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Design and Build Web-Based Interactive Learning Media for Early Childhood in Early Childhood Kindergarten Mujahidin School

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ABSTRACT

The problem faced by At The PAUD Mujahidin School In Barru Regency is that the learning process is still dominated by conventional methods so that it is less interesting and less effective in stimulating children's interest in learning. The solution offered is the development of web-based interactive digital media that contains learning materials, interactive quizzes, and learning outcome reports that can be accessed by teachers and principals. The aim of the study was to create learning media that is able to increase children's involvement, motivation, and learning outcomes. The data was obtained through observation, interviews, library research and the distribution of questionnaires for feasibility tests. The research method used is Research and Development (R&D) with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. The media is tested using Blackbox Testing to ensure system functionality as well as User Acceptance Test (UAT) to evaluate user satisfaction. The results of the study indicate that 88% of respondents stated that this medium is very suitable for use, able to increase children's involvement, and provide a more enjoyable learning experience.

Keywords: Digital learning media, Early childhood education, R&D, ADDIE, Black Box, UAT

Article history

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INTRODUCTION

In today's era, information technology is no longer an option, but a necessity so that learning can take place. Technology has penetrated from simple electronic devices such as printers to much more sophisticated educational software. The shift from traditional forms of learning to technology-based learning has brought opportunities, as well as challenges, for all actors in the education sector. (Sriyono et al., 2022). Early childhood education (PAUD) plays an important role in the formation of children's character, intelligence, and social abilities. This stage is considered the main foundation that determines the child's future development. Early childhood is in the pre-operational stage, where they begin to build basic cognitive abilities through exploration and interaction with the surrounding environment. In addition, the importance of social interaction in children's development, shows that learning occurs in social and cultural contexts. (Arisanti et al., 2024)).

However, in reality, the learning process in PAUD often encounters various difficulties, including the lack of enthusiasm for children's learning due to repetitive teaching methods that are not in accordance with the needs of children in the digital age.

At the Mujahidin PAUD school, this problem is becoming more and more real. Based on the observation results, most children have difficulty concentrating, lack interest in learning, and their learning outcomes are not optimal. Only about 33.3% of students really understand the material well. The limitations of traditional teaching tools and teaching materials are also obstacles in creating an interesting learning atmosphere.

The digital era has changed the learning paradigm dramatically, especially in the educational environment. So far, the source of information in the world of education is only limited to the sciences taught directly by teachers. However, the presence of the internet has made it easier for students to access various sources of information. The process of integrating technology into education requires not only the use of hardware and software, but also human resources who can contribute innovative ideas in system design and digitization of education. The involvement of various stakeholders, including stakeholders, is essential for the system to function properly. The availability of adequate facilities and infrastructure is also a key factor in supporting the application of technology in the world of education. (Tiara Tirta Dewi, 2024).

In addition, research according to (Shaleha & Nisa, 2024) argues that learning is essentially a communicative process. If the child succeeds in absorbing the lessons that the instructor wants to teach, then communication will flow smoothly. Therefore, teachers need media as a means of communication. Children's knowledge is improved by the use of media in early childhood learning because they think practically. Children at an early age are people who are undergoing a very rapid stage of growth and development. This period is often termed as the golden age, because in this period more than 100 billion brain cells can be activated to support the development of children's abilities to the maximum. Abilities that appear in this stage cannot be replicated. For this reason, this period is seen as a phase that determines the direction of a child's life in the future. In addition, the golden age phase is also an important opportunity to accelerate development, especially in optimizing the potential that exists in children. (Azijah & Adawiyah, 2020).

However, the reality is that in the field, early childhood children often feel bored and bored due to the lack of learning media that supports their creativity and interest in learning. Therefore, it is important to design digital learning media that is interactive, engaging, and in accordance with the characteristics of early childhood development. The media is expected to spur the spirit of learning while helping to improve their learning achievements. The development of digital technology has created significant opportunities to create innovative educational media that is relevant to the learning style of PAUD children, the Mujahidin PAUD school as an early childhood education institution is committed to providing the best learning, but the learning media available today is still limited to conventional teaching materials. In fact, children in Mujahidin PAUD schools are mostly familiar with digital devices, such as tablets or smartphones, which can be used as learning media.

In this study, as many as 31 children of PAUD Mujahidin were divided into two groups, namely Group A consisting of 19 children who will use interactive digital learning media, and Group B with 12 children who continue to use conventional learning methods. This division aims to observe the effectiveness of digital media in improving children's learning outcomes compared to traditional learning methods. This research innovation is focused on creating digital learning materials specifically designed to meet the needs of children in PAUD Mujahidin. This media not only serves as a teaching aid, but also incorporates technology-based interactive elements to encourage early childhood participation and learning. In addition, the approach used in this study prioritizes learning personalization, where media can be adjusted to the learning speed and individual

interests of children. Different from previous research which was generally generic, this study focused on the local characteristics of students in PAUD Mujahidin schools, so it is expected to have a direct impact on improving the quality of learning in the institution.

METHOD

The research method is Research and Development (R&D), which is aimed at creating interesting and effective digital learning media in improving early childhood learning outcomes in PAUD Mujahidin. This method includes several systematic stages for designing, developing, and testing learning media. Methods and development (R&D) were applied in this study. The goal of applying this method is to be used in the manufacture of a particular product and can also be used to evaluate how effective a product is. The use of the Research and Development (R&D) method with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model to produce and test a website-based library information system (Waruwu, 2024).

The stages in this method follow the ADDIE (Analyze, Design, Develop, Implement, Evaluate) model, as follows:

1. Analyze
   Analyze At this stage, an analysis of needs is carried out to understand the problems and learning needs in the Early Childhood Education School of Mujahidin Early Childhood School. Data collection was carried out through observation, interviews with teachers and parents, and literature review to identify conventional learning barriers and explore the potential of digital media in increasing children's learning motivation.
2. Design
   Based on the results of the analysis, an interactive and interesting digital learning media concept was designed. This design includes UML design, namely use diagrams, activity diagrams, sequence diagrams and class diagrams and learning content that is in accordance with the characteristics of early childhood. Diagrams such as use cases and activity diagrams are used to visualize user interaction with media. UML system planning as shown in the picture
   1). Designing a Use Case Diagram

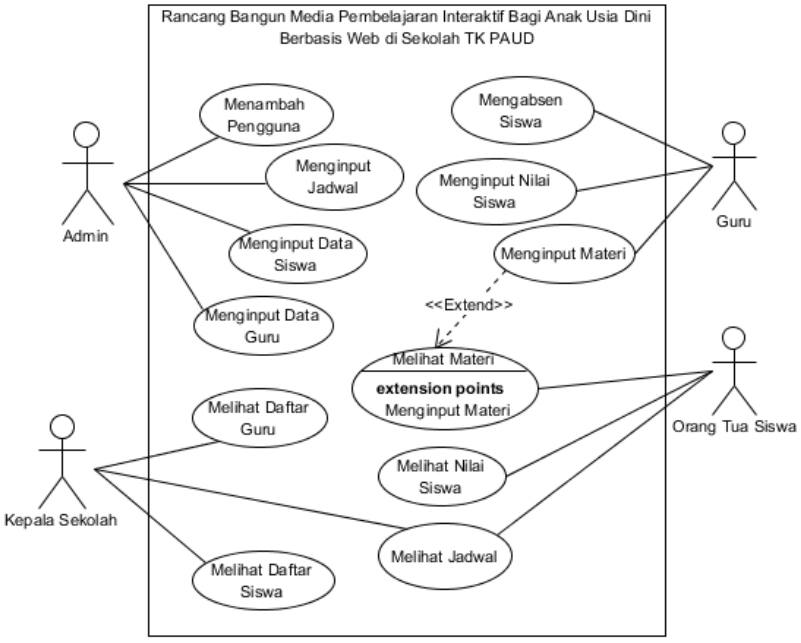

Figure 1. Designing Use Case Diagrams

2). Activity Diagram

Activity diagram is a description of the user's activity with the system to be built. As seen in figure 2, it is an admin diagram activity in adding users.

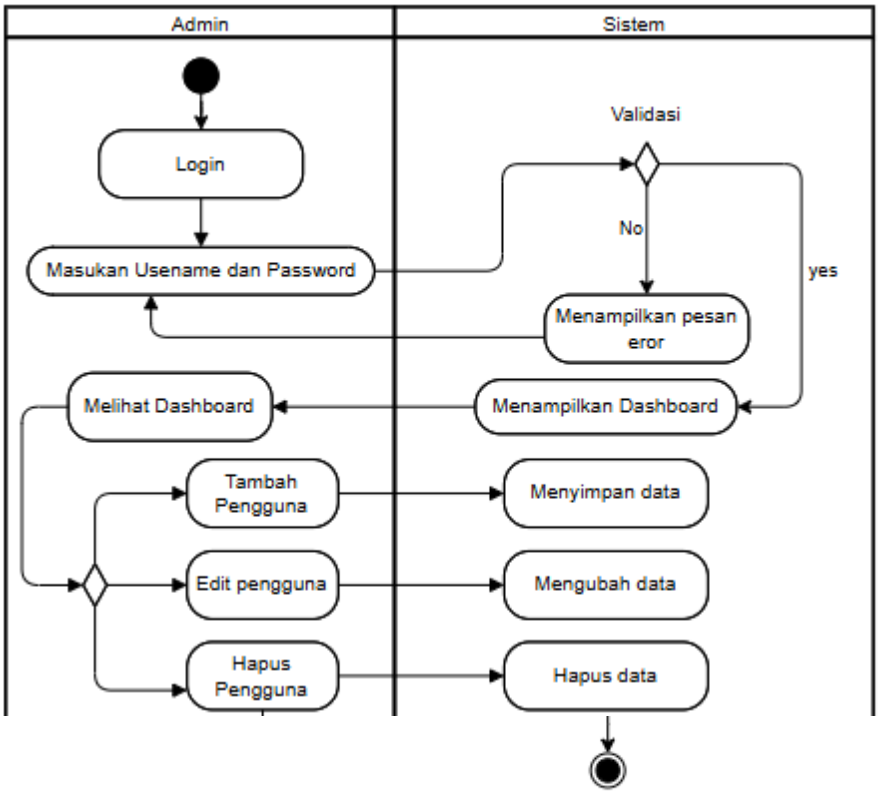

Figure 2. Activity Diagram Inputs Users

3). Sequence Diagram

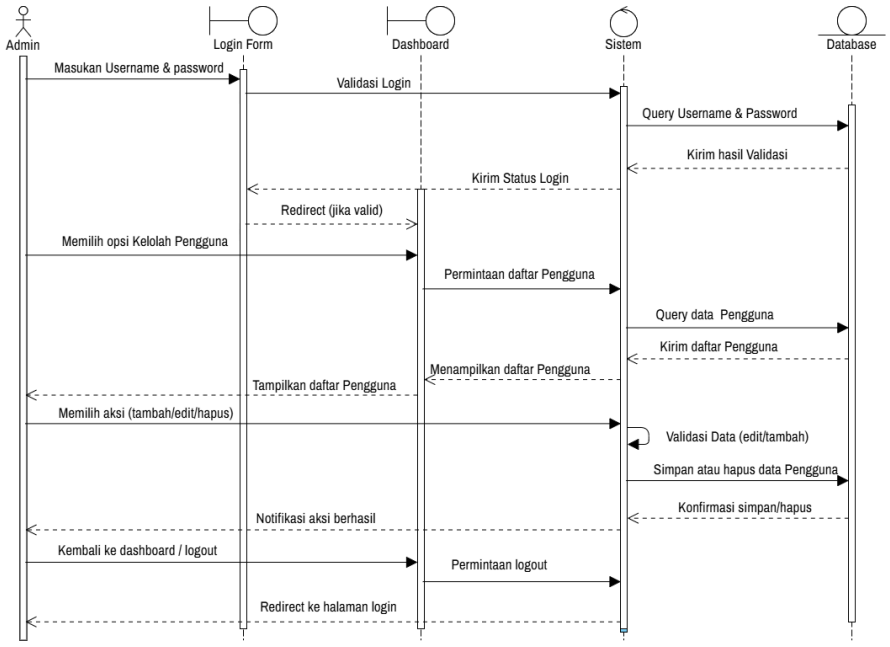

Figure 3. Sequence Diagram Adding Users

4). Class Diagram

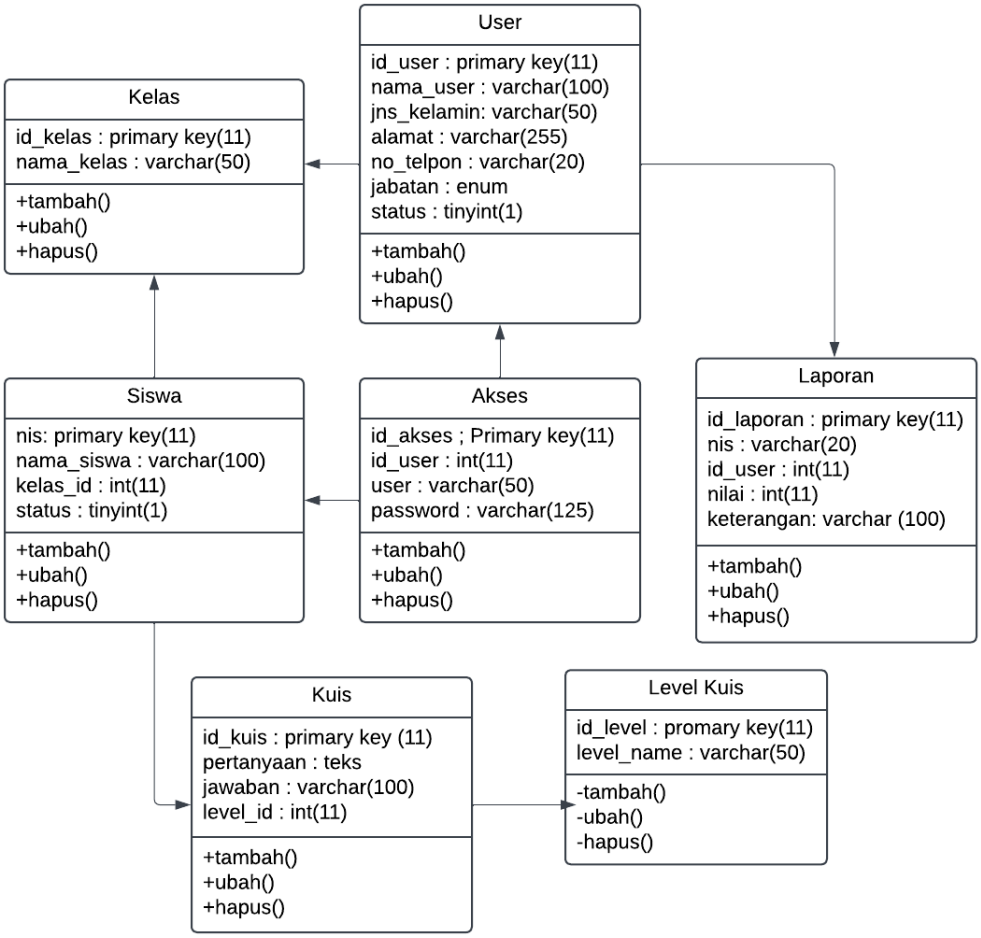

Figure 4. Class Diagram Sistem

1. Develop
   At this stage, digital-based learning materials are produced in accordance with the plan that has been prepared. Early prototypes are created using software such as Figma or Canva for visual design, and Laravel or MySQL to support data management. The prototype is then tested internally to ensure its functionality.
2. Implement
   The learning media that has been developed is being piloted at the Mujahideen PAUD school. The trial was conducted for one month by involving teachers and students to evaluate how this medium is used in daily learning. Data on children's motivation and learning outcomes were collected during this period.
3. Evaluate.
   This stage involves evaluating learning media based on the results of the trial. Feedback from teachers, parents, and children was analyzed to evaluate the effectiveness of learning media in increasing motivation and learning outcomes. This stage of research ends in the implementation of the program at the Mujahidin PAUD school and is given to the school with all its consequences. It is hoped that in the next two or three years the school can evaluate the program provided to be developed according to the needs of the Mujahidin PAUD school.

In application development, the researcher used the programming languages HTML, CSS, PHP, Figram, and JavaScript, with MySQL database and the Visual Studio Code text editor with the Codeigniter Framework. The system was developed using

XAMPP as a local server. The feasibility test of the system was carried out by several respondents, namely teachers and students using User Acceptance Testing (UAT). In addition, functionality testing is carried out using the Black Box Testing method to ensure that all features run as designed. The data obtained was analyzed descriptively quantitatively to assess the feasibility and effectiveness of the system. The validation results are used to revise the system before finalizing the product, so that the resulting interactive learning media can be optimally implemented in the kindergarten and early childhood school environment.

FINDINGS AND DISCUSSION

Findings

This research began with the stages of needs analysis which was carried out through observation, interviews, and documentation of learning methods at PAUD Mujahidin Barru Kindergarten. Based on the results of direct observation, the learning process is still carried out conventionally by demonstrating pictures to students, there is no technological innovation so that students look bored and sleepy with the learning methods given.

Interactive multimedia is a combination of various media from computers, video, audio, images and text that can create innovative learning. The use of interactive multimedia can affect children's learning experience in recognizing letters, the use of interactive multimedia can also affect cognitive development. Especially in the era of technology that is developing very rapidly like today, teachers can create interactive learning media that is designed to support the online learning process. Children's motivation to learn will increase if learning is carried out in a variety of ways that help children understand the learning material. (Dwiqi et al., 2020).

1). Black Box Testing

The results of the black box test of learning media as seen in table 1.

Table 1. Back Box Test Results

No.	Components Tested	Expected Results	Test Results	Conclusion
1.	Form Login	When the user enters the correct username and password, the system will immediately go to the dashboard page.	As expected	Valid
2.	Menu Data Master	When the admin clicks the master data menu, it will display the User data, Student Data, Class Data, Quiz Level and Academic Year menu pages.	As expected	Valid
3.	Menu Data User	When the admin clicks on the user data menu, a list of user data will be displayed.	As expected	Valid
		When the admin presses the add button, the system will display the add form of admin data		
		When the admin presses the access button, the system will display the access form		
		When the admin presses the change button, the system will display the change form		
		When the admin clicks the delete button, it will display a notification if you are sure		

No.	Components Tested	Expected Results	Test Results	Conclusion
4.	Student Data Menu	When the admin clicks the student data menu, it will display a list of student data	As expected	Valid
		When the admin presses the add button, the system will display the student data add form		
		When the admin presses the change button, the system will display the change form		
		When the admin clicks the change button, it will display a notification if you are sure		
5.	Class Data Menu	When the admin clicks the class data menu button, it will display a list of classes	As expected	Valid
		When the admin presses the add button, the system will display the add class form		
		When the admin clicks the change button, it will display the change class form		
		If the admin selects the delete button, the system will provide a warning in the form of a notification asking if the admin believes in the action.		
6.	Meeting Level Menu	If the admin clicks the meeting level menu button, it will display the meeting level.	As expected	Valid
		When the admin clicks the add data button, it will display the add level form.		
		When the admin clicks the change button, it will display the change level form.		
		When an admin presses the delete button, a notification will appear asking if you're sure.		
7.	Curriculum Menu	When the admin clicks the school year menu button, it will display a list of school years.	As expected	Valid
		When the admin clicks the add data button, it will display the add school year form		
		When an admin presses the button to change, a form to edit the school year will appear.		
8.	Quiz Question Menu	When the admin clicks the quiz question menu button, it will display a list of quiz questions	As expected	Valid
		When the admin presses the delete button, the system displays a confirmation notification to make sure to confirm the user's decision		

No.	Components Tested	Expected Results	Test Results	Conclusion
		before proceeding with the process.		
9.	Meeting Menu	If the admin clicks the meeting menu button, it will display a list of meetings	As expected	Valid
		When the admin presses the add data button, the system will display a form to add new meeting data.		
		When the admin clicks the start quiz button, it will be redirected to the quiz page for the meeting.		
		When the admin presses the details button, the system will display complete information regarding the selected meeting.		
		When the admin clicks the end meeting button, it will change the status of the meeting from "In Progress" to "Completed".		
		When the admin clicks the print button, it will generate a print view or print a report of the meeting data.		
10.	Teacher Data Menu	When the admin clicks the teacher data menu, it will display a report on the list of teachers who have been registered in the system.	As expected	Valid
11.	Student Data Menu	When the admin clicks the student data menu, it will display a report on the list of students by class and class.	As expected	Valid

2). Learning Media Display

a. Admin Dashboard Page

The admin dashboard, which is a page that appears after the admin successfully logs in, which contains the view of users, teachers, students, meetings, and several other menus, as seen in figure 5

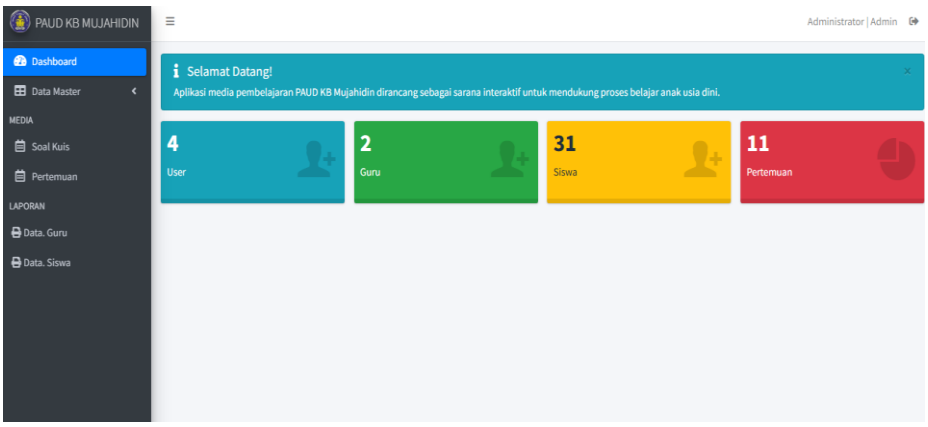

Figure 5. Dashboard Admin

b. User Data Page

Displays the user data page, which contains information such as username, gender, address, phone number, job title, status, and action options such as delete, change, and access. In addition, there is an Add button that is used to add data as seen in figure 6.

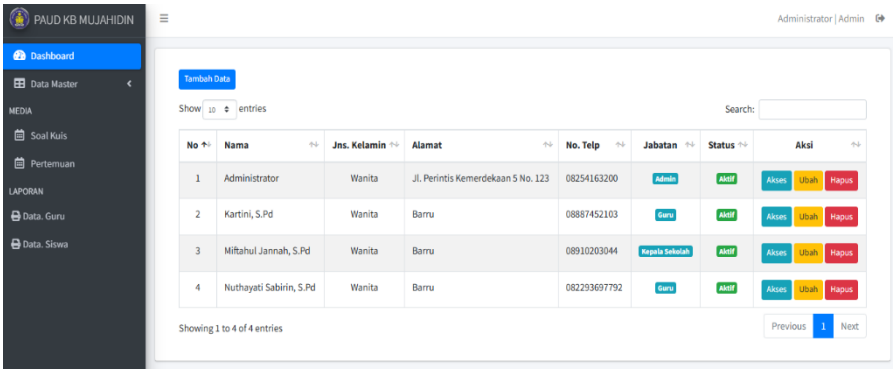

Figure 6. User Data

c. Student Data Page

is a display of the student data page, which displays the member's biodata in the form of name, gender, address, class, school year, status and action in the form of change and delete buttons. Then there is a button at the top left to add members as seen in figure 7.

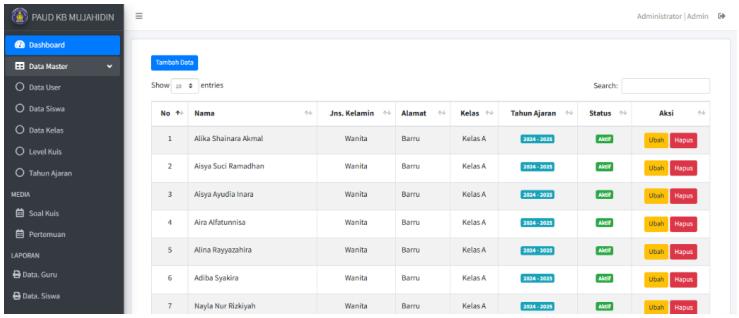

Figure 7. Student Data

d. Class Data

It is a class data page, which displays the available class groups, namely class A and class B. Each table entry displays the group, status (active and inactive), and action buttons to change and delete data. At the top of the table there is an add data button that allows admins to add new class groups as seen in figure 8.

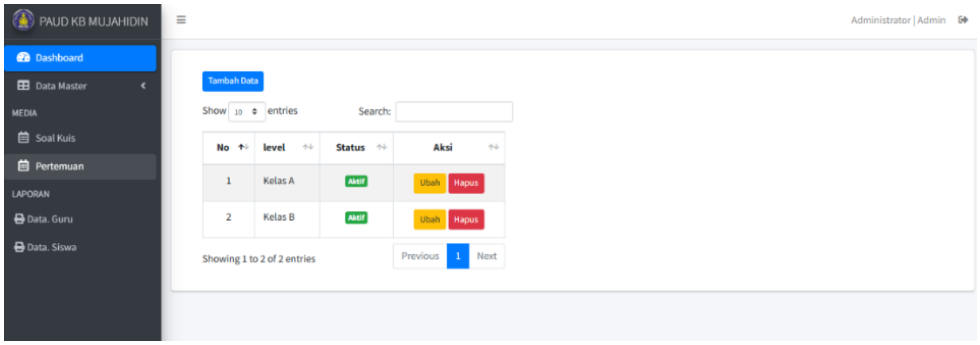

Figure 8. Class Data Page

e. Quiz Question Page

Displays the quiz question page, which consists of meeting levels, questions, pictures (1–4), answers, and action options in the form of delete. In addition, the system provides an add button that functions to enter new data

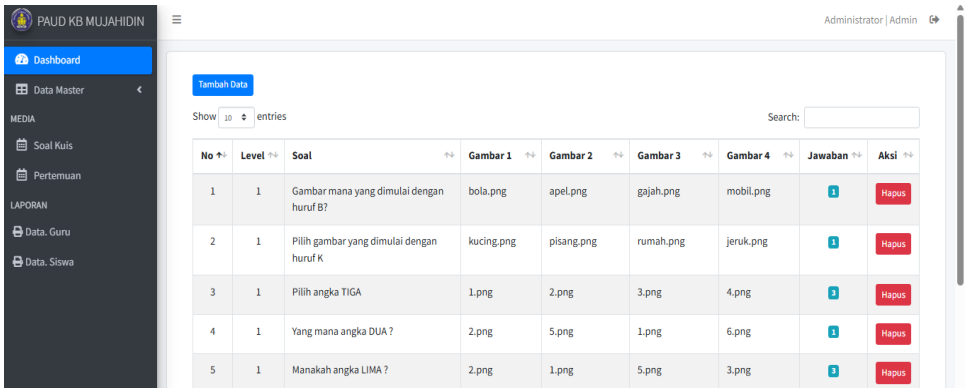

Figure 9. Quiz Question Page

Discussion

To determine the feasibility of using the learning media system, it is carried out using a questionnaire that is prepared in an objective way and tested directly to the respondents with the aim of evaluating how well the developed system has met expectations.

Table 2. User Acceptance Testing (UAT)

No	Aspects	Question
1	Use	Is this learning medium easy to use
		Is the appearance of this media interesting and easy for early children to understand?
		Whether the navigation in the media (menus, buttons, icons) works well and meets the user's expectations?
2	Information	Whether the learning materials displayed are in accordance with the needs and level of development of PAUD children ?
		Whether the learning materials displayed are in accordance with the needs and level of development of PAUD children ?
		Is this media able to convey information or learning concepts clearly and simply ?
3	Kualitas Interaktif Layanan	Does this media help children understand new material more easily and enjoyably? ?
		Does the media provide positive and constructive feedback to children after they complete an activity or quiz?
		Is the interaction between the media (images, sounds, animations, or games) engaging enough to retain the child's attention?
		Does the child seem more motivated to learn after using this medium ?
		Is this media felt useful by teachers and parents in supporting children's learning assistance?

Table 3. Questionnaire Answer Calculation

Aspects	Questions	Answer					Values					Results
		SS	S	N	TS	STS	SS x5	S x4	N x3	TS x2	STS x1	
	Is this learning medium easy to use	7	10	3			35	40	9			84
	Is the appearance of this media interesting and easy to understand by early childhood?	9	11				45	44				89
	Whether the navigation in the media (menus, buttons, icons) works well and meets the user's expectations ?	10	8	2			50	32	6			88
	Whether the learning materials displayed are in accordance with the needs and level of development of PAUD children ?	12	7	1			60	28	3			91
	Is this media able to convey information or learning concepts clearly and simply ?	15	4	1			75	16	3			94
	Does this media help children understand new material more easily and enjoyably? ?	13	7				65	28				88
	Does the media provide positive and constructive feedback to the child after completing an activity or quiz?	9	9	2			45	36	6			87
	Is the interaction between the media (images, sounds, animations, or games) interesting enough for Maintaining the child's attention?	11	8	1			55	32	3			90
	Does the child seem more motivated to learn after using this medium ?	8	12				40	48				88
	Do teachers and parents feel helped in accompanying the child's learning process through this media ?	10	9	1			50	36	3			89

From the User Acceptance Testing (UAT) that has been carried out, the following conclusions were obtained:

1. Analysis of the first question
   In the table above, the results of the assessment from 20 respondents are shown, where for the first question a total score of 84 was obtained. The average score obtained was 84 ÷ 20 = 4.2. If converted into percentages, then the calculation is 4.2 ÷ 5 × 100 = 84%.

2. Analysis of the second question
   In the table above, the results of the assessment of 20 respondents to the second question with a total score of 89 are shown. The average score obtained was 89 ÷ 20 = 4.45.
   If converted into a percentage, then the calculation is 4.45 ÷ 5 × 100 = 89%
3. Analysis of the third question
   Based on the data in the table above, the assessment results of 20 respondents to the third question with a total score of 88 are shown. The average score obtained was 88 ÷ 20 = 4.4. If converted into a percentage, then the result is (4.4 ÷ 5) × 100 = 88%
4. Analysis of the fourth question
   Based on the data in the table above, it can be seen that the total score of the 20 respondents for the fourth question is 91. The average score obtained was 91 ÷ 20 = 4.55. If converted into percentages, then the result is (4.55 ÷ 5) × 100 = 91%
5. Analysis of the fifth question
   Based on the table, the scores obtained from 20 respondents in the fifth question amounted to 94. This result results in an average score of 94/20 = 4.7.
   The average value when calculated in the form of a percentage is 4.7/5 × 100 = 94%
6. Analysis of the sixth question
   Based on the table, the total score obtained from the 20 respondents on the sixth question was 88. The average calculation shows a value of 88/20 = 4.4.
   Furthermore, if expressed in percentages, the result is 4.4/5 × 100 = 88%
7. Analysis of the seventh question
   Based on the table, the total score given by 20 respondents in the seventh question reached 87. The average calculation yields a value of 87/20 = 4.35. The value in the form of a percentage is 4.35/5 × 100 = 87%
8. Analysis of the eighth question
   Based on the table, the number of scores obtained from 20 respondents in the eighth question reached 90. The average calculation shows 90/20 = 4.5.
   Furthermore, if expressed as a percentage, then 4.5/5 × 100 = 90%
9. Analysis of the ninth question
   Based on the table, the total score given by the 20 respondents on the ninth question was 88. From these results, an average of 88/20 = 4.4 was obtained. The average value when calculated in the form of a percentage is 4.4/5 × 100 = 88%
10. Analysis of the tenth question
    Based on the table, the number of scores given by the 20 respondents on the tenth question was 89. From these results, an average of 89/20 = 4.45 was obtained. Furthermore, this value if expressed in percentages is 4.45/5 × 100 = 89%

Based on the tests performed on each question, the final score is obtained with the sum of the statements.

$$\text{Percentages of Succes} = \left(\frac{Observation\ Score}{Expected\ Score}\right) x\ 100\%$$

Number of successful test cases:
(Question 1 + Question 2 + Question 3 + Question 4 + Question 5 + Question 6 + Question 7 + Question 8 + Question 9 + Question 10)

$$= \left(\frac{84 + 89 + 88 + 91 + 94 + 88 + 87 + 90 + 88 + 89}{10}\right) x\ 100\%$$

$$= \left(\frac{888}{10}\right) x\ 100\%$$

$$= 88\%$$

The results of the test using the User Acceptance Testing method produced **a score of 88%,** so it can be concluded that the design of learning media for early childhood at Kindergarten PAUD Mujahidin meets the eligibility criteria for use.

CONCLUSION

The development of early childhood learning media at PAUD Mujahidin Barru Regency can be realized as planned. The learning media for early childhood children at the Mujahidin Barru PAUD school based on *User Acceptance Testing* (UAT) was obtained 88% so that this system is very feasible to use. The research method used is Research and Development (R&D) with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. Through this stage, the research succeeded in producing digital learning media that is in accordance with the needs of early childhood. The results of the feasibility test show that the R&D process not only produces a viable product, but can also be used as a model for the development of learning media in other PAUD institutions.

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