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Android Snake Ladder on Triangle using TGT Learning Model to Increase Learning Motivation

Melania Eva Wulanningtyas [1]*, Yusup Davit Palma Putra [2], Ni Nyoman Triani [3], Nofica Andriyati[4]

[1,2,3]Universitas Mercu Buana Yogyakarta, Indonesia
[4]Shaanxi Normal University, China
*Corresponding Author. E-mail: melaniaeva@mercubuana-yogya.ac.id
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Abstract

The aims of this research were developing mathematics learning media based on android using Teams Games Tournament (TGT) learning type on triangle materials to improve learning motivation of class VII Junior High School students according to these validity, practical, and effective criterias through snake ladder game. The subject of this research were 28 students of class VII D SMP Negeri 1 Sedayu. This research based on ADDIE developing model contains 5 steps: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. The results of this research showed that mathematics learning media based on android using Teams Games Tournament (TGT) learning type on triangle materials to improve learning motivation of class VII Junior High School students was completed on: (1) validity aspect through material expert validation with score 64 and categorized very good in $X > 63$ *criteria also media expert validation with score 64 and categorized very good in* $X > 63$ *criteria. (2) practical aspect through mathematics learning media based on android tested to 28 students with student response questionnaire score was 1.053 and categorized good in* $856{,}8 < X \leq 1.058{,}4$ *criteria. (3) effectiveness aspect through increasing learning motivation students as much as 26% from 54% to 80%. So, it can be concluded that mathematics learning media based on android is appropriate for learning activity and beneficial to improve learning motivation students.*

Keywords: *Learning Media, Android, Teams Games Tournament (TGT), Learning Motivation*

INTRODUCTION

The development of technology today produces a variety of learning media, one of which is android learning media. In 2018, International Data Corporation (IDC) shows that android ranks first with a percentage of 85.1% based on the number of smartphone users in Indonesia (Cahyani & Patrikha, 2019). Meanwhile, in 2020, the use of Android on mobile and tablet in Indonesia reached 91.85% (Statcounter, 2021). Of the many android users in Indonesia, this can be used by teachers to create and use android as a learning media. Android has many features that support the development of learning media so it is expected to increase students' math learning motivation. The use of android-based learning media is known to be able to provide students' interest and motivation in the mathematics learning process compared to learning using traditional methods (Suddin & Deda, 2020; Wahid et al., 2019; Widiansyah et al., 2018). Android is a Linux-based operating system that provides an open platform for developers to create their own applications. Android is an operating system for smartphones and tablets (Chinetha et al., 2015; Kuswanto & Radiansah, 2018; Singh, 2014). Android is growing because it has supporting features, namely: Application Framework; Dalvik Virtual Machine; A series of graph libraries for 2-dimensional and 3-dimensional programming; Supports audio media, video, and image formats; and Provide APIs that can access devices such as cameras, GPS, touchscreen, trackball, and keyboards (Agustina & Wahyudi, 2015; Ismail & Wardani, 2019). Through these features, it is possible for an application to be created for many functions and purposes, one of which is as a medium of learning mathematics.

The benefits that can be obtained from learning media are the learning process becomes more interactive; allow the learning process to be carried out anywhere and anytime; time and energy efficiency; and delivery of standardisable material (Karo-Karo & Rohani, 2018). In addition, through learning media, students' positive attitudes towards learning materials and the learning process can be improved (Istiqlal, 2018). Learning media is used as a tool for teachers in explaining materials to their students. One of the mathematical learning materials in junior high school is to understand the buildings of geometry, its elements and properties, its size and measurement and its use in problem solving (Mawaddah & Maryanti, 2016). In this geometry material, students experience 3 difficulties in triangular material including: Difficulty to understand the

concept and definition of the base and height of the triangle, and learners still have difficulty in understanding the concept of two intersecting lines and mentioning the relationship between angles on two parallel lines. Difficulty identifying and mentioning traits that include difficulty identifying and associating between the nature of the equilateral triangle with the nature of the isosceles triangle, by mentioning that the equilateral triangle is not the isosceles triangle. Difficulty in determining formulas that include difficulty proving the large number of angles in a triangle and determining or proving the formula of the area of the triangle if known the size of the base and its height (Bernard & Sunaryo, 2020). In addition to helping convey material in learning activities, learning media is expected to increase student motivation in learning mathematics.

Motivation is a change (Arends & Kilcher, 2010) with the meaning of processes that energize, direct, and sustain behaviour (Santrock, 2011). Changes in energy in a person characterized by the onset of feelings and reactions to achieve a goal (Lubis & Ikhsan, 2015). In addition, motivation is a good power, drive, or strength that comes from yourself and from outside that encourages learners to learn (Zarkasyi, 2017). Important roles of learning motivation include: Determining the things that are used as learning boosters; Clarify the learning objectives to be achieved; Determine the variety of control over learning stimuli; and Determine the persistence of learning (Widiarti, 2018). Student motivation can arise if the learning media is interesting and empowered to help students in learning mathematics, because mathematics is a science that not only provides numeracy skills but also logical thinking (Wulanningtyas, 2019). One of the efforts that can be done is to collaborate mathematical learning media with math games that are already recognized by junior high school students. The game developed on this learning medium is a snake ladder. Snake ladder is a fairly familiar game among teenage students, so it is expected that students can already understand the rules of the game. Snake ladder is a game that is done in groups, so this learning medium can support a cooperative learning model type Teams Games Tournament (TGT). Teams Games Tournament (TGT) is one of the cooperative learning models that emphasizes games and competitions to achieve learning completion (Wyk, 2011; Zarkasyi, 2017). Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning (Johnson & Johnson, 2019).

Cooperative learning has several characteristics, namely: students work in groups cooperatively to complete the learning material; groups are formed from students who have high, medium, and low abilities; if in the class there are students who consists of different races, cultures, ethnicities, and genders, it is strived that each group consists of different races, cultures, ethnicities, and genders; and rewards are more group-oriented than individual (Kusrini et al., 2014). The stages in Teams Games Tournament (TGT) learning model are: class presentation; team as group learning; game; tournament as competition; and team recognition (Hamdani, 2011; Slavin, 2005). The Teams Games Tournament (TGT) learning model has advantages and disadvantages. The hallmark of the Teams Games Tournament (TGT) learning model is that students gain significantly more friends from their racial group, as well as increasing students' feelings/ perceptions that their results depend on performance and not just luck. While the Teams Games Tournament (TGT) learning model has the difficulty of grouping students who have heterogeneous abilities in terms of academics (Fathurrohman, 2017). Through this learning activity the teacher has changed his role no longer as the highest authority holder of science and indoctrinate, but into a facilitator that guides students to be able to form their own knowledge (Azira et al., 2018; Gazali, 2016).

METHOD

This type of research is research and development known as Research and Development (R&D). Research and development serves to validate and develop products (Sugiyono, 2017). Development research in the field of education is a systematic study of the design, development, and evaluation about programs, processes, and learning products that are practical, valid, and effective and have added value (Soegeng Ysh, 2017). The development model used in this research is ADDIE research. The stages are: 1) Analysis: to initiate the needs of students and material analysis; 2) Design: create flowchart and storyboard; 3) Development: creating products, compiling questionnaires, validation of material experts and media experts; 4) Implementation: small group tests and large group tests; 5) Evaluation: data analysis and final design.

Picture 1: ADDIE Developing Model

This development research uses the Likert scale to analyse the data. The Likert scale is used to develop instruments in measuring the attitudes, perceptions, and opinions of a person or group. The Likert scale has gradations in the form of words, namely, Very Good (5), Good (4), Enough (3), Less (2), and Very Less (1). The five scale is used to analyse data that is an assessment of mathematical learning media. The scale was changed in the form of tables as follows (Yektyastuti & Ikhsan, 2016).

Assessments from material experts and media experts produce quantitative data. The number of values obtained from the assessment of material experts and media experts is further calculated by the total score. Next create a range of quality categories with a Likert scale to get quantitative results. Expert assessment of materials and media experts is carried out by one assessment with many assessment items i.e. 15 items. Thus, an ideal minimum score of 15 can be obtained, the ideal maximum score = 75. Xi = 45 and Sbi = 10. Media is said to be valid if the assessment of material experts and media experts at least falls into the category of good.

Practicality assessment is carried out by students of learning media users, namely students of class VII of Sedayu State Junior High School. The assessment of these students determines the practical criteria in the medium of learning. Assessments from students generate quantitative data. The number of values obtained is then calculated by the total score then makes a range of quality categories with the Likert scale to get quantitative results. There was a test done in a small group. The small group test was conducted by 5 students with many assessment items of 9 items. Thus, will be obtained a minimum score = 45, the ideal maximum score = 225, Xi = 135, Sbi = 30. The medium of learning is said to be practical if the student's research produces a minimum good grade. So that the interval criteria are obtained as Table 2.

Table 1. Value Convertion

Score Interval	Information
X > Xi + 1,8 Sbi	Very Good
Xi + 0,6 Sbi < X ≤ Xi + 1,8 Sbi	Good
Xi – 0,6 Sbi < X ≤ Xi + 0,6 Sbi	Enough
Xi – 1,8 Sbi < X ≤ Xi – 0,6 Sbi	Less
X ≤ Xi – 1,8 Sbi	Very Less

Table 2. Material Expert and Media Expert Value Convertion

Score Interval	Information
X > 63	Very Good
51 < X ≤ 63	Good
39 < X ≤ 51	Enough
27 < X ≤ 38	Less
X ≤ 27	Very Less

After that, a large group test is conducted. The large group test was conducted with a larger number, namely all students of class VII of Sedayu State Junior High School with many items of 9 items. Thus, will be obtained the ideal minimum score = 252, the ideal maximum score = 1260, Xi = 756, Sbi = 168. The medium of learning is said to be practical if the student's assessment produces a minimum good grade. So that the interval criteria are obtained as follows.

Table 3. Small Group Value Convertion

Score Interval	Information
X > 189	Very Good
153 < X ≤ 189	Good
117 < X ≤ 153	Enough
81 < X ≤ 117	Less
X ≤ 81	Very Less

Table 4. Large Group Value Convertion

Score Interval	Information
X > 1058.4	Very Good
856.8 < X ≤ 1058.4	Good
655.2 < X ≤ 856.8	Enough
453.6 < X ≤ 655.2	Less
X ≤ 453.6	Very Less

Table 5. Students' Learning Motivation Value Convertion

Score Interval	Information
X > 2.352	Very Good
1.904 < X ≤ 2.352	Good
1.456 < X ≤ 1.904	Enough
1.008 < X ≤ 1.456	Less
X ≤ 1.008	Very Less

Assessments obtained from students' learning motivation questionnaires before and after using learning media are used to determine the effectiveness of developed learning media. Assessments by one-class students are conducted using 20 assessment items. Thus, obtained the ideal minimum score = 560, the ideal maximum score = 2800, Xi = 1680 and Sbi = 373,333. So that the interval criteria are obtained as follows.

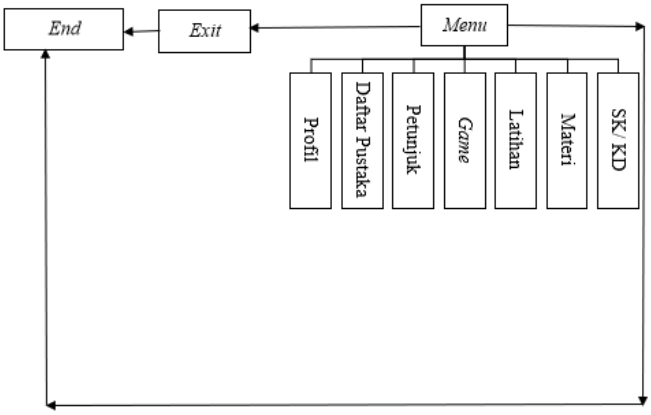
Data obtained will be analyzed with percentage techniques, namely:

$$Percentage\ increase\ in\ motivation = \frac{score\ obtained}{score\ maximum} x\ 100\%$$

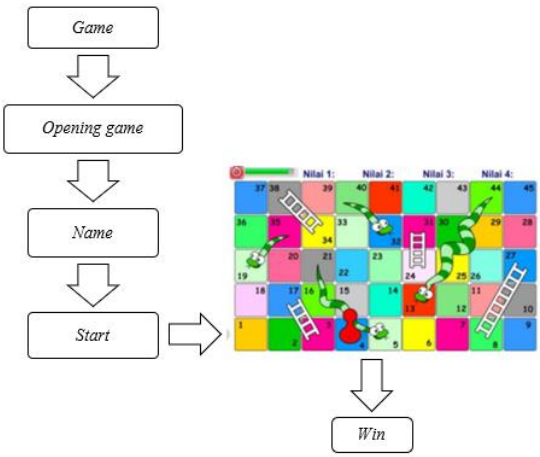
Then the percentage of the final motivation score minus the initial motivation score. Thus, learning media is said to be effective if there is a significant or minimal increase in student learning motivation in the category both before and after using developed learning media.

RESULTS AND DISCUSSIONS

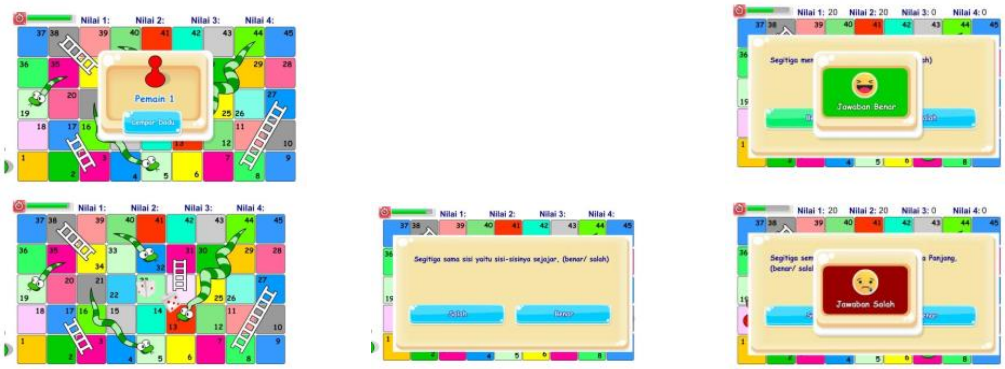
Learning media developed formed using android applications that are aligned with the game of snake ladder. Through this ADDIE development model, the stages of application creation are carried out with the following steps: The Analysis stage consists of two steps, namely field observation with the results of the absence of maximum smartphone use in learning activities and material analysis with the results of the material to be delivered is a triangle. The Design stage consists of two steps, namely making a flowchart and storyboard from the game of snake ladder.



Picture 2. Learning Media *Flowchart*



Picture 3. Snake Ladder *Flowchart*



Picture 4. Snake Ladder *Storyboard*

The Development stage consists of four steps, namely product creation, packaging, material expert validation, and media expert validation. Implementation stage consists of two steps, namely statistical calculations in the form of small group tests and large group tests. The Evaluation stage consists of two steps, namely data analysis and the final design of the product.

Learning media is declared worthy of use based on the results of validation by material experts, media expert validation, and trial results by students. Expert validation of the material is carried out by one of the teachers of Sedayu State Junior High School mathematics to meet valid aspects, the assessment of material experts is divided into 2 criteria, namely: 1) the quality of the content and purpose, and 2) the quality of instructional. Validation results can be viewed in the table 6.

The results of expert validation of material against android-based mathematical learning media obtained a score of 64. When viewed from the expert conversion table, the score is included in criteria X>63, so android-based mathematical learning media falls into the category of very good. Validation of media experts is carried out by one of the lecturers of Mathematics Education, Mercu Buana Yogyakarta University to meet valid aspects, the assessment of media experts is divided into 2, namely: 1) instructional quality, and 2) technical quality. The results of media expert validation can be seen in the table 7.

Table 6. Material Expert Validation Result

No	Criteria	Score
1.	Quality Content and Purpose	25
2.	Quality Instructional	39
	Total score	64

Table 7. Media Expert Validation Result

No	Criteria	Score
1.	Quality Instructional	9
2.	Quality Technical	55
	Total score	64

The results of media expert validation of android-based mathematical learning media obtained a score of 64. When viewed from the conversion table of media experts, the score falls into criteria X>63, so android-based mathematical learning media falls into the category of good.

The large group test involved all students of class VII D Sedayu State Junior High School consisting of 28 students. Large group tests were conducted with the aim of measuring the practicality of the android-based mathematical learning media used. The practicality test consists of 3 criteria, namely: 1) quality of content and purpose, 2) instructional quality, 3) technical skin. The results of the student response can be seen in Table 8.

Table 8. Students' Response Result

No	Criteria	Score
1.	Quality Content and Purpose	117
2.	Quality Instructional	342
3.	Quality Technical	594
	Total score	1.053

The results of the student response to android-based learning media obtained a score of 1,053. When viewed from the student response conversion table, the score falls into the criteria of $856.8<X\leq1{,}058.4$, so that the assessment of android-based learning media falls into the category of good. Thus, it can be said that android-based learning media is practically used.

Learning media that have been declared valid and practical are used in mathematical learning activities on triangular materials. Students are required to be able to enter a group that has been created by the teacher. This group must be adapted to the cognitive condition of the student so that the members of the group consist of students who have heterogeneous abilities. This is to avoid gaps in student ability in the group and also prevent the existence of free riders (Dingel et al., 2013). After that students are asked to play according to the rules of the snake ladder and if there are questions related to the triangular material students are asked to answer. The answer consists of two kinds, namely right and wrong, if the student answers right then the student will get a grade and if wrong then will get a score of zero. The group that wins is the group that

first reaches box number 100 with the highest score. This learning medium helps students to be able to compete with the Teams Games Tournament (TGT) method because students in each group are asked to work together to win this game. Cooperative learning can be applied by teachers as one of the approaches that help mathematical learning activities (Zakaria et al., 2013). In addition, students become motivated to be able to win this game by answering the given questions appropriately because they will be faced with unexpected up and down conditions based on the numbers on the dice that appear. Through this learning activity there are several learning objectives: (1) Cognitive goals related to intellectual knowledge and thinking skills are to answer questions given through games. (2) Affective goals are related to attitudes, namely student learning motivation. (3) Psychomotor purposes relate to movement skills and physical responses i.e. students' skills in the use of learning media (Nitko & Brookhart, 2011).

After using the android-based mathematical learning medium, students fill out the motivational questionnaire at the end of the activity. This stage aims to look at the effectiveness of android-based learning media that is reviewed from students' learning motivation before and after treatment. The results of the analysis of data on the improvement of student learning motivation showed that there was an increase in student learning motivation after using learning media by 26% from 54% to 80%. There are changes in the meaning of behaviour that are the result of practice or learning experience (Schunk, 2012). As many as 15 students have minimal motivation to learn very well in learning activities before using android-based learning media. After that as many as 22 students now have minimal motivation to learn at least good to very good in learning activities after using android-based learning media. This means that there is an increase of 7 students who have minimal good learning motivation This shows that android-based learning media developed effectively used by students.

CONCLUSION

Based on the results and discussions outlined, android-based mathematical learning media developed refers to the ADDIE development model with steps (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation. The resulting media is an android-based mathematical learning medium in the form of a snake ladder game that contains triangular material. Android-based mathematical

learning media developed by researchers meets valid, practical, and effective aspects. This can be seen from the results of expert assessment of the material on the criteria of the quality of content and purpose and the quality of instructional that obtained a score of 64 and fall into the category of very good. Furthermore, the assessment of media experts on its instructional quality criteria and technical quality which obtained a score of 64 and falls into the category is excellent. Android-based mathematical learning media meets the practical aspects seen from the results of charging student response questionnaires obtained a score of 1,053 with a good category. Then the android-based math learning medium meets the effective aspects seen from increasing student learning motivation by 26% from 54% to 80% after using android-based math learning media.

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