

Creation of Cultural Local Wisdom-Based Picture-Science Stories Application for the Introduction of Scientific Literacy for Early Childhood

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Abstract— This article aims to explain the design, development, implementation, and evaluation of the Picture Science Story (CSB) application integrated with local wisdom based on an Android application for early childhood. This application can be used with a touch screen. The aim of making this application is to introduce the science process skills and local wisdom to the children. The research method used was R and D. The initial stage of developing the CSB prototype model was to conduct the needs analysis, child characteristics, and curriculum analysis. Then, the design, development, implementation, and evaluation of the CSB application were carried out. The application used a layered platform. Many experts from different fields were involved in the design process: graphic design experts to create images, multimedia experts to create applications, and teachers for the science material. The CSB prototype design was validated by material, media, and user experts, namely Al-Huffaz Kindergarten teachers and children. The participants in this research were 13 Alhufazh Kindergarten students. A questionnaire was given to get a response from the teachers, consisting of aspects of understanding multimedia, function, and configuration. The average score of the teachers' responses was 92%. Meanwhile, the average score of children's responses was 95%. Based on the results of validation and trials, it was found that the CSB application integrated with local wisdom based on an Android application was valid, effective, and practical for early childhood. The suggestions from users require multidisciplinary knowledge in designing picture-science stories based on Android applications. Then, the feedback addressed the importance of using the Science Story Creation prototype and integration of the Local Wisdom of Minangkabau Culture to introduce Early Childhood Science Literacy.

Keywords— Multimedia; picture-science stories; local wisdom; science process skills; early childhood.

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I. INTRODUCTION

Children are part of a new generation called "digital natives," the "millennials." They were born when technology, ICT, and communication technology were developed, and game tools can only be pressed via a remote button, digital play, or digital camera. These tools play a role in their lives, and they often do not realize that they are at home.

This technology needs to be used as an exciting learning medium for children to learn because their experiences in the early years of their lives have a significant impact on expanding children's interests later in life [1]–[4]. Science activities are critical for early childhood to make a connection between events and objects (make sense of the connection between events and objects [5], [6] The aim of introducing science for early childhood is so that children can understand

the reality that occurs in their environment (sense of realization).

The problem with early childhood science learning is the teacher's lack of ability to provide exciting science content for children. Apart from that, using technology to provide interactive learning for children is still very rare; as a result, children get bored with learning. Ryan stated that there is a lack of use of technology and children's low interest in learning [7]. The survey results do not include picture-science stories (comics) based on Android applications that integrate local wisdom of Minangkabau culture for children. However, some teachers use YouTube technology in their learning. It is just that the available content does not always match the competencies expected in the curriculum, namely an introduction to the environment and culture around the child.

Therefore, through this research, developing an

educational model of picture-science story games (comics) integrated with the local wisdom of Minangkabau culture based on Android applications is necessary. The aim of making this model is so that children enjoy learning science and that cultural preservation can be maintained and not lost by changing times and technology. Early-age children enjoy learning through pictures because some cannot read yet. The advantage of this picture-science story (comic) is that it integrates the local wisdom of Minangkabau culture. The science material is made in the form of an exciting story. The target of this story is that apart from introducing children to science process skills, it also presents the values of local wisdom and material culture in picture-science stories (comics).

A. Related Works

Several researchers [8] have researched creating comics or stories to increase student motivation in learning physics based on folklore. This research revealed increased students' motivation and interest in teaching physics using folklore-based comics, amounting to 5,185. [9] has researched creating comics or stories based on an Android application to stimulate autistic children to tell stories. The results of the study revealed that the participation of autistic children was very high, and they enjoyed telling stories using Android-based games. Comics or picture stories used in Android applications help children who are not autistic or autistic to be able to tell stories.

Moreover, research on using Android applications by [10] realistic mathematics learning for early childhood. The research results reveal that Android-based games can improve children's learning outcomes in understanding realistic mathematics. Based on these three studies, it can be concluded that using educational games based on Android applications can increase the student's interest in learning, interaction with Android-based stories or comics, and ability to learn. Thus, young children need Androids whose content is designed for learning. Not only as a medium for playing but what is more important is to learn to develop the children's abilities.

Furthermore, a study by [11] has researched designing games for early childhood based on Android using linear material and congruent methods, finding that the Linear Congruent learning method can be applied in early childhood learning integrated on Android. This research reveals that reading, writing, and arithmetic implemented through games on Android can increase children's interest in learning. After testing was carried out on child respondents aged 3-8 years, it was found that the presentation data of children with increased motivation was 78.33. The game application created for learning to count uses pictures of animals, as studied by [12], and the development of mobile augmented reality educational games can help young children learn to read, write, and count.

Based on the results of the design, augmented reality technology can be used to attract children's interest in learning. From the games that have been designed using the interactive rapid paper prototype, in the tests that have been carried out, the fun testing games show that data are obtained that children like these games. From the test results, the average pretest result is 76% compared to the posttest; the average is 80%. A study by [13] has created educational games for toddlers and preschool children (Mobile

Educational Games for Toddlers and Preschoolers). Successful integration of technology in learning, such as smartphones, aims to ensure that children successfully achieve curriculum goals, helping the effectiveness of learning goals. Such integration is successful if children have access to various tools suited to the task, which provides benefits for understanding the content used to teach children about geometry, mathematics, and interactions with ecosystems.

Based on the studies carried out above, through this research, a science story application integrated with the local wisdom of Minangkabau culture will be designed and used by children with an Android touch screen. The design of illustrated science stories or comics integrated with local wisdom was based on the needs of the early childhoods who often play with cell phones. Still, the content was not yet related to science learning. For this reason, according to [6], scientific creativity is essential for young children to understand events that occur in their environment and the relationship between one event and another in the child's environment.

Science learning is essential for early childhood because it is the foundation of knowledge and skills. The benefits of this science story for children are that children can carry out scientific investigations and develop observation and investigation skills to learn to think scientifically. Scientific process skills are needed to solve problems that are very important for life. Science process skills (scientific process skills), according to the American Association for the Advancement of Science (AAAS) [14], are essential as a basis for developing science process skills in children so that children can integrate them in the future based on the opinion above that scientific knowledge will have an impact on various aspects of development starting from the ages of one to five years [15], [16].

These science process skills can be integrated into a story, which children will use via an Android application or touch screen. This means children will understand the science process skills through illustrated science stories (comics) with an Android touch screen. Science education is provided through digital technology, and touch screens can be used to achieve social cognitive development goals, behavioral attitudes, and emotional aspects. The use of tablet computers is flexible, can be used anywhere without limited time for studying, and is personal.

The aim of making this picture-science story is that first, the children will learn the sequence of steps and break them down into first, second, and so on. Then, it is replaced with pictures, activities carried out by a person in processing natural raw materials into something, through a series of activities that use pictures examples of the process of doing work or processing raw materials into food such as making *Nira*, *Dadiah*, and *Ampiang*. Children can observe these processes through science stories and process skills. Children may be interested if this is presented with a story script accompanied by music. The story is made simple with pictures that are attractive to children.

In addition, through these stories, children can increase their understanding and the hope of educators that children will know something about their environment, learning from nature as a source of knowledge. *Alam Takambang Jadi Guru*

is well-known as the local wisdom of Minangkabau culture, passed down from generation to generation. In designing and developing an application model that contains picture-science stories (comics), the first requirement is a background page where users can add backgrounds, characters, objects, and text. The second is a page for users. The third is a page where visualizations of the stories and comics created are stored. The language used on the personalization page is Indonesian. Story applications can be used interactively. The application used to design stories is the story creation application found on Android and iOS, Book Creator.

B. Science Learning for Children Aged 5-6 Years and Local Wisdom of Minangkabau Culture

Science is knowledge obtained through scientific processes, such as observation, interaction, exploration, and experimentation, to solve problems and help understand nature and what happens in nature scientifically. Science can also be interpreted as trying to discover the nature of things, attitudes, and skills that enable individuals to solve the problems they face in everyday life [17]–[19]. Science is everything that is around and happens where it is.

Science learning in early childhood can be interpreted as things that stimulate children to increase curiosity, interest, and problem-solving, giving rise to thoughts and actions such as observing, thinking, and linking concepts or events. *Caimns* activities that are meaningful for children are relevant to children's daily lives. Children can make connections between what they know and what they will learn. This will be a means to introduce scientific concepts and raise awareness for learning. When teachers work with children, they learn. Discoveries in technology are also discoveries in science, just as discoveries in science are also discoveries in technology. When there are problems in society, technology comes to solve these problems. In science, three dimensions, namely body of knowledge, process, and procedure, are used to develop a body of knowledge, attitudes, and ideas that lead scientists to work.

Through scientific stages, children learn science through physical activity to discover and try to understand the world they see, namely humans, animals, plants, and other objects in the environment, by carrying out experiments and discoveries. Science activities are carried out so children can develop fine motor skills, awareness of the five senses, creativity, and understanding of protecting the environment [17]. Science combines process skills (how children learn) and content (what they know). Science is a way of thinking and looking at the world around us. Science is a branch of knowledge or subject of discussion that examines facts/reality related to natural phenomena [20]–[27]. The study of science needs to be carried out continuously, and science is knowledge about certain phenomena, the process used to collect and evaluate information and as a form of human adaptation to the environment. It is suggested that children have a congruent natural tendency to observe and think about nature [28]. Thus, young children are motivated to explore the world around them and experience early science learning.

Based on the description above, it can be concluded that science is knowledge obtained through observation and specific methods. The application of science in learning is aimed at meeting human needs. Science activities are carried

out through experimental activities, exploration, and discovery. According to [29], the objectives of science learning for early childhood are as follows: 1) Early childhood builds their knowledge through participation with others in activities that encourage experimentation, problem-solving, and social interaction; 2) Early childhood must be allowed to carry out appropriate exercises. Choice of their learning environment 3) Children's social skills develop best when they have the opportunity to learn and practice in the context of meaningful activities. 4) Nearly all young children do science activities all the time, and they experience the world around them and develop theories about how the world works. Early childhood science learning through exploration and experiments aims to make them understand the world they see, namely humans, animals, plants, and other objects in the environment by experimenting and discovering. Science activities carried out by children can develop fine motor skills, awareness of the five senses, creativity, and awareness of protecting the environment [30].

C. Goals

This research aims to design, develop, and evaluate an application) A prototype model of picture-science stories (CSB) integrated with the local wisdom of Minangkabau culture is based on an Android application for early childhood. This science story has been made as an interactive play application (*edugames*) to attract children's interest. For the introduction of sports for early childhood, it used an Android application.

In the analysis phase, story design, picture illustration, and creating a story application for Android were carried out. The application requirements that must be there were, first, a page for creating a script that can add background, characters, and objects. The first step was that there must be a supporting application that must be fulfilled. The design carried out was developing a story script and visual design, validating the story, and compiling a storyboard. The next phase was conducting limited trials and training teachers as users, followed by evaluation and revision.

II. MATERIAL AND METHODS

A. Method

The teacher used an LCD monitor screen during the trial to introduce the CSB app to the children. In carrying out trials using the CSB app, the teacher first explained the buttons in the picture-science story (CSB) application, such as the start button, continue button, and return to home button (back) and the menu options available on the application. The application had three menu options: stories, exercises, and instructions for using the CSB app. This aims to ensure that all children see the procedures for using the application. This trial started with children who dared to use the CSB application. The purpose of testing this CSB is to determine the quality and effectiveness of the CSB Prototype design and whether it meets the design objectives.

B. Design

Formulating a design for a model of CSB integrated with the local wisdom of Minangkabau culture based on an Android application for early childhood was after compiling

the syntactic steps for learning CSB. The next activity was planning the steps for implementing integrated science learning with the local wisdom of Minangkabau culture based on an Android application for early childhood. This activity was a systematic process that started from setting the objectives of the illustrated science story, designing the illustrated science story tools, designing the illustrated science story activities, and designing the learning outcomes evaluation tool. This phase was a conceptual design that underlined the subsequent development process. Instrument design was also carried out at this stage. This is the design of instruments to validate the products being developed:

1) *Learning objectives for illustrated science stories:* Formulating the goals of designing an illustrated science story. From the problems found in children's scientific knowledge, it was still shallow. The strategies used by teachers were not appropriate. There was a lack of learning media. For this reason, it is necessary to develop picture-science stories that introduce science process skills and Minangkabau cultural local wisdom.

2) *Designing learning scenarios for illustrated science story material:* Designing scenarios for developing science material was through creating story scripts and graphic designs in pictures, which told stories or were like children's comics. Then, this material can be combined with software to develop Android-based applications. The aim is that learning can focus on children, attract children's attention, and motivate children's education; researchers developed illustrated science stories to introduce science process skills and local Minangkabau wisdom.

3) *Designing picture-science story learning tools:* The design of learning tools consisted of lesson plans, teaching materials, and evaluation tools used by teachers.

4) *Designing of learning materials:* The design of the learning materials in this research was adapted to the kindergarten curriculum on the introduction of science process skills and Minangkabau local wisdom.

C. Development

In developing the prototype, the producers, namely graphic design experts and software experts for multimedia of picture-science stories using Android applications, were involved. The story idea from initial research was that most children were unfamiliar with traditional Minangkabau food. The food processing process was called *Ampiang dadiah*, namely traditional Minangkabau food. Namely the process of making brown sugar, *dadiah*, and *ampiang*. From this idea, a story script was created, where in the story, there was knowledge related to science process skills, which was helpful for children as a medium for learning science. The early childhood curriculum adapted the story content to children's learning material related to basic science concepts and science process skills.

The problem found was that teachers had difficulty presenting this material in class, in real situations, about the scientific process skills of making food. Additionally, science process skills need to be taught to children, and children need to be introduced to local Minangkabau wisdom.



Fig. 1 Cover of the Picture-Science Story Prototype (CSB)



Fig. 2 Shows the initial page with instructions for the Picture Science Story (CSB). An icon can be selected when playing CSB.

Playing procedures and playing rules were found in the CSB application. The CSB application has a menu of stories, sounds, images, and essential competencies that children will learn. There were three stories, namely the story about making brown sugar, *dadiah*, and *ampiang*. Within each story was a *Continue* button and a *Back* button (back to home). Children can choose which story they want to play first. After the story has been played, children can continue with practice. On the practice menu, there were five questions related to the story. When they can answer the exercise correctly, they will get a reward; if they do not, they will get a reward to repeat the exercise. This was how the CSB *games application continued to be used* until they completed the game.



Fig. 3 Form of training in CSB Prototype

1) *Trials:* The trial implementation of the Picture-Science Story (CSB) application was carried out at Al Hufazz Kindergarten. This Kindergarten was chosen because it was in a city that was used to using technology.

2) *Participants:* The research participants were Kindergarten children in Al-Hufazh in group B at Al Hufazh Kindergarten. There were 13 respondents, eight girls and five boys aged 5-6 years, from group B1 Kindergarten. Al-Hufazh Payakumbuh City. Five teachers were participants in the Picture-Science Story (CSB) trial. This trial aimed to obtain

criticism and responses to the application that has been created.

The method used was experimental. In carrying out the trial, the children involved take turns trying CSB with other children. The other children watched the CSB that the children had played using the LCD screen from a distance. After the trial, a survey was conducted to obtain responses from the children. In addition, trials on the use of CSB were also carried out on teachers. After that, a survey was also conducted with teachers to obtain responses. As a result, the teachers expressed their enjoyment of using CSB as a medium for children to learn science process skills and scientific literacy. This activity continued until the children played the 3 stories. In this application, three stories and three exercises were used to determine children's understanding and knowledge of science process skills and scientific literacy.



Fig. 4 Children using a computer to play the Picture-Science Story (CSB) application



Fig. 5 Children using the monitor screen to play the Picture-Science Story (CSB) application



Fig. 6 Children using a computer to play the Picture-Science Story (CSB) application



Fig. 7 Children using the monitor screen to play the Picture-Science Story (CSB) application



Fig. 8 Children using the screen tablet to play the Picture-Science Story (CSB) application.

The first step was to demonstrate briefly to the educator and then explain how to interact with this application to the child. Finally, with the application, children will learn about the process of making brown sugar, *dadih*, and *ampiang*. This was very interesting for the children because it was about the local wisdom of Minangkabau's natural culture, namely food that is rarely known by children nowadays. In this application, there was a story that briefly explained the tools and ingredients for the process of making this typical food.

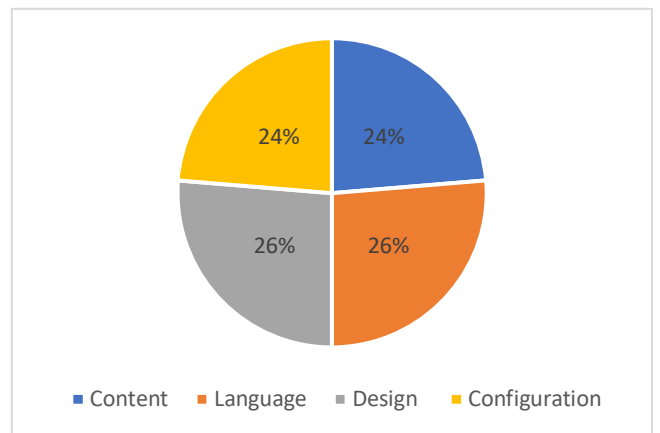


Fig. 9 CSB App Quality Assessment by Experts.

Based on Fig. 9 above, CSB media was assessed by material experts, starting from content or material, language, presentation, and graphics, with a score of 95%. This score suggests that CSB media is very good. This prototype is suitable for children at AL-Huffaz Kindergarten, Payakumbuh City.

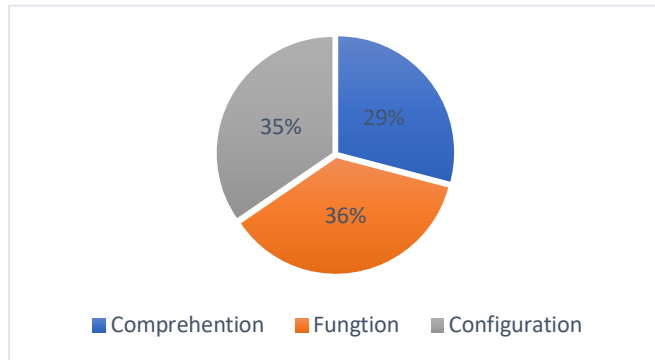


Fig. 10 Quality Assessment Results of the Picture-Science Story App (CSB) by Teachers.

Judging from Fig. 10, the average score of the assessment result of the CSB application with Integrated Local Wisdom based on the Android App as a medium and learning resource by teachers obtained was 92%. This means that this CSB application is of good quality. This value is based on aspects of *media* understanding, function, and arrangement or configuration with many instrument items, namely 13. This proves that the Android App-based illustrated science story (CSB) is a learning medium or resource suitable for young children.

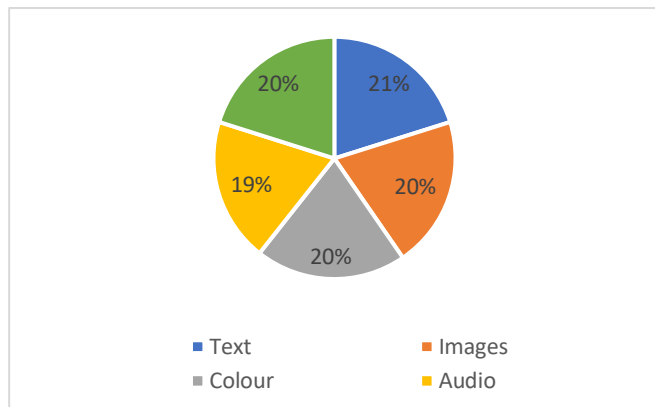


Fig. 11 Assessment of Children's Responses to the Picture-Science Story App (CSB)

Fig. 11 shows that 95% is based on assessing language, images, colors, sounds, content, and arrangement (configuration) in developing illustrated science stories (CSB) integrated with local wisdom based on an Android app. Thus, it can be concluded that this can be implemented in early childhood learning.

3) *Application*: The implementation of CSB integrated with local wisdom based on an Android application for early childhood can easily improve science skills. The CSB application can be accessed using a computer, laptop, tablet, or smartphone. The teachers and children assessed the CSB prototype used in designing the prototype.

A. Results

Children who interact directly using the application start with a story and add words and sounds. Children could play with three choices of stories, and each had practiced in each story and then continued with the existing story. In general, children can use and answer the exercises in the CSB application. After that, they will continue introducing the manufacturing process regarding making brown sugar, *dadiah*, and *ampiang*. When using the application, children can directly act out the story through audio and sound effects of traditional Minangkabau music.

Therefore, the result was that children enjoyed and were happy with the CSB application because it was easy to use. Children can also use the start, continue, sound, and listen to stories. When interacting with CSB, children did not experience problems.

After testing by the teacher users, several things needed to be revised, such as the size of the font in the story, the sound button, which is not high enough in volume, and rewards for children who have succeeded. After that, revisions were made by increasing the font size of the writing in the story, the sound was good, and feedback as appreciation or reward for children who had done the exercises had used words such as hooray accompanied by sound and applause.

After observing, the teachers recommended a setting appropriate to real-world situations, such as the materials and tools used in CSB. In developing the CSB application, children can express themselves with this application and the story of making *dadiah* from fermented milk into *dadiah*. The colors in the application made children interested in playing it, which was suitable for young children aged 5-6.

B. Discussion

This research is R and D research, which produces CSB learning media based on Android applications. The phases of making CSB media included design, development, product validation, product testing, and product evaluation. During the trial implementation of the CSB application, it reached the evaluation phase and received good responses from children and teachers. Children were very enthusiastic when using the CSB application because the images shown in the CSB application were clear and easy to understand. The storyline and language used were easy for children to understand—based on the data from validation of material experts and CSB aspects consisting of content, language, and layout aspects, getting a score with "very good" criteria by a team of experts.

CSB is an alternative media teachers can use in the learning process. According to [31], Android-based learning media can help students understand the learning material for Science Process Skills. Media can be an application used on Android smartphones, and its appearance can combine text, images, and videos. Android-based learning media is quite helpful for students to be more enthusiastic about doing assignments through their respective gadgets. Features developed in the application CSB can make it easier for students to learn about Science Process Skills for making *Ampiang Dadiah* food.

Responses were obtained from children during trials (CSB) up to the evaluation stage. In this work, the Picture-Science Application Integrated with Local Wisdom Based on an

Android App for children was explained after an initial evaluation of what was developed. Children who use this application are very enthusiastic.

Overall, positive results were obtained. Teachers are interested in using the application (CSB) to teach children science process skills because the colors attract children. The buttons on the CSB application were easy to use. There are three choices of children's stories that children can play as they wish. After the children had used the application (CSB), they understood the science story, which included science process skills and the application. There were exercises to determine children's understanding of science stories. Teachers as application users (CSB) find it easy to teach science process skills to children. The configuration in the application (CSB) was good and made it easy to understand the story in the storyline (CSB) very well. There was the ease of use and originality of the application on trial. Strong colors helped attract children's attention, and educational games were appropriate for early childhood education. Children understood how to use the application in a short period.

In introducing the CSB application was integrated with the local wisdom of Minangkabau culture. When children use this application, they indirectly get to know food from Minangkabau culture. This food was one of Minangkabau's local wisdoms because Minangkabau people have a special food called *ampiang Dadiah*. Foods that contain high nutrition are made from buffalo milk, palm sugar, and rice flakes. Children were enthusiastic in listening and seeing the process of making brown sugar, *dadiah*, and *ampiang*.

Thus, it can be seen that children gain ease of use and learning abilities through this application quickly and easily. Children need a little time to understand CSB, the integration of local wisdom of Minangkabau culture to introduce science process skills through making food.

When using the CSB application, some children need to be accompanied and under guidance, but some do not need to be guided. In this way, children will get positive results because they can easily use it without experiencing any difficulties. Children enjoy using the CSB application with a smile because they like it and are enthusiastic about playing it.

IV. CONCLUSION

The application presented in this article contains and focuses on CSB integrated with the local Wisdom of Minangkabau Culture to introduce science process skills and local wisdom in early childhood. The researchers introduced an application that can help teachers interestingly teach science process skills to children. Based on the test results and responses from children and teachers, this application is liked by children. This application provides the process of making brown sugar, *dadiah*, and *ampiang*. The colors and animations displayed were very suitable for the children, who were introduced to science process skills through experiments carried out on children at AL-Huffaz Kindergarten. Even though this application has been tested, suggestions for future researchers to create a different application are provided.

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