

Game-based Digital Media Development to Improve Early Children's Literacy

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Abstract - One aspect of early childhood development that is very important is the language aspect, including early literacy skills. To enhance this development component, media development—including digital-based media—is required. In light of this, the goal of this research is to create digital media that is based on games to enhance early childhood literacy. Assessment/Analysis, Design, Development, Implementation, and Evaluation are the five stages that make up the Lee and Owens paradigm. The kids in the study ranged in age from 4 to 5. Techniques for gathering data include documentation, interviews, and observation. Digital media is designed using the Android operating system. The results show that the N-Gain Score value is 0.77 and the N-Gain Score (%) is 77.00%. Thus, it shows that game-based digital media is effective in improving literacy skills in early childhood with an effectiveness value of 77.00% with very high level of effectiveness.

Keywords: Digital Media, Early Literacy, Early Childhood

I. INTRODUCTION

Normative Background

Education is an effort to develop human resources to the point where they possess the knowledge, expertise, and high level of competitiveness needed to meet all global issues. A method that boosts young children's enthusiasm and active participation is required to promote this development (Hepach et al., 2023; Karim et al., 2023). Instead of being teacher-oriented, the optimal way to execute learning in PAUD should be student-oriented (Branitskiy et al., 2019). To achieve learning objectives effectively and efficiently, students must be psychologically engaged, which calls for student-oriented learning (Evripidou et al., 2020; Saarinen et al., 2020; Zhu et al., 2022). Human resource development initiatives cannot be isolated from all supporting resources, including the outcomes of rapid technical innovations, aside from the implementation of proper learning methodologies (Timotheou et al., 2023; Chan & Hu, 2023; Kultsum et al., 2022).

Technological development has long started in developed countries. This also encourages Indonesia as a developing

country to be on par with these countries, including encouraging efforts to update and utilize technological results in learning activities to create effective learning (Purnomo et al., 2022). So (Seenin et al., 2021) stated that a whole range of supporting components, including media, instructional materials, assessment systems, and other tools, are necessary to create effective learning.

In its implementation, the use of learning media is closely related to current technological developments. So, educators need to have high skills and creative power to create superior learning products (Keshav et al., 2022; Karim et al., 2022). These skills and creativity include 1) the ability to combine media in learning; 2) the ability to manage large groups of students; 3) the flexibility to redesign according to the needs, context, and characteristics of each student; and 4) the ability to present a variety of learning media. To produce superior products, teachers must have the skills to use various learning tools that are available and that have been developed. They need to master the use and development of media, resources, and instructional strategies that match the requirements of their institution (Aydalga et al., 2020). A solid grasp of how to use educational media is very important to support the above abilities. Apart from that, it is also important to understand the learning strategies suggested (Arum et al., 2020), who emphasize that choosing the right learning strategy is very influential. The strategy must be able to grab students' interest and focus and take into account their active participation in the educational process. Educators who understand this will be capable of assessing and modifying learning models to achieve optimal results (Arum et al., 2020; Casta et al., 2021).

Empirical Background

Based on the preliminary showing, its ability for early childhood literacy in Indonesia is still comparatively low. The lack of achievement in children's literacy levels can be caused by the use of conventional learning methods, where the teacher's role is dominant in teaching in front of the class and literacy material is limited to the use of "paper and pencils"

as well as a lack of use of learning media. This the more strengthen low literacy in Indonesia, as explained (Solihin, 2020) regarding the reading emergency in Indonesia that there are 70% of children whose ability to read is at in lower competence minimum.

These findings illustrate that the teaching methods used by teachers have not been effective in increasing literacy levels in early childhood. Thus, it is necessary to develop new learning media to support learning approaches that focus on students and prioritize the principles of play. This opinion is in line with the view (Ndia et al., 2020; Rinto et al., 2020), who emphasize that the creation of innovative teaching methods is based on a paradigm shift regarding the learning process.

Devices that are compatible with these technologies, including smartphones or laptops with AR and VR capabilities, are necessary for certain types of immersive learning, such as mixed reality, which mixes AR and VR, or virtual reality (VR) (Erik et al., 2024). However, at the PAUD level, children generally do not have or are not able to use devices with these features (Karim et al., 2020). So, in this research, the game developed is an educational game for the Android platform that can be accessed by children using smartphones with standard specifications and tailored to their characteristics and abilities (Pokric et al., 2015).

The utilization of educational games aligns with Edgar Dale's theory of the cone of experience, which indicates that people are more likely to remember information when they are actively involved in learning. In this context, the percentages are as follows: 10% from reading, 20% from listening, 30% from seeing, and 50% from both hearing and seeing., and seventy percent of the information they encounter are retained in their memory they express verbally and write, and 90% of the information they put into practice directly. The development of a literacy learning model through digital games creates active involvement and contribution from children in the learning process, which in turn increases overall learning outcomes (Sreekala & Baby, 2019). This approach is also supported by many learning theories, including constructivism, behaviorism, cognitivism, social learning, and connectivism.

The research findings of (Hsiao et al., 2014) showed an increase in children's manual dexterity and inventiveness through a digital learning environment built around games. This research also confirms that children who use the ToES learning model outperform people who employ standard learning approaches in terms of learning. Research (Hwang et al., 2013) shows that educational computer games increase children's learning achievements and their learning attitudes. Other studies, such as that of (Shoosmith et al., 2019; Kowaluk & Woźniowski, 2019), also reveal the effectiveness of interactive games in increasing children's physical activity and digital literacy.

Thus, the significance of this study developing about the early childhood literacy learning media through game-based

digital media is an important step in introducing innovative and effective learning approaches. Consequently, the purpose of this study is considering the need to develop a learning model that is different from the learning models used by teachers so far, the researchers developed a model for early childhood literacy learning through game-based digital media.

II. METHOD

Lee & Owens Model (Lee, 2004) comprises five steps: evaluation, design, development, implementation, and assessment. The Lee and Owens Model is this. The study's participants were elementary school-aged kids from Tasimalaya City, West Java, who were part of a program for young learners. From January to May of 2024, researchers conducted the study. Qualitative data was gathered through writing descriptions of information, conducting interviews, documenting findings, and validating hypotheses. Quantitative data analysis techniques utilized N-gain scores, which were determined by comparing pre- and post-test scores. The N-Gain test is a method commonly used to measure the effectiveness of game-based digital media development in improving children's early literacy.

III. RESULTS AND DISCUSSION

3.1 Digital Media Development Playing Characters

3.1.1 Assessment/Analysis

Through this stage, a summary of the early literacy education process that has been implemented so far can be obtained, including a) early literacy learning is carried out using a one-way method, teaching by only telling the shape and pronunciation of letter symbols; b) the use of media in learning is not optimal (only using images printed by the teacher himself); c) the size of the media used is very small so that students sitting at the back find it difficult to see the media.

3.1.2 Design

Create the conversation flow, storyboard, and application content script at this point. The architecture of Information Programming teams utilizes flowcharts as a guide while developing game systems. Flowcharts: Storyboards are created by game designers using user flows as a reference in Fig. 1.

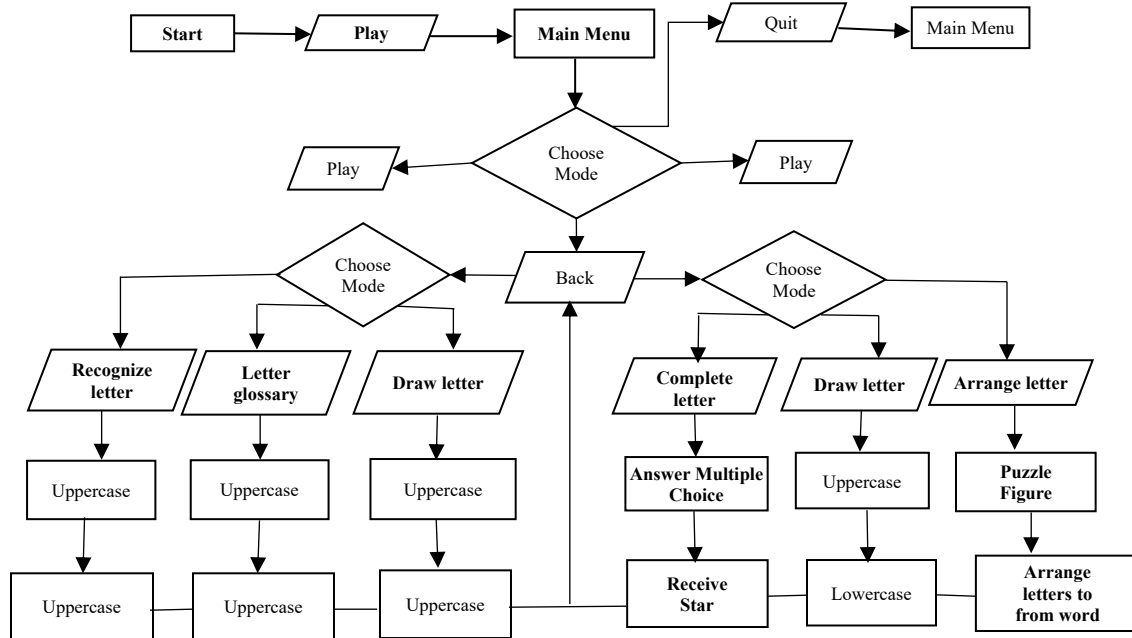


Fig. 1 Information Architecture Flowchart & User Flow Flowchart

3.1.3 Development

Right now, specifically during the pre-production and production phases. Choosing colors, models, icons, buttons, logos, and typography are all part of the pre-production phase. Professionals in the fields of game design, programming, management, and 2D art all work together throughout the production stage of a video game. Three diverse experts evaluated the PROS-VN application using their areas of expertise to validate it (expert judgment) (Karim et al., 2023).

Fig. 2 shows before conducting direct trials on early childhood (4-5 years), this step was carried out to provide relevant input regarding the viability of applying the "Playing Literacy" media. The three experts include practitioners of early childhood education programs, media specialists in early childhood education, and experts in software engineering.



Fig. 2 Playing Characters Application



3.1.4 Implementation

Finding out whether users (children and teachers) can understand the digital media application "Playing Literacy" is the goal of this activity. Implementation activities were carried out in 3 (three) educational institutions, namely RA Al Muttaqin, RA Baiturrahman, and RA At Taufiq, Tasikmalaya City, West Java. As a result, When the teacher presented the "Playing Literacy" application to the kids, they were excited; 2) Kids can mimic how the letters in the application are pronounced; 3) Kids focus intently on the sounds and pictures in every application; 4) Kids can try again if they get the answer wrong; 5) Kids can use apps on their cellphones that the school provides; and 6) Generally, the amount of time kids spend using an application depends

on the length of time they spend using each sub-material to avoid getting bored.

3.1.5 Evaluation (Evaluation)

The penultimate stage of developing PAUD early literacy games included expert evaluations, student one-on-ones, small group assessments, and field testing (Karim et al., 2020). Attached are the findings from expert assessments, student assessments conducted one-on-one, and small group assessments.

3.2 The Effectiveness of Digital Media on Early Childhood Literacy Behavior

By comparing pre- and post-test scores, the N-Gain test may reveal how well a digital media-based game-based reading acquisition strategy works for young children shown in Table I. Each successive assessment yielded the same findings, which are:

TABLE I PRE-TEST AND POST-TEST RESULTS

Subjek	Pre-Test			Post-Test		
	Skor	Nilai	Ket	Skor	Nilai	Ket
A	16	62	BSH	25	96	BSB
A	14	54	BSH	23	88	BSB
R	15	58	BSH	23	88	BSB
H	19	73	BSB	25	96	BSB
R	20	77	BSB	26	100	BSB
G	5	19	MB	15	58	BSH
A	14	54	BSH	24	92	BSB
K	6	23	MB	16	62	BSH
S	15	58	BSH	24	92	BSB
A	14	54	BSH	22	85	BSB
A	19	73	BSB	26	100	BSB
E	18	69	BSB	26	100	BSB
A	12	46	BSH	23	88	BSB
A	13	50	BSH	22	85	BSB
Q	16	62	BSH	25	96	BSB
A	6	23	MB	14	54	BSH
Z	20	77	BSB	26	100	BSB
A	8	31	MB	20	77	BSB
Mean	14	53	BSH	23	87	BSB

After carrying out the N-Gain test, the outcomes that followed were as follows:

TABLE II N-GAIN TEST RESULTS

Descriptive			
		Statistic	Std. Error
Gain	Mean	.7744	.04317
	Interquartile Range (95% CI)	.6833	
	Lower Limit	.8655	
	In Order to Determine		
	Maximum Limit		
	The Reduced Mean by 5%	.7925	
	Median	.7937	
	Variance	.034	
	Average Distinction	.18317	
	Very minimal	.40	
	The top	1.00	
	Range	.60	
	Distance between the two extremes	.25	
	Uneven distribution	- 524	.536
	Kurtosis	- 431	1.038

Based on the calculations carried out, an N-Gain rating of 0.77 was obtained and an N-Gain Score (%) of 77.00%. This

shows that the early childhood literacy learning model through game-based digital media is efficient in raising the level of early literacy of PAUD students with an effectiveness value of 77.00% and is categorized as having a very high level of effectiveness in Table II.

IV. CONCLUSION

Using the Lee and Owens model, which includes steps and descriptions of media displays appropriate for use at the early childhood education level, game-based digital media is developed to enhance the literacy of children aged 4-5. "Playing Literacy" is a digital media application for Android-powered personal computers that serves as early childhood education media. The results support the use of the online tool "Playing Literacy" to improve reading skills in preschoolers. Validity tests conducted by experts. The results of field trials show that digital media has an N-Gain rating of 0.7744 and an N-Gain rating (%) of 77.00%. Thus, it shows that game-based digital media is effective in improving literacy skills in early childhood with an effectiveness value of 77.00% with very high level of effectiveness. The general conclusion to ensure the aim of this study is that development of game-based digital model can improve the literacy skill of children in the early childhood.

It is suggested that educators use this digital medium, which has been developed to increase the literacy of young children aged four to five years, based on the research results that have been given. to improve the literacy of early childhood. It is recommended that the use of digital media be carried out with the guidance of a teacher or parent. For future researchers and developers, it is necessary to develop early childhood literacy learning media through digital media with material covering all themes in PAUD to produce intelligent children in the future.

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