


PAPER

Designing Digital Modules in Project-Based Learning-Based Printing Graphic Design Subjects at SMK N 1 Koto Baru Dharmasraya

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ABSTRACT

Learning in the 21st century is directed towards activities that train students' skills, emphasizing the learning process. This can be achieved by optimizing the use of technology as an educational tool, one of which is using digital learning media in the form of modules, utilizing a project-based learning model. In the development of project-based learning digital modules, the multimedia development life cycle (MDLC) development model is employed. In the process of creating this digital module application, Unity software is used as the main software to manage content layout and animation. Adobe Illustrator is used for creating UI and required assets, while Visual Studio code is utilized for coding the application. Overall, the digital module in the subject of graphic design printing has successfully passed the validity test with very positive results. Based on the practicality analysis of the digital module in the graphic design printing subject, it can be concluded that the module is highly practical for both teachers and students.

KEYWORDS

digital modules, 21st-century learning, project-based learning, multimedia development life cycle (MDLC)

1 INTRODUCTION

Education in the 21st century is undergoing a significant transformation in line with the rapid development of digital technology, information, and media [1], [2]. This transformation affects the paradigm of learning, with a primary focus on developing students' skills through a more interactive and contextual learning process [3]. There is a shift from traditional teacher-centric learning models to an approach that places students at the center of learning activities [4]. In this context, the interaction or feedback between teachers and students is considered a key element in achieving more effective learning objectives.

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In facing these challenges, the use of technology becomes a crucial strategy in the world of education [5]. One tangible form of optimizing the use of technology is through the use of learning media. Learning media serves not only as an additional tool but also as a means to support innovative teaching methods that are responsive to the needs of students [6].

Thus, optimizing the use of technology through learning media is not just an effort to keep up with the times but also a strategic step to improve the quality of education and prepare the younger generation for increasingly complex and dynamic future demands. In this context, learning media becomes an effective means to create a stimulating learning environment, support collaboration, and stimulate the creativity of students [7–9].

Graphic printing design learning is an educational process that emphasizes the development of students' skills in designing and producing graphic materials related to printing [10]. The learning material includes principles of graphic design, the application of the latest technology, and practical skills in using software and printing equipment. The goal is to train students to create aesthetically pleasing and communicative graphic design works in line with the demands of the creative industry and job market, which emphasize effective visualization and communication [10].

Based on observations and interviews conducted with the teacher of graphic design XI multimedia printing at SMK N 1 Koto Baru Dharmasraya, the commonly used teaching methods are lectures, discussions, and question-and-answer sessions. This learning model tends to center learning on the teacher, which can result in students' inactivity and their inability to complete tasks independently. Another challenge faced by the teacher is the lack of learning media that can encourage students to complete tasks independently with challenges, positively impacting the development of students' skills.

Additionally, interviews with the teacher of graphic design XI multimedia printing at SMK N 1 Koto Baru Dharmasraya also highlight the limitations of the currently used learning model. Traditional learning models tend to inadequately accommodate the rapid developments in the world of technology and information. Therefore, a change in the learning model is urgently needed to adapt to the demands of the times. Aligning the learning model with the needs of students in facing current global challenges will positively contribute to achieving educational goals.

This situation indicates the need for innovation in teaching methods, especially in the subject of graphic printing design. Project-based learning models offer a more dynamic and inclusive approach, where students are not just passive listeners but also active participants in the teaching and learning process [11], [12]. By implementing this model, it is hoped that students can develop graphic design skills more comprehensively while fostering creativity, innovation, and the ability to work independently. Therefore, this = aims not only to identify existing problems but also to provide constructive solutions in an effort to improve the quality of graphic printing design learning at SMK N 1 Koto Baru Dharmasraya.

2 THEORY BASIS

2.1 Learning module

The module is a bridge whose job it is to channel information to parties who serve as recipients, for example, a television module, a computer module, or another model [13]. Learning is a communication activity that aims to convey messages from

the message center using channels or modules, and receiving these messages is a communication component [14].

2.2 Digital module

Digital modules are modifications of conventional modules by integrating the use of information technology, so that existing digital modules can be more attractive and interactive [15]. Digital modules allow students to manage their study time effectively [16]. Digital modules can be designed in such a way as to be attractive, and this is a difference from printed modules, which are usually colorless, so the images are not clear [17].

2.3 Graphic design

Graphic design is a form of visual communication that uses images and animations to convey information or messages as effectively as possible [18]. In graphic design, text is also considered audio because it is the result of the abstraction of symbols that can be sounded. Like other types of design, graphic design can refer to the manufacturing process, design methods, products produced (design), or even the disciplines used (design).

2.4 Project-based learning

Project-based learning is a learning model that provides opportunities for educators to manage learning in the classroom by involving project work [19]. Project work contains complex tasks based on problems as the first step in gathering and integrating new knowledge based on their experience in real activities and guides students to carry out activities of designing, solving problems, making decisions, carrying out investigative activities, and providing opportunities for students to work independently or in groups. The end result of the project's work is a product. The steps of the Project Based Learning model include: (1) fundamental questions, namely providing learning stimuli in the form of questions to students so that students raise curiosity to carry out investigations; (2) designing project planning, namely providing opportunities for students to identify problems and formulate them in the form of hypotheses and project work plans; (3) compiling a schedule, namely determining the project work time; (4) monitoring students, namely monitoring actions to reduce the risk of project errors; (5) testing the results, namely proving whether the hypothesis is correct or not; (6) draw conclusions (generalization), namely the process of drawing conclusions from what has been done [20].

2.5 Vektor processing application

Vector processing applications are applications that are used to create images in vector or line form, so they are often referred to as illustrator programs [21]. One of the applications that includes vector processing is Adobe Illustrator. Adobe Illustrator is a vector-based design software that is often referred to as illustration design.

2.6 Modul processing application

A modular processing application is an application that is designed and built by combining elements such as documents, sound, images, animation, and video. One of the applications included in the model processor is Unity. Unity is an application used to develop multi-platform games that are designed to be easy to use.

3 METHOD

The development model used in this study is the one developed by dick and carry. The method used in the development of this digital module is the multimedia development life cycle (MDLC), namely concept, design, material collecting, assembly, testing, and distribution [22]. The stages of the MDLC method are shown in Figure 1.

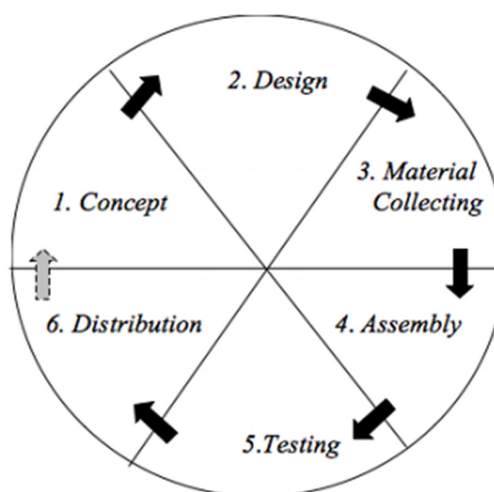


Fig. 1. MDLC method stages

3.1 Concept

This stage is for determining the purpose and who the users of the program are (audience identification). The purpose and end use of the program affect the feel of multimedia as a reflection of the identity of the organization that wants information to reach the end user. At this stage, the researcher conceptualizes, among other things:

- Determine the purpose and benefits of this digital module application.
- Determine the purpose of using this digital module application.
- Describes the concept of this digital module application running and operating on an Android device.

3.2 Design

At this stage, an application specification is made in an application design. Where the manufacture is adjusted based on the appearance of the user interface

application and program flow. The following are the design stages contained in the manufacture of digital printing graphic design modules that are made:

Use case diagram. Use case diagrams describe the expected functionality of an application. What is emphasized is “what” the application does, not “how.” A use case represents an interaction between the user and the application. Below is the flow of how the application process of this digital module runs when it is used by the user.

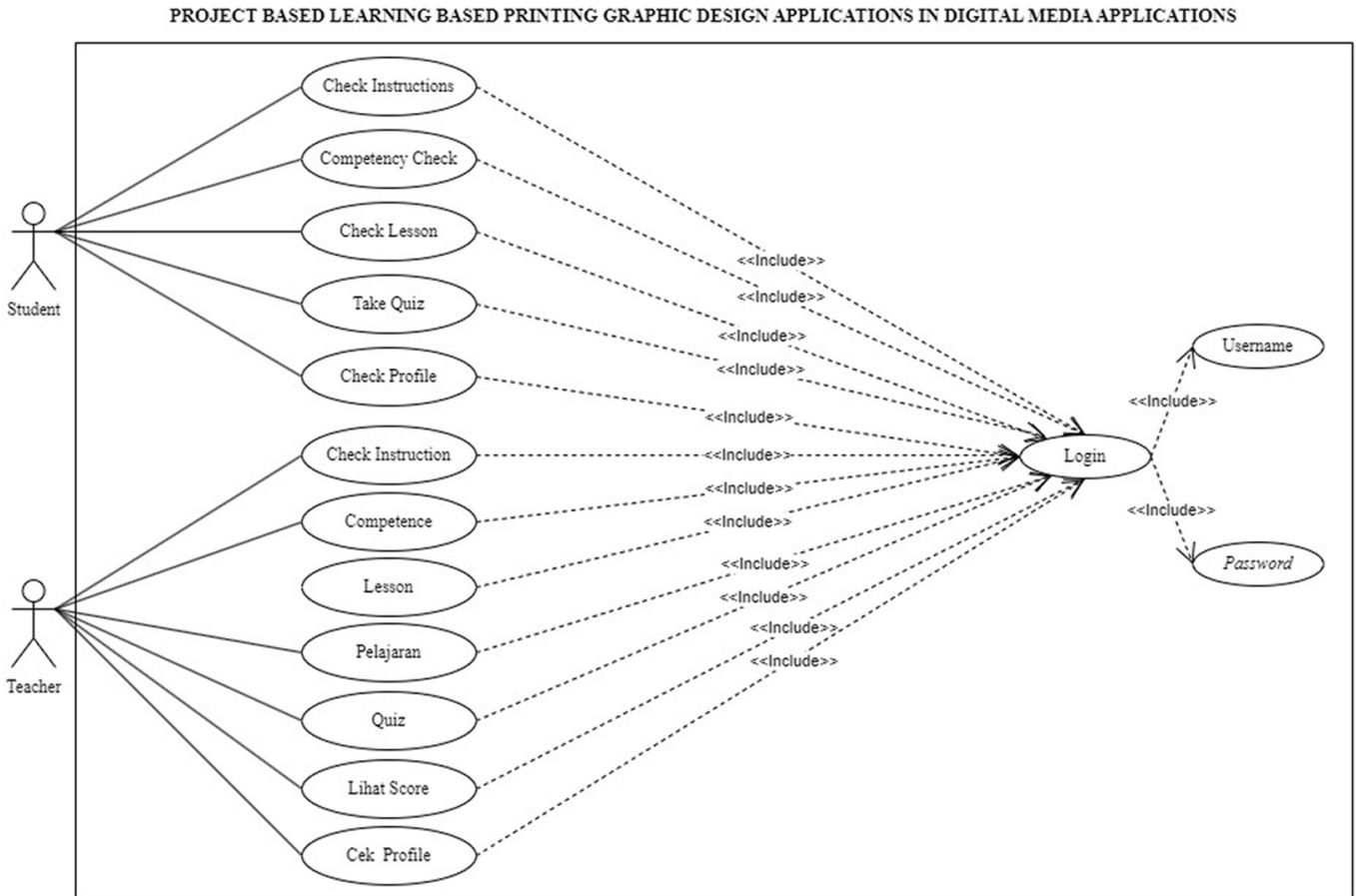
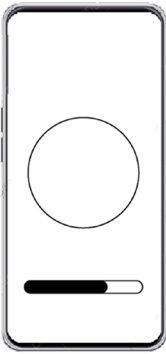


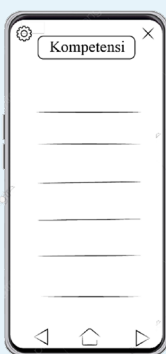


Fig. 2. Use case diagram

Based on the use case diagram above, there are two users who can access the built digital module application, namely teachers and students, where each user has different access rights. In this application, the teacher can log in first, then see instructions for using the application. Besides that, the teacher can also see quiz scores that have been done by students, and the teacher can also access the profile menu to learn about the application. While student users in this application can see the application usage instructions menu, see competencies; see lessons in the form of material and job sheets, and work on quiz questions, they can also see the profile menu to learn about the application.

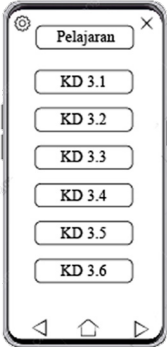
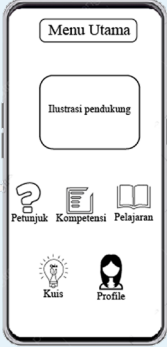

Interfaces design. Interface design is the most important part of designing an application. This is the difficult part because designing an interface must meet three requirements: an interface must be simple, an interface must be complete, and an interface must have fast performance. The goal of interface design is to design an effective interface for the application. The interface design of the digital module application for the printed graphic design subject can be seen in Table 1.

Table 1. Interface design of the digital module

No.	Interface Design	Information
1		Loading bar page interface design
2		Login page interface design
3		Design of the module usage guide page
4		Design of the learning competency page

(Continued)

Table 1. Interface design of the digital module (*Continued*)

No.	Interface Design	Information
5		Design of the learning topic page
7		Interface design for the student main menu page
8		Interface design for the teacher main menu page

3.3 Material collecting

At this stage, material related to teaching and learning materials was obtained from interviews with subject teachers concerned with print graphic design subjects, reading books, and searching for other sources on the Internet.

3.4 Assembly

The assembly stage is the stage where all multimedia objects or materials are made. Application development is based on the design stage. In making digital printing graphic design modules, you need some software like the following:

- Adobe Illustrator 2021_v25.4.1.498x64_Multilingual and other vector processing applications are used to create UI designs for applications to be created.

- Unity 2021.3.6f1 to arrange the layout of the contents of the application to be created.
- Visual studio code is used to code the application.

3.5 Testing

The testing phase is carried out after the assembly stage is finished by running the application to see whether there are errors or not in the application. This stage is also known as the alpha testing stage (alpha test), where the test is carried out by the manufacturer or the manufacturer's environment.

4 RESULTS AND DISCUSSION

The results of the development of digital modules in the subject of graphic printing design can be seen as follows:

4.1 Digital module interface in printing graphic design subject

Loading bar page. The loading bar page is similar to a splash screen. This page is created by the developer to introduce a slight transition from the login page before entering the main menu (home) page. The loading bar page can be seen in Figure 3.



Fig. 3. Loading bar page interface design

On this loading bar page, teacher and student users only need to wait a few seconds before entering the main menu page (home).

Login page. The login page serves as a user verification page before granting access rights to the application based on each user's respective privileges. The implementation of the login page for teacher and student users can be observed in Figure 4.



Fig. 4. Login page interface design

On the login page, teacher and student users must enter a username and password so they can enter the application according to their respective access rights. During the login process, if the username and password are correct, it will immediately go to the loading bar display.

User guide page. The user guide page will be displayed after the user enters the main menu and selects the instruction menu. Users can swipe horizontally to view the next set of usage instructions.

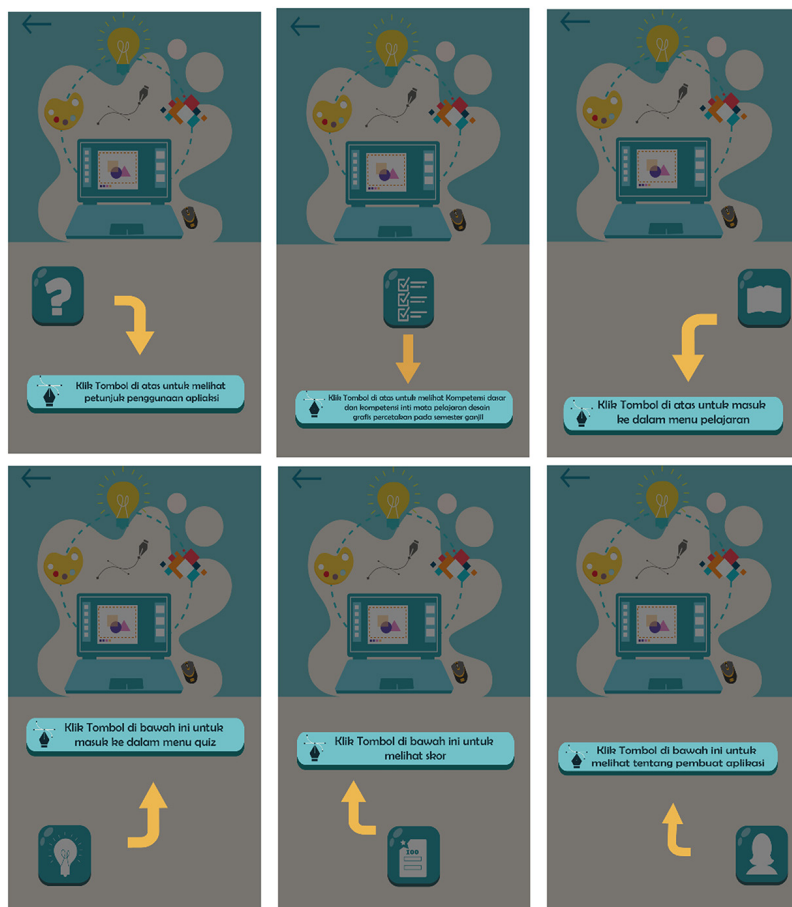


Fig. 5. User guide page

The user guide page contains instructions on how to use the buttons within the digital module application. These usage instructions are intended to assist teacher users in navigating the application effortlessly.

Learning competency page. The student competency page is what students will see when they access the main menu page and select the competency menu.

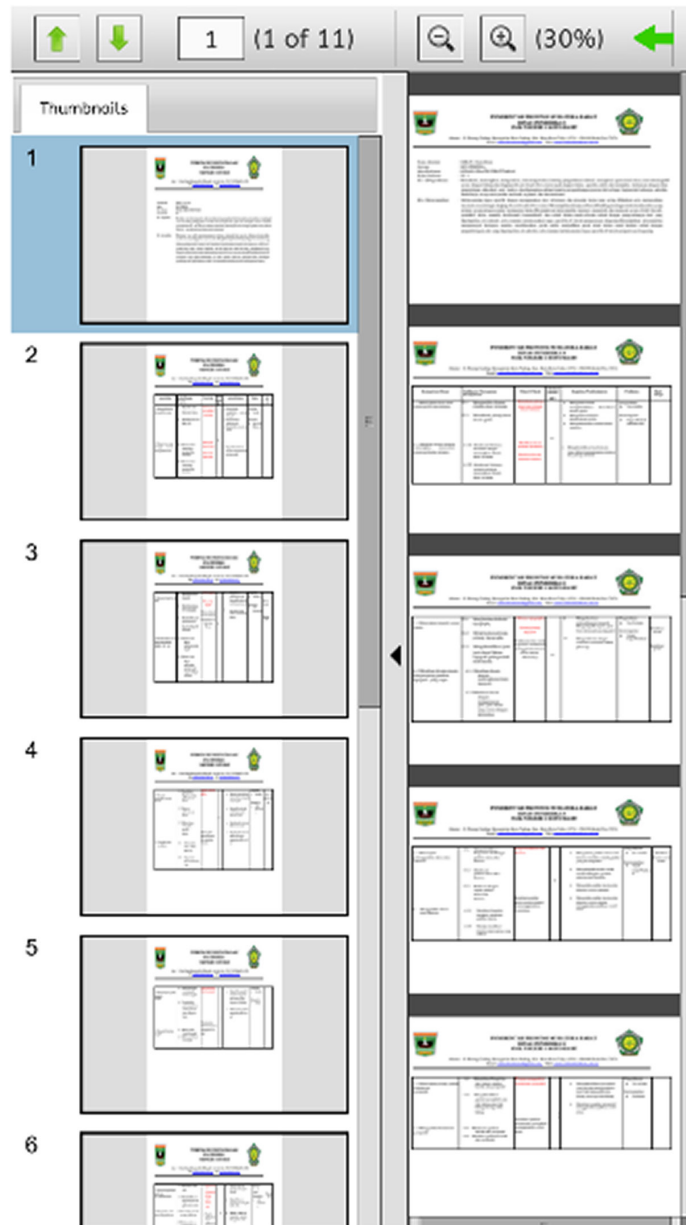


Fig. 6. Learning competency page

This page contains the core competencies and basic competencies of graphic design printing learning for one semester that will be studied by students.

Learning topic page. The lesson page will be displayed after the student user enters the main menu and selects the lesson menu. The student's lesson page will display two submenu options: material and jobsheet.



Fig. 7. Learning topic page

The lesson page for student users displays two sub-menus for each competency (KD). When a student chooses the material sub-menu, they will be directed to the material page corresponding to that competency. Similarly, the jobsheet sub-menu contains practical steps and tasks that students need to perform according to the learning competency.

Quiz page. The quiz page will be displayed after the student user enters the main menu and selects the quiz menu. The quiz page functions to answer quiz questions based on the topics per competency that have been studied.

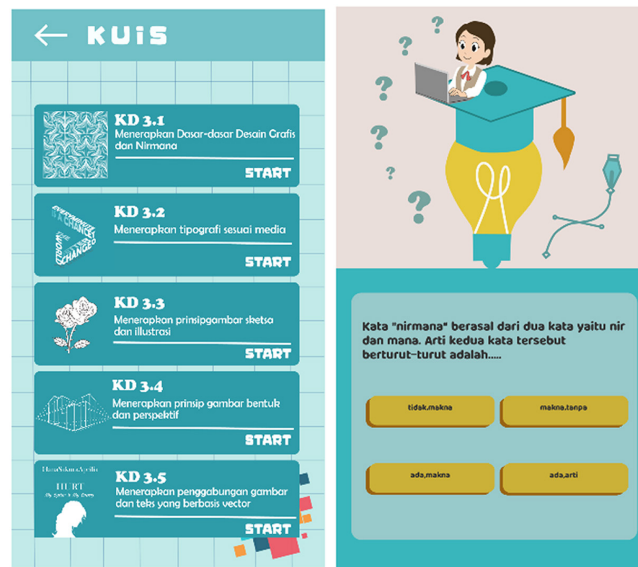


Fig. 8. Quiz page

The quiz page for student users is used to assess their proficiency after studying the previous material and job sheet. Students can access quiz questions by pressing the start button on this quiz page. The quiz question page contains multiple-choice questions that students must answer to obtain quiz scores. Quiz questions will be displayed after the student presses the start button on the quiz page. Below

is a display of the quiz question page for students. Students can answer questions by pressing one of the correct answer options. Quiz questions will automatically switch to the next question after the student chooses an answer. On this page, students are not given a button to exit; they can return to the quiz page after completing all quiz questions for that competency.

Student main menu page interface design. The main menu page for student users is the initial display page for student users in the application after they have logged in, as seen in Figure 9.



Fig. 9. Student main menu

The main menu page for student users will display menu options consisting of menu instructions, competencies, materials, quizzes, and profiles according to the access rights held by student users.

Teacher main menu page interface design. The main menu page for teacher users is the initial display page for teacher users in the application after logging in, as seen in Figure 10.



Fig. 10. Teacher main menu

The main menu page for teacher users will display menu options, including guidance, competencies, materials, quizzes, scores, and profiles, according to the access rights held by the teacher user.

Test results. The testing phase involves black box testing, which focuses on the functionality of the application being developed. During the testing phase, all menus have been functioning well, and each menu effectively demonstrates the performance of this application. The test results are displayed in Table 2.

Table 2. Testing results

No.	Page	Result	Explanation
1	Loading Bar	The application displays a loading bar page.	OK
2	User Login	The application shows the user login page, and the user successfully completes the login process.	OK
3	Module Usage Instructions	The application presents the learning module usage instructions page.	OK
4	Learning Competencies	The application showcases the learning competencies page.	OK
5	Learning Topics	The application exhibits the learning topics page.	OK
6	Quiz	The application features the quiz page, and the student successfully completes the quiz.	OK
7	Student Main Menu	The application reveals the main student interface.	OK
8	Teacher Main Menu	The application demonstrates the main teacher interface.	OK
9	Quiz Scores	The application exhibits the quiz assessment page.	OK

From the testing results of the module in the table, it can be concluded that all main features of the application, such as the loading bar, user login, learning module usage instructions, learning competencies, learning topics, quizzes, student main menu, teacher main menu, and quiz scores, have functioned well. All pages and functionalities of the module have shown performance in line with expectations, with an “OK” status for each testing element. The success of the module in loading these pages provides confidence that the module is reliable and ready for use in the context of learning graphic design printing. The testing results imply that this application can provide a good user experience and fulfill the desired learning objectives.

Validity of digital module in graphic design printing subjects. Validity is a measure to indicate how well the quality of a module [23], [24]. The validity of a module is assessed through expert validation of the product. The indicators in the module validation instrument consist of five aspects: content, language, module workflow, module display, and module engineering. Validation score data are obtained from the scores on the module validation sheet filled out by 10 validators using a checklist (√) on the available rating scale. The rating range is from 1 to 4, with descriptions of 1 (less valid), 2 (sufficiently valid), 3 (valid), and 4 (very valid).

Here are the results of the validity for each aspect, as indicated by the diagram in Figure 11.

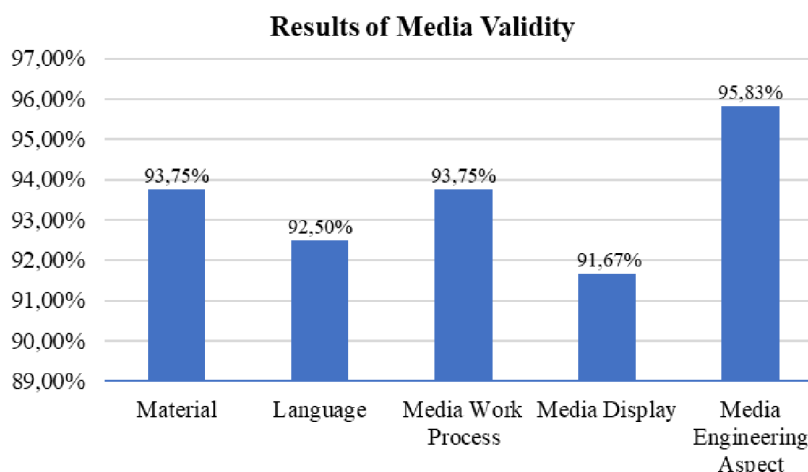


Fig. 11. Validity of digital module in graphic design printing subjects

Based on the overall aspects that have been validated, it can be seen that each aspect meets the criteria of being highly valid. This indicates that the developed module is valid for use as a graphic printing design learning module. The module has been tested in every aspect. The content is systematically elaborated and relevant to daily life. Additionally, the material is supplemented with images and videos that support explanations, making it easier to understand. This is evidenced by the average percentage of validation results for the content aspect, which is 93.75% with a highly valid criterion, indicating that the content in this module can be used to assess the competencies to be achieved.

Another aspect is language, and the module uses clear, concise, and easily understandable language suitable for vocational high school students. This is supported by the average percentage of validation results for the language aspect, which is 92.50%, with a highly valid criterion. A good module is not only assessed based on content and language but also evaluated based on the module's working process and appearance, which significantly support its operation. The module's working process is measurable in terms of speed and ease of operation, and the developed module has the capacity to open videos effectively. In terms of appearance, the module is evaluated based on design, color, the appropriateness of backgrounds for each discussion, and images that align with the content. The module's appearance is expected to support and enhance students' motivation to learn. After validation of the module related to these two aspects, the average percentage of validation results for both the working process and appearance aspects meets the highly valid criteria, which are 93.75% and 91.67%, respectively.

Concerning the module engineering aspect, the developed module represents an innovative form of learning module creation because it does not use complicated software in the production process and has the potential for further development with different materials. This aligns with Adib's (2017) statement that the chosen software is easy to use, allowing teachers to create modules for different topics without having to learn coding [25]. This is evidenced by the average percentage of validation results for the module engineering aspect, which is 95.83%, meeting the highly valid criteria. Based on the description above, all the presented aspects meet the highly valid criteria.

Practicality of digital modules in the printing graphic design subject. The practicality refers to its practical nature, indicating the ease of use of the product when applied [26]. The practicality of the module is assessed based on the evaluation of the practicality of the product by students and teachers who have used the developed module in the learning process. The indicators in the practicality

instrument consist of three aspects: ease of use, time efficiency, and module benefits. Practicality score data is obtained from scores on the module practicality sheet filled out by 100 students and 5 teachers, using a checklist (√) on the available rating scale. The scoring range is between 1 and 4, with descriptions: 1 (less practical), 2 (fairly practical), 3 (practical), and 4 (very practical).

The practicality test results for each aspect are shown in Table 3.

Table 3. Practicality of digital modules in the printing graphic design subject

No.	Name	Aspect			Average
		Ease of Modul Use	Time Efficiency	The Benefits of Modul	
1	Teacher	94.00%	86.72%	94.27%	91.66%
2	Students	89.30%	87.99%	88.54%	88.61%

Based on the analysis of the practicality scores by teachers and students regarding the digital module in the printing graphic design subject, it can be concluded that the digital module in the printing graphic design subject is practical for use. The data analysis tested in the practicality stage consists of three aspects: ease of use, learning time efficiency, and benefits. In the aspect of ease of use, the average practicality score is 94.00, categorized as very valid by teachers, and 89.30, categorized as very practical by students. This indicates that the digital module in the printing graphic design subject is very easy to use for both teachers and students. The digital module in the printing graphic design subject is considered highly practical because the presented material is accurate, the language used is easy to understand, and the font type used is easy to read.

Moving on to the aspect of learning time efficiency, the average practicality score by teachers is 86.72, categorized as very practical. This suggests that the use of digital modules in the learning process of the printing graphic design subject can streamline the learning time. Thus, the digital module in the printing graphic design subject can help students to understand the learning material more easily and quickly.

The use of books can help students learn according to their individual abilities [27]. Based on the benefit aspect, the average practicality score is 94.27 by teachers, categorized as very practical, and 88.54 by students, categorized as very practical. This indicates that the digital module in the printing graphic design subject can assist teachers in the teaching process and help students understand the learning material. The digital module in the printing graphic design subject can support the role of the teacher as a facilitator, aid in delivering learning material to students, and enhance the teacher's creativity in varying teaching modules.

Overall, the average practicality score by teachers is 91.66, categorized as very practical, and 88.60 by students, categorized as very practical. This shows that the use of digital modules in the printing graphic design subject can facilitate the learning process.

5 CONCLUSION

Based on the presented study findings, it can be concluded that the digital module in the printing graphic design subject is categorized as valid and practical. Therefore, the digital module for the printing graphic design subject is deemed suitable for use by both teachers and students. The use of digital modules in the printing graphic design subject can assist teachers and facilitate students in understanding the learning material in printing graphic design.

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