PAPER • OPEN ACCESS

Development of sorting waste game android based for early childhood in environmental education

View the article online for updates and enhancements.

Development of sorting waste game android based for early childhood in environmental education

H Rahmayanti[1], V Oktaviani[2], Y Syani[2]

[1] Transportation Program, Civil Engineering, Faculty of Engineering, State University of Jakarta, Rawamangun, Indonesia
[2] Electronics Engineering Vocational and Education Program, Electrical Engineering, Faculty of Engineering, State University of Jakarta, Rawamangun, Indonesia

Email: henita.rahmayanti@unj.ac.id

Abstract. Waste is one of existing environmental problems have never end. One of the causes was a lack of environmental awareness because lack of education from early age. This study aimed to build Sorting Waste Game Android Based as an education media, study used technology in environmental education. Sorting Waste Game teach early childhood to understand many kinds of waste (organic and an organic) and adjusted waste based on garbage box on environmental. This game application used Android Platform which build using Unity 3D game engine. This study used Research and Development (RnD) method with Waterfall Development Model which consist of 4 steps, are analysis, design, implementation and testing. Testing method used is black box testing to test functional interface application systems thoroughly. Data collection is done using the survey that has been tested its feasibility by experts using Likert scale. Based on testing black box that has been carried out got that all indicator which is with such questions at each item was declared good with the percentage 100 %. This means that Sorting Waste Game is user friendly and can be used and runs smoothly on a platform android as a medium of technology on learning of environmental education.

1. Introduction

Environmental Factors are considered as factors that influence the progress of Smart City because later the environment of a city uses technology in living the survival of its people. Smart environment is an environment that is supported by the rapidly developing technology. Therefore we need environmental to create a community that cares about the environment. Environmental education provided will run more optimally if it starts from early childhood. Early childhood has different characteristics from adults because early childhood grows and develops in different ways. Therefore we need a learning media that supports the characteristic of early childhood. Games are a powerful educational tool if used appropriately [1].

This research develops an Android-based mobile game as an educational media for early childhood in environmental education. The game developed is an environmental that educates young children about waste knowledge. Waste is leftover material from animals, humans, and plants that are not used anymore and released into the form of solids, liquid, or gas. Waste is also a consequence of various human activities. The volume of waste that is the result of household disposal increases along with the

high activities carried out and the increasing needs of a modern society. Every day waste is generated from families/households, which in terms of quantity usually occupies the highest position, hospital and industrial waste which is very dangerous, also rubbish from public place such as terminals, markets, entertainment venues, schools, offices and others [2].

Socialization related to waste reduction and handling activities has been widely carried out, such as training activities through schools, governments, regions and other environment-based organizations, one of the way is establish a Waste Bank[3]. However, the formation of this waste bank has not yet been fully implemented due to the low awareness of the community towards the environment. Therefore, the environmental education should be given from an early age. Early childhood is a group of children who are in a process of growth and development that is unique [4]. They have special patterns of growth and development according to their level of growth and development. Learning using games can provide more relaxed conditions felt by children when learning, with this children will not experience fatigue of learning because the material presented in this game model is really a form of a game [5]. Educational games that are used as learning media, besides being able to increase learning motivation, can also improves student outcomes. The achievement of students who learn to use games on mobile devices is higher compared to students who use e-book applications in learning [6]. One game about environmental education developed is the "Trash Grabber" game. Trash Grabber as an educational game can provide new reference for children to provide knowledge about the types of waste that exist around the environment and teach children not to litter. The educational game "Trash Grabber" received the highest rating in both entertainment and learning aspects [7].

The environmental game about waste has a plot like a hidden treasure game. The character selection of this game is adapted to the characteristic of early childhood. The game is made containing material introduction to the type of waste, how to manage waste, household waste grouping. This game was created to improve children's cognitive abilities which will have an impact of government programs in the field of smart environment. Beside, this game is equipped with a game path that will train the psychometric abilities of early childhood to grouping any kind of waste. This game was created using Adobe Flash and Photoshop software as character design and using android as platform. This game is expected to be one of the learning media and help improving cognitive abilities of young children in recognizing the type of waste along with sorting waste and increasing awareness of environmental.

2. Literature Review

2.1 Learning Media
Media comes from Latin medius word which literally means middle, intermediary or introduction. Whereas in Arabic Media is an intermediary or messenger of messages from the sender to the recipient [8]. Agree with the statement, Heinich et.al, the word media is the plural form of the word medium. The medium can be defined as an intermediary or introduction to communication from the sender to the recipient [9]. According to Gerlach and Ely, media are human, materials and events that establish conditions that make students able to obtain knowledge, skills or attitudes which can be say as Teacher, text book, and the school environment[8,9]. Learning media is a technology messenger that can be used for learning. Learning media is a physical means to deliver subject matter.

2.2 Game
Game is activities that involve player's decisions, trying to achieve goals by being limited on certain contents. Games are each contest between players who interact with each other by following certain rules to achieve certain goals as well. In a game there must be competition so that players are interested in continuing to play, the competition can take the form of winning and losing. Players must able to find strategies or ways to solve problem so they can win game.

Game is a game that uses electronic media, is an entertainment media which make as attractive as possible so that players can get something which make the player satisfy. Playing game can be used as a learning media. Educational game is an activity that very fun and can be educational method or tool that is educational.

2.3 Android
According to Nasruddin Safaat (Programming an Android-based smartphone and tablet PC Application, android is an operating system on mobile phone that is open and based on the Linux Operating system. Android can be used by anyone who wants to use it on their devices. Android provide an open platform for developers to create their own applications that will be used for various mobile devices.

3. Research methodology
This study is using Waterfall method which consist of 4 steps, as follow:

3.1 Analysis
In this step an analysis of system and user requirements will be used to sort of the waste game.

3.2 Design
Design state consist of some steps, which are : the preparation of basic ideas, objectives, themes, target audience, technology, media (Platform), determining the game genre, game play design, determining assets and design levels, determining tools, determining game graphics, determining audio, determine scores and make game storyboards.

3.3 Implementation
In this stage, all designs that have been prepare are implemented. This stage is carried out by developing the Play Menu (consisting of level 1, level 2, and level 3), Learning (Menu that displays knowledge about organic and inorganic waste), Exit (menu to close the application) and Credit (game design menu). This game is used on Android Platform which builds using Unity 3D game engine.

3.4 Testing
At this stage an initial trial is conducted in the form of a test play on a prototype/dummy game that is used to test the game play that has been created is presented to test gameplay of each level. Based on the test play result, the development and integration of all characters, assets, game engines and related elements that have been designed. The testing method used is black box testing to test the functional interface application systems thoroughly. Meanwhile, data collection is done using the survey that has been tested its feasibility by experts using Likert scale.

4. Results and Discussion
Sorting waste game is a 2-dimensional animated game developed using a 3D unity game engine with the C++ programming language. This game is run on the android platform with a minimum specification of Android 4.1 Jelly Bean. This sorting waste game have 4 menu buttons which are: playing, learning, exit and credit. The initial appearance of the game is shown in figure 1. The play menu is a button to start the game. This game have 4 levels with different categories. The play page is shown in figure 2. Each level of the game has a score and displayed in the upper right of the game layer. The game continues to the next level if the user successfully completes each command. The final score will come out when all levels are successfully completed. The final score display can be seen in figure 3. The learning page is a piece of information in the form of knowledge about the type of waste consisting of organic waste and inorganic waste. The learning page display is shown in figure 4. The exit menu is a button to close the game application. While the credit menu is a menu that displays the game development team. The development team is shown in figure 5.
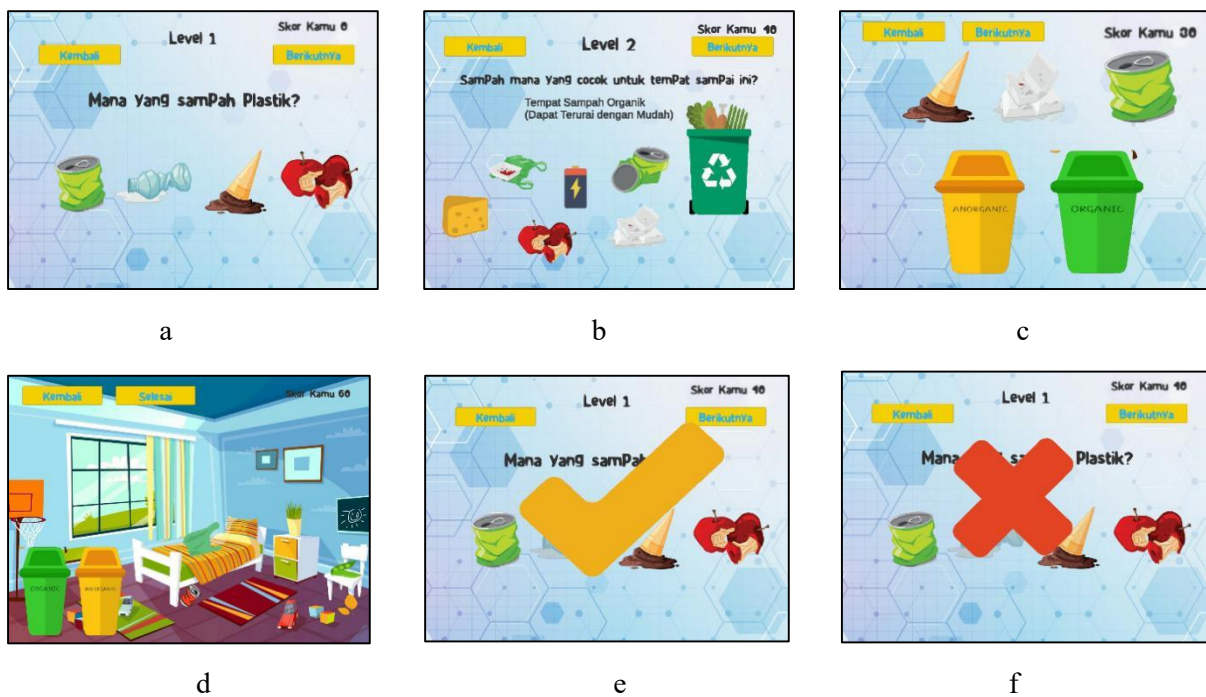
Figure 1. Game Main Page

Figure 2. Page Display consisting of level 1 to level 4 which is equipped with true and false page (e, f).
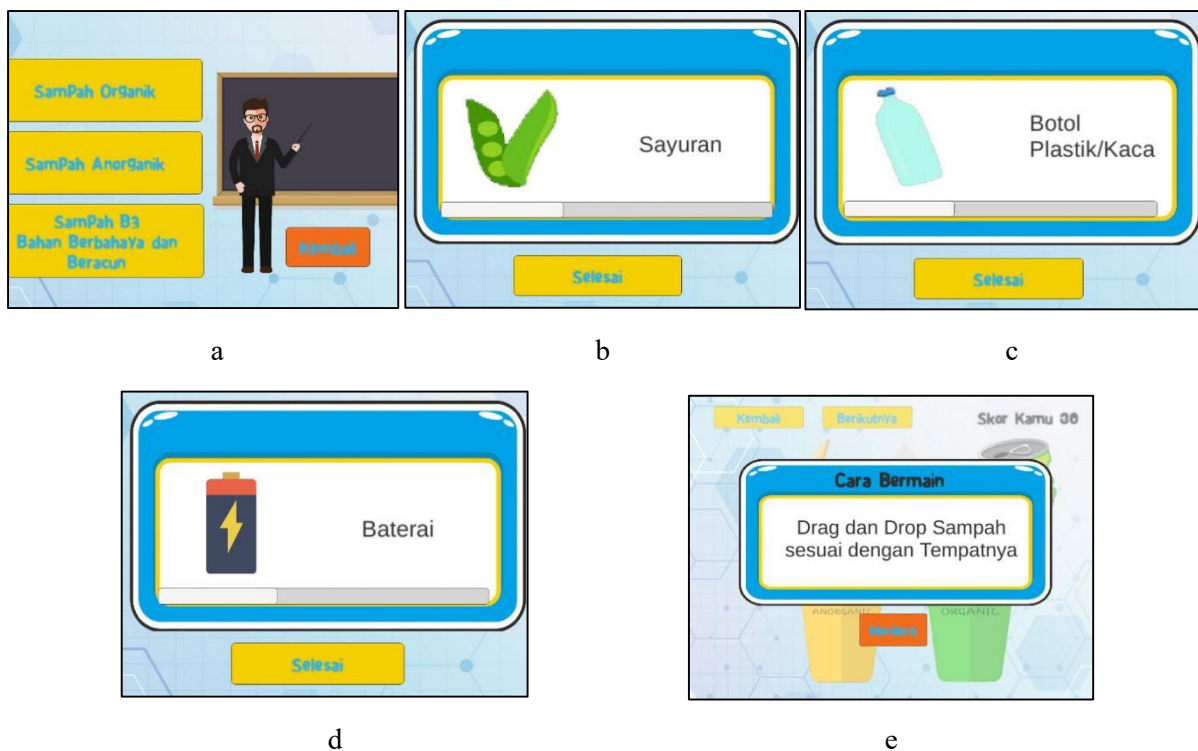
Figure 3. Last Score Page Show

Figure 4. Display of Learning Menu that explains organic waste, inorganic waste and explanation of how to play

Testing is done with 2 stages of testing. The first is by doing a test play. Test play is tested on the prototype game/dummy on the gameplay that has been designed. The prototype results show that all gameplay designs are running. Based on test play the final game development is done. Game that has been completed, need to be test again with testing blackbox which consist of 15 test scenario items. The blackbox testing instrument that was tested to respondents was a questionnaire that have been validated by an expert with a proper category to use. Each scenario items get a value of 1 so that the final

calculation result has 100% percentage. This percentage shows that every software in sorting waste of this game is running well.

Figure 5. Development Team Display

.

5. Conclusion

Development of Environment game with 2-dimensional animation based on android that has been created using the Waterfall Method. This game application is used on Android Platform which builds using Unity 3D game engine. The programming language used is C++. Initial testing is done by doing test play on prototyping sorting waste game. Based on the test play result we developed all the game's elements. Games that have been developed are the subjected to blackbox testing through scenarios that have been designed. Based on the result, it is obtained that 100% of all indicators on each item in the questionnaire can be used. It is means that the waste sorting game is user friendly and can be used and run smoothly on the Android Platform. So the Waste Sorting Game can be used as a technology-based learning media in environmental education.

Acknowledgment

References

[1]   Alessi and Trollip 2001 *Multimedia for Learning: Methods and Development* Massachusetts: A Pearson Education Company
[2]   Suwerda B 2012 *Bank Sampah (Kajian Teori dan Penerapan)* Pustaka Rihama: Yogyakarta
[3]   Sucipto C D S 2012 *Teknologi Pengolahan Daur Ulang Sampah* Yogyakarta: Gosyen publishing.
[4]   Mansur 2005 *Pendidikan AnakUsia Dini Dalam Islam* (Yogyakarta: PustakaPelajar)
[5]   Darmawan D 2013 *Metodologi Penelitian Kuantitatif* Bandung: PT RemajaRosdakarya
[6]   Hung C M, Huang I and Hwang G J 2014 *Journal of Computers in Education* **1** 151-166
[7]   Sudiatmika I. D. P. A., Cahyawan A K A and Buana P W 2014 *Jurnal Ilmiah Merpati* **2** 215-225
[8]   Arsyad A 2014 *Media Pembelajaran* Jakarta: Raja Grafindo Persada.
[9]   Daryanto 2010 *Media Pembelajaran*. Yogyakarta: Gava Media.