Android game implementation in health learning for early childhood education

Fendi Aji Purnomo¹, Eko Harry Pratisto², Ariel Yonatan Alin³
¹,²,³ Informatics Engineering Department, Sebelas Maret University, Jl. Ir. Sutami 36A Keningan Jebres Surakarta 57126, INDONESIA

E-mail: ¹ fendi_aji@mipa.uns.ac.id

Abstract. The challenge as a teacher in adopting the 2013 Indonesian Education Curriculum for early age education is finding an effective learning media to support learning material. This study aims to design, and evaluate an education game about the importance of maintaining health for children. This puzzle game is developed for Android operating system. Ten elementary school students participated in this study. Questionnaire with Likert scale is used to measure the usability of the games. The result indicates that about 60% of respondents strongly agree in terms of ease of use, content and design.

1. Introduction
In Indonesia, 2013 Curriculum is actually a curriculum concept that encourages student-centered learning. Students are required to be active and creative in the learning process and teachers with all their knowledge do not only act as instructors but are required to become inspirators. The problems faced by teachers in implementing the 2013 curriculum includes teacher problems in achieving standards: content, process, graduation, and assessment standards. Teachers face problems in achieving content standards, namely teachers do not understand how to embed concepts without the aid of appropriate props such as the use of information technology-based media (IT); the teacher has difficulty increasing student enthusiasm because he is accustomed to just explaining the theory. Teachers face problems in achieving process standards, namely: teachers feel difficulties in determining learning media, especially those based on information technology (laptops and LCDs)[1].

Now the development of original games for entertainment has developed for purposes such as learning, training with ideas that aim to apply learning that is learned in the real environment [2]. Games that can be referred to as health games are games related to healthy habits such as exercise [2]. Added that according to [3] serious games are more effective in terms of learning knowledge and cognitive skills. For example trauma-focused cognitive-behavioral therapy (TF-CBT) development by [4] has proven that overall tablet-facilitated care is acceptable to providers and families and can be integrated into mental health care with minimal training. An analysis of teacher perceptions of the usefulness of digital games in education has been carried out by [5]; he results show that most teachers who actually use games in the classroom feel the involvement of students with cognitive learning outcomes and outcomes as the effect of using games in formal teaching settings. The use of mobile and wearable technology is stated by [6] to have the opportunity to increase understanding of the neurological development and mental and physical health of adolescents in their youth. Several mobile games with health themes have been developed with genres such as quiz[7], exergame[8], and
puzzle[9]. In this study a mobile game for the introduction of health will be made early on for children so that children can get to know how to maintain health, get to know medical devices and get to know the disease when not maintaining health.

2. Method
The research begins with making health games applications. Games material was taken from one of the themes in the 2013 curriculum, namely the theme of health. The source of the material is taken from a compilation of several RPPs with health themes. Learning content about children's health is focused on 4 cognitive aspects of education and games, namely the introduction of healthy foods, medical equipment, measures to maintain health and types of diseases. Games were developed to train the cognitive and motor aspects of users. The type of game in the application is made using the touch sensor and accelerometer sensor. Picture of making games using UML use case shown in figure 1.

![UML use case games health education](image)

**Figure 1. UML use case games health education**

The results of making an application are tested against users aged between 7-9 years. The results of the tests will be analyzed games from aspects of ease of use, good graphic visual, material presented. Assessment of weights using a Likert scale. Validity and reliability tests are conducted on the results of questionnaire assessments. Testing is also carried out on device compatibility so that a minimum of devices is able to run this Health Education Games. Games that have been created will be evaluated by the game experts to evaluate the features available to them.

3. Result and Discussion
This early childhood education game applies the concept of learning aimed at early childhood, and is equipped with games that trigger memory, interaction, hand movements and in accordance with 2013 Curriculum literacy.

In this game it is divided into two main parts, namely the education section and the game section. In the education section, players are introduced to various types of healthy food, various medical
devices, ways to maintain health, and various types of diseases. In the education section it is equipped with sound or dubbing that matches the sentence that is displayed, shown in figure 2.

![Figure 2](image)

**Figure 2.** Main menu games (a), healthy food education (b), education of medical devices (c), health care education (d), and disease education (e)

In the game section, each game refers to the education section, the games available are: food capture games, picture matching games, tooth brushing games, garbage-throwing games and games to treat canker sores.

![Figure 3](image)

**Figure 3.** Main menu games (a), food capture games (b), picture matching games (c), garbage-throwing games (d), tooth brushing games (e)

The Play Rules games in figure 3 explain that Healthy food games (Figure 3b), players are invited to catch fallen fruit, fruit falls from the top of the screen, the fruit falls one by one. Then for the catch indicator there is an actor of a small child who captures fruit, the actor is driven using an Accelerometer sensor contained in an Android device. Game medical devices (Figure 3c), there are several puzzle images that are closed, the player must match the puzzle that has been made by selecting two appropriate images. If the puzzle box that is opened is not the same then the box will be closed again and the player must return to look for pairs of the puzzle, if the selected puzzle matches then the two puzzle images will disappear. The player must select the image until the entire puzzle image runs out. After the puzzle runs out, it will record how much time is needed to complete the puzzle. In the game of maintaining health (Figure 3e), there is a toothbrush game. In the game there are germs in the teeth that must be removed to get the score. The way to get rid of these germs is to
shift the toothbrush image towards the germ, if the toothbrush touches the germs, then the germs will disappear and the score will increase. Players are limited to eliminating 50 germs, germs appear one by one. After germs have accumulated 50, how much time is needed will be recorded. In the game of maintaining health (Figure 3d), there are also games to throw garbage, there is a trash bin that always moves left and right, the player presses the screen area to determine the location of the trash to be thrown away and tries to put it in the trash. In games of various kinds, there are games to treat canker sores, the player presses the thrush image and counts the number of clicks, after the number of clicks suffices, the player can buy drinks to treat canker sores, after buying a drink the canker will gradually diminish and heal. Health games developed in this study are a combination of game development by [7][9] in terms of utilizing touch sensors and accelerometer sensors. And the genre of games developed is a combination of [7][9], which is packaging the genre of quiz, puzzle and sweeping games in addition to the genre, in general, together provide general health education.

This puzzle game is developed for Android operating system. Ten elementary school students participated in this study. Questionnaire with Likert scale is used to measure the usability of the games. The result indicates that about 60% of respondents agree in terms of ease of use, content and design. The statistical test results of cronbach alpha value 0.9, meaning the results of the questionnaire are declared valid and reliable. Situation and testing documentation when health education games are conducted on students, shown in figure 4. The graph of the game application test results is shown in figure 5.

Figure 4. Testing health education games is done with smartphones and tablets

Figure 5. The graph of the game application test results

Health Games application has also been tested on device compatibility with a variation of 1GB, 2GB, 3GB and 4GB RAM memory. Recommendations for smooth play are required to have 2 GB of RAM.
The results of the assessment by game experts, the lecturers who teach games development courses, stated that the graphic display was contrasting and easy to distinguish between content and navigation. The appearance of animated characters is good and is able to provide illustrations of daily events. Text information is easy to read by presenting different types of fonts and colors. Audio information presented in the game is clearly heard. Classification of learning and game content should be presented on a separate page so learning can be optimized. Children need a companion when playing game content on the application. Gameplay that is presented is controlled by the swipe method of training the finger dexterity in playing, a game played with the help of a gravity sensor trains the hand in playing it. In general the game is already good and can be used as an educational media for children with the notes needing to be assisted in playing it.

4. Conclusions
The application "Android Games for Early Childhood for Health learning" has been created. Games can be accepted and played by users to learn about health. Games can run well minimum Kitkat Android OS Version with 2GB RAM.

References
[1] Maisyaroh, W. Zulkarnain, A. J. Setyowati, and S. Mahanal, “Masalah Guru Dalam Implementasi Kurikulum 2013 Dan Kerangka Model Supervisi Pengajaran,” J. Manaj. Pendidik., vol. 24, no. 3, pp. 213–220, 2014.
[2] V. Wattanasoontorn, I. Boada, R. Garcia, and M. Shert, “Serious games for health,” Entertain. Comput., vol. 4, no. 4, pp. 231–247, 2013.
[3] P. Wouters, E. D. van der Spek, and H. van Oostendorp, Games-Based Learning Advancements for Multi-Sensory Human Computer Interfaces: Techniques and Effective Practices. Hershey: PA: IGI Global, 2009.
[4] T. M. Davidson et al., “Pilot Evaluation of a Tablet-Based Application to Improve Quality of Care in Child Mental Health Treatment,” Behav. Ther., 2018.
[5] J. C. Huizenga, G. T. M. ten Dam, J. M. Voogt, and W. F. Admiraal, “Teacher perceptions of the value of game-based learning in secondary education,” Comput. Educ., vol. 110, pp. 105–115, 2017.
[6] K. S. Bagot et al., “Current, future and potential use of mobile and wearable technologies and social media data in the ABCD study to increase understanding of contributors to child health,” Dev. Cogn. Neurosci., vol. 32, no. April 2017, pp. 121–129, 2018.
[7] Z. de Urturi, A. Zorrilla, and B. Zapirain, “Serious game based on first aid education for individuals with autism spectrum disorder (asd) using android mobile devices,” in 16th International Conference on Computer Games (CGAMES), 2011, pp. 223–227.
[8] A. Laikari, “Exergaming-gaming for health: A bridge between real world and virtual communities,” in IEEE 13th International Symposium on Consumer Electronics (ISCE), 2009, pp. 665–668.
[9] J. Gago, T. Barreira, R. Carrascosa, and P. Segovia, “Nutritional serious-games platform.” In: eChallenges, pp. 1–8, 2010.