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Development of Flipbook-Based E-Module Integrated with External Features to Facilitate Student Self-Learning

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Abstract: This study aims to develop a flipbook-based E-Module integrated with external features to facilitate student self-learning. This research uses a Research and Development (R&D) method with an ADDIE model, which consists of five stages, i.e., analyze, design, develop, implement, and evaluate. The needs analysis of teaching material development was conducted through surveys, interviews, and observations. The validity test used a validation instrument filled out by three experts. Practicality was measured using the results of a questionnaire filled out by students as respondents. The data collected were then analyzed quantitatively. The results showed that the flipbook-based E-Module integrated with external features was categorized as very valid with a percentage of 91.09% and very practical with a score of 90.14%. Flipbook-based E-Module facilitated student self-learning in accordance with its character, namely self-instructional, self-contained, stand-alone, adaptive, and user-friendly characteristics.

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Introduction

The life of society that has now entered the era of the Industrial Revolution 5.0 shows the integration of technology in every inch of activity (Dwiyama, 2021). The rapid advancement of technology and easy access to the results of these advancements have led to a change in trends so that conventional methods are slowly being abandoned. Based on what happened and was felt in the era of the Industrial Revolution 4.0 and now 5.0, there are new demands for education to create students who can adapt to the academic environment that is starting to be digitized (Munandar et al., 2022). The global pandemic in early 2020 has further strengthened the role of technology in implementing education, both nationally and internationally. Technology has become a crucial tool to keep education at primary school, secondary school, undergraduate, and graduate students running during offline class restrictions (Varkey et al., 2023). Communication platforms are one of the most widely used forms of technology to facilitate education during the global pandemic. They allow teachers and students to communicate online, now known as online learning.

Online learning is categorized into two types: synchronous and asynchronous (Latif et al., 2022). The shift from offline to online learning has impacted current learning methods in the post-global pandemic era (Salim, 2023). Educational institutions continue to implement both synchronous and asynchronous online learning in conjunction with offline learning, creating what is known as hybrid learning. Synchronous learning involves real-time interaction between teachers and students through virtual face-to-face communication. Platforms such as Zoom and Google Meet are commonly used for synchronous learning. In contrast, asynchronous learning does not involve direct interaction between teachers and

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students. Instead, students learn materials and complete assignments through online platforms such as Learning Management Systems (LMS), websites, emails, and apps (Fadilah et al., 2021). Asynchronous learning allows students to learn without being restricted by time, classroom, or location (Zuhriyah & Fajarina, 2022). It provides students with more time to work on tasks and submit their work, thereby encouraging independence and student-centered learning (Utomo & Sulistyowati, 2022). One of the universities that has continued to offer both synchronous and asynchronous online learning after the global pandemic is the University of Jember.

Based on the results of interviews and observations with lecturers and students, especially in the Science Education Study Program, University of Jember, the problem found in online learning is the lack of availability of online learning resources in courses that are equipped with assignments and integrated with external sources that can be accessed anytime and anywhere using devices such as smartphones, laptops, and tablets. Initial studies conducted by distributing questionnaires to students related to teaching materials in the Science Teaching and Learning Strategy course, obtained the following data: First, the teaching materials used by students during online learning show that 90% use Powerpoint. Second, the response of students' interest in teaching materials provided by lecturers shows that 60% are quite fond of it. Third, data regarding student expectations of teaching materials provided by lecturers during online learning show that 45% expect interesting teaching materials, 30% expect teaching materials that can be accessed via smartphones, 15% expect teaching materials that can be used independently and equipped with assignments, and 10% expect teaching materials that can be accessed online and offline. Fourth, data on development needs for the development of E-Module teaching materials show that 80% stated the need for the development of E-Module teaching materials that are comprehensive and support the learning process. Based on these problems, it is necessary to develop innovative teaching materials using technology that can be accessed by students anytime and anywhere. The teaching materials developed must accommodate the needs of students and be easily accessible through devices that are currently the needs of students, namely smartphones and laptops. E-Module are teaching materials that meet those criteria (Wiradnyana et al., 2022).

E-Module are electronic format teaching materials intended for self-learning, designed coherently to achieve specific learning goals, and connected through links as navigation in each activity. The links are not only for accessing materials, but also assignments, images, videos, and project tasks to make students more interactive and enrich the learning experience (Manzil et al., 2022). E-Module can be created through online graphic design platforms such as Canva, Adobe Photoshop, Adobe Illustrator, and CorelDRAW. The creation of the E-module is more diverse and interesting with the addition of various external features, providing a wider range of learning resources (Ende et al., 2022). The use of E-Module on electronic devices is made easy and practical by using flipbook applications (Ameriza & Jalinus, 2021). Flipbook is an application that displays a series of images or documents, from one page to another by using the illusion of movement each time the page is flipped quickly and supports the display of e-modules to accommodate interactive learning activities (Juwati et al., 2021; Rahmawati et al., 2023). Flipbook makes the resulting E-Module interactive and attractive with a display that can be folded like a real book, equipped with text, audio, images and video, easy to use and access on various devices, for example, those with Android and MacOs operating systems (Arifitama, 2018; Handayani et al., 2021).

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Several studies on E-Module have been conducted by other researchers, including: Delita et al (2022) about the effects of using E-Module on student efficacy, motivation, and learning outcomes; Herawati & Muhtadi (2018) who developed interactive E-Module in Chemistry subject packaged in the form of Compact Disk (CD) that can be accessed on computer and laptop; Laili et al (2019) who developed a project-based learning E-Module in the form of an application installed on a smartphone; and Febrista & Efrizon (2021) who developed an Android-based interactive E-Module, meaning that only smartphone users with the Android operating system can access. The present studies focus on developing E-Module that are adapted to changes in student learning styles and learning methods after the global pandemic that is still ongoing today, relevant to the times, the rapid innovation of communication tools such as smartphones and laptops, the availability of internet access, also paying attention to the habits and needs of students. Innovations that always create various new technologies, one of which is the integration of digital features, contribute to the dynamics in education that require teachers and students to remain relevant, not outdated, and able to become competitive human resources.

Therefore, this study aims to develop a flipbook-based E-Module integrated with external features to facilitate student self-learning. Student access to teaching materials is not limited to the classroom or specific times; it can be through devices they use and carry every day. An E-Module integrated with several external features helps students achieve predetermined learning objectives and increases the attractiveness of the teaching material (Munir et al., 2022). This flipbook-based E-Module is designed to resemble a book that can be flipped through page by page and is integrated with external features, such as YouTube and Google Forms for assignments.

Research Method

This research method was a Research and Development (R & D). The Research and Development method is used to produce certain products and test the effectiveness of these products (Sugiyono, 2018). The steps of this research referred to the ADDIE model which consists of five stages that include *Analyze, Design, Develop, Implement,* and *Evaluate.* The ADDIE model provides a clear, step-by-step framework that guides researchers to consider and address all important aspects of instructional design (Branch, 2009). The procedures are described in more detail in Table 1.

Table 1. Flipbook-based E-Module Development Procedures

Stage	Activity
Analyze	*Problem identification*: analyzing student needs through surveys, interviews, and observations to identify factors that cause problems so that new product development is needed. *Select task function*: the form of teaching material development (product) needed by students in online learning that accommodates independent learning and assignment activities. *Analyze existing course*: analyzing and identifying related course materials to be included in the developed teaching materials refers to the curriculum of the Science Education Study Program.
Design	Designing the product and its main components.
Develop	Producing products by compiling materials, pictures, assignments, adding external features, and integrating flipbook applications. Then, validate the product to experts in their fields. The validation results will be analyzed to determine the feasibility of implementation.
Implement	Implementing the developed product to students of the 3rd Semester Science

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Stage	Activity
	Education Study Program, University of Jember and measuring practicality through a questionnaire filled out by respondents.
Evaluate	Assessing the performance of the developed product and the final results of the previous stages which aim as a benchmark related to the feasibility of the product being used for learning activities.

The respondent/ sample selection technique is purposive sampling, which is a sample selection technique with certain considerations (Sugiyono, 2016). The respondents of this research were 30 students of the 3rd Semester Science Education Study Program, University of Jember, who took the Science Teaching and Learning Strategy course. The validation of the developed product by three experts using validation instruments. Category of validity by Sunarto (in Nivetiken et al., 2024) can be seen in Table 2.

Table 2. The Validity Category

Interval	Category	Description
81.00% - 100.00%	Very valid	No revision needed
61.00% - 80.00%	Valid	Needs minor revision
41.00% - 60.00%	Fair	Needs medium revision
21.00% - 40.00%	Less valid	Needs major revision
≤ 20.00%	Not valid	Unusable

The practicality of the developed product was analyzed from the questionnaire filled out by students (respondents), and the category of practicality by Purwanto (in Artika et al., 2020) is shown in Table 3.

Table 3. The Practicality Category

Interval	Category
81.00% - 100.00%	Very practical
61.00% - 80.00%	Practical
41.00% - 60.00%	Fair
21.00% - 40.00%	Less practical
0.00% - 20.00%	Not practical

The data analysis technique in this study used quantitative data analysis. Quantitative data obtained in the form of validation tests results and practicality tests in percent (%), which were then interpreted into certain categories to obtain information on the validity and practicality of the products developed.

Results and Discussion

Analyze

The first stage in this research is *analyze*. The purpose of this stage is to find out the problems that occur in online learning so that a solution is needed in the form of product development (teaching materials). The activities carried out are: 1) problem identification, 2) select task function, and 3) analyze existing course.

1) Problem identification was carried out through surveys and interviews with lecturers and students from the 3rd Semester Science Education Study Program at the University of Jember, as well as observations during online learning. The results indicated that the teaching materials used in online learning have not been fully accommodated. Therefore, innovations are needed to integrate the availability of materials and media, as well as the ability to complete and collect assignments, into a single, easily accessible teaching resource.

2) Select task function is identifying the type of teaching material development needed by students based on their characteristics and survey results. The results indicate that the

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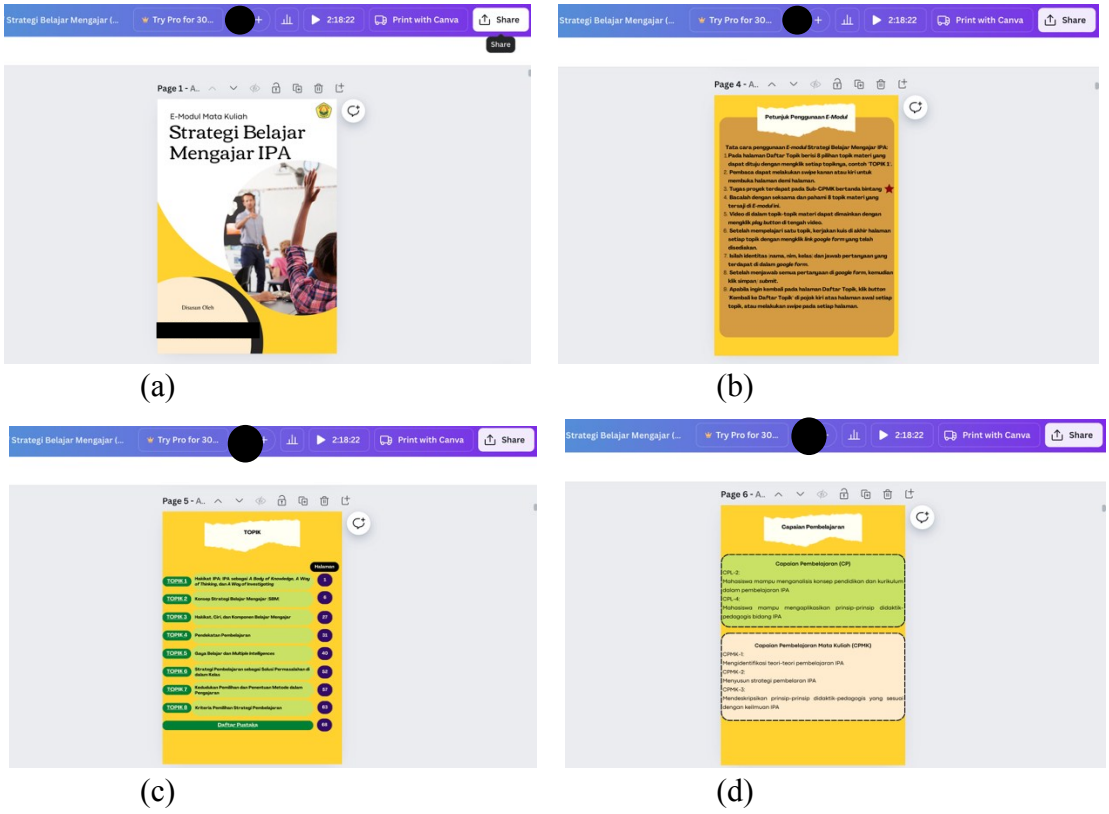
device most frequently carried and used by students in the 3rd Semester Science Education Study Program is a smartphone, which is used intensively for internet access. This aligns with research by Teo et al. (2018), which highlights the crucial role of technology in students' learning experiences. They use various internal and external strategies to explore learning. Smartphones, which facilitate internet and social network access, are increasingly utilized, leading to greater interaction with these devices. Additionally, smartphones provide access to information sources and are used intensively by the younger generation, often defined as Generation Z (Kurmanova et al., 2022). Students in the 3rd Semester Science Education Study Program, aged 18-19 and born between 2004 and 2005, can be classified as Generation Z. According to the Pew Research Center (2018), Generation Z includes individuals born between 1995 and 2015.

3) Analyze existing course is the process of analyzing the course in which the teaching material is developed, namely Science Teaching and Learning Strategy course. The preparation of teaching materials is guided by the curriculum of the Science Education Study Program by identifying graduate learning outcomes (CPL) and course learning outcomes (CPMK), both of which are compiled in the semester learning plan (RPS).

Design

At this stage, the design of teaching materials and materials was carried out. Designing materials and determining CPL and CPMK based on the curriculum of the Science Education Study Program. The design of teaching materials was done by making an overview and design of the E-Module to be developed. Some of the activities carried out at this stage were making E-Module components. E-Module consists of several components, including technical instructions for using the E-Module, basic competencies, indicators to be achieved through the presentation of material, material, and exercise questions (Lastri, 2023). The design of this teaching material was created using an online graphic design platform, known as Canva, which can be seen in Figure 2.



(a) (b)

(c) (d)

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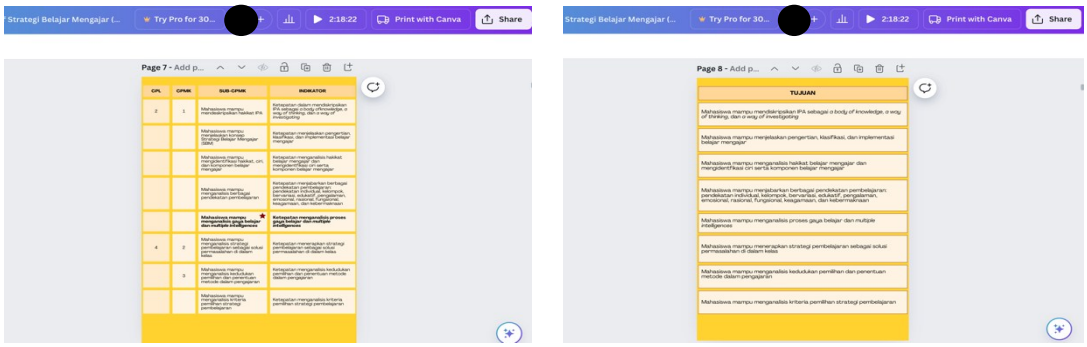

(e) (f)

Figure 1. E-Module design, including its components: (a) cover; (b) instructions for use; (c) list of materials; (d) CPL and CPMK; (e) sub CPMK and indicators; and (f) learning goals

Develop

The next stage is development. Materials, exercise questions, pictures, and videos were included in the E-Module. In the list of materials/ topics, there was a button that could be clicked and went to the intended material, and vice versa when you wanted to return to the topic list, then students clicked the button provided on the material title page. Exercise questions were equipped with the Google Form feature, so that the assignments collected by students will be recorded with the name, student identification number, class, and answers then directly stored in the lecturer's Google Drive. The inputted video is complete with a link, which when clicked will head to the full video player, that is YouTube. The display of this external feature addition can be seen in Figure 3.

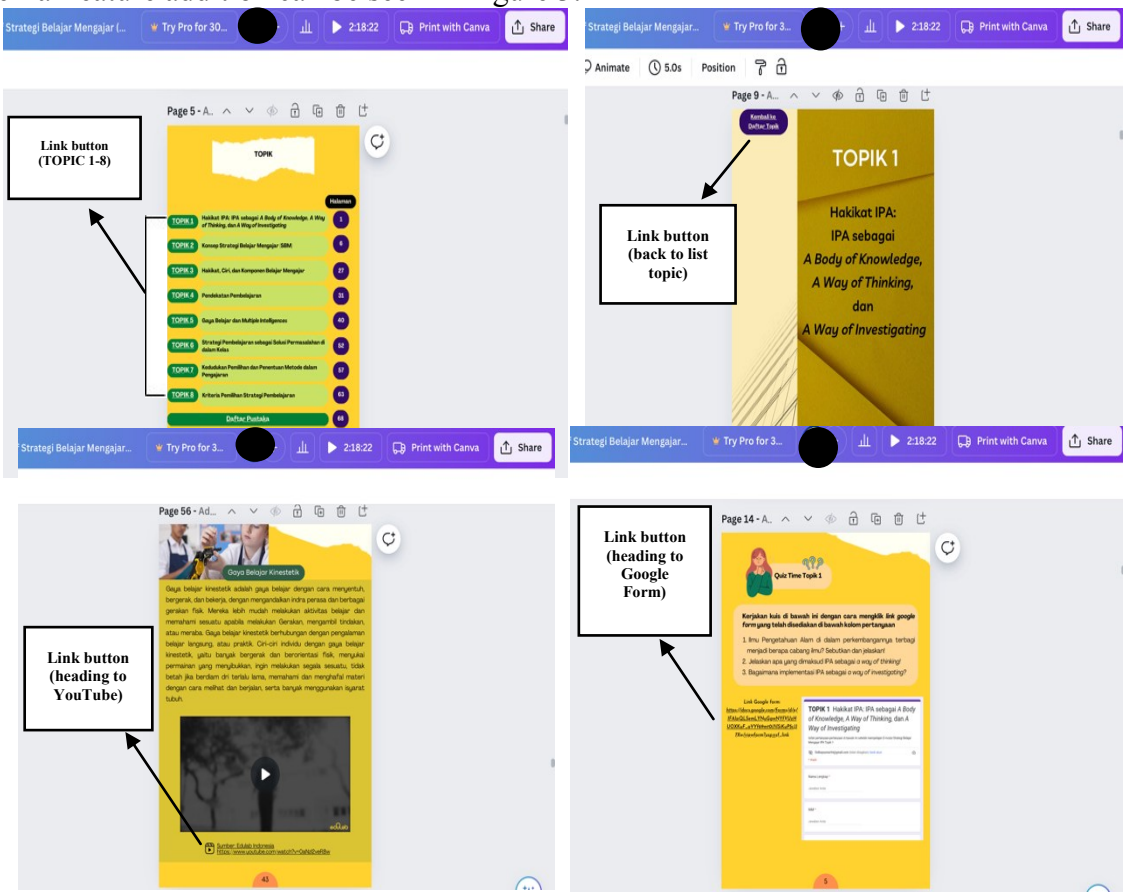

Figure 2. Adding features to E-Module

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After the E-Module was finished, the next step was to shape its appearance into a flipbook so as to produce sheets that can be flipped like book pages through an application called Heyzine. The display of flipbook-based E-Module shows in Figure 4.

Figure 3. Flipbook feature implemented on E-Module

The flipbook-based E-Module was then validated by three experts, namely material experts, media experts, and linguists. The aspects of the validity test include content, presentation, language and writing, graphic, digital form, and so on (Nengsih et al., 2019). The results of validation are in Table 4.

Table 4. Results of Validity Test by Experts

Aspect	Percentage	Category
Content	91.60%	Very valid
Presentation	91.25%	Very valid
Language and writing	90.70%	Very valid
Graphic	89.80%	Very valid
Teaching materials for digital learning	92.08%	Very valid
Average	**91.09%**	**Very valid**

The purpose of product validation by several experts who are experienced in their fields is to evaluate the products developed and so that the product has good quality by getting suggestions from experts (Sugiyono, 2018). There are five aspects that are assessed including content (materials), presentation, language and writing, graphic, and feasibility of teaching materials for digital learning. The following is a description of the validation results for each aspect:

1) Content aspect

The content aspect reached a validation percentage of 91.60%. The assessment results show that the material in the flipbook-based E-Module is in accordance with the CPL and CPMK contained in the curriculum of the Science Education Study Program.

2) Presentation aspect

The validation percentage of the presentation aspect is 91.25%. Based on experts' assessment, flipbook-based E-Module has a coherent concept: there are instructions for use at the beginning, exercise questions at the end of each chapter, and the availability of bibliography.

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3) Language and writing aspect

The language and writing aspect obtained a validation percentage of 90.70%. The language used is in accordance with standardized rules and the grammar is in accordance with refined spelling (EYD).

4) Graphic aspect

The graphic aspect obtained a validation percentage of 89.80%, the results of the experts assessment showed that the cover illustration was in accordance with the contents of the flipbook-based E-Module, the illustrations were well made and attractive, and the presentation of the letters was clear.

5) Feasibility of teaching material for digital learning aspect

This aspect gets a validation percentage of 92.08%. Based on experts assessment, this development product can be used for student self-learning and self-assignments, easily accessed on various devices such as smartphones and laptops, integrated with external features so that in one teaching material it has facilitated the needs of students in independent online learning.

The flipbook-based E-Module validity test results show a percentage of 91.09% and matched with the validity category in Table 2, which shows that the flipbook-based E-Module is in the range 81.00% - 100.00%. Thus, the flipbook-based E-Module is in a "very valid" category and can be used without improvement. These results indicate that the flipbook-based E-Module presentation is interesting and systematic. This is in accordance with Irawan and Suryo (2017) that an attractive and interactive design display affects the quality of good learning and increases learning motivation. Systematic preparation of teaching materials can help students understand the material (Wijaya and Vidianti, 2020). The material in the flipbook-based E-Module is adjusted to the curriculum, this is relevant to the statement of Pratiwi et al (2023), namely the suitability of the material presented has a major effect on student knowledge. If the topic presented is appropriate, students can avoid misconceptions. Based on the results of language and writing validation, the category obtained is "very valid", it shows that this flipbook-based E-Module uses good and correct Indonesian language. Afriyanti et al (2021) stated that good and correct language presented in the teaching material will make it easier for students to learn and understand concepts.

Implement

Flipbook-based E-Module integrated with external features that have been validated by experts and reached "very valid" category then implemented on respondents, namely 30 students of 3rd Semester Science Education Study Program who took Science Teaching and Learning Strategy course. This implementation is a small-scale trial. The purpose of conducting small-scale trials is to determine the practicality of teaching materials. The data from a small-scale trial were poured into a perception questionnaire with 9 questions and 1-5 assessment option score, the obtained score can be seen in Table 5. The aim is to find out students' perceptual responses to flipbook-based E-Module. Furthermore, the results of the questionnaire calculations were converted into percentages and the results were adjusted to the practicality category in Table 3.

Table 5. Result of Questionnaire

Aspect	Indicators	Score (%)
Material	a. The material accordance with CPL and CPMK	91.30
	b. The material is easy to understand	91.30
	c. The material is equipped with exercise questions	91.30
Technical use	a. Flipbook-based E-Module is easy to use	88.70
	b. External features are easily accessible with electronic devices	88.70

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	c. Flipbook-based E-Module can be accessed anytime and anywhere	91.30
General	a. Attractive design and systematically organized	88.70
	b. Feasible for self-learning and self-assignments	91.30
	c. Text, images, and videos are clearly visible and legible	88.70
Average		**90.14**

Questionnaires filled by students after using the flipbook-based E-Module resulted in a score of 90.14%. Then the score is adjusted to the practicality category in Table 3, so the flipbook-based E-Module integrated with external features is included in "very practical" category. This result is in line with Jan's statement (in Alwi et al., 2020) that practicality is related to the use of teaching materials by users, students, lecturers, or other experts. Practicality must consider indicators of usability, clarity, and cost-effectiveness.

Evaluate

The results of the validation test and measurement of the practicality of the flipbook-based E-Module show good results, which are included in the "very valid" and "very practical" categories. Despite obtaining the expected results, the teaching materials developed still have some shortcomings, and are felt by students as users. Some improvements submitted by users: 1) added more pictures that relate to material in each chapter, 2) added sound effects, for example voice-over to make it more interesting, 3) exercise questions are available in the form of essays and multiple choices, and 4) the students need that flipbook-based E-Module can be accessed both online and offline. In addition, respondents stated that this flipbook-based E-Module supports and is feasible for self-learning and self-assignments, this is shown by the indicator score of 91.30% in Table 5. Furthermore, the results of student responses also show that this learning module is able to attract students' interest in studying the module in a sustainable manner. The use of flipbook-based E-Module integrated with external features helps students to be independent in learning the material and answering the exercise questions in it. Therefore, E-Module can be used as an independent learning resource that can help students improve cognitive understanding and not only depend on certain learning resources (Wahyuningtyas & Rosyidah, 2022).

Flipbook-based E-Module integrated external features make it easier and support students to learn independently because it has their own characteristics compared to other types of teaching materials. The unique characteristics of the module by Kosasih (2021) and its application to the flipbook-based E-Module integrated with external features are shown in Table 6.

Table 6. Module Characteristics Applied to Flipbook-based E-Module to Facilitate Student Self-Learning and Self-Assignments

Module Characteristic	Applied to Flipbook-based E-Module
Self-instructional: students are able to not depend on other parties, able to teach themselves	Flipbook-based E-Module presents learning purposes, contains complete material descriptions, illustrations (pictures and videos) that are appropriate, exercise questions, uses standardized language, and provides references that support learning materials
Self-contained: all material is presented as a whole from chapter to sub-chapter, in other words, the material is packaged into a complete unit	The division or separation of material in the Flipbook-based E-Module is presented clearly
Stand-alone: the module does not depend on other learning resource, the availability of	Flipbook-based E-Module integrated external features, namely Google Form and YouTube.

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Module Characteristic	Applied to Flipbook-based E-Module
external features is all presented in the module	Users do not need to leave the E-Module to use these external features, there are already links to them and no need to switch devices
Adaptive: the module has adaptive power, not rigid to a development	Flipbook-based E-Module is developed in accordance with current technological developments and can be accessed on smartphones and laptops, where these two devices are the most frequently used by students
User friendly: considers the interests of its users	Flipbook-based E-Module provides an attractive appearance with a page-turning effect, can be modified with various audio-visual features, does not need to be downloaded so it does not reduce device storage space, and provides a different learning experience from the printed version of the module

This E-Module innovation is expected to be a comprehensive learning resource for users, and can improve concept understanding and learning independence (Imansari & Sunaryantiningsih, 2017). Independent learning is not individualized learning, but rather a learning process that requires the independence of a student to learn. Independent learning is explained as individual learning activities with their freedom without depending on others as an effort to increase knowledge, skills, and utilize various learning resources needed (Mulyaningsih, 2014). Through self-learning, the benefits obtained by individuals are the ability to overcome problems that are formed with the competencies and knowledge they already have (Sidiq et al., 2021).

Conclusion

Based on the information and data obtained in this study, it can be concluded that flipbook-based E-Module integrated with external features is very valid in the aspects of content, presentation, language and writing, graphics, and teaching materials for digital learning. Furthermore, the developed teaching materials are very practical in the aspects of material, technical use, and general. Thus, flipbook-based E-Module integrated with external features is feasible and practical to use to facilitate students' independent learning.

Recommendation

The development of flipbook-based E-Module integrated with external features does not stop here, there is still a lot of potential to develop and create this teaching material from various aspects. Therefore, researchers provide recommendations regarding the continuation of this research for:

1) *Lecturers*

Online learning methods that are currently still being applied, even becoming a new trend in post-pandemic learning, allows for the need of innovative online teaching materials along with technological advances. Therefore, lecturers can develop similar teaching materials in different courses according to student needs, curriculum, and learning outcomes.

2) Students

Almost all student activities today are inseparable from smartphones, including learning. Flipbook-based E-Module integrated with external features is teaching materials that are easily accessible, flexible, and comprehensive for students. It did not take up storage space

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because it was online-used. When exploring the digital world, learning opportunities are available without the need to move.

3) Future Researchers

Flipbook-based E-Module can be further developed by integrating other external features, adding games, and even sounds (voice-over). On the other hand, this flipbook-based E-Module can be further modified so that it can be accessed both online and offline.

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