



Development of Science Learning E-Modules Using the Flip PDF Application

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Abstract: This study aims to analyze the results of the validity and the practicality of science e-modules using the flip pdf application at SMP Muhammadiyah Al-Kautsar PK. Development research was conducted using the ADDIE model. Interviews and questionnaires were used as data collection techniques. The data analysis technique used descriptive qualitative and quantitative analysis. The e-module product validation was carried out by three experts, namely subject content experts, design experts, and media experts, with an average score of 93.3%, indicating that the E-Module was in very good qualification. The practicality test was carried out using a student response questionnaire after using the e-module; an average of 93.7% was obtained with very practical criteria. The conclusion is that the science e-module developed using the flip pdf application is valid and practical.

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Introduction

The rapid development of technology has caused enormous changes in human life. Technological developments have entered the industrial revolution 4.0, marked by the rapid development of data, factory technology that leads to automation, and easy and fast data exchange (Maulana et al., 2019). In this era, information technology is needed, becomes the basis, and is very important for human life. It has real consequences and impacts on education, where education must be based on the need to meet future needs through technology (Sutrisno, 2018).

The era of the industrial revolution 4.0 made important changes, namely in the education system in Indonesia. One of the biggest affected by this change in the education system is the teacher. Teachers must be able to adapt and guide students in the class to produce students who can compete and answer the various challenges that exist in the industrial revolution 4.0. In order to be able to face opposition, education must also be changed according to the needs and developments of the times. The Industrial Revolution 4.0 also affected education which is called Education 4.0, so it can be said that education 4.0 education which is characterized by the use of digital technology in teaching and learning activities (Maulana et al., 2019). Technology and information, especially in education, have changed how humans learn to obtain and interpret information. Technology and information have a key role in creating creative and interesting innovations in learning activities, one of which is the creation of electronic learning, better known as electronic learning. *E-learning* is a learning and teaching process using electronic circuits to convey learning content (Wan Jusoh & Jusoff, 2009).

E-learning has many benefits that can be applied in the learning process and provides a way for teaching materials to reach students using the internet or other computer network



media. The existence of e-learning learning, or in this digital form, causes students to be more comfortable and enthusiastic in learning when the material is displayed that attracts students (Elangoan, 1999; Soekartawi, 2002; Mulvihil & 1997, 2019). The use of digital technology in learning during the Covid-19 pandemic has been carried out in almost all schools in Indonesia. The Covid-19 pandemic forced all schools to use digital technology in learning activities because face-to-face learning was not permitted to reduce the spread of the Covid-19 virus. Teachers and students must work hard and adapt to digital technology used in learning, starting from WhatsApp, YouTube, video conference applications, learning management systems (LMS), websites, and many other types of applications (Siahaan, 2020). The use of digital technology is different for each school because it adjusts the school's resources.

After the Covid-19 pandemic began to decline, schools began conducting face-to-face learning again after two years of undergoing online learning. The return of face-to-face schools also impacts the use of digital technology in learning. When schools started face-to-face, teachers faced various other problems that were raised when implementing digital learning in the classroom. What often becomes an obstacle is the infrastructure and school facilities that still need improvement. This obstacle did not affect one of the schools in Sukoharjo Regency, namely SMP Muhammadiyah Al-Kautsar PK.

SMP Muhammadiyah Al-Kautsar PK is one of the schools in Sukoharjo Regency. After the pandemic, even though learning has returned to normal, it is still consistent in using digital technology in learning and even changing all learning to digital. In learning, they no longer use printed books and notebooks but have been replaced by laptops. The school has facilitated all classrooms with wifi transmitters so that all students can connect to the internet smoothly. Even though all students' laptops are connected to the internet and students can easily access learning resources from anywhere and in any form, it turns out that students still need guidelines in learning that contain essential material taught by the teacher. Meanwhile, teaching materials provided by teachers as reading and student learning materials are in the form of e-books in pdf form provided by the government. The e-book provided by the government is very good for use in learning but based on initial interviews with teachers and students of SMP Muhammadiyah Al-Kautsar PK, several complaints were found regarding the use of e-books as a source of student learning, namely: 1) e-books are less attractive and boring, 2) e-books are only in the form of writing and pictures not equipped with information in the form of audio or video.

In addition to e-modules that support understanding of knowledge, e-modules that can support students' 21st-century skills are also needed. These 21st-century skills are needed by students to face the challenges of rapid technological developments so that in the future, students can utilize technology instead of being people whose roles are replaced by technology. The 21st-century learning e-module focuses on student centers to provide students with thinking skills, including (1) critical thinking, (2) solving problems, (3) metacognition, (4) communicating, (5) collaborating, (6) innovation and creativity, (7) information literacy (Rifa Hanifa Mardiyah, 2021) (Susanti & Sholihah, 2021).

With the many shortcomings associated with e-books in pdf form provided by the government, schools have to make teaching materials for students in a more interesting, interactive, communicative form and, of course, with material adapted to important material for students or essential material (Wulandari et al., 2021). The most appropriate way to answer the school's needs is to develop an e-module with a professional flip pdf application. Lots of software can be used in the development of e-module Professional 3D page flip



(Adawiyah et al., 2022), kvisoft flipbook maker (Huda et al., 2021), and flip pdf professional (Lestari & Wijayanti, 2021) (Putri et al., 2021). Among the three software, flip pdf professional has advantages in the ease of processing and operation of the resulting final product. Application results flip pdf professional can be run on a computer and smartphone. Flip pdf professional is software that can convert PDF files to digital books like a book when flipped through. On flip pdf, a professional can also add various learning media in the form of images, audio, video, animation, quizzes, buttons, and others, to make the appearance attractive and interactive (Sudarsana et al., 2021).

The results of research conducted by (Komikesari et al., 2020) show that students can use e-modules independently. The e-module uses professional flip pdf applying information technology so that learning can be accessed using a laptop or computer, which can help understand temperature and heat material. Thus the e-module using flip pdf professional can be used as a learning medium in physics material. The practical capabilities of e-modules have also been tested and validly proven by the research conducted (M et al., 2022). Developing science learning e-modules is a solution for implementing digital learning at SMP Muhammadiyah Al-Kautsar PK. This study aims to analyze the results of the validity and the practicality of science e-modules using the flip pdf application at SMP Muhammadiyah Al-Kautsar PK.

Research Method

The method of research used in this research was development research. Research and development aim to produce a product, either in the form of a new product or by improving an existing one. The resulting product can be in the form of hardware (hardware) and software (software) (von Grünigen et al., 2021). The R&D model was appropriate for use in this study because the goal of the research is to develop interactive e-modules that replace ordinary e-books, which are monotonous and less attractive to students. This study's population was all class VII students at SMP Muhammadiyah Al-Kautsar PK, totaling 93 students. The development model used is the ADDIE model, which consists of 5 stages, namely: analysis (Analyze), design (Design), development (Develop), implementation (Implement), and evaluation (Evaluate) (Fajaryati, 2020) as shown in the chart below.

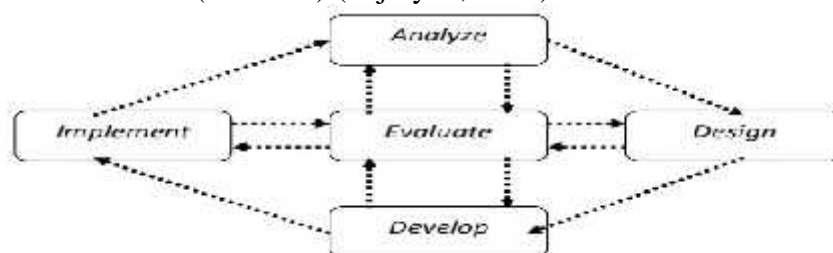


Figure 3.1. ADDIE Development Model Diagram

This study used two data collection methods, namely interviews, and questionnaires. (1) Interview is a method of collecting data through systematic debriefing, where the interview results can be recorded or recorded. (2) The questionnaire method obtains or collects data by sending a list of questions or statements to respondents or research subjects. In this development research, two analytical techniques were used, namely qualitative descriptive analysis techniques and quantitative descriptive techniques. Testing e-module validation was done in using a questionnaire validation sheet filled in by an expert validator who aims to determine the validity e-module on media, material, and language aspects with indicators from each aspect presented in Table 1 below:



Table 1. Validation sheet grid e-module

Aspect	Indicator	Item Number
Media	Ease of use e-module	1, 2, 3, 4
	Clarity of instructions for use e-module	5
	Compatibility of text, colors, images, audio and video on e-module	6, 7, 8, 9
	Layout suitability/e-module layout	10
Theory	Compatibility of CP and ATP materials	1, 2
	Completeness of material on e-module	3, 4, 5
	Material systematics on e-module	6, 7
	Appropriateness of formative tests, summative and enrichment tests	8, 9, 10
Language	Appropriate use of language on e-module with the EYD guidelines	1, 2
	Ease of use of language on e-module	3, 4, 5

After obtaining the results of the Likert scale combined validation analysis, the e-module validity level in media, material, and language was determined by adjusting the validity criteria, as shown in Table 2 below.

Table 2. Validity Categorization e-module

No	Validity Criteria	Validity Level
1	80.01% – 100%	Very valid, can be used without revision
2	60.01% – 80.00%	Valid, can be used but needs minor revision
3	40.01% – 60.00%	Invalid, it is recommended not to use it because it needs major revisions
4	20.01% – 40.00%	Invalid, may not be used
5	00.00% – 20.00%	Very invalid, should not be used

In addition to the validity assessment from experts, the e-module was also tested on students in learning activities and measured student responses by giving a questionnaire to obtain an assessment of the aspects of usefulness and practicality with the grid presented in Table 3 below:

Table 3. Grid of Student Response Questionnaire Sheets

Aspect	Indicator	Number grain
Benefits	Student interests in using e-module	1
	Increasing student learning motivation	3
	Increasing student independence in learning	4
	Presentation of the material makes it easier for students to understand the material	5
Practicality	The practicality of the e-module in carrying and storing it	6
	Completeness of e-modules ranging from materials to tests	7
	Convenience and suitability e-module used in learning	8
	Easy to understand user manual e-module	9
	Ease of operation e-module	10



Validity assessment e-module on aspects of media, material, and language and student response questionnaires using scale measurements *Likert* with a scale model of five, starting from the lowest score 1 indicates very poor, score 2 indicates not good, score 3 indicates quite good, score 4 indicates good, and score 5 indicates very good (Pranatawijaya et al., 2019).

Results and Discussion

The results of this study are science e-module teaching materials with the help of flip pdf software which contains material on the solar system for class VII junior high school. The e-modules were developed following the ADDIE development procedure, with the results of developing e-modules from each stage as follows:

1) Analysis Phase

The analysis phase was carried out to initiate this research which was carried out with literature studies and field studies. This activity was carried out to collect and analyze information obtained regarding the problems and needs of students in the current learning process, namely in terms of science subject matter, student characteristics during the learning process, and the teaching materials used. A literature study was carried out by looking for relevant literature studies so that the development research carried out has a strong basis; this can support field studies that cannot directly analyze the learning process (Puspitasari, 2019).

The field study was conducted by interviewing a class VII science teacher at SMP Muhammadiyah Al-Kautsar PK. Based on the activities carried out, the analysis results were obtained; namely, the teacher had used e-module teaching materials, but the e-modules used by the teacher were only e-books provided by the government and were still in PDF format. Due to teachers' limitations in mastering information and communication technology, teachers have yet to take advantage of existing software to develop e-modules with a more attractive appearance and can present learning audio and videos. Current learning activities with limited good teaching materials causing learning to become monotonous and boring because students tend to be passive, and teachers are more active in explaining through the learning media they have. Managing digital learning with student-centered learning is difficult for teachers because teachers must choose the right media, teaching materials, and the internet web to launch learning activities. The characteristics of teachers and students who already have laptops supported by the school's internet network are excellent assets for carrying out digital learning. Of course, this must be supported with appropriate teaching materials, so an e-module is needed that can be used on a laptop and can be linked to the internet (Hanifah, 2022).

2) Design Stage

At this stage, the preparation of the material and the design of the appearance of the e-module in Microsoft Word are carried out. The design of this e-module is divided into four aspects, namely (1) layout design, (2) learning materials, (3) media that includes images, audio, video, and (4) evaluation activities and their follow-up (Rama et al., 2022). This process begins with collecting all materials and looking for references to learning modules used for the development stage. The designed e-module will contain 25 pages, consisting of a title page, preface, table of contents, Learning Outcomes (CP) and "Learning Objective Flow" (ATP), Islamic astronomical figures, and concept maps. The core material about the solar system consists of the origin of the solar system, celestial

bodies, earth, moon, and eclipses. In addition, at the end of each sub-chapter discussion, a formative test is provided to test students' understanding after studying the material. Finally, the final section includes a summative test page, a follow-up page, an e-mail, a bibliography, and an author profile.

3) Development Stage

E-module development is carried out through several stages, namely:

(1) Install Flip pdf professional application

This pdf flip application can be downloaded at the address <https://www.flipbuilder.com/> and follow all the instructions provided to install it.

(2) Make an e-module design in Ms Word

Flip pdf requires input in pdf format, but before that a draft is created in MS Word (Susanti & Sholihah, 2021). The design made can be seen in the following figure:

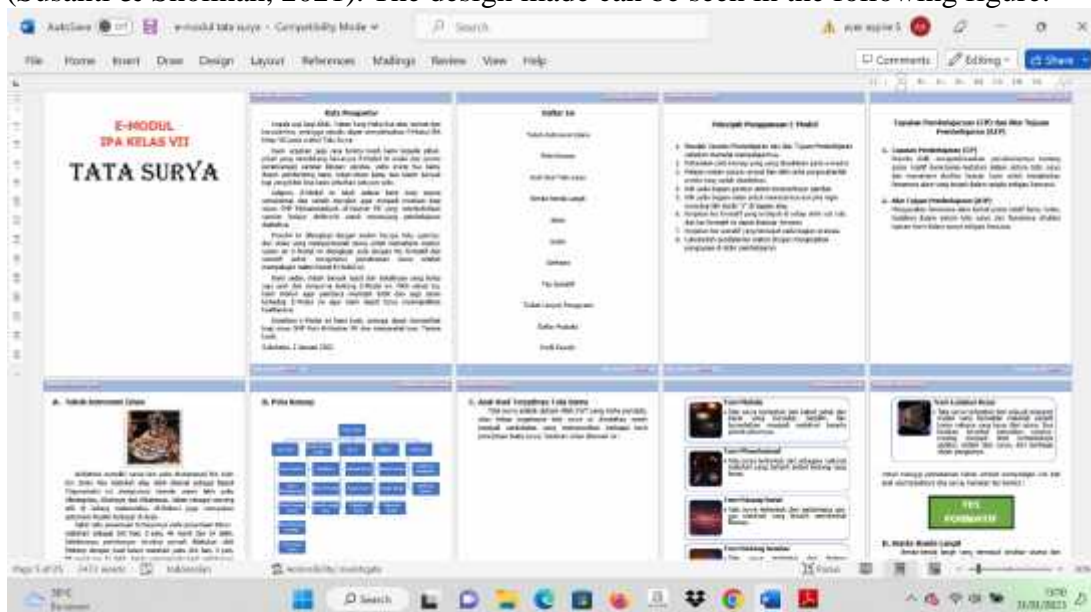


Figure1. Design of E-module in MS Word

In this design, there is indeed a lot of empty space that will be filled by pasting videos or buttons that were done through the Flip pdf application

(3) Editing e-modules in flip pdf app

The design results in Ms word are then saved in PDF format and then converted into a professional Flip pdf file, namely by inserting audio and video explanations for some materials, making buttons on the electronic module page, linking several links, inserting the school logo on the module, customizing some of the buttons on Flip pdf Professional and a link to take quizzes or grades (Aprilia et al., 2022). The results of the e-module edits can be seen in the following figure:





Figure 2. Creating an e-module using the flip pdf application

(4)e-module validation test

Three validators then reviewed the electronic module that had been developed based on four aspects, namely material aspects, media aspects, and language aspects. The validators consisted of 3 teacher lecturers at SMP Muhammadiyah Al-Kautsar PK: Indonesian language teachers, ICT teachers, and Science teachers. When reviewing the evaluation of the e-module, the validator also provided comments and suggestions for deficiencies and errors that need to be corrected in the electronic module (Hunaidah et al., 2022). The validation results and suggestions provided by the validator were used as a basis for revision and improvement. Suggestions and improvements to development e-module presented in Table 4 below.

Table 4. Suggestions and Revisions E-module

Before Revision	Suggestions and Improvements	After Revision
	<p>The preface is made in the form of a video, the table of contents is made more attractive, the background is replaced with a more attractive image.</p>	
	<p>The planetary image is used as a link to the description of each planet Writing arrangement is made better.</p>	

The validation sheet filled in by the validator is then analyzed to determine the level of validity criteria e-module developed (Zinurain, 2021). Data validation results e-module from the assessment of each validator is presented in Table 5.

Table 5. Validation Results E-module

Validators	Empirical Score	Max Score	Average Percentage Validity of Each Validator	Validity Criteria
Validators 1 (media expert)	46	50	92%	Very Valid
Validators 2 (material expert)	48	50	96%	Very Valid
Validators 3 (Linguist)	23	25	92%	Very Valid
Average Percentage Combined			93.3%	Very Valid

Based on Table 5 it is known that the validation results e-module on the feasibility aspect of presentation using scale measurements *Likert* the combined average percentage of the three validators is 93.3% with the criteria of "very valid". It proves that e-module developed have been arranged according to the format and components that are mandatory in a module teaching material that is packaged in electronic form.

4) Implementation Stage (Implementation)

After the developed e-module is validated, revised, and finalized according to the validator's proposal, carry out the implementation in class (M et al., 2022). The trial was carried out by involving all 93 students in class VII of SMP Muhammadiyah Al-Kautsar PK. Implementation activities were carried out by distributing e-modules uploaded on Google Drive beforehand, so students only had to download them. After all, students have the e-module; start instructing students to open and use the e-module. In this activity, the teacher teaches students how to use the e-module and explains the activities and components contained in the e-module. Then ask students to complete some of the learning activities presented in the e-module, including listening to, and watching audio and video and answering questions on formative tests at the end of sub-chapters.

Students look enthusiastic and enjoy using this e-module because those who normally use regular pdf e-books can now learn through e-modules that look like ordinary books and flip through pages. In this e-module, students also try to play the videos provided following the material and take tests that can be repeated when they do something wrong. Students think the e-module has very attractive colors and pictures, buttons on each page, and audio and video lessons. The learning activities presented in the e-module can also help students understand material concepts and solve given problems. This implementation activity was carried out alternately in three different classes. To complete this e-module, each class requires two meetings or 4 x 40 minutes. The process of implementing this e-module can be seen in the following figure:



Figure 4. Students operate and carry out activities on e-module



At the end of the learning activity, students were given a student response questionnaire. The assessment on the student response questionnaire was then analyzed to find the practical results data e-module in the form of the combined average percentage of the 93 students and their practicality criteria. Based on the analysis, the average percentage of students' assessment results of the science e-module developed using the professional flip pdf application on class VII solar system material was obtained at 93.7%, with the criteria of "very practical."

5) Evaluation Stage

The evaluation in this study was only carried out until the formative evaluation, namely the evaluation to improve the e-module that was developed based on the evaluation results of the validity and practicality tests (Anggraeni & Puspasari, 2022). The e-module was revised based on the suggestions obtained from the validator on the validation sheet. In the media aspect, the e-module underwent revision in the introductory section, originally in text, then changed to video. The background has also been changed to a more attractive and appropriate image. To make the table of contents clearer, enable the button to move to the intended page. In the material aspect of the e-module, enrichment materials are added and linked to web addresses to increase student knowledge. In the aspect of language, several word editors have been corrected.

Based on the results of the e-module development from the five stages of the ADDIE development model that has been carried out, it is known that the product produced in this study, namely the science e-module using the professional flip pdf application on class VII solar system material at SMP Muhammadiyah Al-Kautsar PK, is a development "very valid" and "very practical" e-modules.

The advantages of the e-module developed in this study are buttons on several e-module pages to make it easier to open the desired page quickly; audio and video contain new and interesting material for students. In the developed e-module, formative practice questions can be done repeatedly for student practice, and summative tests can be made using Google Forms. Most importantly, this e-module can be used offline, so it does not depend on an internet connection.

While the weaknesses in this study are: 1) this e-module cannot be edited, tagged, and copied, so it is quite difficult if students want to copy information from this e-module. 2) It is not easy to edit because you have to go through the MS Word program and convert it into a new PDF that can be edited using this application. 3) the file size of this e-module is quite large due to a large number of images and videos included in this e-module.

Based on the research results on developing e-modules using the flip pdf application, it is hoped that this e-module can be used as the main teaching material that is interesting and exhilarating for students in digital learning. E-modules can be maximized by adding movable image galleries and animations. E-modules can also be developed into online e-modules that anyone can use at any time (Ellysia & Irfan, 2021). The e-module is expected to be developed by other teachers so that all subjects have teaching materials that are more interesting, interactive, and communicative.

Conclusion

Based on the results of the research and discussion, it can be concluded that the results of the validation test of the science e-module teaching materials developed using the professional flip pdf application on the solar system material for class VII SMP for the assessment of



media, material, and language aspects obtained an average percentage of 93.3 % with the criteria of "very valid." In addition, the results of the practicality test based on the assessment of the student response questionnaire obtained an average percentage of 93.7% with the "very practical" criterion. Thus, the science e-module teaching materials develops using the professional flip pdf application on class VIII solar system material at SMP Muhammadiyah Al-Kautsar PK have tested their validity and practicality.

Recommendation

Recommendations submitted based on the results of this study, namely; (1) Teachers are expected to take part in making learning e-modules that are developed using flip pdf. (2) It is recommended for schools carry out training on making e-modules using the flip pdf application for all teachers. (3) For future researchers to develop online e-modules that can be accessed via cellphones and maximize the features in the flip pdf application.

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