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Development of a Desktop Application Based on Interactive Learning Multimedia for Introduction to Computer Hardware for Students of the Madrasah Ibtidaiyah Teacher Education Study Program

Pengembangan Aplikasi Desktop Berbasis Multimedia Pembelajaran Interaktif Untuk Pengenalan Hardware Komputer Untuk Mahasiswa Calon Guru Sekolah Dasar

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Abstract
This research is intended to create and develop interactive multimedia-based desktop application products that are effective and have advantages for use in learning to introduce computer hardware in PGMI study programs, and evaluate the benefits of these products in improving PGMI student learning outcomes. The development process of this research adopted the Alessi & Trollip development model with the following procedures, namely stage planning, stage design, and stage development. Product trials include an alpha test carried out by media experts and material experts, as well as a beta test involving 21 PGMI study program students. Data collection was carried out through interviews, observations and questionnaires which were given to media experts, material experts and students as users. The results of the research show that interactive multimedia learning has been packaged in Disc format, and this multimedia product is considered very feasible by material experts, media experts, and trial participants.
Keywords: Interactive Learning Media, Learning Multimedia, Computer Applications

Abstrak
Penelitian ini dimaksudkan untuk membuat dan mengembangkan produk aplikasi dekstop berbasis multimedia pembelajaran interaktif yang efektif dan memiliki keunggulan untuk digunakan dalam pembelajaran pengenalan hardware komputer di program studi PGMI, dan mengevaluasi manfaat produk tersebut dalam meningkatkan hasil belajar mahasiswa PGMI. Proses pengembangan penelitian ini mengadopsi model pengembangan Alessi & Trollip dengan beberapa prosedur sebagai berikut, yaitu tahap perencanaan, tahap desain, dan tahap pengembangan. Uji coba produk mencakup uji alpha yang dilakukan oleh ahli media dan ahli materi, serta uji beta yang melibatkan 21 Mahasiswa Prodi PGMI. Pengumpulan data dilakukan melalui wawancara, observasi, serta angket yang diberikan kepada ahli media, ahli materi, dan mahasiswa sebagai pengguna. Hasil penelitian menunjukkan bahwa telah dihasilkan multimedia pembelajaran interaktif yang dikemas dalam format Disc, dan produk multimedia ini dinilai sangat layak oleh ahli materi, ahli media, dan peserta uji coba.
***Kata Kunci**: Media Pembelajaran Interaktif, Multimedia Pembelajaran, Aplikasi Komputer*

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INTRODUCTION

Nowadays, there are many things that can be used to support the learning process in the lecture process, one of which is by utilizing a learning media application. Multimedia learning is a means and infrastructure that can help students to understand and understand the content of the material delivered by lecturers, especially if the material is related to technical matters such as in computer application courses (Surjono, 2013) where in the course there are some material that is difficult to understand when only explained verbally, such as on computer device components, it is because to explain these components the lecturer will need a medium that can visualize these components. (Arriany et al., 2020).

Institut Agama Islam Negeri Manado is a formal institution that has several courses related to information and communication technology such as computer application courses, computer science, computers, computer information systems and computer data processing which are included in the structure of study program courses. Computer application is a course that must be taught in several study programs such as Islamic Education Study Program and Madrasah Ibtidaiyah Teacher Education Study Program. This course is designed to equip students with an awareness of the world of information and communication technology (ICT) and enable them to utilize ICT effectively and appropriately. During classroom observations, the researcher identified several challenges in teaching the computer applications course, primarily due to the lack of specific instructional media to assist students in understanding computer systems, particularly the hardware components. This issue became evident through interviews conducted with students in class regarding their knowledge of computer components. In response to these challenges, this study aims to conduct research and development of interactive multimedia learning tools for the computer applications course, specifically for students in the Madrasah Ibtidaiyah Teacher Education program. This initiative addresses the problems encountered in the field and offers a proposed solution. The developed learning media will serve as a supporting tool for students to better understand the computer applications course. Ultimately, the multimedia-based desktop application will function as an educational aid to enhance the learning process in this subject.

The use of interactive learning multimedia has become an important innovation in education, especially to facilitate the delivery of technical and complex material. As a form of technology integration in learning, learning multimedia combines visual, audio, text and animation elements to create a more interesting and effective learning experience. Nelawati (2021) revealed that the use of Adobe Flash-based multimedia succeeded in improving junior high school students' understanding of social studies learning by presenting material in a dynamic visual form. Meanwhile, the research by Yulia et al. (2023) on 'Calculator Box' learning media shows the effectiveness of using interactive tools in helping Madrasah Ibtidaiyah students understand addition and subtraction operations. These studies prove that interactive multimedia can be a significant tool in improving students' understanding of learning materials.

However, although the success of learning multimedia has been proven, the focus of research is generally still limited to primary and secondary level students. In fact, prospective educator students, such as those in the Madrasah Ibtidaiyah Teacher Education (PGMI) study program, have more complex needs. These students not only need to understand the material, but also prepare themselves to teach it in the future. In the context of introducing computer hardware, PGMI students need learning media that not only provides technical understanding but also trains their skills to deliver the material effectively to students at the elementary level. Unfortunately, learning media designed to fulfil this need are still very rare in the literature.

Furthermore, the technology used in previous research is often limited to software such as Adobe Flash or other simple applications. While effective for improving understanding of the material, these technologies have limitations in providing a more immersive and interactive learning experience. With the advancement of technology, tools such as Blender for 3D animation and Autoplay for integrating multimedia elements have opened up new opportunities in learning media development. The use of these technologies allows for a more realistic and engaging presentation of material, thus increasing student engagement in the learning process. Unfortunately, this innovation has not been widely utilised in previous research, especially in the context of prospective teacher education.

The novelty applied in this research is in the development of 3D animation using Blender to develop illustrations of computer hardware components and utilising the Autoplay application to combine them into a complete multimedia for it to be easy to use.

Multimedia design principles also play an important role in determining the success of a learning media (Yaumi, 2017). Clark & Mayer (2008) emphasise the importance of effective design, where multimedia elements, such as text, images, audio and video, should complement each other and be designed to facilitate understanding. This principle has been widely applied in the development of learning media for students, but its application in the context of prospective teacher education is still minimal. By using Mayer's principle, learning media can be designed to not only convey information but also facilitate interaction that encourages active learning. This research tries to fill the gap by utilising Mayer's principle to design interactive multimedia applications that suit the needs of PGMI students.

The focus of this research on PGMI students provides a new perspective in the development of learning multimedia. As future educators, these students need learning media that not only help them understand the material but also become a learning model that can be applied in the classroom. In the context of introducing computer hardware, learning media designed specifically for them can be a significant tool in preparing them to teach technology to their students in the future. Thus, this research not only offers practical solutions for computer hardware learning but also contributes to the development of literature on teacher education relevant to the digital era.

This research also attempts to answer the challenges of technology integration in education by utilising the latest technology, such as 3D animation and interactive simulation. The use of 3D animation allows for a more realistic presentation of computer hardware components, making it easier for students to understand their functions and characteristics (Rukmana et al, 2023). In addition, interactive simulations allow students to interact directly with the material, so they can learn more actively and independently (Palyanti, 2023). With this approach, the developed application is expected to not only improve students' understanding of the material, but also motivate them to integrate technology in their teaching in the future.

This study aims to develop an interactive multimedia-based desktop application specifically designed for PGMI students. The application is designed to utilise multimedia elements such as text, images, video, and animation, combined with effective multimedia design principles. With this approach, the application is expected to be a learning tool that is not only effective but also relevant to the needs of PGMI students as future educators. This approach makes a significant contribution in enriching the literature on

interactive learning multimedia, as well as answering the challenges in technology education in the digital era.

This research also aims to evaluate the effectiveness of the application in supporting the learning process and improving student learning outcomes. It is expected that this application can be an innovative alternative for learning computer hardware that does not only depend on conventional methods or lectures. By filling the gap of previous research, the developed application is expected to be able to answer the needs of PGMI students in understanding computer hardware introduction material in depth and interactively. More than that, this application contributes to forming future educators who are able to utilise technology to create a more interesting and effective learning experience for students at the basic education level.

RESEARCH METHOD

This research applied the Research and Development (R&D) model, which is research that focuses on research activities, design, production, and testing the validity of multimedia products to be produced (Sugiyono, 2014). The purpose of this research was to develop an interactive learning multimedia product by applying Mayer's principles, and in the development of the product, the Alessi & Trollip model was used (Alessi & Trollip, 2021). In general, this model consists of three main stages: planning, designing, and developing.

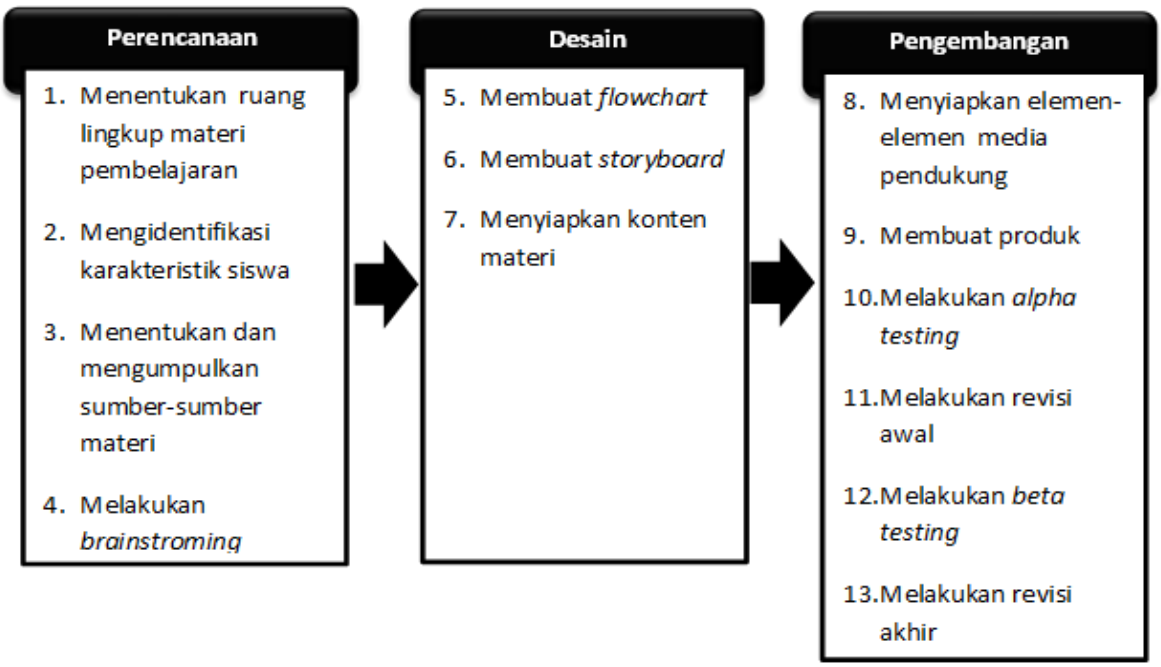

Figure 1. Multimedia Development Process of Alessi & Trollip Model

The sample in this study used 21 students from the PGMI study program at IAIN Manado's FTIK, to see the user response. The respondents selected were students who had taken basic computer or information technology courses in their curriculum, with the consideration that they had a basic understanding of technology. In addition, the selection of PGMI students as respondents was also based on their need to understand and master computer hardware concepts as part of basic digital literacy, which will help them develop technology-based teaching skills at the basic education level. Before the implementation stage of the multimedia application, an assessment was first carried out by media experts and material experts to assess whether the product was ready to be implemented or not.

Quantitative data obtained from media experts, material experts and student responses were analysed using the following score conversion table:

Table 1. Rating Sheet Score Conversion (Sugiyono, 2014)

Description	Score
Very Good	4
Good	3
Lacking	2
Very Lacking	1

After the data was collected, the average score was calculated using the following formula:

$$\underline{X} = \frac{\sum \quad X}{N}$$

Description:

$\underline{X}$: Actual average

$\sum \quad X$: Total score

N : Number of raters

Then convert the value of each aspect of the criteria into a qualitative value in accordance with the ideal assessment category criteria with the following provisions according to the ideal assessment category criteria table:

Table 2. Ideal Assessment Category Criteria (Mardapi, 2018)

Interval	Category
$\underline{\boldsymbol{X}}_{\boldsymbol{i}} + \mathbf{1}\boldsymbol{SB}_{\boldsymbol{i}} \leq \underline{\boldsymbol{X}}$	Very Good
$\underline{\boldsymbol{X}}_{\boldsymbol{i}} \leq \underline{\boldsymbol{X}} < \underline{\boldsymbol{X}}_{\boldsymbol{i}} + \mathbf{1}\boldsymbol{SB}_{\boldsymbol{i}}$	Good

$\underline{X}_i - 1SB_i \leq \underline{X} < \underline{X}_i$	Lacking
$\underline{X} < \underline{X}_i - 1SB_i$	Very Lacking

Description:

$\underline{X}$: Actual Average

$\underline{X}_i$: Ideal average, determined with this calculation:

$\underline{X}_i = \frac{1}{2}$ (ideal maximum score + ideal minimum score)

: Ideal standard deviation, determined with this calculation:

$SB_i = \frac{1}{6}$ (ideal maximum score - ideal minimum score)

Maximum ideal score = ∑ item criteria x highest score ideal minimum score = ∑ item criteria x lowest score

Next, determine the overall score by calculating the average score. Then converted into qualitative values according to the ideal assessment category criteria (Iskander, 2014). Learning multimedia applications are said to be feasible to use in learning if they meet the minimum criteria (Good).

FINDINGS AND DISCUSSION

This research produced a learning multimedia application product through several stages.

1. Planning
   a. Scope of the material: The material to be developed in interactive learning multimedia is computer application course material. This is based on identifying the needs that are the problems that exist in computer application material. The needs analysis was carried out from May to June 2021 and found that the scope of the material was the introduction of hardware or hardware on the computer. Therefore that the material raised in this interactive learning multimedia is focused on introducing computer hardware.
   b. Identification of student character: Identification obtained from the results of interviews and observations at IAIN Manado in June 2021, students still found it difficult to understand the types of computer hardware and the functions of each computer hardware. To overcome this, an interactive learning multimedia was created which can be used independently to learn about computer hardware.
   c. Source collection: At this stage of the activity carried out is to collect sources that support the process of developing interactive learning multimedia on computer hardware introduction material. The activities carried out are as follows the

collection of teaching materials that will later be included in multimedia applications and the selection of software such as autoplay, adobe illustrator, adobe photoshop and various other supporting applications that will be used in the development process later.

d. Brainstorming: At this stage, the activities carried out were discussions with lecturers teaching computer application courses, peers and media experts regarding: The interface of interactive learning multimedia and the types of images, videos, content that will be used later in the interactive learning multimedia development process.

2. Design

a. Flowchart: In the developed interactive learning multimedia application, the flowchart describes how the functions, workings and interrelationships between the parts in the interactive learning multimedia include: Media identity page which contains the name of the interactive learning multimedia and contains a button to enter the material menu. The competency objectives page contains the competency objectives to be achieved in learning. The main menu page which contains buttons to enter the material menus presented in the media. Instructions for use page which contains a brief description with pictures on how to use interactive multimedia.

b. Storyboard: The storyboard of the developed interactive learning multimedia contains the appearance and explanation of the pages in the interactive learning multimedia. The creation of the storyboard aims as a visual description of the multimedia developed.

c. Preparing material content: All material content in the interactive learning multimedia in the form of text, images, audio, and video is collected and arranged systematically and synergised to fill the content in the interactive learning multimedia. The content collected and presented in the product is developed from sources such as books, the internet, modules and homemade.

3. Development

a. Prepare the Media Elements Used: To create an interface or display design for interactive learning multimedia, the next step is to prepare the required multimedia elements. The multimedia elements are images, text, and video.

b. Initial Product Creation: At this stage, combining and assembling the interactive learning multimedia using the Autoplay Media Studio 8 application program, where

multimedia elements and material content are put together using the application program. The merging process is adjusted to the flowchart and storyboard. The parts in the interactive learning multimedia are as follows:

The display on this Initial page contains the name of the interactive learning multimedia developed and in its development combines several elements such as text and images.

Figure 2. Start Page Display

The next display is the display of the main menu page which contains the material menu, instructions for use menu, and about the developer menu.

Figure 3. Menu Selection Page

The material menu page contains materials about the introduction of computer hardware, starting from the processor, RAM, VGA, HDD, and so on.

Image 4. Display of the Material Menu Page

The material display contains an explanation of computer hardware which includes a video to clarify the material content provided.

Image 5. Material Page Display

c. Alpha Testing: This test involved two media experts and two material experts who validated the product. The assessment was carried out using a questionnaire with a scale of 4, where the results of the assessment from the media expert showed an average of 4.0 and 3.9.

Table 3. Media Expert Assessment Results

NO	ASSESSMENT ASPECTS	TOTAL ITEMS	SUM OF ASSESSMENTS	
			MEDIA EXPERT 1	MEDIA EXPERT 2
1	DESIGN	10	40	36
2	DISPLAY	9	36	36
3	PROGRAMMING	8	32	32
4	UTILISATION	5	20	20
SUM OF ALL ASPECTS			128	124
AVERAGE			4,0	3,9
CRITERIA			VERY DECENT	VERY DECENT

While the media expert gave an average of 4.0. This assessment category showed that the interactive learning multimedia-based desktop application product developed is included in the 'Very Feasible' category to be used or applied as a learning tool.

Table 4. Media Expert Assessment Results

NO	ASSESSMENT ASPECTS	TOTAL ITEMS	SUM OF ASSESSMENTS	
			MEDIA EXPERT 1	MEDIA EXPERT 1
1	INTRODUCTION	4	15	16
2	MATERIAL CONTENT	8	34	33
3	LESSONS	6	23	23
SUM OF ALL ASPECTS			72	72
AVERAGE			4,0	3,9
CRITERIA			VERY DECENT	VERY DECENT

d. Conduct Initial Revision: Based on the assessment, input, and suggestions given by media experts, improvements were made to the interactive learning multimedia. The improvements that were made included several displays such as the type of font used on the home page, text on the material content, then on several buttons on the learning multimedia. Based on the assessment, suggestions and input given by the material expert, revisions were made to the material content in the interactive learning multimedia. There are several parts that have been changed in the material content such as in the material section regarding the discussion of solid state drive devices, CPU material and RAM material by adding more videos and explanations.

d. Beta Testing: The beta test was given to 21 students of IAIN Manado's Madrasah Ibtidaiyah Teacher Education program (PGMI). The respondents were based on the students' learning achievements obtained from the lecturers of computer application courses. The things that were assessed by respondents in the beta test this time were aspects of learning, material, and appearance. The assessment carried out is a 4-scale questionnaire with the provisions of 1 if the product is less suitable for use, 2 if the product is quite suitable for use, 3 if the product is suitable for use and 4 if the product is very suitable for use. For more details can be seen in the table below:

Table 5. Student Response Assessment Result

NO	NAME	ASSESSMENT RESULT																	AVERAGE	CATEGORY
1	User 1	3	4	4	4	3	4	4	4	4	3	3	4	4	4	4	4	4	3,8	VERY SUITABLE
2	User 2	4	4	4	4	3	3	3	4	3	3	4	4	4	4	4	4	4	3,8	VERY SUITABLE
3	User 3	4	4	4	3	4	3	4	4	3	3	4	4	4	4	4	4	4	3,8	VERY SUITABLE
4	User 4	4	4	4	3	3	3	4	2	4	4	2	4	2	4	4	4	4	3,5	VERY SUITABLE
4	User 5	4	3	4	3	4	4	3	4	4	4	4	4	4	4	4	4	3	3,8	VERY SUITABLE
6	User 6	3	4	4	4	4	3	4	3	4	4	4	4	4	4	4	3	4	3,8	VERY SUITABLE
7	User 7	4	4	4	4	3	3	4	4	3	4	4	2	4	2	2	4	4	3,5	VERY SUITABLE
8	User 8	4	4	4	4	4	4	4	4	3	4	4	3	3	3	4	4	4	3,8	VERY SUITABLE
9	User 9	4	3	4	4	3	4	3	3	4	3	4	4	3	4	4	4	4	3,6	VERY SUITABLE
10	User 10	4	4	2	4	3	4	4	4	3	4	4	4	3	4	4	4	4	3,7	VERY SUITABLE
11	User 11	4	4	3	3	4	4	3	3	4	4	4	3	4	4	4	4	3	3,6	VERY SUITABLE
12	User 12	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3,6	VERY SUITABLE
13	User 13	4	4	4	4	4	4	3	4	4	4	4	3	4	4	4	4	4	3,9	VERY SUITABLE
14	User 14	4	4	4	4	4	4	4	3	4	4	3	4	4	4	4	4	4	3,9	VERY SUITABLE
14	User 15	3	3	4	4	4	4	4	3	3	4	4	4	4	4	4	4	4	3,8	VERY SUITABLE
16	User 16	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3,9	VERY SUITABLE
17	User 17	3	3	4	4	4	4	3	4	4	4	4	3	4	3	4	4	4	3,7	VERY SUITABLE
18	User 18	4	4	3	4	3	4	3	4	4	4	4	4	4	4	4	4	4	3,8	VERY SUITABLE
19	User 19	4	3	3	3	4	3	4	4	4	4	3	4	4	4	4	4	4	3,7	VERY SUITABLE

20	User 20	4	4	4	3	4	3	4	4	4	4	3	4	4	4	2	4	4	3,7	VERY SUITABLE
21	User 21	3	3	4	4	4	4	4	4	4	4	4	3	4	4	4	4	3	3,8	VERY SUITABLE
TOTAL																			78,3	
AVERAGE																			3,7	VERY SUITABLE

Based on the respondents' evaluation results, the average rating obtained was 3.7. Therefore, the interactive learning multimedia developed in this study is deemed highly suitable for use as both a learning medium and a supplementary tool in the computer applications course.

e. Final Revision: After the results of the beta test, revisions were made based on the results of the questionnaire that had been filled in by the respondents. The improvements made are correcting typing errors in the material content, increasing the font size, and changing the font type accordingly.

This study focuses on the development of an interactive multimedia-based desktop application aimed at assisting students of the Madrasah Ibtidaiyah Teacher Education Program (PGMI) in understanding the fundamental concepts of computer hardware. The primary objective of this research is to provide a more engaging, dynamic, and effective learning medium, particularly for introducing the components of computer hardware. The integration of multimedia elements, such as animated visualizations and interactive simulations, is expected to enhance student engagement and deepen their understanding of this technical subject, which may be challenging to grasp through conventional teaching methods.

The results of this study indicate that interactive multimedia-based desktop applications developed using 3D animation technology and Mayer principles are very effective in improving PGMI students' understanding of computer hardware introduction material. This application visualises computer hardware components realistically, providing a more in-depth and interactive learning experience (Setiawan et al,. 2023). This result is in line with the research of Nelawati (2021), who states that Adobe Flash-based multimedia can improve student understanding through dynamic visualisation. However, this research goes a step further by utilising the latest technologies such as Blender and

Autoplay, making a new contribution in creating a more immersive learning experience than Nelawati's approach.

Compared with the research by Yulia et al. (2023), who developed the 'Calculator Box' learning media for basic maths operations, this app offers a more complex innovation. If 'Calculator Box' focuses on simplifying mathematical concepts through simple visual elements, the application in this study is designed to help PGMI students understand more abstract technical material, namely the introduction of computer hardware. The addition of multimedia elements such as animation, video, and interactive simulation provides significant added value. Creating learning media that not only supports understanding but also increases student engagement in the learning process (Setiyanto et al, 2023).

In addition, this research is also relevant to the findings of Abdelaziz (2014), who underlines the importance of interactive learning activity design in improving students' understanding. Abdelaziz mentioned that interactive simulations allow students to test their understanding independently and get immediate feedback. The results of this study confirm this, where the developed application not only provides information but also creates an interactive learning experience through simulating computer hardware components. Thus, this study strengthens previous findings and makes new contributions with the application of modern technology relevant for future educator students.

Another advantage of this research is the application of Mayer's principle that ensures each multimedia element is designed to complement each other and support effective learning. This research adds a new dimension by integrating 3D animation and simulation in multimedia design, which is rarely found in previous research. In this case, the developed application provides uniqueness and flexibility that allows PGMI students to learn independently, while still following the principles of learning design that have proven effective.

The beta test results show that the app is very feasible to use, with an average student rating of 3.7 on a scale of 4. This finding indicates that the app is not only visually appealing but also able to increase students' learning motivation. This is consistent with the findings of Helianak & Surjono (2014), which shows that e-learning-based multimedia can increase student learning motivation by presenting material in an interesting and interactive format. In the context of this research, the motivation aspect is strengthened by the interactive simulation feature that allows students to directly explore the material and understand the function of computer hardware components.

Overall, this study makes a novel contribution by developing a modern technology-based learning medium tailored to the needs of PGMI students as future educators. By utilizing technologies such as 3D animation, the application addresses gaps in previous research, which predominantly focused on elementary and secondary school students. Furthermore, the application offers flexibility and effectiveness, making it applicable not only for teaching introductory computer hardware but also for other topics requiring technical visualization. This approach positions the study as relevant not only within the context of educational technology but also as a model that can be adapted for the development of learning media across various fields. In other words, this research provides innovation not only in the domain of educational applications but also contributes to the advancement of technology-based learning literature, specifically tailored to the needs of future educators in religious education. It is particularly significant in preparing them to integrate technology into Madrasah Ibtidaiyah classrooms.

CONCLUSION

The interactive multimedia-based desktop application developed successfully integrates elements such as text, images, videos, and animations into a single, user-friendly platform accessible to students. This product enables students to learn more flexibly and interactively, allowing them to control the pace and sequence of their learning. The interactive features of this multimedia application also play a significant role in enhancing students' interest in and understanding of computer applications material. The development of this interactive multimedia-based desktop application has been proven to be feasible, effective, and efficient in supporting the teaching of computer hardware fundamentals in elementary school education programs. This product not only simplifies the comprehension of complex material for students but also boosts their learning interest and motivation. This research makes a substantial contribution to the development of innovative and relevant interactive learning media that align with the current needs of education.

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