electronic book package). According to KhairinalSuratno and Aftiani (2021), the developed E-book can increase students' independence and interest in learning. Based on the research results of Sriwahyuni I. Risdianto E. & Johan H. (2019), the presentation aspect validity test obtained a percentage result of 7812% with a very good category of content aspects of 81, 88% with a very good category of language aspects of 8281% and media aspects of 75% with very good category. Based on these results, it can be concluded that the electronic teaching materials using Flip PDF Professional produced are valid with a total percentage of 79, 45%, which is included in the very good category.

This Modern Physics E-book, which will be made based on Flip PDF Professional, can be used independently and according to student needs. Flip PDF Professional is different from other pdfs. This application is used to create an electronic book by combining material in the form of a pdf file with animated images, MP4 videos, audio videos, hyperlinks, and flash quizzes, which are still rarely used in physics learning. According to Yamin (2013), independence requires the responsibility of those who are independent, namely those responsible for taking the initiative, having the courage and being able to accept risks, and becoming learners themselves. Independence is the behavior of taking the initiative, overcoming obstacles or problems, having self-confidence and being able to do things without the help of others, and the desire to do something for oneself. From several opinions regarding indicators of learning independence, it can be concluded that indicators of learning independence are as follows: a) Not dependent on others; b) Confidence; c) Discipline; d) Responsible; e) Self-initiated; and f) Self-control. The research objectives to be achieved in research are: to develop a Modern Physics E-book, use the decent Flip PDF Professional, to develop a Modern Physics E-book, use the practical Flip PDF Professional,to develop a Modern Physics E-book, utilize Flip PDF Professional, which can increase independent,to develop a Modern Physics E-book, use the effective Flip PDF Professional.

Research methods

This study use the Research and Development (R&D) method. The stages of research and development of the Brog& Gall R&D (Research and Development) model. This studyinstrument or data collection tool was a questionnaires, observation, and documentation. Questionnaires were given to media experts; material experts, teacher's response, and response were given to students taking modern Physics courses. The data analysis technique was carried out using analytical methods. After all the data had been obtained and collected, the data needed to be analyzed. Researchers in this development used qualitative and quantitative data analysis techniques. Qualitative data were obtained from the survey results in interviews before researching the 2018 B stamp of the Physics Department at State University of Medan. Criticisms and suggestions for developed products. Quantitative data consists of assessment scores by media experts and students for the effectiveness of the e-book media and also using a questionnaire for the practicality of student independent.

$$P = \frac{X}{Xi} \; x\,100\%$$

Information:
P = Percentage of each criteria
X = score of each criteria
Xi = maximum score for each criteria

Table1. Percentage Scale According to Arikunto (1996: 244)

Achievement Percentage	Scale	Interpretation Value
76% ≤ score ≤ 100%	4	Very worth it
51% ≤ score ≤ 75%	3	Worthy
26% ≤ score ≤ 50%	2	Decent enough
0% ≤ score ≤ 25% 1	1	Not worth it

The practicality of the product can be seen in the table below:

Table 2. Product practicality interpretation criteria

Interpretation Criteria	Percentage
Very practical	81%<X<100%
Practical	61%<X<80%
Practical enough	41%<X<60%
Not Practical	21%<X<40%
Very impractical	0% <X<20%

Data analysis for increasing student learning independence using a Likert scale formula as follows:

$$p = \frac{f}{n} \times 100\%$$

Information:
p = percentage
f = frequency
n = number of ideal scores

After the score is obtained then, it is entered into the rating scale to find out the results of the questionnaire data with conditions such as the following table:

Table 3. Criteria for increasing independent

Interpretation Criteria	Score
Very good	81%<X<100%
Good	61%<X<80%
Pretty good	41%<X<60%
Not good	21%<X<40%
Very not good	0% <X<20%

Effectiveness Data Analysis

To test the effectiveness of experimental video media based on a scientific approach, it is obtained in the following way:

$$P = \frac{Raw\ Score}{Maximum\ Score} x\ 100\%$$

Table 4. Media effectiveness assessment criteria

Criteria	Percentage
Very good	80%<X<100%
Good	60%<X<80%
Pretty good	40%<X<60%
Not good	20%<X<40%
Very not good	0% <X<20%

Gain value, according to Hake, can be calculated using the following formula:

$$Gain\ standard\ (g) = \frac{Postest\ Score - Pretest\ Score}{Maximum\ Score - Pretest\ Score}$$

Table 5. Gain classification by Hake

Criteria	Percentage
Tall	070<g<1.00
Currently	03 <g< 07
Low	000<g< 03
Same	g = 000
Decrease	-100< g <000

5.1 Research Results

This research produces a product, namely the modern Physics e-book media that is very feasible to use.

Description of Media Development

Based on the development of Borg & Gall's Research and Development (R&D) development model used in this study, namely:

1. **Research and data collection**

   a. Need Analysis
   Researchers found problems faced by lecturers and students. Lecturers must choose the correct media in online learning to foster student interest. Then it isn't easy to find Modern Physics books, many of which are textbooks.

   b. Literature Study
   Conduct literature studies in the form of books and journals. Literature studies are carried out to strengthen the modern Physics e-book media.

   c. Smale-scale Research
   Researchers conducted field studies by interviewing students via WhatsApp.

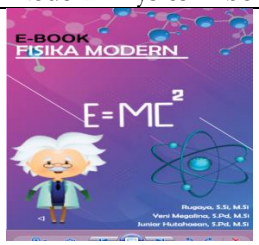
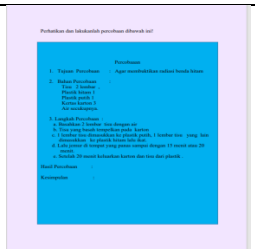
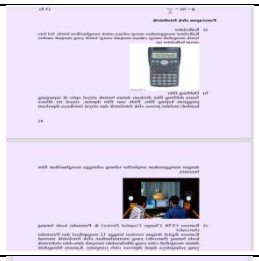
2. **Planning**

   The Student Worksheet media design is developed so that:

   a. Lecturers can attract and motivate students to learn Modern Physics
   b. The target users of the product are students who take Modern Physics courses, namelyClass B Dik 2020and Class D Dik 2020, majoring in Physics
   c. The e-book media created can achieve learning outcomes (CPL).

The initial product is the Modern Physics e-book media.

Table 6. Modern Physics e-book media

No	Modern Physics E-book	Description
1		Cover
2		There are experiments on black body radiation.
3		The E-book also made engaging animations and pictures.
4		The E-book also discusses the application of Modern Physics, such as the application of the photoelectric effect.
5		Equation description
6		In the E-book, there are examples of questions.

In the initial product development, student worksheets were validated by material experts and media experts.

The results of the development of the Modern Physics e-book media obtained data: (1) Material expert evaluation data consisting of feasibility data and input. (2) Media expert evaluation data consists of feasibility results and inputs. Overview of Experts

a) Material Expert

Based on a feasibility questionnaire by a material expert, it includes three aspects, namely content feasibility, presentation feasibility, and readability. The data on the results of the feasibility by the material expert can be seen in the table below is the result of the material expert's assessment in terms of (1) content feasibility, obtaining a score of 69 (86%), (2) presentation feasibility obtaining a score of 40 (80%) (3) Language feasibility 59 (86%) Overall the eligibility questionnaire obtained a score of 252 (84%).

Table 7. Eligibility For Material Expert

No.	Aspect	Frequency					Score	Item	Maximum	Percentage
		1	**2**	**3**	**4**	**5**				
1	Content eligibility	0	0	1	9	6	69	16	80	86
2	Serving eligibility	0	0	2	6	2	40	10	50	80
3	Legibility	0	0	1	7	5	59	13	65	86
Total							**168**	**39**	**245**	**84%**

So the Modern Physics e-book media is very feasible to use.

b) Media Expert Review

The feasibility questionnaire for media experts covers four aspects: the media display aspect, the size aspect, the cover design aspect, and the content design aspect. The results of this media expert's assessment are viewed from the aspects: (1) display gets a score of 7 (87.5%), (2) presentation feasibility gets a score of 24 (82%), (3) graphics gets a score of 48 (80%) and (4) feasibility language scored 68(84%). Overall, the media feasibility level scored 112 (85%). Look at the table below:

Table 8. Eligibility For Media Experts

No.	Aspect	Frequency				Score	Item	Maximum	Percentage
		1	**2**	**3**	**4**				
1	Size	0	0	1	1	7	2	8	87.5%
2	Cover Design	0	0	4	3	24	7	28	82%
3	Content Design	0	0	12	7	68	19	76	84%
Total						**99**	**28**	**112**	**85%**

3. Initial field trials

The initial field trial of the e-book was carried out in class B stamps 2020. After students read and understood the e-book media, they were asked to fill out the e-book practicality test instrument. This response questionnaire consists of 18 questions. The results of this trial assessment are viewed from the aspects: (1) ease of use, obtaining a score of

457 (86.5%), (2) attractiveness, obtaining a score of 255 (86.1%), (3) benefits, obtaining a score of 439 (83.1%). Overall the percentage value is 1151 (85.23) %; based on the table; the score is included in the very practical category.

Table 9. Student Questionnaire Response

No.	Aspects	Frequency					Score	Item	Max	Percentage
		1	**2**	**3**	**4**					
1	Convenience	0	1	69	62		457	132	528	86,5%
2	Attractiveness	0	1	39	34		255	74	296	86%
3	Benefits	0	2	85	45		439	132	528	83%
Total							**1151**	**338**	**1352**	**85,23%**

4. Revision the main product

After conducting the trial, the results of the data analysis showed that e-book media was included in the very practical category to use.

5. Main field trial

After the feasibility test from material experts, media experts, small group trials, and revisions, this E-book media was tested on the main field, namely Dik C stamp 2020 students. After students read and understood the next Modern Physics e-book, students were asked to response by filling out an independent questionnaire. This response questionnaire consists of 11 questions. The results of the trial assessment in class Dik Cstamp 2020 are viewed from the aspects: (1) independence, obtaining a score of 561 (87.11%), (2) motivation, obtaining a score of 453 (83%). Overall, the student's questionnaire assessment of the e-book media was 1014 (85%). Based on the score scale table, it is included in the very good category.

Table 10. Large Group Independent Test

No.	Aspects	Frequency					Score	Item	Max	Percentage
		1	**2**	**3**	**4**					
1	Independent	0	1	69	62		457	132	528	86,5%
2	Motivation	0	1	39	34		255	74	296	86%
Total							**1151**	**338**	**1352**	**85,23%**

In the main field trial, the effectiveness test was carried out by giving pretest questions, providing Modern Physics E-book media and then giving Post-test questions in the Physics Department, DIK D stamp 2022 class. From the data processing of the research conducted, average learning outcomes were obtained from the pretest scoresand Posttest. The student test results with the average value of the pretest results were 70.32, and the total average value of the post-test results was 82.58. After conducting the effectiveness test, it was found that the Modern Physics e-book media using flip had an N-gain score of 0.41 in the medium category and an N-gain score (%) 41% with a moderate interpretation.

7. Product Improvement

This research was carried out up to the 7th stage. Then the product results in e-book media using Flip PDF Professional.

Discussion

The results showed that the Modern Physics e-book media was very feasible to use, very practical, greatly increasing independence and moderate effectiveness criteria. In this study, the learning media developed was an e-book using FLIP PDF Professional in the Modern Physics course. The development model used Research and Development (R & D) from Borg and Gall up to stage 7. The e-book media was designed so that students can understand Modern Physics courses which are usually very difficult to understand. The material contained in the Student Worksheet is modern physics, namely 1) The development of modern physics, 2) The theory of relativity, Galileo transformation, Lorentz transformation, the concept of long contraction, the concept of time dilation and equality mass and energy 3) Black body radiation, photoelectric effect, Compton effect, De Broglie hypothesis, Heisenberg uncertainty and electron diffraction concept, 4) Hydrogen atomic spectrum and atomic model, 5) Schrodinger equation.

This e-book media is produced through a laptop and using the Flip PDF Professional application. The Modern Physics E-book that will be made consists of audio image text and will be made into several formats such as pdf, exe, html, and zip. So with this e-book, it can attract students to study Modern Physics. This e-book consists of materials, experiments/experiments that can be done in everyday life and also using virtual laboratories such as PhET and Amrita laboratories, the application of Modern physics material in everyday life, examples of questions, questions, and also equipped with videos. This E-book media is assessed for feasibility of this media assessed by material experts and media experts. The feasibility assessment was measured based on the results of material experts with a score of 168 with an achievement percentage of 84%, and media experts showed a score of 99. The percentage of achievement was 85%. After being assessed according to the expert, the media of this worksheet was revised according to the suggestions and comments of the experts. Furthermore, this media was given to the initial field, namely students from the Physics Department of Dik B stamp 2020, then given the practicality of the media instrument. The results of the responses in the form of scores and percentages of students are 1151 with 85.23% with very practical criteria. Then this E-book media was revised.

Furthermore, the main field trial was carried out on students of the Department of Physics for class D stamp 2020 by providing independent instruments with the results of 1014 with 85% with very good criteria. In the main field trial, the effectiveness of this e-book media was tested, which was obtained from the average number of pretest results of 70.32, name and the number of post-test results of 85.31. Then obtained an N-gain score of 0.75 with a high category and an N-gain score (%) 75% with an effective interpretation. Based on student responses, a) this e-book is very good and helps understand modern physics material b) it is very practical to use because it can be inserted into cellphones, laptops, and flash drives and can be used anytime and anywhere c) the material in this e-book is presented with correct so that the material is conveyed well d) this media makes students more motivated to study modern physics because so far modern physics is known to be challenging to understand because there are too many equations that students do not understand e) with this e-book it adds insight. Suggestions from students to provide lots of pictures with attractive colours and display videos, using language that is easy for students to understand.

Conclusion

1. The results from material experts and media experts on E-book media show that the criteria are very feasible to use.
2. This modern physics E-book media is very practical to use.
3. This E-book media can increase student independence, namely 85% with very good category.
4. The effectiveness test results show that the Modern Physics E-book media using flip book has an N-gain score of 0.41 in the medium category and an N-gain score (%) 41% with a moderate interpretation.

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