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Electronic Learning Media E-Module Open Source-Based on Planetary Type Starter System for Vocational Students

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Abstract

Post-pandemic COVID-19 learning that is carried out in a hybrid manner experiences problems, one of which is minimal self-learning supplements, which affect students' understanding of the material. This study aims to develop an e-module using Sigil software on planetary-type starter system material. Hopefully, it can support improving students' knowledge of the material. This research uses the Research and Development (RnD) method with the ADDIE model. The results of this product were tested on a limited basis by using a one-group pretest-posttest design in class XI TKRO-A with 30 students. The results showed that the E-module that had been developed received a very decent category from media experts, who scored 89.26%, and from material experts, who scored 95.5%. The e-module developed can increase the understanding of the material with a gain value of 0.64 with a moderate category, and a score of 93.75% from the students' responses showed that the e-module is feasible. The conclusion is that the e-module developed is very feasible to use in independent learning and the learning process at school.

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INTRODUCTION

Electronic instructional media pose several scientific challenges that researchers have identified. One significant issue is technical challenges, such as dysfunction in high-tech instructional media, which can hinder the teaching and learning process [1]. Concerns exist regarding effectively utilizing electronic media to enhance traditional scientific communication flows, ensuring quality, preservation, and dissemination of information as a common good [2].

Moreover, the development and implementation of electronic instructional media can lead to new problems, including alienating students from the real world, difficulty maintaining student focus on learning goals, and increasing cognitive load due to integrating various elements [3]. The suitability of instructional media for specific subjects, like biology in high schools, can also be a problem, impacting the effectiveness of teaching and learning.

Electronic instructional media pose various scientific challenges that educators and researchers must tackle. These challenges include optimizing instructional media to enhance learning motivation and outcomes, effectively utilizing technology to support learning goals [4], and addressing potential issues such as alienating students from the real world and increasing cognitive load [3]. Concerns also exist regarding the suboptimal use of instructional media in science learning [5], which can result in diminished learning outcomes [6].

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The COVID-19 pandemic has significantly impacted the education sector, where learning that is usually done offline (face-to-face) has changed to online or distance learning [7], [8], [9], [10], [11], [12]. Learning at home not only provides a significant disruption to parents' productivity but also to children's social and learning lives [13], [14], [15]. Problems that usually arise in online learning, namely the delivery of material from educators can be conveyed well and clearly to students, requires excellent or stable internet connection conditions. Some students do not understand and tend to be bored and less motivated in learning, impacting their grades and learning achievements [16].

The positive impact of information technology on the instructional process is evident in its ability to enhance learning outcomes, engagement, and efficiency in the Pandemic Era. Integrating information technology into teaching practices supports teachers and students in achieving better outcomes [17]. This integration increases engagement and motivation and improves student learning experiences. Teachers exhibit positive perceptions regarding technology integration, highlighting its potential to transform teaching and learning practices [18].

Furthermore, using information technology in the instructional process has improved learning achievement and retention [19]. Studies have shown that technology-mediated instruction can trigger student interest and engagement, leading to better learning outcomes [20]. The positive impact of technology on the teaching-learning process has been acknowledged, emphasizing its role in enhancing the overall educational experience [21].

Determination of learning media in learning is essential. Several elements can either make the use of educational technology in teaching and learning successful or unsuccessful [22], [23], [24], [25]. There are many cases of choosing learning media that are unsuitable and result in making learning look monotonous and boring. Reinforced by states that learning that is done monotonously can make students bored and not excited. Research has shown that interactive multimedia can help prevent students from quickly becoming bored and disinterested in the presented material [26]. Research indicates meaningful learning materials significantly prevent boredom and enhance student interest [27]. So, it is necessary to use learning media that can arouse students' motivation and interest in learning. Interactive and creative delivery of educational content through media can attract student attention and reduce boredom stemming from uninteresting teaching methods [28]. One of the learning media that is often used is modules. Based on the results of direct interviews with the Head of the Automotive Light Vehicle Engineering (TKRO) expertise competency and subject teachers at Muhammadiyah Semarang Vocational High School (VHS) on Feb. 08, 2022, the learning media used in learning still printed modules/teaching materials and pdfs, videos on YouTube, PowerPoint (ppt), and media used for self-study students still use printed modules and YouTube links. Vehicle products with huge engine capacities will be created because of technological advancements in the automotive industry [29], [30], [31], [32], [33], [34]. The module is a teaching material made in a structured manner using language that is easy for students to understand and adjust to the students' cognitive level and age so that it can be used for independent learning with minimal assistance or guidance from educators. Most printed modules are informative among students, containing simple images and practice questions [35], [36], [37].

Reinforced by the opinion, printed modules make it difficult for students to understand the concept of the material provided, and students feel bored quickly learning it and must spend money to print modules. This causes learning is still not optimal. This reduces students' motivation and interest in learning, so it is necessary to make an innovative breakthrough by utilizing current technological developments. One form of innovation that utilizes technology is the creation of E-modules. E-modules are modules that are packaged electronically. E-modules are learning media that are effective and efficient when used to train students' independence. Another advantage of E-modules is that they can minimize using paper in learning activities. E-modules are also helpful for students in controlling and measuring their learning abilities and seriousness [38].

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Based on the Flow of Learning Objectives (FLO) class XI Light Vehicle Electrical Systems on the material on how to maintain the starter system, the material studied includes the concept of the starter system on the vehicle, the name of the components, and functions of the starter system components, how the starter system works. Starter system maintenance, with the ability to teach educators, can deliver the material well [39]. However, the results of observations at Muhammadiyah VHS 2 Semarang on starter systems for media used for independent learning of students at home are minimal, so students have difficulty understanding the material presented. This is evidenced by the material understanding of students who are less than KKM in starter system subjects with an average score below 65.

Based on the problems described above, it is necessary to apply learning media that is expected to increase motivation and interest in learning students and make it easier to understand the material, especially the concept of an electrical starter system planetary-type. So, researchers intend to develop "E-modules Using Sigil on Planetary Type Starter Systems." The Sigil application can convert Word format into ePub extension files. Electronic publication (EPub) is one of the digital book formats agreed upon by the International Digital Publishing Forum (IDPF) in October 2011. The replacement software for Open eBook, which serves as an open book format, is epub and can be accessed from HTML, XHTML, XML, and CSS files, presented in one file with the epub extension [40]. Sigil software has many advantages when used to compile E-modules. The application has benefits, including video links to YouTube to facilitate audio-visual learning styles. From a visual perspective, it has images that are contextual to everyday life and a freeware digital bookmaker application with complete features that are friendly on all types of reader devices and flexible to use. Moreover, running tests and prototype results are lightweight and easy to operate. Furthermore, users or readers can play videos themselves because videos do not run alone like the appearance of a digital book application. ePub has a friendly nature and supports many devices, such as Android computers (using Ideal Reader, FBReader, iOS (reader), computers (accessed in Google Chrome), Blackberry playbook, SonyReader, and various other devices.

METHODS

This research uses the research and development (RnD) method. The scope of this research is the development of e-module learning media using Sigil on planetary-type starter systems for class XI VHS students using the ADDIE model. Respondents of this research product were tested on a limited basis to class XI TKRO-A students with 30 students. The data collection techniques can be seen in Table 1.

Table 1. Data Collection Techniques

No.	Data Type	Instrument Technique	Technique
1.	Feasibility of e-modules	Media expert and material expert validation	Validation sheet
2.	Understanding of the material	Given before and after treatment	Pretest and posttest
3.	Student response questionnaire	Distribution of questionnaires to students	Questionnaire sheet

The step of the ADDIE model is shown in Figure 1. The ADDIE model comprises five stages: Analysis, Design, Development, Implementation, and Evaluation [41], [42]. The data analysis in this study uses qualitative descriptive analysis techniques that describe the results of e-module product development using Sigil on planetary-type starter systems. Data obtained through trial instruments were analyzed using qualitative descriptive statistics. Experts validated our study. This includes validating questionnaires related to ease of use, language, grammar, presentation, and benefits of e-modules using Sigil on planetary-type starter systems. The results of the assessment scores from each material expert, the validator, and the media expert, as well as the results of the student response questionnaire, were averaged and converted. The next stage is determining the effect of using e-modules on increasing understanding of the material by finding the gain value to show an increased understanding of the material after learning.

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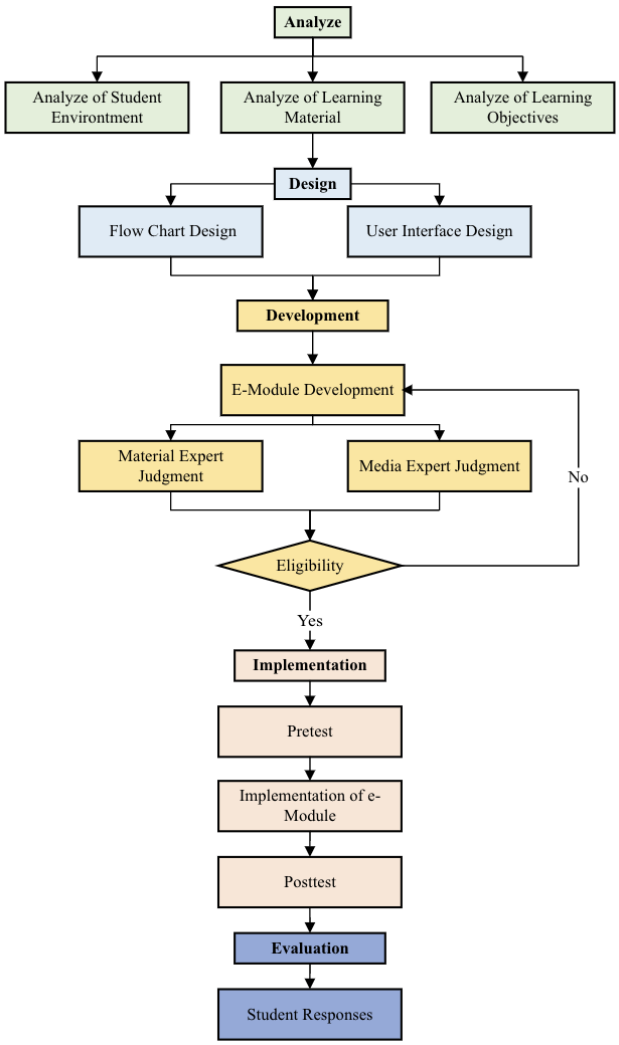

Figure 1. ADDIE Step

RESULT AND DISCUSSION

This research uses the ADDIE development model, which has five stages: Analysis, Design, Development, Implementation, and Evaluation.

Analyze

The first stage of analysis is carried out: performance analysis, learner analysis, analysis of facts, concepts, principles, and procedures of learning materials, and analysis of learning objectives. In the results of observations and interviews with educators/teachers at Muhammadiyah 2 Semarang VHS, the difficulties encountered in learning are that there are many choices of learning media that are unsuitable and impact boring and monotonous learning. The media in learning were still printed modules that tend to be informative, but self-study supplements at home are minimal, and there is a low understanding of student material in starter system subjects. This analysis utilizes classroom observations, interviews with one of the subject teachers, and learning outcomes data. From the observations and interviews, the understanding of starter system material, motivation, and interest in class is low due to limited learning media facilities. The material presented in the e-module content is adjusted to the indicators and learning objectives in the independent curriculum's ATP (Flow of Learning Objectives). The material contained in the e-module that the learning outcomes will develop is how to maintain the starter system, which includes understanding basic principles, types of motor starters, components, especially planetary types, how the starter system works, planetary types, how to maintain and test the motor starter, especially

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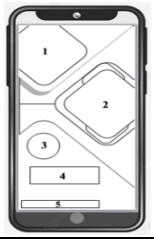
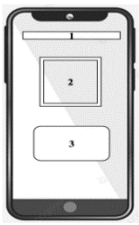
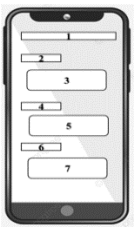
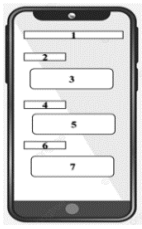
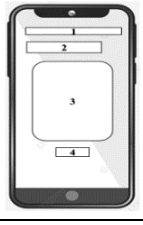
planetary types. Reviewing the ATP (Flow of Learning Objectives) of the independent curriculum class XI TKRO, This research uses the ADDIE development model, which has five stages: Analysis, Design, Development, Implementation, and Evaluation.

Design

At this stage, the developer starts with team formation, determining the structure of the material, designing the initial product, which is illustrated on a flowchart, and making an initial product storyboard shown in Table 2.

Table 2. Storyboard of Learning Media

Display	Description
	"Cover Page" 1. Title 2. Motor starter picture 3. Unnes logo 4. Material description 5. Author's name
	"Foreword" 1. Foreword 2. Contents
	"Author Profile" 1. Author Profile 2. Author's photo 3. Author's Profile
	"Introduction" 1. Introduction 2. Subchapters (General Description) 3. Contents 4. Subchapter (Final Objective) 5. Contents 6. Subchapter (Learning Outcomes) 7. Contents The next subchapter
	"Learning Activities" 1. Learning Activities 2. Sub-chapter (Brief description) 3. Contents 4. Subchapters (Relevance) 5. Contents 6. Subchapter (Learning Outcomes) 7. Materials about planetary-type starter systems.
	"Evaluation" 1. Evaluation 2. Instructions for completion 3. Example of quiz picture 4. Quiz link

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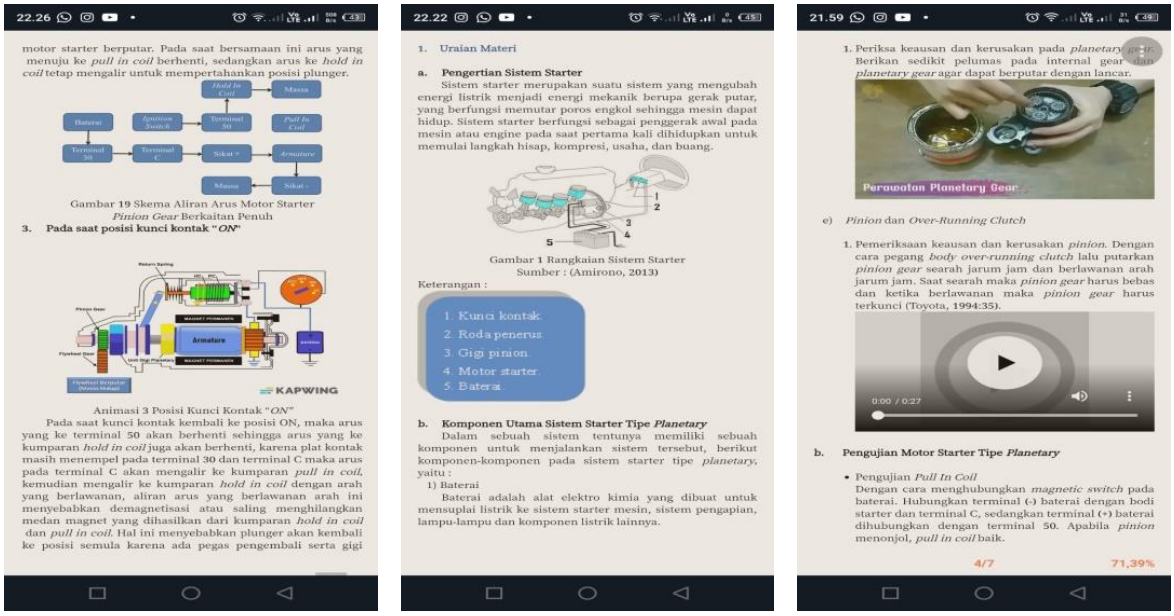
Development

The development stage is making e-modules with the storyboard made at the design stage. This e-module is made with Sigil software, as shown in Figure 2, Figure 3, and Figure 4 below.



(a) (b) (c)

Figure 2. E-module display with storyboard: (a) The Content Learning Media; (b) Learning Material Description; and (c) Visualization and Video Content

Feasibility testing of e-modules using Sigil on planetary-type starter systems was carried out by three média experts, shown in Table 3.

Table 3. Feasibility Media by Expert

Media Expert	Total Score
Media Expert 1	81
Media Expert 2	75
Media Expert 3	85
Total Score	241
Maximum Score	270
Percentage	89.26%
Category	Very Feasible

Two material experts carried out feasibility testing of e-modules using Sigil on planetary-type starter systems, as shown in Table 4.

Table 4. Feasibility Learning Material by Expert

Learning Material Expert (LME)	Total Score
LME 1	95
LME 2	96
Total Score	191
Maximum Score	200
Percentage	95.5%
Category	Very Feasible

The score results obtained from product validation are 89.26% from media experts and 95.5% from material experts. Both scores fall into the "very feasible" category for use.

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Implementation

This field trial was conducted in class XI TKRO-A with 30 students. The field trial results obtained an average pretest score of 35.5, while the average posttest score was 76.77. Students increase their understanding of the material. The increase of n-gain obtained a gain value of 0.64 in the "medium" category. The final stage is by distributing questionnaires to find out the responses from students regarding the use of e-modules using Sigil on planetary-type starter systems. The results of students' responses received a score of 93.75%, concluding that the e-module is very feasible to use in the learning process.

Evaluation

Based on the validation results conducted by media experts and material experts, the results obtained were 89.26% and 95.5%, concluding that the e-module developed was very feasible to use. Judging from the data results in class XI TKRO-A Muhammadiyah 2 Semarang VHS, there is an increase in understanding of the material with the n-gain test results of 0.64, categorized as a "moderate" increase. From the questionnaire data of students' responses, the results obtained were 93.75%, which can be concluded that the e-module using Sigil on the planetary type starter system is very feasible to use in the classroom learning process.

The development of electronic instructional media holds significant promise for advancing scientific education. By leveraging technology, educators can enhance the learning experience and improve student outcomes. Research has shown that instructional media, such as online learning environments [43], interactive video media [44], and computer-based instruction [45], can positively impact student engagement and understanding. These tools make learning more interactive and engaging and cater to different learning styles, thereby improving the effectiveness of instruction [46]. Moreover, using electronic media, such as e-media and expert systems, is effective in delivering educational content [47], [48]. These tools provide teachers with innovative ways to present information and engage students in learning. Additionally, the integration of media literacy strategies within science instruction can help students critically evaluate scientific information encountered online [49], [50]. Furthermore, the development of electronic instructional media can contribute to enhancing scientific literacy and promoting scientific thinking among students [51], [52], [53]. Educators can foster a deeper understanding of scientific concepts and encourage curiosity and critical thinking skills by providing access to a wide range of scientific information and engaging students through new media platforms.

Electronic instructional media, from online platforms to interactive videos and computer-based tools, offer valuable resources for educators to enhance science education. By leveraging these technologies effectively, educators can create engaging learning experiences, promote scientific literacy, and support students in developing essential skills for success in the 21st century.

CONCLUSION

Based on the results of research on the development of e-modules using Sigil on planetary-type starter systems, it can be concluded that the e-modules developed are very feasible to use in the learning process. This research only focuses on theoretical learning. Further research needs to be carried out on the impact of using electronic media on students' practical abilities. Because theoretical knowledge will support skills in practical activities.

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