

Development Of Physics Learning E-Books Based On Problem-Based Learning (Pbl) On The Subject Matter Of Effort & Energy Class X Even Semester At Senior High School N 3 Binjai T. A. 2021/2022

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ABSTRACT

The purpose of this study was to develop problem-based learning media e-book physics (PBL) using professional flip pdf on the material Effort & Energy and to test the feasibility of e-book media developed through validation of experts and determine the attractiveness of teacher and student responses. The research and development steps are guided by Thiagaraja's 4-D cycle model (Define, Design, Develop, Disseminate). The develop stage involved two validators to assess the feasibility of materials and media. The disseminate stage involved 31 students (at SMA N 3, Binjai). The data collection instrument used was a questionnaire with descriptive qualitative data analysis. The results of this study indicate that; (1) The variable feasibility test of e-books as learning media by media experts, the overall average score is 100% and by material experts, the overall average score is 98% which is classified in the high category, meaning that the e-book developed with professional flip pdf is very feasible to use. (2) The effectiveness variable has an overall average score of 90.93% which is classified in the very effective category, meaning that the e-book is effective enough to help students in improving the value of physics learning material Effort & Energy. (3) The results of the physics teacher's response at SMA N 3 BINJAI to the e-book with an overall average score of 88.2% with decent criteria and product trials to students to respond to the e-book with an overall average score of 86% with decent criteria, it can be concluded that the e-book received a good response from teachers and students.

Keywords: Digital Book, professional flip pdf, Effort & Energy

INTRODUCTION

Currently, the world is entering the era of industrial revolution 4.0 or the fourth world industrial revolution where technology has become the basis of human life. Everything has become borderless and unlimited due to the development of digital technology. This era has affected many aspects of life in the fields of economy, politics, culture, art, and even education.

Education is something that is important today and one of the benchmarks of a nation's progress, because education is an absolute necessity that must be fulfilled in the life of mankind. A nation can be said to be advanced if education in that nation is advanced. According to Law No. 20 of 2003, education is a conscious and planned effort in realizing conditions and learning processes with the aim that students can develop their potential in order to have religious spiritual strength, personality, self-control, noble character, intelligence, and skills needed by themselves, society, nation and state.

Education plays a very important role in the development and improvement of human resources. The use of technology in education helps learning activities in developing, processing and presenting materials so that learning is more effective, efficient and easily understood by the person learning.

The use of learning technology in schools can create a more pleasant learning atmosphere, learning methods will be more varied and students tend to be more active (Asryad, 2009). The use of technology serves to create a learning atmosphere that can attract participants' interest and motivation to learn. This shows that the use of technology in the learning process can improve the quality of student learning if it is tailored to educational needs in order to achieve learning objectives.

Facing the current global challenges requires the world of education to always adapt technological developments to efforts in improving the quality of education (Komalasari, 2020), especially in the learning process. The use of technology in the learning process leads to the use of media. This has an impact on the presentation of teaching materials that are used as a source of learning information. Currently, the use of teaching materials in the form of printed media is gradually turning into digital (electronic) media. Therefore, it does not rule out the possibility that teachers are required to be able to integrate information and communication technology in the learning process to make it more interesting and can eliminate the impression of rigidity in teaching.

The use and development of learning media is divided into several, namely print-based media, visual-based media, audio-visual-based media and also computer-based media. Learning media in the form of the most sophisticated presentation media is media that can convey five forms of information in the form of images, lines, symbols, sounds and movements. Media that includes the five forms of information are live images (movies) and television (videos). In this case, learning media is needed that can attract students' interest and is easily accessible anywhere and anytime.

Based on the results of interviews conducted with one of the physics teachers at SMA N 3 Binjai, the learning ability of students in learning is low, this is based on the interest of students in physics lessons in the low category. Not only conducting interviews with teachers, the distribution of questionnaires was also carried out to students of classes X, XI, XII MIA totaling 46 people. The results of the data obtained from the questionnaire regarding lessons, students who do not like lessons are 60.9%, students find it difficult to understand the concept of material and use formulas as much as 71.7%, it is difficult to memorize formulas 86.9%, it is difficult to solve problems given by the teacher as much as 33.3%. Students' learning interest which is classified as moderate based on the questionnaire is caused by students' difficulties in learning, with the reason that 97.8% of students say teaching and learning activities are less interesting, lack of learning media in the learning process carried out by teachers at SMA N 3 Binjai, to attract students' interest in learning, teachers should make learning activities more interesting with learning models and media that can spur students' interest in learning. So that learning activities that were originally teacher-oriented become learner-oriented learning activities. One of the media that can be used to overcome the problem is by developing a physics learning e-book that can be used by students during the learning process and can also be used independently outside of learning.

So that many students have less interest in the learning process, therefore a practical and effective learning media is needed, and can attract students' interest and be easily accessed anywhere and anytime. Practical media is a medium that can be developed seen from the level of ease and helpfulness in using it, according to Nieveen (Rochmad, 2012) states that practicality in a learning media device to be developed can be seen from the level of ease and helpfulness in using the learning media. Therefore, e-books are a solution that can be used to help the learning process to increase student interest in learning.

E-books are teaching materials that are systematically designed based on a particular curriculum and packaged in the smallest learning units and allow students to study independently within a certain time (Purwanto, 2007). In addition to learning media, in its implementation, a model is also needed so that learning is not monotonous. One of the learning models that is in accordance with Curriculum 2013 is Problem Based Learning (PBL).

E-books are electronic versions of books that can be read on laptop screens or other portable devices and can combine features such as images, video, audio, hyperlinks that allow interaction between students and teachers (Muhammad, 2017). According to Alwan's research (2018) e-books are very effective for use in learning as evidenced by the learning outcomes of students, namely 58.49% in the good category and 35.85% in the very good category. The e-book developed is designed to have the advantage of being equipped with images that can be pop-up, videos, hyperlinks, current information, evaluations, and project-making activities that can train creative thinking skills. The e-book development chosen is to use Flip PDF professional software, flip pdf professional is an interactive media that can easily add various types of animative media types to the flipbook. The advantages of the professional flip pdf application are Interactive publishing with an attractive appearance, by adding videos, images, links, and others to make the flipbook interactive with the user, there are various templates, themes, scenes, backgrounds, and plugins to customize our e-book can be supported with text and audio (Aulia, 2016). Flexible output formats, such as html, exe, zip, MacApp, mobile version and burn to CD. It can be concluded that electronic teaching materials using flip PDF Professional that have been developed are tested designs.

E-books are designed using professional flip pdf software to make features more interactive. This statement is supported by Lestari's research (2018) features in e-books that are packaged using software can create a visual understanding of students and can attract students' interest in understanding the material so that students will enjoy learning with a different impression and learning can be done practically.

This development is a different research from previous research because it uses a learning model, according to Rusman (2017: 132) the learning model is a conceptual framework that describes systematic procedures in organizing learning experiences to achieve learning competencies. Therefore, the use of the model in this development is very important because it will see the achievement of student learning competencies after using the e-book.

The Problem Based Learning (PBL) learning model is a model where learning that occurs is based on problems in everyday life which are related to the material being studied. According to Muhammad Fathurrohman (2015: 112), Problem Based

Learning (PBL) is a form of learning based on the constructivism paradigm which is oriented towards the learning process of students. The main focus of PBL is on what students think. Problem Based Learning (PBL) sharpens students' thinking skills so that Problem Based Learning (PBL) can improve students' learning outcomes.

METHODS

The research was conducted at SMA Negeri 3 Binjai, Binjai City. The time of this development research was carried out in the even semester of the 2021/2022 school year. The implementation was carried out on students of class X MIA-2 SMA N 3 Binjai. The population in this study were students in class X MIA-2 SMA Negeri 3 Binjai in the 2021/2022 academic year, totaling 5 classes. With an average number of 36 students per class. The object of research is a Problem Based Learning (PBL) based e-book developed with the help of flip pdf professional. The type of research used in this study is The method used in this study uses the Research & Development (R&D) development research method or is included in development research. The R&D model that will be used in this research is Thiagarajan's 4-D cycle model (1974) in Sugiono's book (2019). This model consists of 4 stages of development, namely Define, Design, Develop, and Disseminate. At the Define stage, initial analysis, learner analysis, task analysis, concept analysis, and formulation of learning objectives are carried out. At the Design stage, instrument preparation, media selection, format selection, and initial product design are carried out. The Develop stage includes expert assessment and field trials. At the Disseminate stage, it is only done on a limited basis, namely in the classroom.

The selection of this development model is due to the consideration of the development steps in the 4-D model which are detailed but simple and easy to follow the development procedure. The selection of this type of development model is based on systematic considerations and demands on the theoretical basis of a learning process. This development model is programmed with a systematic sequence of activities to solve learning problems related to learning.

This development model is programmed with a systematic sequence of activities to solve learning problems related to a learning media that is tailored to the needs of students. The advantage of the 4-D development model is that it is better used as the main point for developing a learning device not only to develop a learning system (Arywiantari: 2015).

The stages carried out at each stage of the 4-D model development can be explained as follows:

A. Define

Activities at this stage are carried out to establish and define the requirements for development. In other models, this stage is often called needs analysis. Each product certainly requires a different analysis. In general, in this definition, activities are carried out to analyze development needs, product development requirements that are in accordance with user needs and research and development models (R & D models) that are suitable for developing products. Analysis can be done through literature studies or preliminary research.

The stages carried out at each stage of the 4-D model development can be explained as follows: a. Front-end analysis At this stage, the teacher conducts an initial diagnosis to improve the efficiency and effectiveness of learning.,b. Learner

analysis At this stage, the characteristics of learners are studied, for example: ability, motivation to learn, background experience, etc. c. Task analysis The educator analyzes the main tasks that must be mastered by the learners so that the learners can achieve the minimum competencies. d. Concept analysis Analyzes the concepts that will be taught. Concept analysis Analyzing the concepts to be taught, compiling the steps to be taken rationally. e. Specifying instructional objectives Writing learning objectives, changes in behavior expected after learning with operational verbs.

B. Design

Thiagarajan divided the design stage into four activities, namely: constructing criterion-referenced tests, media selection, format selection, initial design. The activities carried out at this stage include:

- a. Develop a criterion test, as the first action to determine the initial ability of students, and as an evaluation tool after the implementation of activities.
- b. Selecting learning media that are suitable for the material and characteristics of the learners.
- c. The selection of the form of learning presentation is adjusted to the learning media used. If the teacher will use audio visual media, during learning, of course, students are told to see and appreciate the audio visual media impressions.
- d. Simulate the presentation of material with the media and learning steps that have been designed.

C. Develop.

Thiagarajan divided the development stage into two activities, namely: expert appraisal and developmental testing. Expert appraisal is a technique to validate or assess the feasibility of product design. In this activity, an evaluation is carried out by experts in their fields. The suggestions given are used to improve the materials and learning designs that have been prepared. Developmental testing is an activity to test the product design on real target subjects. At the time of this trial, data on responses, reactions or comments from target users of the model were sought. The test results are used to improve the product. After the product has been improved, it is then tested again until effective results are obtained.

D. Disseminate

Thiagarajan divides the disseminate stage into three activities, namely: validation testing, packaging, diffusion and adoption. At the validation testing stage, the product that has been revised at the development stage is then implemented on the actual target. At the time of implementation, measurements of goal achievement were made. This measurement is carried out to determine the effectiveness of the product developed. After the product is implemented, the developer needs to see the results of achieving the goals. Goals that have not been achieved need to be explained so that the same mistakes are not repeated after the product is disseminated.

Research Instruments

This research instrument is in the form of interview guidelines, needs analysis questionnaires, validation sheets from material experts, media experts, feasibility tests by teachers and students and effectiveness tests in terms of student learning

outcomes. Interview guidelines and needs analysis questionnaires are used to find out learning needs, comments and suggestions from teachers and students on the availability of Usaha & Energi learning media. The material expert validation sheet is used to determine the feasibility and depth of the material presented and its relevance to the expected competencies. The media expert validation sheet is used to determine the feasibility of the media to be used in learning. Assessment sheets from teachers and students to determine the efficiency of the developed media while to determine the effectiveness of learning media using question instruments in the form of pretests and posttests. These instruments are divided into:

Data Collection Techniques

A. Information Collection

At the information gathering stage, researchers conducted a needs analysis by conducting interviews with physics teachers at X-Ipa SMA Negeri 3 Binjai and distributing questionnaires to X-Ipa students of SMA Negeri 3 Binjai to find potential and problems. The potential obtained from Sma X-Ipa SMA Negeri 3 Binjai is that the school allows students to bring Android as an additional learning tool, so that of the students studied, all of them already have Android and they bring their android to school. Meanwhile, the results of interviews obtained from teachers about the use of learning media at school, so far teachers have used learning media such as quisis, whatsapp, google classroom. Therefore, students do not become bored because the learning media by the teacher is less interesting.

ICT learning that can help students in learning physics so that physics learning is easier to understand and can generate student interest in learning.

B. Data Analysis of Expert Validation Questionnaire Results

After all questionnaires from material experts and media experts are collected, the scores or responses are analyzed using a Likert scale. The questionnaire uses a score range of 1 to 5, each answer choice is given a score, namely (1) (SL) Very Feasible; (2) (L) Feasible; (4) (TL) Not Feasible; and (5) (STL) Very Not Feasible (Sugiyono, 2011). The data obtained from the answers to the questionnaires given were analyzed with the following steps

1. The data obtained in the form of a check list summarized in a Likert scale that has been given a score as shown in the table below:

Table 1. Criteria for Validation Instrument Item Answers with Likert Scale

No	Answers	Score
1.	Very worthy	5
2.	Worthy	4
3.	Worthy Enough	3
4.	Not Worthy	2
5.	Very Unworthy	1

(Sugiyono, 2011)

Calculate the feasibility level with the following formula:

$$P = \frac{\sum}{N} \times 100\%$$

Description

P = Percentage of category,

\sum = Number of category answer scores selected , N = Total Score.
 From the results of the calculation of the formula above, the results are in the form of percentages. The score classification is then converted into a classification in percentage form, then interpreted with a quality sentence.

Table 2. Scale of eligibility criteria

Scale Range	Interval Percentage	Criteria
$81 \leq 100$	$81 \leq x \leq 100\%$	Very worthy
$61 \leq 80$	$61 \leq x \leq 80\%$	Worthy
$41 \leq 60$	$41 \leq x \leq 60\%$	Worthy Enough
$21 \leq 40$	$21 \leq x \leq 40\%$	Not Worthy
$0 \leq 100$	$0 \leq x \leq 100\%$	Very Unworthy

(Arikunto, 2010)

C. Analysis of Teacher and Learner Response Questionnaires

The questionnaire uses a Likert scale, the score range is 1 to 4, each answer choice is given a score, namely (1) (SS) strongly agree; (2) (S) agree; (3) (TS) disagree; and (5) (STS) strongly disagree (Sugiyono, 2016). Data from the teacher response questionnaire were analyzed with the following steps. Make a recapitulation of the questionnaire results on the e-book. The data obtained in the form of a check list is summarized in the form of a Likert scale table that has been given a score as shown in the table below.

Table 3. Criteria for answering the instrument with a Likert scale

No	Answers	Score
1.	Strongly agree	4
2.	Agree	3
3.	Disagree	2
4.	Strongly disagree	1

(Sugiyono, 2016)

The percentage of teacher and learner responses was calculated using the following formula:

$$\text{Response Percentage} = \frac{\text{number of scores}}{\text{maximum number of scores}} 100\%$$

The percentage response results were converted into qualitative data according to the standards shown in the following table 5:

Table 4. Teacher and learner response criteria

Scale Range	Interval Percentage	Criteria
$81 \leq 100$	$81 \leq x \leq 100\%$	Very good
$61 \leq 80$	$61 \leq x \leq 80\%$	Good
$41 \leq 60$	$41 \leq x \leq 60\%$	Fairly Good
$21 \leq 40$	$21 \leq x \leq 40\%$	Not Good
$0 \leq 100$	$0 \leq x \leq 100\%$	Not very good

RESULT & DISCUSSION

The e-book learning media with the help of Flip Pdf Professional based on Problem Based Learning (PBL) developed by researchers in this study used the Research and Development (R&D) development model. Through the 4D learning system design model, namely defining (define), designing (design), developing (development) and disseminating (dissemination). The steps and processes in researching e-book learning media development with the help of Problem Based Learning (PBL) based Flip Pdf Professional are explained as below:

A. Defining (Define)

In this study to find out the existing problems identified by conducting interviews with Physics subject teachers at SMAN 3 Binjai and also conducting interviews with several students at SMAN 3 Binjai. What is obtained from the results of interviews with Physics teachers shows that the potential that exists is:

- At SMAN 3 Binjai there is already an LCD Projector with infocus that can be used for learning purposes.
- Educators already have laptops and smartphones, and all students have smartphones to bring to school.
- Educators and students are able to operate smartphones.

The problems encountered are:

- Learning media used is limited to 2013 curriculum printed books, while software learning media has not been used, for example e-book learning media.
- Lack of printed books for students during the Covid-19 pandemic.
- The material contained in the package book is too concise, and less systematic.

The results of interviews by students show that:

- The lack of printed books that will be used by students during the pandemic
- Lack of understanding of the material in the package books by students.
- all students have smartphones, but only a few students use their smartphones in the learning process during the pandemic, used only at the start of learning hours.

Based on the results of interviews with teachers and students, it is known that there is potential, namely all students in class X MIA have smartphones, so this is used as the basis for developing Problem Based Learning (PBL)-based e-book learning media on Business & Energy material. This learning media will be in the form of e-book media to open and read it if from a smartphone it will be connected

via google browsure or chrome, and if using a laptop it is enough to download the e-book and can be accessed without a data network.

B. Design

At this product design stage there are several things that will be done, the preparation of this Problem Based Learning (PBL) based e-book product design is adjusted to the material compiled by researchers from several sources of teaching materials. This e-book is made using the help of the Flip Pdf Professional application, the e-book is also run using an android smartphone and computer/laptop. The displays contained in this e-book are as follows:

1) E-book cover

Introduction to the learning media in the form of this e-book there is a cover that has the title of the e-book and the name of the designer.

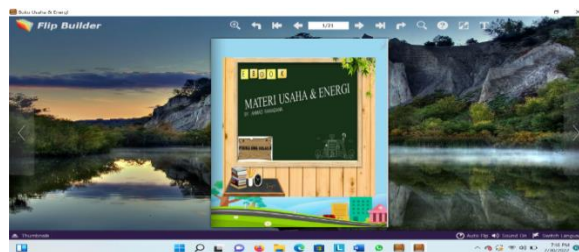


Figure 1: E-book cover

The contents of this e-book assisted by the Flip Pdf Professional application consist of, Effort & Energy material, 1 learning video about Effort & Energy material which lasts approximately 16 minutes, and material evaluation.

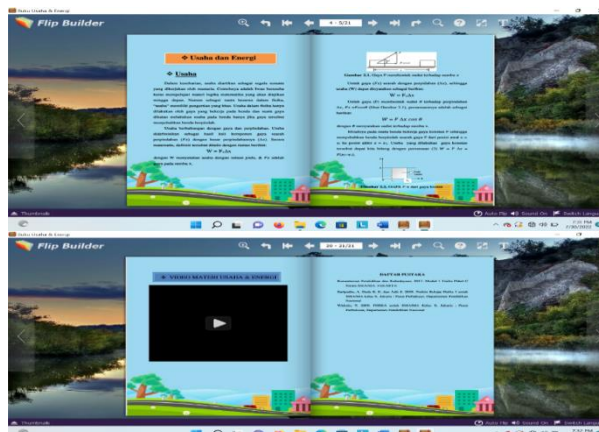


Figure 2: E-book contents

C. Development

In this development stage, there are several things that are done, including:

1) Making Learning Media

Learning media created and developed by researchers in the form of e-books. This media was developed using the Flip Pdf Professional



application. The contents of this learning media consist of Effort & Energy sub-matter obtained from several class X physics books.

2) Product Feasibility Validation

After the learning media has been made, product feasibility validation is carried out. Validation of this learning media is carried out by expert validators and asks for theoretical and practical considerations. Expert validators consist of media expert validators and material experts.

Material Expert Validation

Validation of this material was carried out by 1 material expert, namely, Mr. Abdul Rais, S.Pd, ST, M.Si which aims to determine the quality of content feasibility, presentation feasibility, language feasibility. The results of the assessment through the validation questionnaire by the material expert are as follows.

Table 5: Material Expert Questionnaire Assessment Results

Indicator	Score	Score max	%	Criteria
Content Eligibility	47	48	97%	Very Worthy
Presentation Feasibility	31	32	97%	Very worthy
Language Feasibility	36	36	100%	Very worthy
% Average	98 %			Very worthy

Based on table 5 above, it can be concluded that the feasibility of content, feasibility of presentation, and feasibility of language meet the scale of eligibility criteria $81 \leq x \leq 100\%$ with very feasible criteria. In the validation of learning media using Flip Pdf Professional is Mr. Purwanto, Si, M.Pd. The validation carried out by media experts is related to aspects of media display. Validation by material experts in addition to conducting feasibility assessments, media experts also provide comments and suggestions for improving the media. The results of the validation carried out by the material expert can be seen at table 6 below:

Table 6 : The results of the validation carried out by the material expert

Indicator	Score	Score max	%	Criteria
Display Design	12	12	100%	Very Worthy
Ease of Use	8	8	100%	Very worthy
Usability	12	12	100%	Very worthy
Graphics	4	4	100%	Very worthy
% Average	100 %			Very worthy

Based on table 6 above, it can be concluded that the media aspect obtained an average of 100% which is included in the very feasible category. So that overall, learning media with which has been developed by researchers can be tested.

D. Dissemination

This stage is an extension of the development stage. At this stage, all media designs that have been developed are implemented after revision. Learning media using professional flip pdf that has been developed, dissemination is carried out in a real situation, namely in the classroom. In this stage, researchers conducted product trials on 34 students in class X MIA-2 by looking at the responses of teachers and responses from students to the learning media that had been developed, as well as trials intended to see the level of effectiveness of the media. At this stage, trials were also conducted to measure the effectiveness of e-books with the help of Flip Pdf Professional in physics subjects on the material of Effort & Energy used by students. This effectiveness test includes giving a learning outcome test to class X students of SMAN 3 Binjai, the test questions are given at the beginning and end of learning, each of which consists of 5 questions.

DISCUSSION

The research and development (R&D) method is a research method used to produce certain products, and test the effectiveness of these products. To be able to produce certain products, needs analysis research is used and to test the effectiveness of the product so that it functions in the wider community, it is necessary to test the effectiveness of the product (Sugiyono, 2019).

Based on the observations of researchers, at the beginning of learning using e-books assisted by professional flip pdf experienced obstacles including, students still do not understand the physics learning e-books that they will use, so students have a lack of interest in learning e-books so that researchers must first provide an explanation of the e-books they will use, as well as researchers explaining what features I have in the e-books to arouse curiosity in students. The advantages of the research are that the learning e-books they use are easy to access, so students can easily access them through their whatshapp grub which can be shared in the form of website links. Students also feel interested in the videos and display buttons contained in the e-book. The results of this study also show that student learning outcomes have increased compared to before using professional flip pdf-based physics learning e-books and students give a positive response to the use of professional flip pdf-assisted learning e-books. The results of this response are in accordance with research (Rafiudin, 2021) which states that the development of teaching materials (e-books) can increase the knowledge and skills of trainees, this is supported by data on the percentage of final test results higher than the percentage of initial test results.

CONCLUSION

Based on the research and discussion previously described, the development of e-book learning media with the help of the professional flip pdf application using the Research and Development (R&D) research method was developed with the 4D development model which goes through four stages, namely defining, designing, developing and disseminating.

The development of e-book learning media for class X SMAN 3 Binjai which is made with the help of the Flip Pdf Professional application, in this application there are components including: a table of contents menu where in this table of contents

there are materials, namely; a) Definition, Images, and Video Material, b) Effort & Energy Material c) Potential Energy d) Kinetic Energy e) Mechanical Energy f) Law of Conservation of Energy g) Material Evaluation.

The conclusions that can be drawn from the development research are as follows:

1. To determine the feasibility level of the product, the validation stage has been carried out, namely: a) media validation with an overall average score of 100% which means that this e-book is declared "Very Feasible", b) material expert validation with an overall average score of 98% which also states that the e-book is "Very Feasible" to use.
2. And to determine the effectiveness of the product through pretest-posttest scores using the N-Gain formula on Effort & Energy material in class X MIA-2, the average obtained was 90.93% which was declared "very effective" with an increase in student scores above KKM.
3. For the students' response to the e-book developed with a percentage obtained of 86% so with the "Good" category, and the product qualification is declared usable after making revisions.

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