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Animal Diary: The Design and Development of a Game Application to Enhance Early Primary School Children's Attention

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Abstract

Attention is a fundamental component of academic achievement, as it allows children to concentrate on tasks, filter out distractions, and process information efficiently. This article presents an academic discussion on the development and design of Animal Diary, a smartphone-based digital game specifically designed to enhance selective attention in early primary school children. The discussion emphasizes the game's conceptual framework and implementation process. Animal Diary integrates principles from cognitive psychology and child-computer interaction (CCI) to provide an engaging, developmentally appropriate experience that supports attention training in young learners.

"Animal Diary" consists of three mini-games—Crocodile Dentist Roulette, Egg Chess, and Cooking Matching—each designed to challenge and improve children's ability to maintain focus. The game incorporates intuitive controls, a progressive challenge system, real-time feedback, and reward-based mechanics to sustain engagement and motivation. Developed using Unity, the application features a pixel art aesthetic and an interface optimized for young users, ensuring usability and eye-pleasing.

The conceptual design of the game was refined through interview sessions with primary school teachers, who provided insights and feedback on the developmental appropriateness and educational value of the game content. The feedback was positive, supporting the game's relevance for the target age group. In addition, a pilot test was conducted with two early primary school children to assess the game's usability and engagement. The results were positive, indicating that the games captured attention and maintained user interest.

Keywords: Sustained attention, Educational game design, Interactive learning, Gamification, Child-computer interaction

Background and Statement of the problem

Children today are increasingly exposed to interactive technologies, which play a significant role in education. Tools such as mobile devices, MOOCs, tablets, and laptops are widely used to enhance children's educational access and academic achievement (Anthony et al., 2021). Research has shown a positive association between interactive media use and cognitive as well as language development (Arabiat et al., 2022). One key cognitive skill that influences a child's learning and academic success is attention. Two types of attention related to this are selective attention and sustained attention. Selective attention refers the ability to focus on a specific object or event while filtering out distractions (Godwin et al., 2015). Sustained attention is the ability to maintain focus on a task or stimulus over a prolonged period of time (Betts et al., 2006). As a form of interactive media, video games have also been recognized as potential educational tools. Studies suggest that video games can enhance selective attention by engaging children in structured, goal-oriented activities that require sustained focus (Samson et al., 2021).

This paper is not presented as a research article, but rather as an academic discussion focusing on the development process and design considerations of a game intended for children. "Animal Diary" specifically created to enhance selective attention in young children. The game is engaging, age-appropriate, and based on cognitive psychology principles that support attention training. It incorporates visually stimulating yet balanced graphics, interactive gameplay mechanics, and a reward system to maintain focus without overwhelming the child. Key design and development considerations include intuitive controls, reward systems, and progressive challenges that gradually improve the child's ability to concentrate. Moreover, the game is designed to provide real-time feedback to reinforce positive behaviors, ensuring that children stay motivated and enjoy the learning process.

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Objectives

The objectives of this study, "Animal Diary: The Design and Development of a Game Application to Enhance Attention for Early Primary School Children," are as follows:

1. To design and develop an interactive digital game that enhances selective attention in early primary school children through engaging and age-appropriate gameplay.
2. To implement and evaluate key design features such as intuitive controls, progressive challenges, reward systems, and real-time feedback to maintain engagement and motivation.
3. To integrate cognitive psychology principles into the game's mechanics, ensuring that it effectively supports attention training.
4. To interview primary school teachers in order to gather feedback and pedagogical insights that inform the game's design and evaluate its relevance and applicability
5. To conduct a pilot usability testing with early primary school children to assess the game's usability and engagement level

Expected benefits

The expected benefits of this article are as follows:

1. By gamifying learning experiences, this game makes cognitive training more engaging and enjoyable, motivating children to develop their attention skills.
2. This study contributes to the field of educational technology (EdTech) by showcasing how game mechanics can effectively support cognitive development.
3. This project could serve as a foundation for further research on how digital games influence cognitive development in children.
4. This project may inspire the development of more specialized educational games targeting other cognitive skills like memory, problem-solving, and executive function.

Literature Review

A. Designing Interactive Systems for Children

As technology becomes more important in children's daily lives, interactive systems must be designed to support developmentally appropriate engagement. Child-Computer Interaction (CCI) is a field that focuses on the design, assessment, and implementation of digital systems tailored for children users. It also explores how technology influences children (Hourcade, 2022).

Children differ from adults not only in age but also in physics and cognition. Physically, children have smaller body, smaller hands, and had less developed fine motor control. This can make a certain interaction that require fine motor precision and control more difficult for children (Bruckman et al., 2007). In addition to physical differences, children also have distinct cognitive abilities. Their language development is under progress; thus, their vocabulary can be limited. Some children may have difficulty reading or comprehending written instructions (Druin et al., 2001). To improve accessibility, text-based interfaces should be avoided, or simplified language and age-appropriate vocabulary should be used (Bruckman et al., 2007). Furthermore, children's working memory capacity is smaller compared to adults, which can impact their ability to remember instructions, navigate complex menus, and retain prior interactions (Hourcade, 2022).

By considering children's unique physical, cognitive, and behavioral characteristics, designers and developers can create interactive systems that are more intuitive, engaging, and developmentally appropriate for young users.

B. Attention

One of cognitive functions that strongly influence children school performance is attention. Two types of attention related to this are selective attention and sustained attention. Selective attention refers the ability to focus on a specific object or event while filtering out distractions (Godwin et al., 2015), whereas sustained attention is the ability to maintain focus on a task or stimulus over a prolonged period of time (Betts et al., 2006). A study by McKay et al. (1994) indicates that the performance of sustained attention in healthy children aged 7 to 11 was stable but was less efficient in comparison to adults. The study also states that there was significant improvement in children's performances around 11 years of age. Another study also shows similar findings. Rebok at al. (1997) found that attentional performance, such as accuracy

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and reaction time improved from 8-10 years and again from 10 to 13 years. These findings suggest that sustained attention in children was less efficient that the adults and attentional abilities continue to develop throughout childhood, with notable improvements occurring during late childhood.

Research Methodology

A. Conceptual Design

The current version of Animal Diary includes three mini-games: Crocodile Dentist, Egg Chess, and Cooking Matching. In Crocodile Dentist, several teeth are randomly designated as "sore" teeth each time the mouth resets. These target teeth are initially highlighted in yellow for fifteen seconds before returning to a neutral white color. Players are required to concentrate and memorize the positions of all sore teeth to succeed. The second game, Egg Chess, is played on a 3x3 grid using eggs of three different sizes—small, medium, and large—instead of traditional chess pieces. Players take turns either placing an egg on an unoccupied square or upgrading an existing egg to a larger size. The gameplay demands sustained attention, as players must track both their own strategy and their opponent's moves. The third game, Cooking Matching, challenges players to match ingredients to a given recipe in the correct order. This game requires players to stay attentive and accurately recall the sequence of ingredients to complete the recipe successfully. In the design and development process, key features such as intuitive controls, progressive challenges, reward systems, and real-time feedback were carefully implemented and evaluated to maintain engagement and motivation among young users. These design elements were integrated into each mini-game to ensure an interactive and stimulating experience that encourages sustained attention and repeated play.

Prior to the game's implementation, an interview was conducted with two primary school teachers to obtain feedback on the conceptual framework and game design, as well as to assess the developmental appropriateness and practical applicability of the games in educational settings. The feedback received was positive and promising. Both teachers affirmed that the game content was understandable and age-appropriate for early primary school children. They noted that the difficulty level of the games was well-balanced—challenging enough to stimulate engagement without causing frustration. Importantly, both educators agreed that the games had strong potential to support the enhancement of children's selective attention, particularly through mechanisms that require memorization, sustained focus, and strategic thinking.

B. System Architecture

Animal Diary is a mobile application developed to enhance selective attention in early primary school children. The application was developed using Unity as the game development framework and was optimized for display on a smartphone screen in vertical orientation. Figure 1 illustrates the system architecture of the "Animal Diary" application, developed in Unity. The figure depicts the interaction between different components within the system:

1. User Interaction (Left Side):

The user interacts with the game through the user interface (UI), which runs on a mobile device. The user interface aesthetic was designed using the Procreate™ application, allowing for the creation of custom, visually appealing graphics tailored to young users. The interaction involves sending requests (user inputs) and receiving responses (feedback from the game).

2. Unity Engine (Middle Section)

The Unity engine serves as the game development framework, consisting of two main components: the user interface and the game system. The user interface manages player interactions and displays game elements, while the game system processes game logic, mechanics, and interactions.

3. Database (Right Side):

The database is responsible for storing and retrieving essential data, such as player progress, game settings, scores, and achievements.

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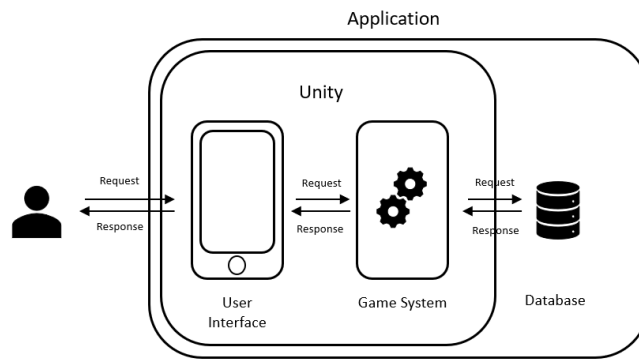Thonburi University, Bangkok, Thailand
May 15, 2025

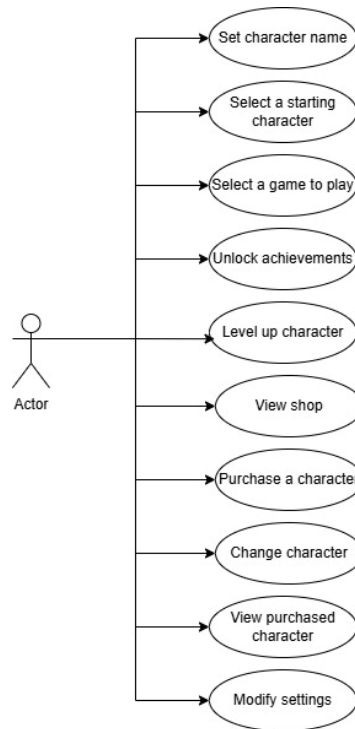Figure 1 System Architecture Diagram

Figure 2 Use Case Diagram

Figure 2 presents a Use Case diagram which describes the interactions between the user (actor) and the functionalities of the application. From the figure, the following use cases are included:
1. Set character name – allows the user to assign a name to their character
2. Selecting a starting character – Lets the user select a character at the beginning of the game
3. Select a game to play – Provide an option for the user to choose a game they want to play. In this current version of the game, there are three games available.
4. Unlock achievements – Enable the user to view milestones they have achieved and all that available.
5. Level up character – Allows the character to increase in level. In this game, this function allows user to gain additional costume for a character.
6. View shop – Lets the user browse characters available for purchase
7. Purchase a character – Provides options to buy new characters in the game
8. Change character – Allows user to switch between different characters
9. View purchased character – Lets the user see the character they own
10. Modify settings – Allows customization of game settings

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Research Results

    A. Implementation

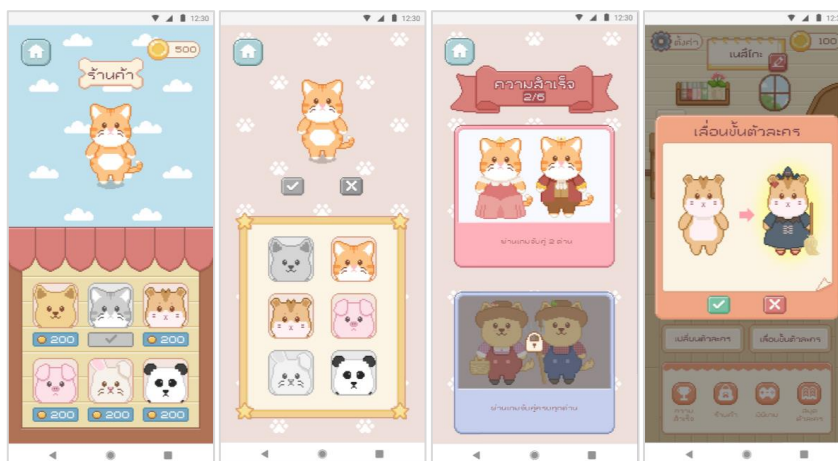Figure 3 - 6 Animal Diary Sample Screenshots (1)

Figure 7 - 10 Animal Diary Sample Screenshots (2)

       To create a visually appealing experience for young children, pixel art was adopted as the primary design style. Usability heuristics, such as maintaining consistency, preventing errors, ensuring system visibility, and providing real-time feedback, were integrated to enhance usability and engagement (Nielsen, 2020). Additionally, design considerations for young users were applied, including limiting text, offering concise descriptions, and employing visually attractive elements to maintain focus and interest (Hourcade, 2022). Figure 3–6 presents some screenshots from the game, starting with the landing page (leftmost), followed by the character selection page, the character name setting page, and finally, the lobby page (rightmost).

       Figure 7–10 presents screenshots from the character purchase page (leftmost), followed by the view purchased character page, the achievement page, and finally, the character level-up page (rightmost). In the current version of the game, six characters and six achievements are available. The idea behind unlocking multiple characters and achievements is to encourage users to replay the game.

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Figure 11 - 14 Animal Diary Sample Screenshots (3)

Figure 11-14 presents screenshots from the game selection page (leftmost), followed by the crocodile dentist roulette game, the egg chess game, and finally, the cooking matching game (rightmost). In the Crocodile Dentist game, multiple teeth are designated as "sore" teeth, which change randomly each time the mouth is reset. These sore teeth are highlighted in yellow for fifteen seconds before turning white. Players must stay focused and memorize the positions of all sore teeth. If a player taps a sore tooth, they lose the game. This game supports multiple players. The second game is Egg Chess. It is played on a 3x3 board using eggs instead of traditional chess pieces. The eggs come in three sizes: small, medium, and large. Players take turns either placing an egg on an empty square or replacing an existing egg to a larger size. The objective is to align three eggs of the same player in a row—horizontally, vertically, or diagonally— to win the game. This game supports multiple players. The third game is Cooking Matching. In this game, the player aims to match ingredients to a recipe in the correct sequence. This game supports single player. All the games, the players need to focus and memorize all the sore teeth. Thus, this game helps improve attention and concentration.

B. Pilot Usability Testing

A pilot usability test was conducted with two early primary school children to evaluate the game's usability, engagement, and overall user experience. During the session, the children were observed interacting with each mini-game, and informal feedback was gathered regarding ease of use, clarity of instructions, and level of enjoyment. The results were positive, indicating that the game successfully captured the children's attention, maintained their interest throughout gameplay, and was intuitive for the target age group to navigate without requiring extensive guidance.

Summary of the Study

The Animal Diary project centers on the design and development of a smartphone-based digital game intended to enhance selective attention in early primary school children. Recognizing that attention is a foundational cognitive skill vital to academic success—enabling learners to focus, resist distractions, and process information—this study explores how interactive technologies can be leveraged to support attention development through gameplay.

The game comprises three mini-games—Crocodile Dentist Roulette, Egg Chess, and Cooking Matching—each carefully designed to promote concentration, memory, and sustained focus. These games feature progressive challenge systems, real-time feedback, and reward-based mechanics to maintain engagement. The application, developed using Unity, includes an intuitive vertical interface tailored for smartphones, along with pixel art aesthetics that appeal to young users. Key gamified elements such as character customization, achievements, level progression, and an in-game shop were implemented to encourage continued play and cognitive reinforcement.

Prior to implementation, the conceptual design was reviewed through interviews with two primary school teachers. Their feedback was positive, highlighting the developmental appropriateness, clarity of gameplay mechanics, and the game's potential to enhance attention in young learners. The teachers also

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affirmed that the difficulty level and design features were well-suited for the target age group. After implementation, a pilot usability test was subsequently conducted with two early primary school children to assess ease of use, engagement, and attentional response. Observations and informal feedback from the session indicated that the game was intuitive, engaging, and capable of maintaining the children's interest throughout the gameplay experience. Overall, the initial findings suggest that Animal Diary holds promise as an educational tool for supporting attention development in young learners through interactive and age-appropriate game design.

Recommendations

This article does not present a research study but rather provides an academic exploration of the conceptualization, design, and development of an educational game for children. Acknowledging the current limitations of the Animal Diary application, we propose the following recommendations and directions for future development:

1. Usability testing was conducted with a limited number of participants (two early primary school children). To obtain more comprehensive insights into user experience and potential design improvements, future evaluations should involve a larger and more diverse sample of users.

2. To enrich the gameplay experience and sustain long-term engagement, additional content should be introduced. This may include new mini-games, adjustable difficulty levels, expanded achievement systems, and customizable character costumes.

3. Interviews with two primary school teachers provided valuable feedback on the conceptual design of the game. While the feedback was generally positive, the teachers also suggested that expanding the variety of content and increasing gameplay complexity over time could further benefit children's cognitive growth. These insights should inform future iterations of the application.

References

Anthony, W. L., Zhu, Y., & Nower, L. (2021). The relationship of interactive technology use for entertainment and school performance and engagement: Evidence from a longitudinal study in a nationally representative sample of middle school students in China. *Computers in human behavior*, 122, 106846.

Arabiat, D., Al Jabery, M., Robinson, S., Whitehead, L., & Mörelius, E. (2023). Interactive technology use and child development: A systematic review. *Child: care, health and development, 49*(4), 679-715.

Betts, J., Mckay, J., Maruff, P., & Anderson, V. (2006). The development of sustained attention in children: The effect of age and task load. *Child neuropsychology, 12*(3), 205-221.

Bruckman, A., Bandlow, A., & Forte, A. (2007). HCI for kids. In *The human-computer interaction handbook* (pp. 819-836). CRC Press.

Druin, A., Bederson, B. B., Hourcade, J. P., Sherman, L., Revelle, G., Platner, M., & Weng, S. (2001). Designing a Digital Library for Young Children. *Proceedings of the 1st ACM/IEEE-CS Joint Conference on Digital Libraries*, 398–405. https://doi.org/10.1145/379437.379735

Godwin, K. E., Lomas, D., Koedinger, K. R., & Fisher, A. V. (2015). Monster Mischief: Designing a video game to assess selective sustained attention. *International Journal of Gaming and Computer-Mediated Simulations (IJGCMS), 7*(4), 18-39.

Hourcade, J. P. (2022). *Child-Computer Interaction* 2ed. http://homepage.cs.uiowa.edu/~hourcade/book/hourcade_cci_2nd_edition.pdf

McKay, K. E., Halperin, J. M., Schwartz, S. T., & Sharma, V. (1994). Developmental analysis of three aspects of information processing: Sustained attention, selective attention, and response organization. *Developmental Neuropsychology, 10*(2), 121-132.

Rebok, G. W., Smith, C. B., Pascualvaca, D. M., Mirsky, A. F., Anthony, B. J., & Kellam, S. G. (1997). Developmental changes in attentional performance in urban children from eight to thirteen years. *Child Neuropsychology, 3*(1), 28-46.

Samson, A. D., Rohr, C. S., Park, S., Arora, A., Ip, A., Tansey, R., ... & Bray, S. (2021). Videogame exposure positively associates with selective attention in a cross-sectional sample of young children. *PloS One, 16*(9), e0257877.