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Application-based Elementary Schools Interactive Education Platform Analysis and Design

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ABSTRACT

The rapid digital transformation fueled by widespread Internet use has significantly impacted education. As of April 2023, there are over 5.18 billion Internet users worldwide, necessitating innovative educational solutions. **This study analyzes** and designs an interactive educational platform tailored for elementary students aged 7-12, employing technologies such as Artificial Intelligence (AI) and Augmented Reality (AR) to enhance learning. The platform emphasizes user-friendly interfaces and engaging content to boost children's motivation and participation. Despite the potential of digital educational tools, challenges such as unequal access to technology, screen addiction, and the need for improved digital literacy persist. **This study addresses** these issues by proposing a platform that provides equitable access and delivers high-quality, safe, and educationally rich content. The design process involved a literature review, iterative user interface development, and collaboration with educational professionals to meet the specific needs of young users. By integrating interactive multimedia and contemporary interface technologies, the platform offers a personalized and differentiated learning experience beyond traditional methods. **The study highlights** the significant potential of digital learning tools in improving education quality for children while addressing access and security challenges. Ultimately, this research aims to develop effective educational technologies that support sustainable education for young learners in the digital age.

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1. INTRODUCTION

The rapid growth of Internet usage has driven digital transformation across various sectors, including education. By April 2023, over 5.18 billion individuals, or approximately 64.6% of the global population, had access to the Internet [1, 2]. This vast connectivity creates opportunities to leverage technology for improving educational experiences, particularly for young learners. Emerging technologies, such as Artificial Intelligence (AI) and Augmented Reality (AR), offer the potential to enhance the teaching-learning process by fostering engagement and providing personalized educational experiences.

Recent studies highlight the effectiveness of digital tools in improving learning outcomes, especially through the integration of interactive multimedia and contemporary interface technologies. As mobile device adoption grows among school age children, the demand for user friendly, visually engaging educational plat-

forms continues to rise. These platforms not only enhance traditional learning methods but also address key challenges, including unequal access to technology, screen addiction, and the digital literacy gap.

Recent studies highlight the effectiveness of digital tools in improving learning outcomes, especially through the integration of interactive multimedia and contemporary interface technologies [3, 4]. As mobile device adoption grows among school-age children, the demand for user friendly, visually engaging educational platforms continues to rise. These platforms not only enhance traditional learning methods but also address key challenges, including unequal access to technology, screen addiction, and the digital literacy gap [3, 5].

To address these challenges, this study focuses on designing an interactive educational platform tailored for elementary students aged 7-12. The platform integrates AI and AR to deliver engaging, high-quality content while ensuring equitable access and addressing concerns around data security. By emphasizing innovative and inclusive solutions, this research aims to support sustainable education for young learners in the digital age [6].

Despite the significant advancements in technology, one of the persisting challenges in education is the unequal distribution of technology among children. This imbalance in access to technology poses several risks, including screen addiction, excessive screen time leading to a higher likelihood of obesity, the potential development of visual impairment, and disturbances in sleep patterns resulting in reduced sleep quality [7, 8]. There is still a need for improvement in the digital literacy abilities of children aged 7-12, particularly when it comes to the responsible utilization of technology. Insufficient access to technology and high-quality education remains a prevalent issue in numerous developing nations.

Acquiring knowledge during the formative years of 7-12 is really significant. This technique has the potential to enhance children's engagement in the learning process, inspire them to learn in a more pleasurable manner, and equip them for the forthcoming educational obstacles [9, 10]. Despite the persisting obstacles, we have made efforts to surmount them by creating novel instructional technology. This interactive learning introduces novel educational concepts to children. Applying AI and AR technology to enhance the authenticity and interactivity of learning [11]. The transition of the educational field towards technology-driven learning creates possibilities for interactive educational platforms to offer a more customized and diverse learning experience, beyond the constraints of conventional learning approaches. Hasan, in the year 2024. Interactive media offers numerous benefits as a learning medium for children. It enhances children's motivation and incorporates vibrant colors, music, and animated visuals in films to provide a more realistic experience [12, 13]. The utilization of artificial intelligence in educational platforms is now in its nascent phase but holds the potential to completely transform the process of learning. Utilizing artificial intelligence to offer tailored educational assistance for children [14].

The objective of the research is to examine and develop an educational platform that is based on applications. Our goal is to enhance comprehension of the developmental traits of children within that specific age group and demonstrate how interactive educational platforms may effectively address their educational requirements [15]. Moreover, the study seeks to enhance understanding of the significance of high-quality interactive education for children in today's digital society. By advocating strongly, our goal is to raise awareness about the need of high-quality educational technology and encourage investments in the creation of interactive educational platforms that may greatly benefit the education of children between the ages of 7 and 12.

The integration of digital media in early childhood education presents a transformative approach to enhance learning outcomes. By leveraging technology, educators can create more engaging and interactive learning environments that cater to the developmental needs of young learners. This involves careful planning and the implementation of innovative strategies, as outlined in Figure 1, which highlights the interconnected roles of educators, parents, and technological tools. The supervision and guidance in the use of digital media are crucial to ensure that its application remains balanced and supports holistic development [16]. Furthermore, addressing the challenges of digital literacy, accessibility, and potential overuse is essential to maximize the positive impact of digital learning tools. These efforts contribute to building a robust framework for early childhood education that aligns with the demands of a rapidly evolving digital society.

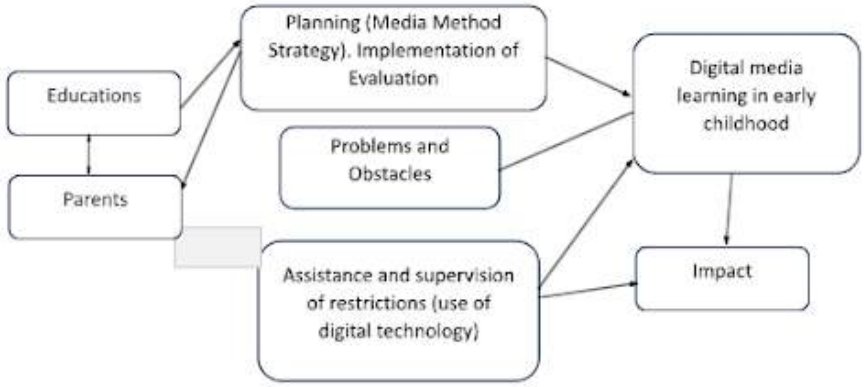

Figure 1. Digital media-based learning for children

Figure 1 emerged as a significant forum for delving into the use of digital technologies in early childhood education. The main focus is on how to integrate learning through digital media for early childhood children, and the actions that educators and parents should follow to ensure learning success. Additionally, the possible influence of using digital technology in the learning process of early childhood children is also examined. Acquiring this knowledge will offer fresh insights to parents and educators, empowering them to thoughtfully contemplate the most successful methods for implementing suitable education, while also offering efficient support in shepherding young children through the learning journey.

2. RESEARCH METHODS

2.1. Drainage System

Literature Studies: This phase will commence with gathering knowledge on the developmental attributes of children aged 7-12 and the most recent advancements in educational technology through an extensive examination of literature. Subsequently, we will assess the strengths and weaknesses of current interactive educational platforms. This investigation will yield useful information to enhance the construction of more efficacious interactive teaching platforms.

Platform Design: After acquiring a comprehensive comprehension of the field of literature, the subsequent phase involves creating an interactive instructional platform. This include the creation of user interfaces, interactive functionalities, and educational content that is both relevant and captivating.

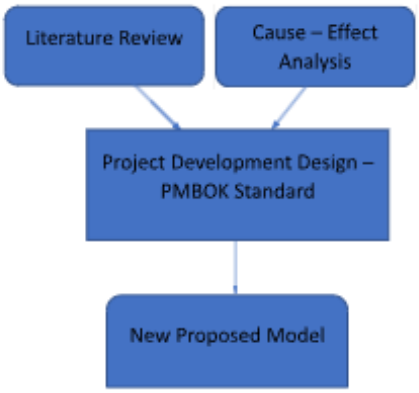

Figure 2. Study Framework

As depicted in Figure 2 the first step in our research is to study literature carefully. We reflect on various relevant sources to understand the current landscape and trends that exist in our research area. Through in-depth cause and effect analysis, we managed to identify patterns and important relationships between the variables involved. From this research, we have succeeded in formulating the new model proposed, which we believe will make a significant contribution to our research. Next, we will step into the design phase, where this new model will be further developed using the PMBOK standard as the primary guide.

This Table 1 will ensure that the proposed model conforms to the principles and best practices in project management, ensuring the quality and sustainability of our research results.

Table 1. Literature review

Authors	**Research Study**
Aeni, A. N., Nofriani, A. N., Fauziah, I. A., & Fauzi, I. A. (2022).	You can use the Renderforest application to create animated content that aids in the development of Islamic personalities in 4th grade students. It provides insight into the effectiveness of animated media in improving the understanding and promotion of Islamic values, as well as how it can affect the development of the personalities of students at the elementary education level [17].
Fauziyah, N. (2020).	This study assesses how changes in learning conditions due to the COVID-19 pandemic affect the effectiveness of online learning in the field of Islamic education [18].
Firmansyahputra, B., & Cherid, A. (2020).	The research focuses on the development of multimedia applications that use AR to help users, especially children, understand alphabetic letters and recognize fruits and animals. [19]
Hastini, L. Y., Fahmi, R., & Lukito, H. (2020).	This study evaluates the impact of the use of technology in learning on human literacy levels in Generation Z in Indonesia [20].
Hidayat, N. R. (2023).	This article discusses the effectiveness of the use of learning device information systems in the preparation of a learning plan. (Rohita & Hidayat, 2023) [21].
Isrofah, I., Sitisaharia, S., & Hamida, H. (2022).	This article discusses the use of digital media in early childhood education and its potential to support learning in the midst of the industrial revolution [22].
Jamilah, S., & Andrisyah, A. (2020).	This study discusses the introduction of child literacy in cognitive abilities in the family through the application of marine animal education children's games [23].
Kaffah, S. A. (2020).	This article is likely to discuss the impact and effectiveness of such media in helping early children to know the names of fruit in three languages [24].
Ningsih, I. W., Widodo, A., & Asrin, A. (2021).	Discussing the urgency of digital literacy competencies in learning during the COVID-19 pandemic. The conclusions emphasize the importance of digital literacy in the context of technology usage and online learning becoming more prevalent [25].
Novitasari, K. (2019).	The conclusions emphasize the use of multimedia technology as an effective learning tool to enhance literacy in early childhood [26].
Nurjanah, N. E., & Mukarromah, T. T. (2021).	Includes findings related to the use of digital media in early childhood learning, emphasizing its relevance and benefits in the Industrial Revolution 4.0 ([27].

Nuryadin, H. (2022).	Discussing the design of educational applications focused on recognizing animal names in English using the Android platform. The conclusions highlight the application design process and its educational objectives [28].
Purandina, I. P. Y., & Juliari, I. G. A. I. T. (2021).	Emphasizes using YouTube as a platform to introduce digital literacy and shape children's character. The study highlights the impact of English-language narrative stories through digital media on child literacy and character [29].
Rohmadini, F., Suzanti, L., & Widiavati, R. D. (2022).	Discussing the use of learning technology through the "Moving Giat" application for children aged 4-6 during the COVID-19 pandemic. The conclusions highlight its implementation and impact in supporting early childhood learning during pandemics.
Safitri, D., Suzanti, L., & Widiavati, R. D. (2022).	Discusses the perception of early childhood education educators (PAUD) of the application of Maru Edusame as an alternative medium for distance learning [30].
Setiawan, A., Prakerdhiono, H., & Sulthoni, S. (2019).	Discussing the use of digital educational games as a means of learning for early childhood. The conclusions emphasize the benefits and potential of such games in supporting early childhood learning [31].
Yulia, A. I., & Ikwati, H. D. (2022).	Discusses the role of the development of educational technology in improving the quality of learning. The conclusions emphasize the importance of developing educational technology as a tool for improving learning quality [32].
Zaini, M., & Soenarto, S. (2019).	Discusses the role of educational technology in improving learning quality and explores various applications for enhancing education [33].

3. DISCUSSIONS AND FINDINGS

The findings from the cause-effect analysis emphasize the critical need for a proactive approach in addressing the key factors that impact children's engagement with educational applications. These factors, including technical issues such as server reliability, user interface design, and data security, must be prioritized to enhance the overall user experience. Moreover, the role of educators and parents as mediators in fostering digital literacy and encouraging positive interactions with technology cannot be understated. By providing support and guidance, they play a pivotal role in ensuring children derive maximum benefits from these digital tools. Additionally, addressing content relevance and instructional value is essential to maintain children's motivation and interest. This underscores the importance of a collaborative effort between developers, educators, and policymakers to create robust, inclusive, and engaging educational platforms that cater to the diverse needs of young learners.

3.1. Cause – Effect Analysis

By utilizing sources from WBS, we can discern information pertaining to Project Quality, specifically actions that are connected to aspects that impact the quality of service.

During the process of problem analysis, the initial phase involves clearly and precisely defining the problem. Subsequently, it is imperative to ascertain the distinct classifications of primary factors that could potentially contribute to the issue at hand. The concept encompasses individuals, techniques, machinery, resources, and surroundings. Subsequently, we engaged in a brainstorming session to pinpoint certain factors within each category that might be responsible for the decrease in sales. Accurate data, meticulous observation, and valuable input from the team are indispensable in this process. Next, we need to examine and rank the causes according to their potential impact and feasibility for resolution. Subsequently, we employ the method-

ology to ascertain the root cause of the decrease in sales. Subsequently, it is necessary to formulate prospective remedies that can effectively tackle the underlying factors indicated in the diagram. Utilizing diagrams is crucial for visualizing the impact of various solutions on the overarching problem. Ultimately, the solution is selected and put into action, with close monitoring of its efficacy. Cause-effect diagrams are regularly revised in response to the outcomes of their execution to ensure the long-term resolution of problems.

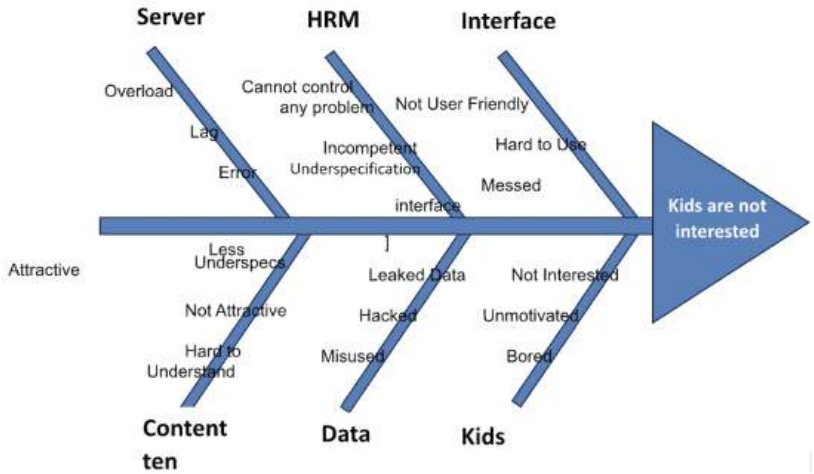

Figure 3. Fishbone Diagram/Cause – Effect - Things That Cause Children Not Interested

Figure 3 based on the aforementioned data, it can be inferred that there are multiple elements that contribute to children's waning interest in utilizing educational applications. The elements encompass issues related to servers, Human Resource, application display, content, data security, and the individual characteristics of children. Server overloads, lags, or mistakes can cause users, even children, to become dissatisfied and lose interest. The absence of SDM's capability to address issues might adversely affect the user's experience. Children may lose interest in applications that appear unpleasant, challenging to navigate, or disorganized. Content that is uninteresting, without instructional value, or difficult to comprehend can also lead to a decrease in interest. In addition, data security that is susceptible to breaches or cyber attacks can also result in a decline in interest. The aggregation of these issues causes discomfort and lack of motivation for children and parents to utilize such applications in the educational process. Hence, it is imperative for makers of educational applications to rectify these issues in order to enhance children's engagement and the caliber of their learning

3.2. Project Schedule

The Project Schedule outlines the chronological order and estimated duration for each task within the project. Project schedules are crucial in project management as they guarantee timely completion of the project within a predefined budget. Our scheduling process relies on data extracted from the Work Breakdown Structure (WBS) and the Project Charter documents. The Work Breakdown Structure (WBS) facilitates the division of projects into smaller, meticulously controlled tasks.

The process of developing the project schedule commences with Schedule Planning, wherein all the tasks necessary to finish the project are defined and categorized into distinct parts or stages. Subsequently, an assessment is conducted to determine the anticipated timeframe and necessary resources for each individual activity. After the project schedule is created, the Schedule Assessment procedure is conducted to evaluate its feasibility and success. It utilizes methodologies like critical path analysis or resource load analysis to verify that these schedules are both achievable and traceable. Project schedules are regularly monitored in Schedule Control, and appropriate corrective measures are implemented when required. Tools and procedures, such as project scheduling software or project management systems, are employed in this process to guarantee that the project adheres to the planned schedule and can be finished within the designated timeframe.

In Figure 4 describe of the duration of our project will span 8 months, commencing on December 5th and concluding on December 19th, with a focus on Project Planning during the initial two-week period. Following the project planning phase from December 19th to January 2nd, which spans a duration of two weeks, we will proceed with the UX UI Concept Design. Following the UX Concept Planning phase from January

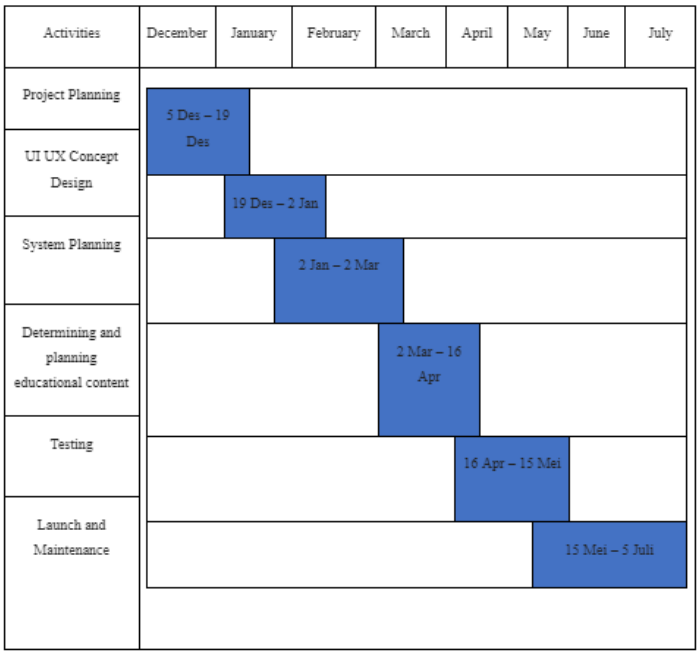

Figure 4. Output Project Scheduling with Gantt Chart

2nd to March 2nd (lasting 1 month), we move on to the System Planning stage. Subsequently, we engage in Educational Content Determination and Planning, which takes place from March 2nd to April 16th (spanning 2 weeks). Next, we go to the Testing phase, which will take place from April 16th to May 15th, lasting for a duration of one month. Subsequently, we will enter the concluding stage of Launch and Maintenance, which will span from May 15th to July 5th.

3.3. Project Cost Management

The input documents utilized in cost diagrams comprise the Work Breakdown Structure (WBS) and Project Charter. By utilizing a Work Breakdown Structure (WBS), we can effectively determine the necessary resources and associated expenses for each component of a project. This aids in the meticulous planning and estimation of expenditures. The Project Charter, within the realm of Project Cost Management, includes details pertaining to the sequence of actions performed in the project. This information is crucial for comprehending and strategizing project expenses.

During the process of creating the cost structure, we incorporate multiple efficient methodologies to guarantee the precision and achievement of project cost planning. Initially, we employ Expert Judgement to acquire insights and evaluations from specialists in several associated domains. They offer significant perspectives to facilitate informed decision-making and assess intricate circumstances pertaining to project expenditures. Furthermore, we hold frequent meetings between the Project Management team and project directors. During these sessions, we meticulously analyze many facets of the project's expenses, such as cost projections, allocation of resources, and management of the budget. This thorough deliberation guarantees the active participation of all stakeholders in the decision-making process regarding project expenses, resulting in the creation of a comprehensive cost framework that aligns with the project requirements. By integrating Expert Judgement and Meetings, we can provide precise and comprehensive cost structures, which serve as a robust foundation for efficiently and successfully managing project costs.

Project Team Member	20	Rp 900.000	Rp 18.000.000	12%
Functional and Nonfunctional Cost	7	Rp 2.000.000	Rp 14.000.000	9%
2. Designing UI UX				
Creating the Wireframe	2	Rp 850.000	Rp 1.700.000	1%
Creating the System Mockup	2	Rp 1.000.000	Rp 2.000.000	1%
3. System Planning				
Software License	5	Rp 4.000.000	Rp 20.000.000	13%
Database System Planning	3	Rp 10.000.000	Rp 30.000.000	19%
Security System Planning	2	Rp 10.000.000	Rp 20.000.000	13%
System Framework Planning	2	Rp 5.000.000	Rp 10.000.000	6%
4. Content Planning and Creating				
Content Creation Planning	3	Rp 500.000	Rp 1.500.000	1%
Creating Educative Content	3	Rp 1.000.000	Rp 3.000.000	2%
5. Testing				
UI/UX Testing	3	Rp 500.000	Rp 1.500.000	1%
Apps System Testing	5	Rp 500.000	Rp 2.500.000	2%
Security System Testing	3	Rp 2.000.000	Rp 6.000.000	4%
6. Publishing dan Maintenance				
Maintenance	10	Rp 600.000	Rp 6.000.000	4%
System Evaluation	5	Rp 2.000.000	Rp 10.000.000	6%
Total				

Table 2. Cost Structure Project

Details	**Unit**	**Cost per Unit**	**Subtotals**	**% from Total**
1. Project Planning				
Project Manager	2	Rp 2.000.000	Rp 4.000.000	3%

Table 2 outlines the detailed breakdown of the project cost structure, covering various stages from planning, development, testing, and maintenance. The costs are organized by task, required units, cost per unit, subtotal, and the percentage of the total project budget. The first category, Project Planning, includes salaries for the project manager and team members, accounting for 24% of the total budget. This stage focuses on initial coordination and management activities. The second category, Designing UI/UX, represents 2% of the budget and involves creating wireframes and system mockups to ensure an intuitive and user friendly design. System Planning is the most significant category, making up 51% of the total budget. It encompasses software licensing, database planning, security system planning, and system framework planning, which are critical for establishing a robust infrastructure. Content Planning and Creating comprises only 3% of the budget, focusing on planning and creating educational content for the platform.

Testing activities account for 7% of the budget and include UI/UX testing, application system testing, and security system testing to ensure the platform quality and security before launch. Lastly, Publishing and Maintenance, which includes system maintenance and evaluation, constitutes 10% of the budget, emphasizing the longterm sustainability of the system. In summary, Table 2 demonstrates a well-organized allocation of costs, with significant emphasis on system planning (51%) to ensure a strong foundation for the project. Adequate funding is also allocated to other areas, such as testing and maintenance, to guarantee the quality and longevity of the system.

The cost structure outlined in Table 2 reflects a strategic allocation of resources to ensure the project success at every stage. By dedicating over half of the total budget to system planning, the project prioritizes building a secure and reliable infrastructure that can support the platform longterm objectives. Additionally, while categories like Designing UI/UX and Content Planning may represent smaller portions of the budget,

their significance lies in enhancing the user experience and ensuring the platform remains engaging and educationally valuable. The attention to testing and maintenance further highlights the commitment to delivering a high quality product that not only meets user needs but also sustains its performance over time. This balanced approach to cost distribution underscores the project focus on achieving both immediate functionality and longterm sustainability.

3.4. UI/UX

A. Login/Register

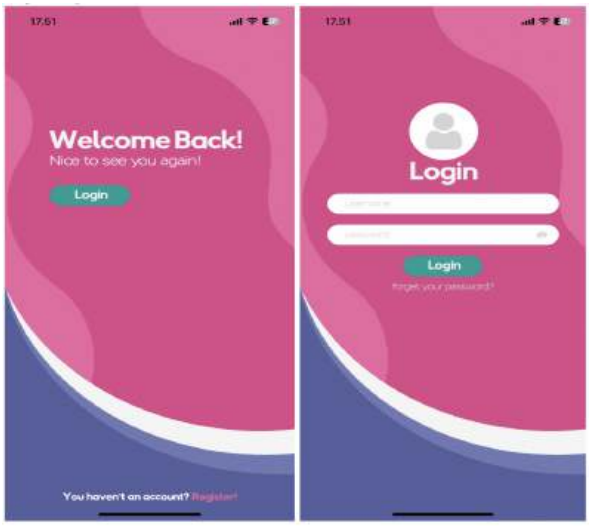

Figure 5. Login/Register

Figure 5 showcases the user interface design for the login and registration process of the application. The design prioritizes simplicity and accessibility to ensure a seamless user experience. This UI design reflects the application focus on intuitive navigation and a welcoming user experience, making it accessible to all users, including those less familiar with technology.

B. Home Page

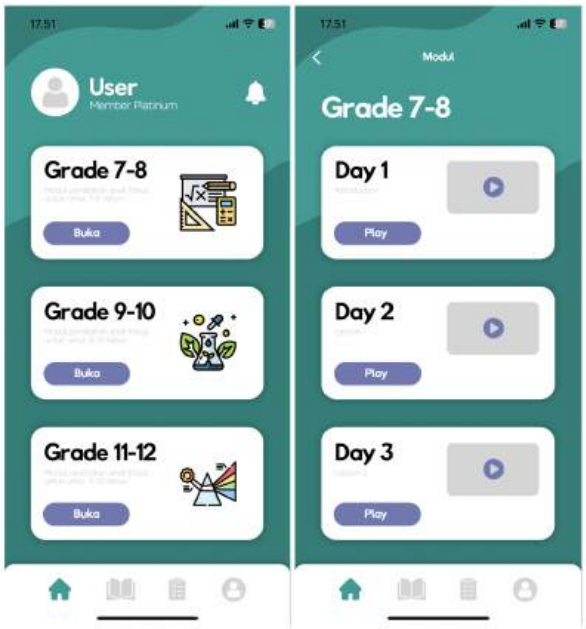

Figure 6. Homepage

Figure 6 illustrates the design of the application homepage interface, focusing on intuitive navigation and accessibility for users. This homepage design demonstrates a user centered approach, providing quick

access to personalized content while maintaining a visually appealing and structured interface. It ensures that users, especially children, can easily find and engage with the learning materials tailored to their educational needs.

C. List of Lessons and Reading Materials

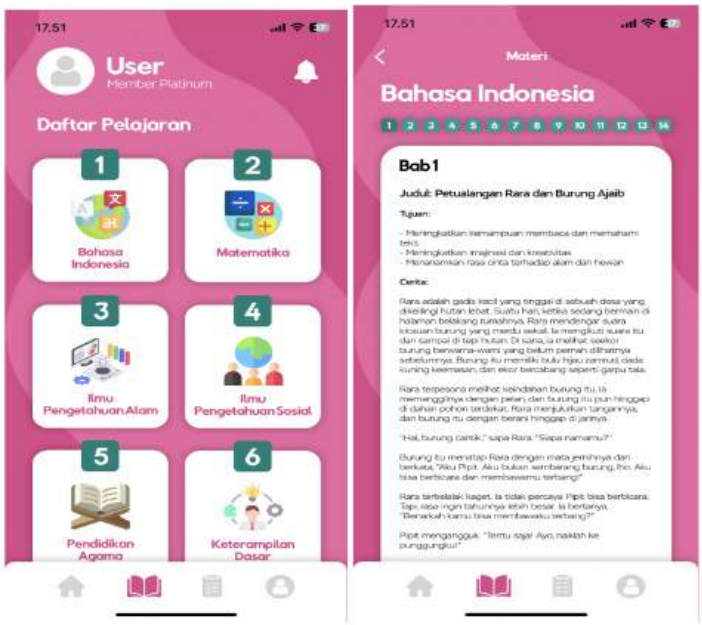

Figure 7. Lessons and Reading Materials

Figure 7 showcases the user interface for accessing lessons and reading materials within the application. The left screen displays the main menu with a list of subjects, such as Bahasa Indonesia, Mathematics, Natural Sciences, Social Sciences, Religious Education, and Basic Skills. Each subject is represented by a numbered button with an icon, providing a clear and intuitive navigation experience for users.

D. List of Tasks & Task Questions

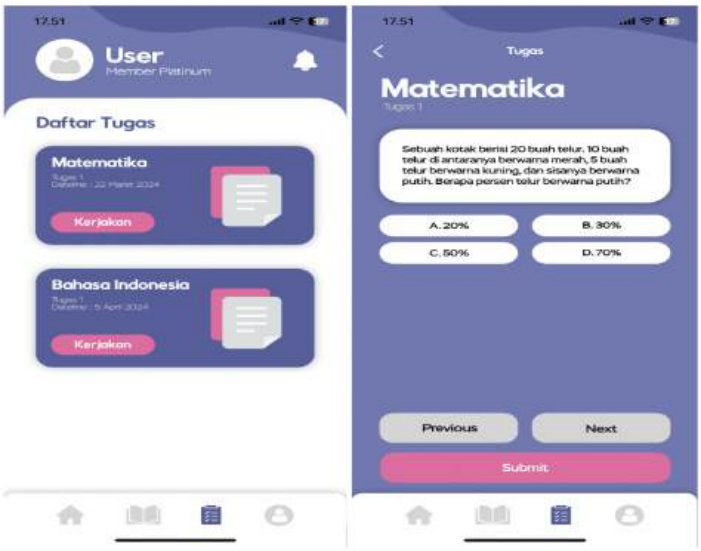

Figure 8. Tasks & Task Questions

Figure 8 illustrates the user interface for managing and completing tasks within the application. The left screen displays a list of tasks organized by subject, such as Mathematics and Bahasa Indonesia. Each task card includes the task title, due date, and a prominent ”Kerjakan” (Do) button, enabling users to easily access and work on their assignments.

E. Profile & Settings

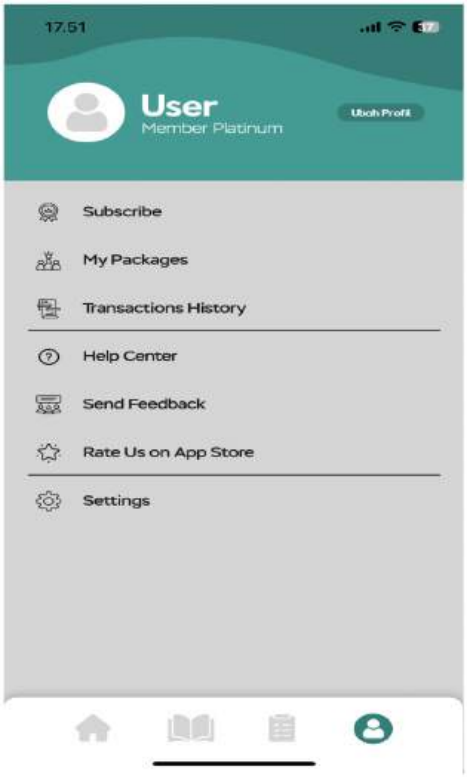

Figure 9. Profile & Settings

Figure 9 showcases the Profile and Settings interface, providing users with various options to manage their account and access application features. At the top, the interface displays the user’s profile name and membership status, along with an option to edit the profile through the ”Ubah Profil” (Edit Profile) button.

4. MANAGERIAL IMPLICATIONS

The study highlights the need for integrating advanced technologies like AI and AR into educational platforms to enhance personalized learning for children aged 7-12. Educational institutions and policymakers must focus on bridging digital literacy gaps, ensuring responsible technology use, and addressing disparities in access to digital tools. By fostering inclusive and engaging learning environments, these efforts can improve educational outcomes while preparing students for the challenges of the digital era.

5. CONCLUSION

Digital transformation has profoundly impacted education, especially for children aged 7 to 12. Leveraging advancements in AI and AR, this study highlights the potential of interactive platforms to enhance engagement, motivation, and learning outcomes. Despite these opportunities, challenges such as unequal access to technology, excessive screen time, and the need for improved digital literacy remain pressing issues that must be addressed.

This research developed an interactive educational platform tailored to the specific needs of young learners. Through a user centered design process encompassing literature reviews, iterative user interface

development, content creation, and testing the platform integrates personalized learning pathways, engaging multimedia, and immersive AR experiences. It also emphasizes data security and digital literacy, ensuring safe and responsible technology usage among children.

To advance this work, future efforts should focus on expanding access to underserved regions, enhancing digital literacy modules, and incorporating adaptive learning analytics for greater personalization. By addressing these areas, the platform can continue to evolve as a sustainable, inclusive solution, fostering creativity, interpersonal skills, and academic growth for the next generation in the digital age.

6. DECLARATIONS

6.1. About Authors

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6.2. Author Contributions

Conceptualization: AF; Methodology: DY, AS and FE; Software: RN dan AF; Validation: AF; Formal Analysis: RN, FE and DY; Investigation: AF, DY, and FE; Resources: AF; Data Curation: FE; Writing Original Draft Preparation: DY and AS; Writing Review and Editing: AF, AS, and FE; Visualization: FE; All authors, RN, FE, DY and AF, have read and agreed to the published version of the manuscript.

6.3. Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6.4. Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

6.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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