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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 is a Research and Development (R&D) study using the ADDIE model. 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 is measured using the results of a questionnaire filled out by students as respondents. The data collected were then analyzed quantitatively and qualitatively. Flipbook-based E-Module are categorized as very valid with a percentage of 91.09% and very practical with a score of 91.09%. Flipbook-based E-Modules facilitate 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 has 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 are able to adapt to the academic environment that is starting to be digitized (Munandar et al., 2022). The global pandemic that occurred in early 2020 has further strengthened the role of technology in the implementation of education, both nationally and internationally. Technology has become the crucial tools 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 that allows 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 change from offline to online learning has an impact on current learning methods (post global pandemic) (Salim, 2023). Educational institutions continue to implement online learning (synchronous and asynchronous) collaborated with offline learning, which is called hybrid learning. Synchronous learning is a situation where teachers and students interact in real time in the educational process through virtual face-to-face.

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Some communication platforms such as Zoom and Google Meet are used as synchronous learning media. Asynchronous learning is the opposite of synchronous learning, where there is no direct interaction between teachers and students through communication platforms (Fadilah et al., 2021). Students learn materials, do and submit assignments through online learning platforms such as LMS (Learning Management System), websites, emails, and apps. Asynchronous learning facilitates students to learn without being limited by time, classroom, and place (Zuhriyah & Fajarina, 2022). Students are given more time to work on tasks and submit their answers. Therefore, asynchronous learning encourages student independence and student-centered learning (Utomo & Sulistyowati, 2022). One of the universities that has continue online learning (synchronous and asynchronous) after the global pandemic is 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 power point. 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 so as 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 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,

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equipped with text, audio, images and video, and easy to use and access on various devices, for example those with Android and MacOs operating systems (Arifitama, 2018; Handayani et al., 2021).

Based on the problems described above, research will be conducted, namely the development of flipbook-based E-Module integrated with external features. The development of this course E-Module aims to facilitate students in learning and doing assignments independently. Thus, student access to teaching materials is not limited to classrooms and time. Access to teaching materials can be through devices that are used and carried daily by students. E-Module that are integrated with several external features helps students achieve predetermined learning objectives and adds to the attractiveness of the teaching material (Munir et al., 2022). The appearance of this flipbook-based E-Module is designed like a book sheet that can be flipped through each page and integrated with external features, for example YouTube and Google Form for assignments.

Research Method

This research method is 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 refer to the ADDIE model which consist 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). Scheme of the ADDIE model is shown in Figure 1.

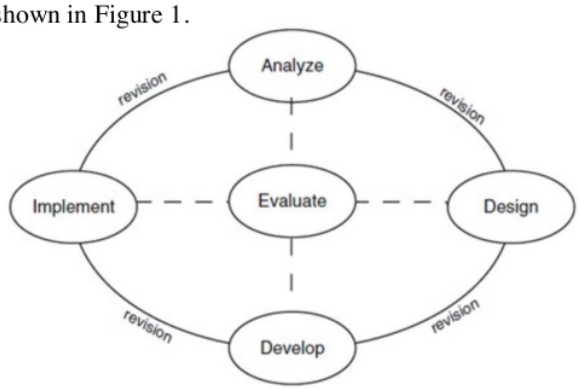


Figure 1. Scheme of the ADDIE model (Branch, 2009)

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

Stage	Activity
	curriculum of the Science Education Study Program.
Design	Designing the product and its main components.
Develop	Producing product by compiling materials, picture, assignment, adding external features, and integrating flipbook application. 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 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 respondents of this research were thirty students of the 3rd Semester Science Education Study Program, University of Jember. 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 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

Result 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.

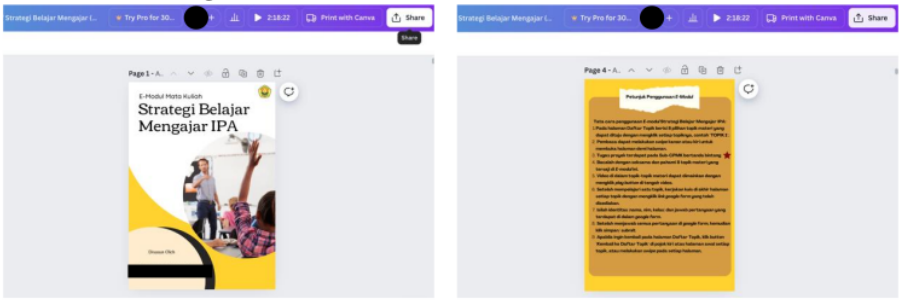
1) Problem identification is done through surveys and interviews with lecturers and students of the 3rd Semester Science Education Study Program, University of Jember, and observations during online learning. The results obtained that the teaching materials in online learning used has not fully accommodated, so that innovations are needed that

accommodate the availability of materials, media, also do, and collect assignments which are packaged in one easily accessible teaching material.

2) *Select task function* is the process of identifying the form of teaching material development needed by students based on their character and survey results. Results shows that the device which is always carried and used by students of the 3rd Semester Science Education Study Program is smartphones with intensive internet use. This is in line with research by Teo et al (2018) that the role of technology in students' learning experience is very important, in fact they use different types of strategies both internal and external to explore learning. Smartphones that facilitate access to internet and social networks are increasingly being used, resulting in increased interaction with these devices. In addition, smartphones also provide access to information sources and are used intensively by the younger generation defined as Generation Z (Kurmanova et al., 2022). Students of the 3rd Semester Science Education Study Program are in the age range of 18-19 years old, born in 2004-2005 and can be classified as Generation Z. Pew Research Center (2018), informed that Generation Z are 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 is carried out. Designing materials and determining CPL and CPMK based on the curriculum of the Science Education Study Program. The design of teaching materials is done by making an overview and design of E-Module to be developed. Some of the activities carried out at this stage are 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)

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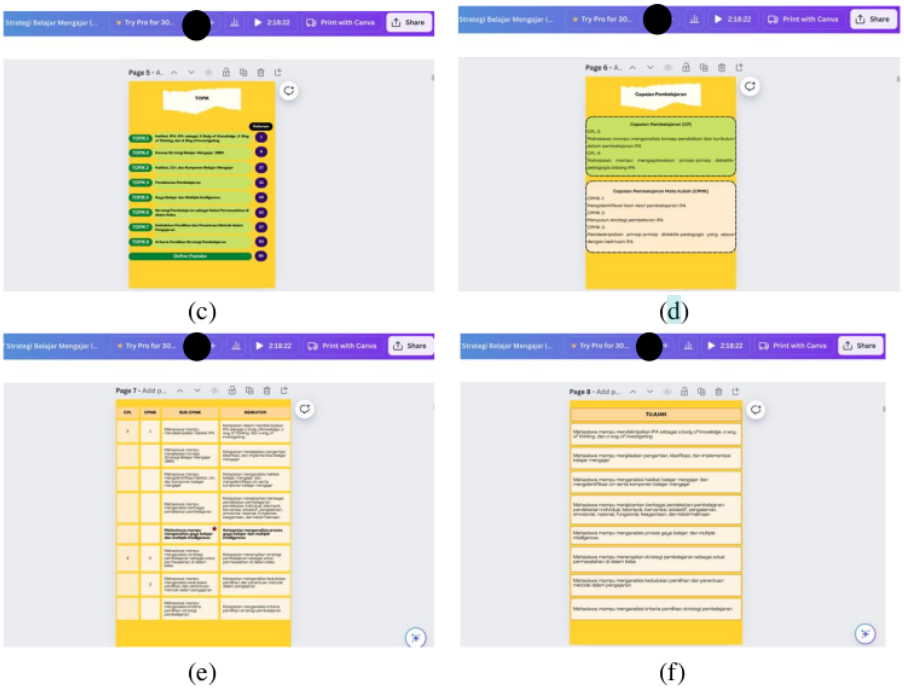


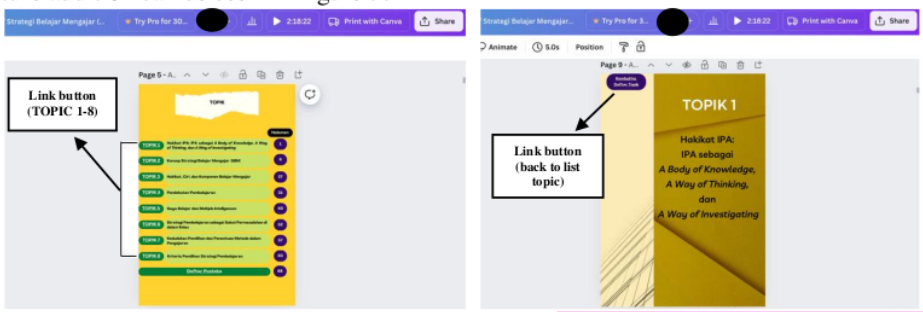
(c) (d)

(e) (f)

Figure 2. 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 are included in the E-Module. In the list of materials/ topics, there is a button that can be clicked and go to the intended material, and vice versa when you want to return to the topic list, then students click the button provided on the material title page. Exercise questions are equipped with the Google Form feature, so that the assignments collected by students will be clearly 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 heading to the full video player, that is YouTube. The display of this external feature addition can be seen in Figure 3.



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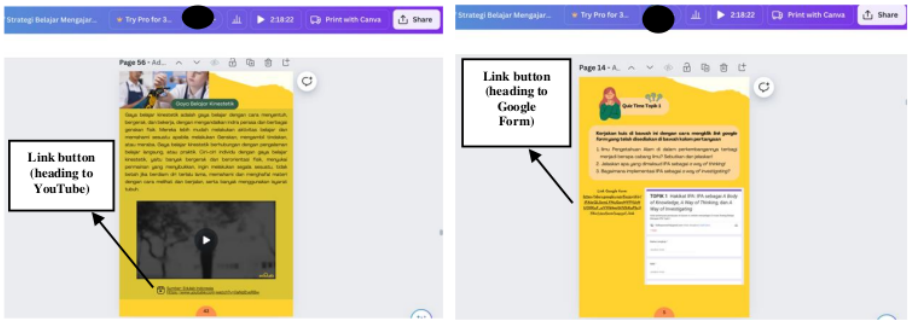

Figure 3. Adding features to E-Module

After the E-Module is finished, the next step is 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 4. Flipbook feature implemented on E-Module

The flipbook-based E-Module was then validated by three experts. The aspects of 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.[illegible]%**	**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 presentation aspect is 91.25%. Based on experts assessment, flipbook-based E-Module has a coherent concept, there is instructions for use at the beginning, exercise questions at the end of each chapter, and the availability of bibliography.

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 show that 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 thirty 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
	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**

Questionnaire 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, be it 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 student 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 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-Modules 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 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 sources, the availability of external features is all presented in the module	Flipbook-based E-Module integrated external features, namely Google Form and YouTube. 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

Flipbook-based E-Modules can be further developed by integrating other external features, adding games and sounds (voice-over), and applied to other courses. 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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