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Culturally-Embedded Educational Toys For Children Awareness: A Case Study on Julang Ngapak with User Centered Design

Anisa Silviana Putri[1], Nurul Fitriana Bahri[2], Hanif Azhar[3].
[1]Telkom University, Bandung, Indonesia, anisasilviana@student.telkomuniversity.ac.id
[2]Telkom University, Bandung, Indonesia, nurulfitrianabahri@telkomuniversity.ac.id
[3]Telkom University, Bandung, Indonesia, hanifazhar@telkomuniversity.ac.id

Corresponding Author: anisasilviana@student.telkomuniversity.ac.id

Abstract: This research analyzes the application of the user-centered design (UCD) method in developing educational toys that focus on introducing culture, especially the Sundanese Julang Ngapak traditional house. The main goal of this research is to create products that are useful in entertainment and can also encourage children's cognitive, social, and emotional development. Qualitative methodology was applied through observation and interview techniques at SDN Cijagra 119 Bandung. The results showed that children were more enthusiastic about interactive and group games while tending to be more passive in formal learning activities. Aesthetic toy designs, characterized by the choice of relevant colors and shapes, have proven effective in attracting children's attention. Through an evaluation by media experts and child psychologists, the resulting product was declared safe, followed the curriculum, and was able to improve cognitive skills, such as cooperation and problem-solving. The best sketches integrate the Julang Ngapak structure with a puzzle system to support active learning. This research emphasizes the importance of the UCD approach in improving the quality and relevance of educational toys rooted in cultural values.

Keyword: Education, User-Centered Design, Julang Ngapak, Child's Cognition, Sundanese Culture

INTRODUCTION

In today's digital era, technological developments have significantly influenced how children learn and play. Children's learning methods have substantially changed, affecting how they receive information and interact with learning environments. With broad internet access, children can now explore various sources of information instantly, enabling independent learning and allowing them to pursue their interests without geographical limitations. Online learning platforms and educational applications offer engaging, interactive experiences, transforming traditional learning methods into more dynamic and enjoyable ones (Bahri, 2023). However, challenges have emerged alongside these benefits, such as decreased concentration levels due to rapid stimulation from digital media. Excessive exposure to information can make it difficult for children to filter relevant data and reduce their ability to focus on tasks requiring prolonged attention. Additionally, interactions through social media influence how children communicate and collaborate while also posing risks related to mental

health and social pressure. Amid efforts to capture children's attention without overwhelming them with stimuli, educational toys have become valuable learning tools. These toys allow children to absorb information while avoiding excessive exposure to digital stimulation (Putri, 2023). The use of educational toys as learning aids has proliferated in recent years, driven by increasing awareness of the importance of early childhood education. Educational toys are designed to stimulate children's cognitive, social, and motor development in enjoyable and interactive ways. These products provide entertainment and integrate educational elements, allowing children to learn through play. The availability of various educational toys—from puzzles and construction games to musical instruments and digital devices—offers children opportunities to explore concepts such as math, language, science, and art. This approach aligns with the digital era, where children are more accustomed to technology and visual stimuli (Azhar, 2021).

Educational toys also encourage active learning, involving children directly in learning, fostering problem-solving skills, and developing social abilities through peer collaboration. Thus, educational toys serve as tools for knowledge introduction and help hone critical thinking and creativity (Affandi, 2023). Although widespread internet access enables children to explore various information sources, introducing culture at an early age plays a crucial role in shaping identity and character development. Educational programs that integrate cultural awareness through educational toys have the potential to enhance children's understanding of their cultural identity while empowering them to navigate the increasingly complex demands of globalization. Educational toys are effective because they capture children's attention, encourage interaction, and stimulate exploration, all of which contribute to a better learning experience. It is essential to ensure that these toys entertain and help children grasp fundamental concepts, develop motor skills, and build social competence. (Rusyda, 2016)

The Julang Ngapak traditional Sundanese house, with its distinctive architecture and function, symbolizes cultural values that can be incorporated into educational toys. By employing a user-centered design (UCD) approach, the development of culturally embedded educational toys aims to provide entertainment and instill an understanding of local culture. Toys that combine cultural elements with intellectual challenges, such as puzzles, encourage children to think critically and creatively, optimizing cognitive development amid the rapid flow of information. The UCD approach emphasizes understanding the needs and experiences of users—in this case, children and parents. Through this method, designers can gather insights into how children interact with toys, the challenges they face, and the features they enjoy most. This information is essential for informing design improvements and ensuring that educational toys align with children's preferences and developmental needs (Aziz, 2020).

The qualitative method was chosen for data collection and analysis. This approach, which involves in-depth interviews, focus groups, and observations, provides designers valuable insights into user experiences. Direct observation of children playing with educational toys offers further valuable information. Designers can monitor children's behavior, interactions with toys, and their levels of engagement and motivation. This iterative process allows designers to continuously refine and adapt toys to better meet user needs and preferences while ensuring that educational toys are enjoyable and provide meaningful learning benefits (Zakaria, 2019; Subakti, 2023).

METHOD

The design method employed in this study is a qualitative approach using the User-Centered Design (UCD) framework. This approach emphasizes in-depth data collection from various sources, such as interviews, observations, and document analysis, as the initial stage of the UCD process. In this case, observations and analysis focus on how children play and acquire information through the game. Additionally, semi-structured interviews are conducted with educators, focusing on children's learning methods and the suitability of educational toys

for their development. The appropriateness of the toys is assessed from multiple perspectives, including child psychology, with input from experts specializing in child psychology. Furthermore, evaluations by subject matter experts and media specialists, in collaboration with psychologists, provide valuable insights to guide the development of toy designs that align more effectively with children's characteristics and curriculum requirements.

The scoring table used for evaluation is designed to systematically assess the quality and effectiveness of the educational toy based on specific criteria. The scoring system ranges from 1 to 5, where 5 represents the highest rating, and 1 represents the lowest.

1. 5 (Excellent): Indicates exceptional quality, outstanding performance, and full compliance with educational goals. The toy is highly engaging and safe and effectively promotes cognitive, social, and emotional development.
2. 4 (Good): Reflects a high level of quality and performance, meeting most educational objectives well. The toy is engaging and safe, with minor areas for improvement.
3. 3 (Satisfactory): This represents an average level of quality and effectiveness. The toy meets some educational criteria but may lack engagement or safety features. There are notable areas for improvement.
4. 2 (Needs Improvement) indicates below-average performance. The toy fails to meet several educational goals and may pose safety concerns. Significant modifications are needed to enhance engagement and educational value.
5. 1 (Poor): Represents a lack of effectiveness and quality. The toy is not engaging, presents safety issues, and does not fulfill educational objectives. It requires substantial redesign before it can be considered suitable for children.

Table 1. Evaluation Score

Criteria	Score
Excelent	5
Good	4
Satisfactory	3
Needs Improvement	2
Poor	

Source:Author Data, 2023

This scoring system allows evaluators to provide a clear and structured assessment of the educational toy, helping to identify strengths and areas for improvement in its design and functionality. Notably, the method also incorporates expert scoring to assess the alignment of the toy sketches with the intended user needs. This scoring serves as an additional evaluative tool to ensure that the designs meet educational objectives and resonate with children's interests and developmental stages. By integrating these expert assessments, the study aims to refine the designs and enhance their effectiveness as educational tools.

RESULTS AND DISCUSSION

The use of User-Centered Design (UCD) is expected to produce product designs that align with users' needs. In this study, the product must meet specific requirements, including suitability for users' needs and characteristics and alignment with the curriculum used as a teaching framework for children. As an educational tool, the toy must effectively deliver instructional content while engaging children.The compatibility of the content and design is a primary focus. Therefore, the UCD method aims to generate design ideas seamlessly integrating educational and playful elements (Elfandari, 2022). To achieve optimal results, the first step in the UCD approach involves conducting observations and interviews.

Empirical Observation

Table 2. Empirical Observations and Interviews

No	Observation Results	Explanation
1	Children show high enthusiasm when involved in group activities or working together on an activity.	
2	They enjoy social interactions when they have similar interests, even though they haven't known each other before	
3	When physical activities are carried out in the context of play, children will show enthusiasm and divert all their attention to the communication between friends.	
4	If physical activities are carried out in a learning context, they tend to feel lazy and appear passive; their thinking and communication become fragmented, although interactions between friends remain.	
5	Children tend to gather based on their interests, such as how to play, types of games, and daily conversation.	
6	The variety of game colors or shapes interests children.	

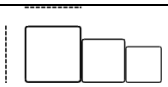
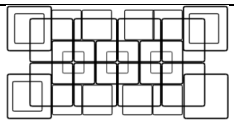
Source: Author Data, 2023

This table contains the results of observations and interviews conducted with children at SDN Cijagra 119 Bandung. The data in the table reflects children's behavior and preferences when playing and learning individually and in groups. Several vital points show that children are more enthusiastic when physical or interactive activities are carried out in the context of play but become passive when the activities are oriented toward formal learning. Apart from that, their interest in games is also influenced by the diversity of colors and shapes. The author conducted observations and semi-structured interviews by conducting direct question-and-answer sessions with the children and teaching staff. Questions include children's learning habits, learning things, behavior by the child's type of development, and responses to children's toys and ways of playing, individually and in groups. In observations and interviews, it was found that children experienced several types of interest in playing or learning. Children love group, interactive games they can touch and not just look at. Children also have a great interest in games involving physical activity, but if this type of game begins with a learning context, the child's response looks more passive. Children can form groups of different arrangements when they usually play if they have the same interest in two-way communication, which can change opinions or come up with solutions to problems when playing this game or learning. The colors or shapes in educational game tools are also one way to get children to want to take part in activities or hear and see forms of education in the types of games in these products.

User-Centered Design-Based Concept

Table 3. Visual Design Concept

No	Visual Design	Descriptions	Illustrations
1.	Form	A. This product consists of various blocks of different sizes, with patterns printed on the outside so children can easily arrange the patterns according to the picture. B. This product has blunt corners or is not dangerous for children aged 7 to 11 years. C. Has a shape that can be recognized as Julang Ngapak from the outside.	 Sundanese Traditional House; Julang Ngapak

2.	Dimentions	This product has dimensions that have been adapted to the anthropometry of children aged 7 to 11. Based on BMI/U body mass data for children in this age range, these blocks come in various shapes and sizes, which can stimulate children to recognize and remember shapes better.	 Dimensions were matched to the anthropometry of children aged 7-11 years.
3.	Colors	This product uses muted colors or calm and soft colors. These colors function as visual stimuli for children. Using neutral colors can give the impression of being free, flexible, and not too flashy (Yunidar, 2012). In contrast to young children who can only understand colors with a low spectrum or need contrasting colors, children aged 7 to 11 years can already differentiate between types of colors ranging from dark to light, as well as different colors from contrasting to soft.	 Color chart
4.	Material	Pine wood is affordable and easy to find. Its bright color makes it easier to stain or paint with other colors, both dark and light. Pine wood is also often used as the primary material in making wooden toys. (Pambudiningtyas, 2020)	 Pinus
5.	Composition and proportions	This product has a variety of shapes and sizes that are adjusted to the pattern; the product arrangement is organized from bottom to top or according to the placement of a predetermined pattern. The composition of the center of the beam is adjusted to the placement based on the philosophy discussed in Chapter 2, as well as relevant general concepts. The product will have a size corresponding to the engineering drawing designed and adjusted to the previous anthropometry.	 1:1

Source: Author Data, 2023

Determining the visual design concept begins with a form that has been determined and chosen after conducting interviews with educators and cultural experts to help choose from several types of Sundanese traditional houses; Julang Ngapak has the most voters and is the main form of inspiration for the design of educational toys. After that, the product's dimensions are determined according to the child's anthropometry, based on the BMI/U of children aged 7-11 years who will not have a mass exceeding 2 kilograms. Colors adapt to the age and spectrum of children aged 7-11. The material used is pine, which is easy to find but is also continually used as material for educational toys. Composition and proportions will be made according to engineering drawings designed according to the child's anthropometry.

Table 4. Weighting Instruments

No	Instrument	Explanations
1	Difficulty Level [T.K]	In terms of difficulty level, this instrument indicates or discusses the level of operational difficulty for children when using toys
2	Security [K.N]	Regarding safety, this instrument indicates whether or not it is dangerous for children when playing with the product.
3	Strength [K.T]	In terms of strength, this instrument measures whether or not the structure of a product that will be used as an educational game tool is fragile.
4	Appearance Aspect [A.R]	Appearance aspects are measured based on how well the sketch fits with the concept formed and also the aesthetics of the product itself.
5	Age Suitability [K.U]	In this instrument, products are measured by the type of conformity games at an age, which is one of the requirements for forming APE.
6	Endurance [D.T]	In this instrument, durability is measured by how well a toy can survive after a long period.
7	Mass [M.S]	This instrument measures the weight or weight of the product children's game
8	Production Time [W.P]	This instrument measures how long it takes to create a product from start to finish.
9	Production Cost [B.P]	This instrument measures the costs involved in producing the gaming equipment being produced.

Source: Author Data, 2023

This table explains the criteria used in the sketch assessment process. Each criterion, such as safety, strength, and durability, is measured to ensure that the product is safe but also functional and effective as an educational play tool. This criterion also includes production costs and time aspects, which are crucial in the product implementation stage. There are nine types of needs to think about when selecting a sketch. The ability of the design results will be given a score of 1 as the highest and five as the lowest. Some of these aspects are present in the requirements for making educational game tools, such as the safety of using game equipment, possible strength of the product, level of difficulty and age suitability, and also the production process of the product, such as determining production costs and production time. All parts of the sketch will be assessed for suitability to these aspects, and then a summation will be carried out, and the final result will determine the sketch.

Instrument Based Evaluation

Table 5. Material Expert Instruments

No	Observed aspects	Score
1.	The suitability of the product with the function of introducing children to culture	4
2.	The suitability of the product with its function improves the child's cognitive aspects in the child's social-emotional state	4
3.	The suitability of the product to its function improves children's cognitive aspects in solving problems by composing	5
4.	Suitability of the media to the material	4
5.	Media suitability for group use	5
6.	Suitability of media for children's developmental stages	4
7.	Matching the child's characteristics	4
8.	Product suitability to clarify the material	4

9.	Product suitability to the curriculum	4
10.	Concrete (concretizes cultural introduction material)	4
11.	Material in the media can make children interested	4
12.	Children can understand the material contained in the media	4
13.	Children can understand problem-solving instructions in the media.	4
	Total Score	54

Source: Author Data, 2023

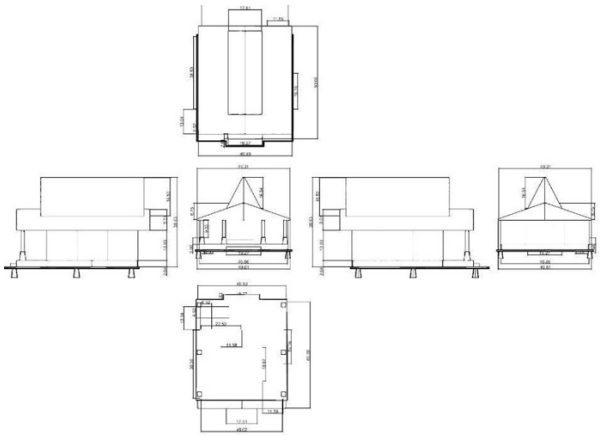
In designing educational game tools using traditional Sundanese house structures, Julang Ngapak. Selected product sketches also had a suitability assessment conducted by a child psychologist, Mrs. Tiara Delia Madyani, S.Psi., M.P.Si., a psychologist, on June 26, 2023. The conformity assessment is seen from the suitability of the curriculum, the child's characteristics, the product's function in the child's development, and the product's suitability as an educational game tool or teaching aid for children. The psychologist-based assessment has two sessions: the child psychologist's suitability as a material expert and a media expert. In material assessment, psychologists assess the suitability of the product form in the curriculum. This is done to adjust the game tools to be teaching tools for children. It is sure that children can understand the material presented through the game tools; the material presented must also attract children's interest in trying and understanding; children can also understand the shapes, patterns, and instructions of the product.

Table 6. Media Experts

No	Observed aspects	Score
1.	Clarity of form in the media	4
2.	Clarity of color on the media	3
3.	Suitability of media form to material	4
4.	Suitability of color composition on the media	4
5.	Color suitability to the child's characteristics	3
6.	The attractiveness of the form applied to the media	4
7.	Suitability of shape composition to the media	4
8.	Appropriateness of shape proportions to the media	4
9.	Media safety when used by children	4
10.	Media resistance when used by children	4
11.	Ease of use of media	4
12.	Feasibility of using media as an APE	4
	Total Score	49

Source: Author Data, 2023

In media assessment, the product's shape must be suitable for children's use. Products must have clarity in shape patterns so that children understand they are getting to know Sundanese traditional houses. Julang gasped. Color is also essential as a form of media that supports or helps children's interest in products. Therefore, the color aspect is also part of the assessment. The suitability of product proportions and composition is essential because it is also related to the requirements for educational game tools regarding the product's safety, durability, and strength. After the assessment is complete, the results of the instrument will be added up and become part of the information or evidence of design consideration. As the next stage of user-centered design, we are conducting trials with design and material experts. We are carrying out suitability and feasibility trials to ensure that the product can meet the urgency of helping to introduce culture to children and help children's cognitive abilities by meeting the requirements for educational game tools (APE).



Source: Author Data, 2023

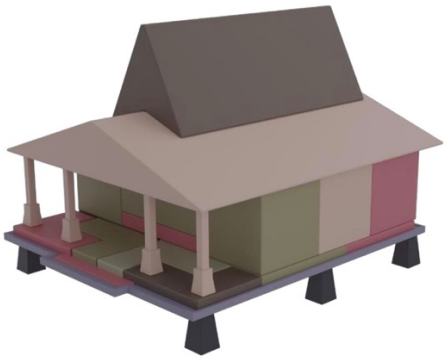
Figure 1. Technical Drawing

The final technical drawings of the educational toy based on the Julang Ngapak model have been meticulously developed to align with the established criteria and scoring derived from prior observations and evaluations. This process involved extensive adjustments informed by feedback from various evaluators, including psychologists and cultural experts, ensuring that the design is pedagogically sound and culturally relevant. The technical representations illustrate a design that effectively integrates elements of traditional Sundanese culture, reflecting the distinctive architectural features of the Julang Ngapak. These elements serve as aesthetic components and provide a tangible connection for children to their cultural heritage. The drawings portray various aspects of the structure, such as the raised platform characteristic of the Julang Ngapak design. This facilitates an engaging learning experience while prompting discussions about cultural significance and historical context.

The technical drawings adhere to the scoring outlined in the evaluation table in terms of educational criteria. Each aspect, from the product's suitability for introducing cultural concepts to its effectiveness in fostering cognitive and social interactions among children, has been thoughtfully incorporated into the design. For instance, including puzzle elements within the structure encourages problem-solving and cooperation among peers, aligning with the high scores received in these categories. Furthermore, considerations regarding child anthropometry have been meticulously implemented, ensuring that the toy's dimensions are appropriate for the target age group. This factor not only enhances safety—by minimizing risks associated with sharp edges or small detachable parts—but also ensures that the product is accessible and engaging for children at various developmental stages.

Feedback from psychologists emphasized the importance of creating a stimulating and safe environment for children's learning. As a result, the final technical drawings incorporate rounded edges and sturdy construction, thus addressing potential safety concerns while promoting interactive play. The playful color schemes and textures presented in the drawings are intended to attract children's attention and sustain their interest, fulfilling the aesthetic criteria outlined by the evaluators. Culturally informed recommendations from cultural experts have also been integrated into the design. These suggestions included enhancing the representation of cultural symbols and narratives that can facilitate discussions among children regarding their heritage. By embedding cultural references within the educational play experience, the design deepens children's understanding and appreciation of their traditional roots, thereby effectively addressing the scoring for cultural appropriateness. In conclusion, the final technical drawings reflect a comprehensive approach that harmonizes educational goals, cultural significance, and developmental appropriateness. By incorporating insights from psychologists and cultural experts, the design meets established criteria and aspires to create a meaningful learning experience that resonates with children, fostering cognitive growth and

cultural awareness. The ongoing commitment to refining the product based on such expert feedback highlights the importance of a user-centered design methodology that prioritizes the needs and characteristics of children in educational contexts.



Source: Author Data, 2023
Figure 2. Final Product

The third sketch became the choice after obtaining suitability at the sketch weighting stage. The pattern or shape of the selected sketch is safer than the fourth to sixth sketches because it does not have empty spaces that allow the product to break when used by children. Its denser shape also prevents it from being a sharp object for children. The parts of the structure also do not have too small parts, so they are easily lost, become sharp objects, or come into contact with the child's mouth or eyes. The interior, mainly in blocks, is also a puzzle for children to play with. The structure of the house on stilts, apart from introducing that traditional Sundanese houses have houses on stilts with a shorter size, also acts as a supporting medium for the beams and triangles above. So that children can easily understand the initial arrangement from what must be formed to the end on a flat media, which also becomes a house on stilts. This design also has a magnet that makes the puzzle parts stick together well. The size of this product will adjust to the child's interest in playing together, which also improves the child's cognitive aspects in working together and communicating. Then, after selecting a sketch, the author will conduct an evaluation stage with design and material experts to ensure that the sketch for the product is appropriate. The author conducted an evaluation stage with a child psychologist concerning education and children.

Product Testing

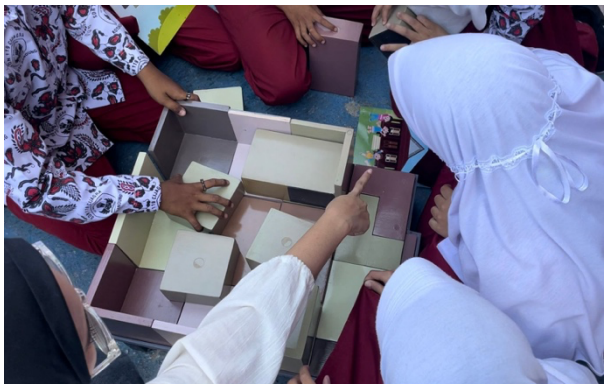
The user validation test was conducted at 2:00 PM at SDN 119 Cijagra Bandung. The author communicated their intention to conduct validation with the fourth-grade teacher, who assisted in addressing the children. The teacher selected six children through a random number draw. The chosen children were Arrova, Fyras, Adit, Syauqi, Anggita, and Ghania, all aged 10 to 11 years. At the beginning of the trial, the children were asked questions related to their learning in the Sundanese language class. Five of the six children stated that they were proficient in using Sundanese in everyday conversations and were still learning the correct forms as provided in their textbooks. They were then asked about traditional Sundanese houses, and they mentioned that they had previously made crafts in the shape of traditional houses but needed to recognize the names of the houses.

Source: Author Data, 2023
Figure 3. Product Testing 1

The author explained the types of Sundanese houses, mainly focusing on the traditional house that served as the theme for the tested educational toy: the Julang Ngapak house. The children recognized the shape of the Julang Ngapak house but did not know its name or meaning. The author gave the children an instructional book containing information about the product and the philosophy behind the traditional house theme. The children looked at and read about the meaning of Julang Ngapak and why Sundanese traditional houses have three distinct parts. Next, they turned to the following page and examined the block patterns and the instructions for arranging the blocks. The children reviewed the first steps for using the blocks and began by spreading them out before trying to assemble them again. After reading the instructions, the children started constructing the first section on a support structure that resembled a stage part of the house.

Source: Author Data, 2023
Figure 4. Product Testing 2

As they read the instructions, the children recognized matching shapes and colors in the book corresponding to their blocks. Without being prompted, they began dividing the tasks for arranging the blocks. Syauqi and Anggita held and referred to the instruction book, while Fyras, Anggita, and Arrova matched the shapes and patterns. Adit was responsible for bringing the blocks and aligning them with the instructions' patterns. The final assembly section, the roof, required the most assistance and guidance. Due to the similar shapes and stronger magnetization of the hollow parts, while the pieces could fit together, the roof pieces tended to be misaligned. At this point, the children were informed about the different colors on the underside that could help them determine which part of the roof belonged to the left and which to the right.



Source: Author Data, 2023

Figure 5. Product Testing 3

The children then installed the support pillars at the front. The trial concluded with some roof pieces that did not adhere properly, which needed to be adjusted again. The playtesting session began at 1:59 PM and ended at 2:20 PM, lasting 21 minutes to complete the assembly with assistance and guidance.

CONCLUSION

This discovery helps introduce culture to children and promotes cultural themes, enabling them to recognize better and understand their cultural heritage. In this context, culturally based educational tools, such as games inspired by the traditional Sundanese house, Julang Ngapak, play a vital role in supporting children's learning processes. By applying the User-Centered Design (UCD) method, the designed toys provide fun and effectively stimulate children's cognitive, social, and emotional development. Observation and interview results showed that children were more engaged in group activities and interactive physical games. This indicates that a more dynamic and exciting approach can enhance children's active participation in the learning process. Aesthetic elements, such as color and shape, also play a significant role in the appeal of educational games. Through careful design evaluation, it was found that sketches integrating traditional Sundanese house elements and puzzle systems successfully improved essential skills such as cooperation and problem-solving. Support from media experts and child psychologists ensures that the final product is safe and appropriate for the educational curriculum and children's characteristics. Overall, this research highlights that educational games designed with user needs in mind can enrich children's learning experiences. Continuous innovation in the development of culturally-based educational game tools is expected to have a positive impact not only on education but also on the preservation of local culture.

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