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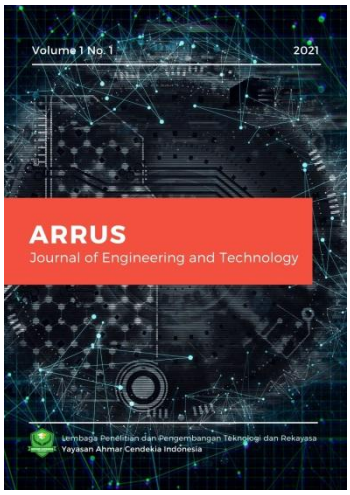

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RESEARCH ARTICLE / REVIEW ARTICLE

Development of An Educational Alphabet Game for Early Childhood Using Construct 3

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Abstract: The shift in learning behavior among Generation Z and millennial children, born into the digital era, emphasizes the need for engaging, interactive, and meaningful educational tools. This study aims to develop an Android-based educational game application using Construct 3 to help early childhood learners recognize and spell alphabets. The development follows the ADDIE model, which includes Analysis, Design, Development, Implementation, and Evaluation phases. The game incorporates drag-and-drop mechanics to arrange letters into words based on visual prompts. Black-box testing confirmed the application functioned as intended. The game is expected to enhance early literacy by providing a fun, interactive learning experience on mobile platforms.

Keywords: Educational Game, Alphabet Learning, Early Childhood, Construct 3, Android.

1. Introduction

In the digital age, early childhood education is undergoing a rapid transformation, particularly in how foundational literacy skills such as letter recognition are introduced. Children from Generation Z, born into a technology-driven world, tend to prefer interactive, game-like learning experiences over traditional textbook-based instruction. As such, educational game applications have emerged as effective tools for engaging young learners. According to Lin and Aloe (2021), game-based learning demonstrates moderate to strong effects on early learners' cognitive development, motivation, and social-emotional engagement, making it an ideal approach for promoting foundational literacy skills.

Letter recognition plays a critical role in a child's ability to read and write. Mastery of alphabet knowledge serves as a prerequisite for phonemic awareness and decoding, which are core components of early literacy (Ignacio & Panergayo, 2023). The use of educational games that incorporate drag-and-drop functionality, visual prompts, and auditory reinforcement can significantly enhance children's letter recognition skills. Research by Andini (2023) found that letter card box games, which use visual and tactile elements, improved letter naming accuracy and engagement among children aged 4–5 years.

Mobile-based educational applications are particularly effective due to their accessibility and ease of use. Android platforms dominate the mobile market in many developing regions, making them

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suitable targets for educational content deployment. Construct 3, a 2D game development engine that utilizes HTML5, allows non-programmers to develop highly interactive and visually appealing games through its drag-and-drop interface. Previous research by Purnomo et al. (2023) highlights the suitability of Construct 3 in designing educational games that support narrative-driven learning while also providing intuitive control systems suitable for young users.

This study aims to develop an educational game focused on alphabet sequencing for early childhood learners. The application is built using Construct 3 and follows the ADDIE instructional design model: Analysis, Design, Development, Implementation, and Evaluation. Each phase is intended to ensure the application addresses real learning needs, incorporates effective pedagogical design, and functions reliably across Android devices. By combining interactive gameplay with structured instructional methodology, this research contributes to the growing field of mobile learning and supports the development of literacy skills in a playful, accessible, and educationally sound manner.

2. Literature Review

2.1. Game-Based Learning in Early Childhood

Game-based learning (GBL) has been widely recognized as an effective instructional approach in early childhood education. It promotes engagement, motivation, and cognitive development by integrating gameplay mechanics with educational content. A meta-analysis by Clark et al. (2016) revealed that serious educational games significantly improve learning outcomes, especially among learners aged 3–10. Moreover, Lin and Aloe (2021) emphasized that GBL is particularly effective in enhancing early literacy, numeracy, and social-emotional learning, as it provides a safe space for exploration and repetition..

2.2. Alphabet Recognition and Literacy Development

Construct 3 is a visual programming tool designed for rapid game development without requiring extensive coding skills. Its HTML5-based engine supports cross-platform deployment, including Android, making it ideal for educational contexts. Purnomo et al. (2023) noted that Construct 3's drag-and-drop interface and real-time preview capabilities enable efficient development of educational games suitable for young learners. The tool is particularly beneficial in low-resource settings, where intuitive design and deployment flexibility are critical.

2.3. Construct 3 for Educational Game Development

Construct 3 is a visual programming tool designed for rapid game development without requiring extensive coding skills. Its HTML5-based engine supports cross-platform deployment, including Android, making it ideal for educational contexts. Purnomo et al. (2023) noted that Construct 3's drag-and-drop interface and real-time preview capabilities enable efficient development of educational games suitable for young learners. The tool is particularly beneficial in low-resource settings, where intuitive design and deployment flexibility are critical..

2.4. The ADDIE Model in Instructional Design

The ADDIE model—comprising Analysis, Design, Development, Implementation, and Evaluation—is one of the most widely used frameworks in instructional design. It provides a systematic method to ensure that learning materials meet learners' needs while maintaining pedagogical soundness (Branch, 2015). In the context of educational game development, ADDIE helps designers align gameplay with learning objectives, user experience, and technological feasibility. This model has been successfully applied in various multimedia learning applications, including literacy-focused games (Ramadani & Yusuf, 2022).

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2.5. Related Works

Several studies have explored the design of educational games using Construct 2 and 3. Pebi Suherni (2024) developed an animal-naming game using Construct 2, showing positive user reception and functional performance. Similarly, Krisdiawan (2022) created an alphabet and number recognition game that significantly improved children's reading preparedness. These works demonstrate the practical and pedagogical effectiveness of simple 2D educational games in early childhood contexts.

3. Research Method and Materials

3.1. Research Design

This study adopts a Research and Development (R&D) methodology with the ADDIE development model, which is widely used in educational technology. The ADDIE framework consists of five sequential stages: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2015). This approach provides a systematic structure for designing, developing, and validating interactive multimedia applications such as educational games.

3.2. Development Stages Using ADDIE

3.2.1. Analysis

At this stage, researchers identified the learning challenges experienced by early childhood students in recognizing and spelling alphabets. Needs analysis was conducted through field observation and informal consultation with early childhood educators. The conclusion highlighted the need for an engaging, mobile-based application that helps children practice arranging letters into meaningful words.

3.2.2. Design

This stage focused on storyboard creation, interface layout, navigation flow, and categorization of game content. Two main categories were selected—objects and animals—each containing several words to be spelled by arranging letters. Game mechanics were designed to be drag-and-drop, with immediate visual and textual feedback upon correct answers.

3.2.3. Development

The educational game was developed using Construct 3, a 2D HTML5-based game engine that requires no programming knowledge. Game assets, including images, backgrounds, and UI components, were created and imported. Each game scene was developed to reflect intuitive interactions for children aged 4–6.

3.2.4. Implementation

The finished game was exported as an Android-compatible application and tested on devices with Android versions 7.0 and above. Offline functionality was enabled to ensure accessibility without internet access.

3.2.5. Evaluation

Evaluation was carried out using Black Box Testing and informal user testing with 10 early childhood students. The testing confirmed that all features—including navigation buttons, question flow, and feedback systems—functioned correctly. Additionally, positive feedback was received from both children and supervising teachers regarding usability and engagement

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3.3. Tools and Materials

The tools and materials used in this research include:

Table 1. Materials

No	Tools/Materials	Description
1	Construct 3	Game engine for drag-and-drop-based game creation
2	Android Smartphone	Target platform for deployment
3	Audio & Graphic Assets	Alphabet images, icons, and feedback sounds
4	Storyboard & Flowchart	Planning and organizing learning flow
5	Testing Questionnaire	For user experience evaluation

3.4. Target Audience

The target audience of this game includes children aged 4 to 6 years old, particularly those in pre-kindergarten or early kindergarten levels. The design prioritizes visual simplicity, intuitive interaction, and motivational reinforcement.

4. Results and Discussion

4.1. Software Specifications

The development of the educational alphabet game was carried out using various software tools to ensure a smooth workflow and high compatibility with Android devices. The following table outlines the software specifications used throughout the development and testing process::

Table 2. Software Specifications

No	Software Name	Function
1	Construct 3	Main development platform for creating 2D drag-and-drop game scenes
2	Web Browser	Used to preview and test the game (Chrome or Firefox recommended)
3	Photoshop / Canva	Design tools used to create and edit images and background visuals
4	Audacity	Audio editing tool used to process voice prompts and sound effects
5	APK Exporter	To compile and package the game into Android APK format
6	Android Emulator	For in-development testing of the mobile app before real deployment

4.2. System Specifications

The development and rendering process for the virtual tour application was carried out on a system with the following specifications:

Table 3. System Specifications

Component	System Name	Function
Processor	Intel Core i5 or equivalent	Intel Core i7-11700H
RAM	8 GB	16 GB DDR4
Storage	256 GB SSD	512 GB SSD
VGA/GPU	NVIDIA GTX 1050 or equivalent	NVIDIA RTX 3060
Operating System	Windows 10 or macOS High Sierra	Windows 11 Pro
Monitor Resolution	Minimum 1366×768	1920×1080 Full HD

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4.3. Application Usage Guide

The application is designed to be intuitive and simple for early childhood users. It consists of a series of interactive screens that guide the user through the learning process. Below is a step-by-step usage guide for navigating the educational alphabet game:

Step 1: Launch the Application

Upon opening the game, users will be presented with the Main Menu, which includes three buttons:

Figure 1. Launch the Application

(1). Start – Begins the game by navigating to the category selection screen.
(2). Help – Opens an instruction screen explaining how to play the game.
(3). Profile – Displays information about the developer and version of the game.

Step 2: Select a Category

After clicking Start, the user is taken to a Category Selection screen. Two categories are available:

Figure 2. Select a Category

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(1). Objects – Includes questions related to common daily items.
(2). Animals – Includes questions that feature various animal names.
(3). Clicking on either category will bring the user to the corresponding set of questions.

Step 3: Answer Questions

Each game question displays:

Figure 3. Answer Questions

(1). A picture representing an object or animal.
(2). A set of letter tiles below the image.
(3). Empty answer boxes to be filled by dragging the correct letters in order.

The player must drag and drop each letter into the correct position. If a letter is placed incorrectly, it will return to its original location.

Step 4: Receive Feedback

eIf the answer is correct, a message such as "Great Job!" will appear along with a sound effect to reinforce positive feedback. The user will then have two options:

Figure 4. Receive Feedback

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(1). Next – Proceed to the next question.
(2). Replay – Repeat the current question.

Step 5: Using Help and Profile Features

The Help menu explains how to interact with the game, including drag-and-drop mechanics and how to navigate between screens.

The Profile menu displays developer identity, including name, major, and institutional affiliation.

Figure 4. Receive Feedback

4.4. User Requirements Testing

To ensure that the application functions properly and meets its intended educational purpose, a user testing session was conducted with 10 early childhood learners aged between 4 to 6 years old. This evaluation focused on usability, comprehension, and engagement.

The children were introduced to the application and allowed to interact freely after brief guidance. Observations were made regarding their interaction with key features of the application.

Table 4. Observation Table of User Testing

No	Participant	Navigation Ability	Drag-and-Drop Success	Error Handling	Feedback Response	Completion Status
1	Child 1	✓ Easily navigated	✓ Correctly arranged letters	✓ Understood retry	✓ Smiled and continued	Completed
2	Child 2	✓	✓	✓	✓	Completed
3	Child 3	✓	✓	✓	✓	Completed
4	Child 4	✓	✓	✓	✓	Completed
5	Child 5	✓	✓	✓	✓	Completed
6	Child 6	✓	✓	✓	✓	Completed
7	Child 7	✓	✓	✓	✓	Completed
8	Child 8	✓	✓	✓	✓	Completed
9	Child 9	✓	✓	✓	✓	Completed
10	Child 10	✓ With some help	✓	✓	✓	Completed

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5. Conclusion

Based on the research and development process, the following conclusions can be drawn:

The Android-based educational game developed using Construct 3 effectively helps early childhood learners recognize and arrange letters into words.

The application follows the ADDIE development model and meets functional requirements, as confirmed through successful Black Box Testing.

User testing with 10 children showed that the game is intuitive, engaging, and supports independent learning through interactive drag-and-drop mechanics and immediate feedback.

The game runs offline, making it accessible in various environments and suitable for both school and home-based learning

References

Lin, L., & Aloe, A. M. (2021). The effects of game-based learning on early childhood education: A meta-analysis. Educational Research Review, 33, 100395. https://doi.org/10.1016/j.edurev.2021.100395

Ignacio, D. M., & Panergayo, J. (2023). Game-based instruction for letter recognition among preschoolers. Cognizance Journal of Research, 4(12), 59–66.

Andini, R. (2023). An analysis of letter recognition skills through the letter card box game in children aged 4–5 years. Early Childhood Research Journal, 15(2), 112–118.

Purnomo, H., et al. (2023). Design and building a 2D game as educational media for folklore learning using Construct 3. ARRUS Journal of Engineering and Technology, 4(2), 81–89.

Branch, R. M. (2015). Instructional Design: The ADDIE Approach. Springer.

Clark, D. B., Tanner-Smith, E. E., & Killingsworth, S. S. (2016). Digital games, design, and learning: A systematic review and meta-analysis. Review of Educational Research, 86(1), 79–122.

Ignacio, D. M., & Panergayo, J. (2023). Game-based instruction for letter recognition among preschoolers. Cognizance Journal of Research, 4(12), 59–66.

Lin, L., & Aloe, A. M. (2021). The effects of game-based learning on early childhood education: A meta-analysis. Educational Research Review, 33, 100395. https://doi.org/10.1016/j.edurev.2021.100395

Piasta, S. B., & Wagner, R. K. (2010). Developing early literacy skills: The role of letter knowledge. Early Childhood Research Quarterly, 25(2), 152–164.

Purnomo, H., et al. (2023). Design and building a 2D game as educational media for folklore learning using Construct 3. ARRUS Journal of Engineering and Technology, 4(2), 81–89.

Andini, R. (2023). An analysis of letter recognition skills through the letter card box game in children aged 4–5 years. Early Childhood Research Journal, 15(2), 112–118.

Ramadani, T., & Yusuf, H. (2022). Application of the ADDIE model in interactive educational game development. Journal of Educational Technology, 10(1), 44–51.