*Advances in Social Science, Education and Humanities Research, volume 464*
**Proceedings of the 1st Progress in Social Science, Humanities and Education Research Symposium (PSSHERS 2019)**

# The Design and Development of Android-Based "Puzzle Games" Mathematics Learning Media

Za'imatun Niswati[1], Ari Irawan[1*], Syamsiah[1], Chatarina Febriyanti[1], Gita Kencanawaty[1], Itsar Bolo Rangka[1]

[1]*University of Indraprasta PGRI (Indonesian Teachers Association). Highway Middle Kp Gedong, Pasar Rebo District, East Jakarta. Indonesia*
[*]*Corresponding author. Email: ari_irawan@unindra..ac.id*

**ABSTRACT**
Games that improve the ability of elementary school students to learn abstract things is needed more now than ever before. Learning media is important in presenting the subject of learning. The purpose of this study was to develop a mathematical learning media design on plane subject using the Android operating system applicable on mobile phones. The methodology used was Research and Development (RnD) with ADDIE approach. The research included three stages 1) Analysis of the needs and availability of mathematics learning media needed by elementary school students. 2). Designing the appearance of puzzle and games subject suitable for elementary school students. 3) Development of mathematics learning media using android-based puzzle games.

***Keywords:*** *Mathematics, puzzle games, android, elementary school*

## 1. INTRODUCTION

Learning mathematics by elementary school students is very important and helps in introducing many concepts to them. In reality, students need more contextual learning than abstract ones. For this reason, there is need for interactive learning tools to assist develop students' ability to understand the subject in better way. In each concept, students must be able to explore, discover and express their findings in daily life.

Not many games are suitable for learning purpose. It is absolutely necessary to develop games that support learning process and makes it more meaningful. Moreover, students are often enthusiastic about learning activities carried out in class when the subject presented is more interesting. The study on perceptions and readiness of mobile learning is mostly used as the object of student research. However, studies that focuses exclusively on those are very limited (Yusri, Goodwin, & Mooney, 2015). Android is one of the most famous options utilized lately. Its operating system is not only on hand phone but has developed in other electronics as well. With the increasing number of people using Android phones, all forms of information will be easily obtained and can be used as learning media. Educational puzzle games are available on iPad or Android (Larkin & Calder, 2016). During this time students were unsupervised and allowed to play their chosen games in the classroom as well as in the school environment (Roberts, 2015)

The game designed and developed by the research team was android-based contained in mobile phones. Since the learning process is not just conventional as most teachers do, information technology can be used so that the delivery can be easier for students to grasp. However, supervision in the process of utilizing the technology used must also be considered by instructors.

Android-based teaching approach is developed in an effort to facilitate student learning, especially in elementary schools. Learning is easier and more fun when it is game based. In this study, Android-based game about type of plane shapes is developed. With it, students are expected to be capable of distinguishing one plane from the other. This learning approach is also designed as a conventional learning and adds to the attractiveness of students (Yazdi, 2012).

Android-based learning facilitates the learning process, especially for elementary school children. Through this strategy, students easily understand apart from being fun since in form of a play. In this study, the concept of introducing plane geometry through developed games was a puzzle. It was expected that students would be able to know the types of plane shapes and distinguish types of such figures.

## 2. METHOD

The methodology used was research and development (RnD) and the approach used was ADDIE. The process

of developing learning media involved designing stages of the puzzle and then development of the game itself with the Android system as a learning media. This study designed a tablet-based learning with a computer qualification that uses the Android operating system. This is the Open Source operating system widely used. Nevertheless, the Android design is different from other operating systems (Waiyakoon, Khlaisang, & Koraneekij, 2015).

The data used in this study is needs analysis, designed and developed according to the results that have been made. The design included the appearance, design, and subject that was appropriate with the elementary school curriculum.

## 3. RESULT AND DISCUSSION

The stages in creating mathematics puzzle learning media as an introduction to plane shapes to elementary school students with the first ADDIE approach were as follows:

### 3.1. Analysis

The analysis stage involves observations on students to determine why most of them often have difficulties in acknowledging the shapes of planes. In this study, specifically first grade elementary school, students were introduced to kinds of plane shapes such as squares, rectangles, triangles, trapezoids, parallelograms, rhombuses, and circles.

### 3.2 Design

This stage involved designing mathematical puzzle games to be used as learning media in the introduction of plane shapes to elementary school students.

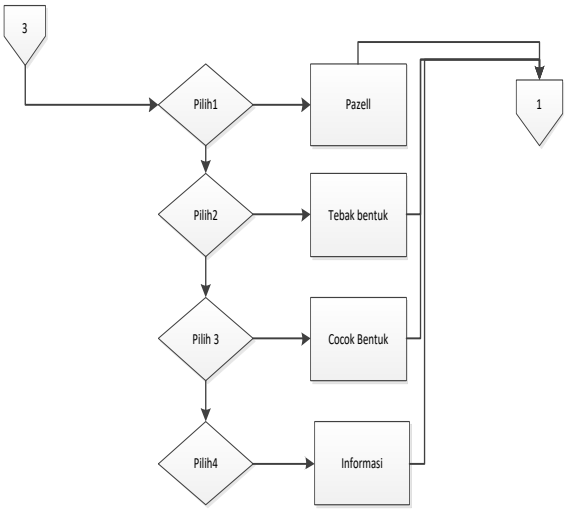


Figure 1: Flowchart

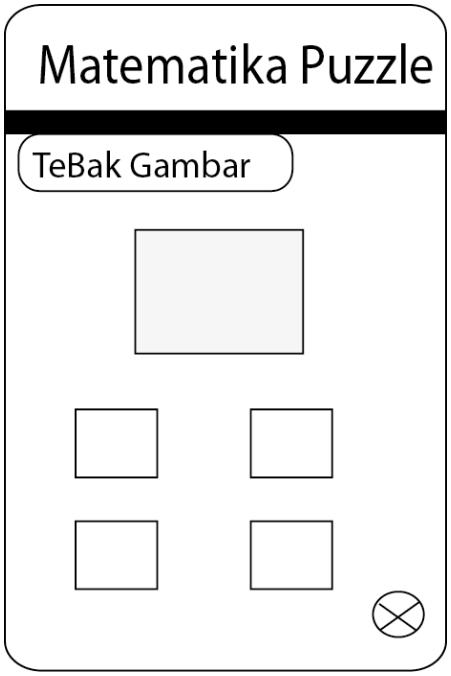


Figure 2: Design Guess a Picture

The picture above is an example of a design be created in the development of mathematics teaching subjects and the introduction of plane shapes for elementary school students. Based on the findings, the concept of counting and practicing has the same function as memorizing. The differences related to the characteristics of mathematics itself (Wang, Liang, Lin, & Tsai, 2017). The same statement was also pronounced by Nkopodi & Mosimege, (2009).

At this stage the research team displayed the designs of the game developed based on Android and later menus.

### 3.3 Developing

Based on the design made, the next step was the development, including consultations with elementary school teachers as subject experts and professionals of learning technological design to improve the design and content of the subject presented in the math puzzle application. This was done as an input for the team in the development of the game. It was expected that puzzle games would be compatible with the research objectives.


Figure 3: Display Home


Figure 4: Display Menu


Figure 5: Display for Example plane shapes.

Game-based learning involve instructions using the media. It is designed to learn favorably, incorporate content into the game, and let students play. Students gain knowledge through playing games, helping them to absorb and understand concepts (Waiyakoon et al., 2015). With educational games for plane subject, it is expected that students are able to understand the learning subject optimally, thus improving learning outcomes. The compatibility between the subject taught and games designed (to support the learning process in the classroom) was the goal of designing the puzzle game.

Since the game is easy to analyze logically and mathematically, playing is an activity that is integrally related to the cultural and world heritage surrounding its players. Many games results in competition, and as a result players can apply analytical thinking to advance their understanding. The various games played by Negev Bedouin, elders, and children are a major part of the culture in the deserts. Some of these games include mathematical values that help them develop numerical thinking, integrated and used as teaching strategies in the education process (Fouze & Amit, 2018).

The researchers consulted the design developed by various experts, especially on subjects related to planes. The education technology experts were also consulted to determine whether the appearance was appropriate with the expectations of the development of mathematics learning media or not. The design experts were also considered, including visual communication plan to

ensure the screen display of the puzzle game was more interactive.

On the basis of the stages and level of thinking for students, teachers must allow students learn mathematical concepts appropriate with their level of development. For junior high school students, instructors must provide learning experiences appropriate to the level of development as well as their thinking. Generally, games and puzzles are mostly preferred by junior high school students. Therefore, teachers are advised to present the context through plays or puzzle. (Kusumah, 2014).

The research was intended to determine subject preferences for educational computer games including children. This was a valuable study and can help other researchers choose their subject and type of play. This can also be used as a comparison with students from other countries. Another study shows that Spanish children seem to follow the same trend on the use of electronic games carried out byin their counterparts in other countries (Furió, González-gancedo, Juan, Seguí, & Rando, 2013).

It is good to answer procedurally questions whether "you don't need all the other parts". This is an opportunity to investigate students' thinking, and to have class puzzles on whether and why these two points determine a thought. Therefore, the argument that MfT is a function of the topic taught together with the teacher's approach to teaching, which includes the ways and ideas cannot be ignored. (Kazima, Pillay, & Adler, 2008).

All classroom and pre-service teachers except pre-school ones appeared to have a preference for VMs when the graph was examined (Akkan, 2012).

The Comparison done on previous research proves that with games, learning that was originally abstract, especially in plane subjects, are easier to understand. Games and technology are two combinations in optimizing the implementation of learning carried out in class, making it more attractive to students and improve their understanding.

## 4. CONCLUSIONS

The study concluded that there is a need for improvements in the subject or educational content on introduction to the planes in the elementary school curriculum. It is our hope that puzzle game will be more useful in plane geometry subject and improve the quality of learning for elementary school students.

## REFERENCES

Akkan, Y. (2012). VIRTUAL OR PHYSICAL: In-service and Pre- Service Teacher's Beliefs and Preferences on Manipulatives. *Turkish Online Journal of Distance Education*, *13*(4), 167–192.

Fouze, A. Q., & Amit, M. (2018). On the importance of an ethnomathematical curriculum in mathematics education. *EURASIA Journal of Mathematics, Science and Technology Education*, *14*(2), 561–567. https://doi.org/10.12973/ejmste/76956

Furió, D., González-gancedo, S., Juan, M., Seguí, I., & Rando, N. (2013). Computers & Education Evaluation of learning outcomes using an educational iPhone game vs . traditional game. *Computers & Education*, *64*, 1–23. https://doi.org/10.1016/j.compedu.2012.12.001

Kazima, M., Pillay, V., & Adler, J. (2008). Mathematics for teaching: observations from two case studies. *South African Journal of Education*, *28*(2), 283–299.

Kusumah, Y. S. (2014). Development of Didactical Design of Mathematics Pedagogy Through Professional Program of Mathematics Teacher Education. *Jurnal Pendidikan Dan Pembelajaran*, *21*(1), 10–23.

Larkin, K., & Calder, N. (2016). Mathematics education and mobile technologies. *Mathematics Education Research Journal*, *28*(1), 1–7. https://doi.org/10.1007/s13394-015-0167-6

Nkopodi, N., & Mosimege, M. (2009). Incorporating the indigenous game of morabaraba in the learning of mathematics. *South African Journal of Education*, *29*(2005), 377–392.

Roberts, D. M. (2015). Cracks in support for two Tanzanian rural elementary schools with high performance on national exams. *International Journal of Educational Development*, *43*, 32–40. https://doi.org/10.1016/j.ijedudev.2015.04.006

Waiyakoon, S., Khlaisang, J., & Koraneekij, P. (2015). Development of an Instructional Learning Object Design Model for Tablets Using Game-based Learning with Scaffolding to Enhance Mathematical Concepts for Mathematic Learning Disability Students. *Procedia - Social and Behavioral Sciences*, *174*, 1489–1496. https://doi.org/10.1016/j.sbspro.2015.01.779

Wang, Y., Liang, J., Lin, C., & Tsai, C. (2017). Identifying Taiwanese junior-high school students ' mathematics learning pro fi les and their roles in mathematics learning self-ef fi cacy and academic performance. *Learning and Individual Differences*, *54*, 92–101. https://doi.org/10.1016/j.lindif.2017.01.008

Yazdi, M. (2012). E-learning sebagai media pembelajaran interaktif berbasis teknologi informasi. *Jurnal Ilmiah Foristek*, *2*(1), 143–152.

Yusri, I. K., Goodwin, R., & Mooney, C. (2015). Teachers and Mobile Learning Perception: Towards a Conceptual Model of Mobile Learning for Training. *Procedia - Social and Behavioral Sciences*, *176*, 425–430. https://doi.org/10.1016/j.sbspro.2015.01.492