



## Development of Electronic Handout Media Using the Double Loop Problem Solving (DLPS) Model on Physics Material for Class X High School Student

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**Abstract:** This study aims to develop electronic handout media with the Double Loop Problem Solving (DLPS) model on physical materials, namely energy source materials for the tenth-grade high school students to determine the feasibility and attractiveness of the electronic handout being developed. This electronic handout was created using Smart Apps Creator which is a mobile application for Android and iOS without a programming code and the form is html.5 and exe. This study uses the ADDIE model which consists of five stages, namely analysis, design, development, implementation, and evaluation. This research was conducted in two Bandar Lampung tenth grade schools and was validated by material and media experts. This study aims to get a validation score of 83% with the "very decent" category from material experts and 79% with the "very decent" category from media experts. While the results of development trials obtained a score of 78% in the "very interesting" category. Educator responses reached 89% in the "very interesting" category. The conclusion of this study is that the electronic handouts developed are very practical and very interesting to be used as learning media.

**Keywords:** Double Loop Problem Solving (DLPS), Electronic Handouts, Smart Apps Creator (SAC), Learning Media

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## INTRODUCTION

Development of science and technology especially in the field of media technology has a very important impact on the categorization and use of learning sketches. One aspect that is affected by technological change is the educational aspect (Damayanti et al., 2018). Both schools have implemented their respective curricula based on preliminary survey results, but the use of technology as a learning medium is enough to encourage students to learn actively, creatively and innovatively. There are some students who still have difficulty carrying cell phones. This shows the need to develop interactive teaching materials to increase student interest. The teacher agrees to the use of electronic distribution media. This media is equipped with pictures, video learning materials, and various learning aids. Supports physics learning in class and makes learning physics fun for students without getting bored. Electronic handouts for this research were created using Smart App Maker. Smart Apps Creator is an application that creates mobile applications for Android or iOS without programming code, the output is html.5 and exe. The reason researchers chose this application is because it can easily create interactive learning materials, which can be combined with animation, images, videos, music and other menus to make the content more interesting (Syahputra et al., 2021). Education includes formal education, unofficial and informal education, each of which has the same role in the process of transformation and formation of the personality of a child or student (Inanna, 2018). The goals of education in Indonesia are regulated in Law No.2. In 2003, a national education system was introduced to prepare a better generation. to improve and develop skills, attitudes and potential and help people become human beings with noble character, knowledge and responsibility (Sujana, 2019).

The development of the era of globalization with the use of science and technology, the application of educational concepts has changed into an effort to apply modern learning (Suprihatien et al., 2019). With the development of technology and science, it encourages the creation of innovative, efficient and effective use of learning media (Salsabila et al., 2020). Basically, even modern characteristics have been achieved in the development of education and learning, but are still at the level of software intelligence. One of them is the use of a smartphone (Diani et al., 2018). The development of sophisticated and relatively inexpensive smartphones to support the growth of smartphone users. The Digital Marketing Institute predicts that the number of active smartphone users in Indonesia is more than 100 million in 2018.

Currently, the world of education is facing a paradigm shift in the era of globalization. which faces two challenges, the first is internal changes in learning practices, second, the rapid development of information and communication technology and the provision of diverse learning opportunities. Students often use smartphones to play games and social media, thus affecting learning by reducing or distracting them from concentrating. Based on observations at the two schools, students are increasingly

focused on smartphone screens to the point of becoming addicted to smartphones. From the observation results, the percentage was obtained at 76.7%. To overcome this problem, it would be good if we could use smartphones for learning so that students can learn independently using smartphones (Astuti et al., 2017). Physics is part of science that deals with mass, energy and natural phenomena, physics explains and analyzes structures and processes in nature, technology and the environment. Meanwhile, nature has rules or laws that can explain its phenomena based on a logical structure between cause and effect (Amin, n.d.). One way to achieve quality classroom learning in the independent curriculum is to use the Double Loop Problem Solving model.

The two cycle problem solving model is an evolution of problem solving learning focused on finding the root cause of a problem (Ramadhana et al., 2018). The stages of the DLPS (Solution of the double loop problem) Model are identifying problems, not just symptoms, identifying (direct) causes and implementing temporary solutions, assessing success and temporary solutions, and root cause analysis. Specifically, whether it is necessary. Root cause, solve the problem to improve and develop the root cause solution (Shoimin, n.d.). Multiple loop problem solving model a two-stage learning process (double loop) in which students apply a temporary solution in the first stage based on identifying the original cause of the problem, and in the second loop, find the solution (Sarah & Kartono, 2022).

Learning media is used for independent learning and the role of the media is to fully meet the learning needs of students (Rezeki & Ishafit, 2017). According to Devangga Putra Adhitya Pratama's research, (2020) media in APBN and APBD material can still be optimized so that in the next meeting it can add to students' classical completeness at the end of the semester. This is in accordance with the results of his research on the new educational environment in the form of android applications through validating the feasibility of materials, media, evaluations and questions that can be applied appropriately to APBN and APBD material optimally (Pratama & Sakti, 2020). So that with this application, the Android-based learning environment can be used as learning materials for learning materials. educational material are formally divided into four types: printed materials, video materials, audio materials, audiovisual materials, and interactive materials (Magdalena et al., 2020). According to Supriyati, (2019) learning style-based teaching materials have a positive and significant relationship between learning styles and learning outcomes, but the percentage obtained from kinesthetic learning styles is low. This is according to results his research that in development of Electronic Handouts on Simple Harmonic Motion Material for Students with Kinesthetic Learning Styles. Likewise, research results show electronic handouts passed the validation test stage with 87.85% (very feasible) by media experts and 80.54% (very feasible) by material experts (Supriyati et al., 2019). The results of this study are also consistent those stated by Nurjanah (2021) that learning on fable text material for Indonesian subjects has never used teaching materials to support teaching materials and only relies on student textbooks provided ministry of education and culture and

development of electronic handout teaching materials has never been carried out. This is in accordance with the results of his research that requires the development of electronic handout educational materials should be implemented in this school (Nurjanah et al., 2021).

Teaching materials, namely handouts, electronic handouts, modules, books, LKS, brochures, the internet, or other types of materials that can be used in writing to support teaching and learning activities in learning. One of the learning tools for educators is handouts. According to Sriwahyuni, et al. (2019), namely regarding electronic educational materials with Flip PDF Professional on optics device material with the title "Development of electronic learning materials using professional PDF materials for optical devices in SMA" with a percentage of 79.45% in the "very good" category, from these results it was concluded that the development product is electronic educational material for optical devices, was feasible to use for the learning process (Sriwahyuni et al., 2019). Handouts is learning material that contains a summary of core competency material from various other references. The handout is based on the applicable curriculum to cover the competencies students must have. The learning process using handout media has several objectives, including facilitating the dissemination of learning materials, increasing student knowledge, and supporting other materials (Ayuningrum & Mulyono, 2022). Thalia et al (2021) Web-based handouts are learning media and tools used by students to communicate the intent of delivering teaching material delivered over the network (Yulistiana et al., 2021).

Handouts electronically contains learning materials that involve students and facilitate learning in face-to-face learning or independent learning. Therefore, electronic handouts are media that support student learning. in the form of summaries of learning materials, concepts, work processes, or the use of mathematical formulas packaged digitally (Muhammad Yaumi, n.d.). According to Lathifah Turrohmah and Nasrul Hakim's research, (2021) said that the learning process still used printed books, modules, worksheets and occasionally used projectors to display Power point and videos, he explained that he had never mixed printed educational materials with electronic media and have never used or developed an electronic handout. based on the overall results, the percentage of electronic handout evaluations reached an average of 88.32% in the "very likely" category and can be used for biological studies in schools (Magfirah et al., 2020). The results of this study are also consistent those stated by Jeklin Hutagaol, et al. (2022) regarding electronic handout media on ecosystem material for class X high school (Hutagaol et al., 2022).

Based on observations in the two Bandar Lampung schools, the independent curriculum has been used, but using technology as a teaching tool has helped students to be active, creative and innovative in their learning. As a result, students' interest in physics lessons is low. This shows the need to develop interactive teaching materials to increase student interest. Educators agree to use electronic handout media because this electronic handout media can be supplemented with animation, pictures, videos, music,

various learning references, and other menus. To support physics learning in class and make physics learning fun for students without feeling bored. Electronic Handouts in this development are made using Smart Apps Creator. Smart Apps Creator is an application for creating mobile applications for Android or iOS without code, Output is in Html.5 and Exe format (Alpiani et al., 2022). The point is this development various types of applications that can be accessed via Android, iOS, Desktop, HTML5 Web, Browser (Syahputra & Prisma, 2021).

Based on the description above, a study was made with the title "Development of Electronic Handout Media Using the Double Loop Problem Solving (DLPS) Model in Physics Teaching Materials for Class X SMA/MA Students". Electronic handouts are very suitable as learning media and provide student facilities with the opportunity to support their learning process.

**METHOD**

This development method uses the ADDIE model. Advantages the ADDIE development model is a step-by-step evaluation to minimize the error rate and product defects at the end of the model. According to Sugiyono (2015: 38) the ADDIE model consists of five phases: analysis, design, development, implementation, and evaluation. The ADDIE model stage is shown in the figure below:

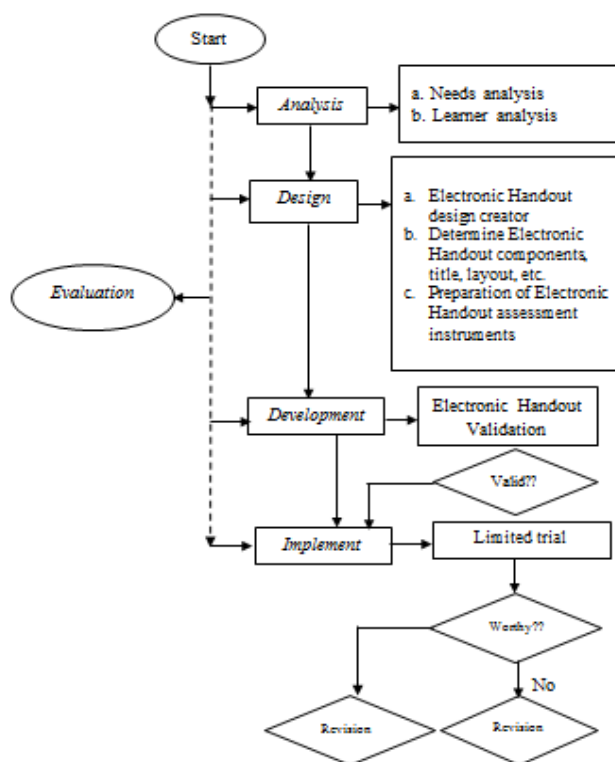


Figure 2. ADDIE model Development Stage Flowchart

## Research Design & Procedures

The parts of the ADDIE model Stages are:

### 1. *Analysis (analysis)*

Analysis is the process of identifying problem areas as examples of study. In this phase, the researcher is actually divided into two phases: needs analysis and student analysis. The actions taken at each stage are:

#### a. *Needs Analysis*

Stages the aim is to find problems that exist in the school environment, especially in teaching materials used for learning, especially in energy source materials. As part of the needs analysis, researchers interviewed physics educators in Bandar Lampung. Results of conversations with teachers include: Curriculum in the two schools is based on the independent curriculum; The materials used by educators are still limited; Students are not interested in physics because they think physics is difficult; the on-going learning process is still less active; Educators still cannot take advantage of developed technology. In this way, needs analysis is like research made by researchers, starting with previous research by previous researchers. Besides that,

#### b. *Student Analysis*

This stage identifies problems that exist in schools based on experiences and students, and describes and develops Electronic Handouts using Double Loop Problem Solving (DLPS) model for energy sources material. Based on the results of the questionnaire distributed in class X MIPA MAN 1 Bandar Lampung and MA Muhammadiyah Sukarame Bandar Lampung. The researchers obtained the following basic information: Students had difficulty understanding physics content; The physics material used is less attractive and has low interactivity; students' interest in learning physics is low; There is no electronic handout learning material that uses Double Loop Problem Solving (DLPS) model for physical material.

### 2. *Design (design)*

The next stage of the development method is the design stage, namely analysis. After doing the analysis, the researcher then decided to develop an Electronic Handout learning media using Double Loop Problem Solving (DLPS) model on physics material. Electronic handouts that have been developed are tested by material experts and media experts to find defects in the resulting electronics handouts so that they are valid and can be used at a later stage. The contents of the electronic handout are adjusted to the competencies students want to achieve. The structure of this activity is based on the DLPS (Double Loop Problem Solving)

syntax. This syntax consists of Problem identification; Detecting causal causes; tentative solution; Solution considerations; Casual analysis; another casual analysis and selected solution plan (Sari & Hidayat, 2019).

### **3. Development (development)**

At this development stage, a feasibility validation test is carried out that the designed electronic handout is suitable for use in the next stage, implementation stage, or product testing. This validation was carried out by several experts consisting of 3 material expert validators and 3 media expert validators.

### **4. Implementation (implementation)**

This stage is a continuation of the development stage. After the material is approved, then the implementation between the teacher and students is carried out by a team of material experts and a media team. Students are divided into two stages: small group experiment and field experiment.

### **5. Evaluation (evaluation)**

Evaluation is the process by which researchers determine whether the learning materials developed are appropriate. The learning environment developed by the researcher is an electronic publication for creating programs based on the Double Loop Problem Solving (DLPS) model for intelligent software developers. At this evaluation stage it can be done at one of the four ADDIE stages. Evaluation is carried out with formative evaluation while the final stage of evaluation is called summative evaluation.

## **Population and Sample**

This research was conducted at MAN 1 Bandar Lampung and MA Muhammadiyah Sukarame Bandar Lampung with class X students totaling 20-35 students.

## **Data Collection and Instrument**

This study uses a non-test method, namely interviews and questionnaire formats. Electronic handouts were evaluated through a questionnaire content experta and media experts. Electronic handouts are used to test the feasibility of electronic handouts. To find out the attractiveness of electronic handouts, by evaluating questionnaires by educators and students.

The purpose of this study was to determine the feasibility of the product based on effectiveness and practicality of the resulting electronic handouts. To find out the feasibility category of this electronic handout used with questionnaires and questionnaires.

## Data Analysis

The data obtained from the Likert scale results are in the form of numbers. The following are the rules for scoring using a Likert scale:

Table 1. Score Interpretation Table

No	Category	Rating
1	very good	4
2	good	3
3	not good	2
4	very bad	1

The score obtained is converted to a feasibility score using the following formula (Hadi et.al, 1991):

$$P = \frac{E_x}{E_{xi}} \times 100\%$$

After the calculation results are known, the calculation results are classified according to the following table.

- a. Verification results of interpretation scales by experts in materials and media (sugiyono, 2017):

Table 2. Criterion Interpretation Scale

No	Reference	Interval
1	0% - 25%	very inappropriate
2	25% - 50%	worthless
3	50% - 75%	decent
4	75% - 100%	very decent

- b. Interpretation scale between educators and students (Sugiyono, 2017):

Table 3. Criterion interpretation scale

Criteria	Intervals
0% - 25%	Very unattractive
25% - 50%	Uninteresting
50% - 75%	Interesting
75% - 100%	Very interesting

## RESULT AND DISCUSSION

### Define

At this stage it was found that the use of various types of subject matter had not fully attracted the attention and intelligence of students in learning, especially physics material. This is supported by the results of learning with educators that students find it difficult to understand physics material even though they have used digital learning materials with supporting media Television (TV), worksheets, E-Modules, PhET, and



so on. The results of the curriculum analysis show that MAN 1 Bandar Lampung and MA Muhammadiyah Sukarame Bandar Lampung use the independent curriculum as the relevance of learning. So that the learning media that will be used with the basic competency indicators below:

Table 4. Basic Competency Indicators and Competency Achievement

Basic competencies	Indicators of Competence Achievement
3.11 Analysis of finite energy sources and their impact on life	3.11.1 Identifying renewable energy sources and impacts on life
	3.11.2 Identify sources of non-renewable energy and impacts on life
	3.11.3 Identify renewable and non-renewable electricity generation
	3.11.4 Describe alternative energy
	3.11.5 Identify the limits of energy sources and their impact on life
4.11 Present ideas/ideas to solve problems of limited energy resources, alternative energy their impact on life	4.11.1 Presentation of ideas/ideas to overcome the problems of limited energy sources, alternative energy sources, and their effects on our lives

In addition, during the Teacher Learning process, the lecture method, discussion method, and related methods are used to convey material. Demonstration. Learning activities take place once a week. As a result, students are unable to discover new concepts while studying. Therefore, we need good learning models to ensure that the information is there transferred correctly from teacher to student.

From the problems found, This shows that it is necessary to develop electronic handout media use the Double Loop Problem Solving (DLPS) model because this electronic handout media is made using smart apps creators which are equipped with pictures, video learning materials, various learning references, etc. To support learning in class and make learning fun for students without feeling bored.

## Design

Research and development (R&D) development in the form of electronic handouts using the Double Loop Problem Solving (DLPS) model. An electronic handout design using the Double Loop Problem Solving (DLPS) model is shown below.



Figure 3. Front view of the cellphone, first view and the electronic handout logo



Figure 4. Display of Electronic Handout bar menus

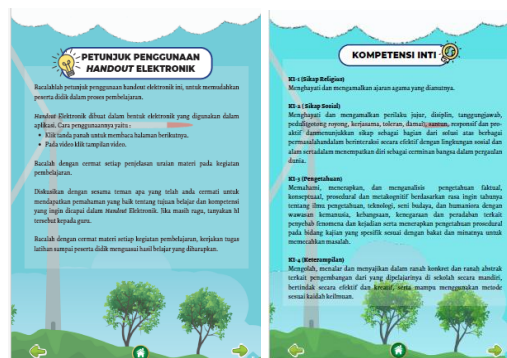


Figure 5. Display instructions for use and Core Competency electronic handouts

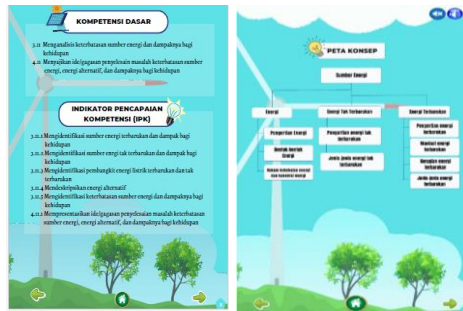


Figure 6. Appearance KD, GPA, learning objectives and concept maps in electronic handouts.



Figure 7. Material display in the DLPS model syntax is problem identification and casual detection

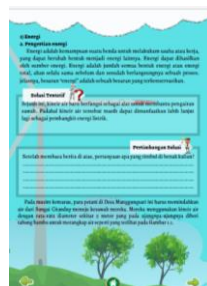


Figure 8. Material display on tentative solution syntax and solution considerations



Figure 9. Display material in DLPS syntax, namely casual analysis, Another casual detection and selected solution plan

Handouts electronics developed on the Double Loop Problem Solving (DLPS) model was validated using questionnaires from material experts and media experts. This validation is carried out before the teacher-student evaluation with the aim of determining the eligibility of the electronic handout.

### Development

The development of electronic handout media was validated by 3 lecturers consisting of three material experts and media experts. The validator evaluation results are shown in the following table.

Table 5. Material Expert Validation Results

No	Aspect	Percentage	Category
1.	Presentation	82%	Very Worth it
2.	Content quality	83%	Very Decent
3.	language eligibility	82%	Very Worth it
4.	<i>Double Loop Problem Solving(DLPS)</i>	83%	Very Worth it
<b>Average</b>		<b>83%</b>	<b>Very Worth it</b>

The results of the material validation were 3 validators with 83% of the total percentage with the Electronic Handout category very feasible to use. Based on the aspects namely 82% is presentation aspect, 83% is content quality aspect, 82% is language feasibility aspect and 83% is Double Loop Problem Solving (DLPS) aspect.

Table 6. Media Expert Validation Results

No	Aspect	Percentage	Appropriateness
1.	Electronic Handout Cover Design	80%	Very Worth it
2.	Electronic Handout Fill Design	79%	Very Worth it
3.	Ease of Use	79%	Very Worth it
<b>Average</b>		<b>79%</b>	<b>Very Worth it</b>

In addition, the results of media expert validation conducted by three validators generally produce a percentage of 79% which is a very feasible category. Based on the aspects, namely the design aspect of the Electronic Handout cover by 80%, the design aspect of the content of the Electronic Handout by 79% and the ease of use aspect by 79%.

### Implementation

After the electronic handout was approved by the material experts and media experts, the implementation phase was then carried out for educators and students, where students were divided into two stages, namely small group trials and field trials. This is to see the practicality or attractiveness of electronic handouts using the double loop problem solving (DLPS) model. The following table shows the results of responses from educators and students.

Table 7. The results of the responses of educators and students

Respondents	Average score %	Category
Educator	89%	Very worth it
Learners	78%	Very interesting

From the teacher's response, 89% were in the "very appropriate" category, and 78% of the student responses were included in the "very interesting" category.

## Discussion

According to Prastowo, handouts are media or teaching materials in the form of writing that are used to enrich students' knowledge in achieving their competence. The learning process that utilizes Handout media has several objectives, namely to facilitate the delivery of learning material, broaden students' knowledge, and help other teaching materials (Ayuningrum & Mulyono, 2022).

Based on the results of observations in the two schools, the use of technology as a learning medium has not fully supported students to be active, creative and innovative in learning. For this reason, the researcher developed a media in the form of electronic handouts, where educators and students agree to use electronic handout media because this media can be equipped with pictures, learning videos, various study reference materials, etc. To support learning in class and make students not feel bored and can be fun.

The development of electronic handouts successful use of Double Loop Problem Solving (DLPS) model ADDIE development model. To obtain a feasibility score, the development of electronic handout media was validated by three Material Experts and Media Experts. Improvement suggestions from experts will help researchers improve electronic handouts; researchers will try to make it a feasible product that can be used by students for independent learning.

After obtaining an attractive e-handout eligibility score, the researcher created a feasibility assessment, a product developed for educators and students. The teacher's answer was 89% "very decent" category and 78% students it's in a very interesting category. Based on the results of previous researchers' research, the development of electronic handouts with Double Loop Problem Solving Model (DLPS) physics material for class X SMA/MA students suitable as a learning material.

Based on the explanation presented above, it can be said that the electronic physics handout media developed reflects teaching material that is very practical and interesting to study. The advantage of electronic handouts using the Double Loop Problem Solving (DLPS) model in physics material for class and enthusiastic when

using these teaching materials. Apart from that, time limitations in studying physics can be overcome, because the teaching materials can be studied individually by students; electronic handouts can be accessed online on Google Chrome in the form of a link or offline in the form of an application; electronic handouts equipped with practice questions and learning videos to help students' understanding; Electronic handouts are prepared based on the Double Loop Problem Solving (DLPS) model. The disadvantages of electronic handouts are that some parts of the font size are not clear; there are fewer evaluation questions and the answer sheets are presented electronically.

## CONCLUSION

Based on data received in the field including the results of feasibility assessments from material experts, media experts, and development test results. material experts rate it in the "very good" category, and media experts fall into the very appropriate category. The results of the teacher's response to the electronic handout media model Double Loop Problem Solving (DLPS) physics teaching materials for SMA/MA students made using the smart apps creator are in the Very Interesting category.

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