The Impact of *Electronic Puzzle* on two-dimensional shapes grouping lesson

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**Abstract.** This research aimed at developing *Electronic Puzzle* media to assist students in understanding an abstract concept of two-dimensional shapes grouping lessons. This research employed a quantitative approach with quasi-experimental method. This research further intended to determine the effect of *Electronic Puzzle* media on student learning achievement. To determine the sample, it employed random sampling technique. The research data were tested and analysed through SPSS 21.0 for Windows. The results showed that there was an influence of use *Electronic Puzzle* using application I'm a Puzzle to improve student learning achievement in class II SDN Gadang 01 Malang. There are difference learning achievement between students taught using *Electronic Puzzle* and not. Through these results it is expected that elementary school teachers can develop themselves in the use and development of electronic-based media and teaching aids in their classroom learning.

1. Introduction

Electronic Puzzle is a creative electronic learning media that support children's thinking abilities in learning. Development of Electronic Puzzle or E-puzzle media is feasible, with the consideration that use of technology will make it easier for students to do learning and avoid the possible lack of interest during the learning process. This media offers both play amenities and learning media to children to create an enjoyable learning process. Multimedia is useful for achieving learning objectives easily with a variety of innovations given [1]. It has also been proven that multimedia is a good instructional media for effective learning [2,3].

Puzzle is a media that is played by disassembling and uniting parts to form images or writing [4]. Conventional puzzle in the form of image/visual media can only be processed by single sense [5]. Multimedia technology is more preferable to be implemented since it does not only involve the visual perception, but it also involves auditory perception since multimedia can be in the form of both audio and visual technology.

Several studies have discussed the use of Multimedia Puzzle in the educational setting to support students in understanding lesson content easily, systematically, and interestingly. The results confirmed a positive effect of using Multimedia Puzzle to improve students' understanding. It further affirmed that this media offers a detail and systematic feature as well as attractive interface that encourages student’s learning process [6]. The use of Multimedia Puzzle has been proven to be able to improve student learning outcomes from the first cycle to the second cycle from an average of 39.90 (low category) to 79.70 (good category) [7]. In addition, this media can also increase student learning
motivation [8]. The results showed that the use of this media in the learning process was able to make students feel relaxed and less aggressive [9]. Electronic Puzzle Media is proven to be effective and feasible to be used in learning activities [10].

The distinguishes from previous research is develops Electronic Puzzles using the application I’m a Puzzle for the introduction of geometry material for low grade elementary school students. I’m a Puzzle application can use various modes and levels of difficulty of the game that are adjusted to the characteristics of students. This research is focused on identifying the impact of using Electronic Puzzles on flat material on student learning outcomes. The development of Electronic Puzzle or E-puzzle media was chosen for students of Class II of SDN Gadang 01 Malang in mathematics subject matter in two dimensional grouping. This is based on the consideration that mathematics has abstract object characteristics [11], so elementary students who are still in the development stage of thinking concrete operations often have difficulty understanding something abstract, especially in mathematics.

What distinguishes this present research and the previous one is the development of Electronic Puzzle by using I’m a Puzzle application for the introduction to geometry lesson for low grade elementary school students. I’m a Puzzle application offers various playing mode with diverse difficulty based on the student’s characteristics. This research focused on identifying the effect of the implementation of Electronic Puzzle or E-puzzle for two-dimensional shapes grouping lesson on student’s learning achievement. This E-puzzle was implemented on the second graders in SDN Gadang 1 Malang. The implementation of the media was based on the abstract characteristics of Mathematics to assist elementary school students who commonly still in the stage of concrete operation thinking and frequently encounter a difficulty in understanding an abstract concept, particularly within Mathematics lesson [11].

2. Methods

This research employed an experimental procedure by collecting quantitative data using statistical analysis to examine the influence of the use Electronic Puzzle on two-dimensional shapes grouping lesson to increase student learning achievement in class II SDN Gadang 01 Malang [12]. The population of this research was the second grade students of SDN Gadang 01 Malang City in the academic year 2013/2014, amounting to 120 people and it was divided into three classes, namely class IIA, IIB, and IIC. The sampling was done randomly and it obtained students of class IIA and IIB as the subject. To determine the experimental class and the control class, it used a lottery method, students in Class IIA as an experimental class and class IIB as a control class. The experimental group received a treatment by using the Electronic Puzzle media, while the control group did not use Electronic Puzzle media. Thus, the research design used in this study was a quasi-experimental to find out the impact of Electronic Puzzle media on improving student learning outcomes on two-dimensional shapes grouping lesson.

To collect the data, this research used tests as research instruments. To investigate the impact of using Electronic Puzzle on learning achievement, this research compared the results of pre-test and post-tests. Pre-test was given to identify the initial knowledge and ability of students, while the post test was done to identify the results after they received the treatment. The collected data was then analysed through statistical analysis using SPSS 21.0 for Windows.

2.1. Electronic puzzle (e-puzzle)

Electronic Puzzle is a creative electronic learning media that support children's thinking abilities in learning. Electronic Puzzle help students understand abstract concept of two-dimensional shapes to be more concrete. This research focused on developing Electronic Puzzle using the application I’m a Puzzle on two-dimensional shapes grouping lesson. I’m a Puzzle is an application that allows students to create and play Puzzle from any image. I’m a Puzzle application use various modes and levels of difficulty of the game that are adjusted to the characteristics of students. I’m a Puzzle allows students to choose from six different puzzle modes namely, Classic Puzzle, Heart Puzzle, Puzzle Stars, Honeycomb Puzzle, Slide Puzzle, Puzzle Swap. Each level of difficulty can be arranged that is easy,
medium, difficult, and very difficult. Figures 1 and 2 show how the use of Electronic Puzzles with I'm a Puzzle application uses modes and difficulty levels adjusted to the characteristics of students in two-dimensional shapes grouping lesson.

![Figure 1. Electronic puzzle with classic easy mode.](image1)

![Figure 2. Electronic puzzle with star medium mode.](image2)

3. **Result and discussion**

The results of normality and homogeneity test using an independent sample test using SPSS 21.0 for Windows are shown in Table 1 and Table 2 below.
Table 1. The result of normality test.

| Kolmogorov-Smirnova | Shapiro-Wilk |
|---------------------|-------------|
| Statistic | Df | Sig. | Statistic | df | Sig. |
| Result 2A | .124 | 40 | .124 | .927 | 40 | .013 |
| Result 2B | .134 | 40 | .066 | .959 | 40 | .149 |

Table 2. The result of homogeneity variances test.

| Levene Statistic | df1 | df2 | Sig. |
|------------------|-----|-----|------|
| 1.136 | 1 | 78 | .290 |

The results of normality test data from the pre-test and post-tests showed a significant average value of class IIA (0.124) and class IIB (0.066) which means that the data were normally distributed (> 0.05). Homogeneity test results on both the pre-test and post-tests also showed a significant average (0.290) which showed that the data was homogeneous (> 0.05).

After knowing that class IIA and class IIB data were normally distributed and homogeneous, then it was proceeded by the hypothesis testing using t-test. The hypothesis testing was also processed by using SPSS 21.0. The results of the analysis are presented in Table 3 below.

Table 3. The result of independent samples test.

| Levene's Test for Equality of Variances | t-test for Equality of Means | 95% Confidence Interval of the Difference |
|----------------------------------------|-----------------------------|----------------------------------------|
| F | Sig. | t | df | Sig. (2-tailed) | Mean | Std. Error | Difference | Lower | Upper |
| Equal variances assumed | .162 | .688 | 2.949 | 78 | .004 | 3.400 | 1.153 | 1.104 | 5.695 |
| Equal variances not assumed | | | 2.949 | 76.771 | .004 | 3.400 | 1.153 | 1.104 | 5.696 |

Based on the hypothesis test, both with the t test on 2 free samples, which have a calculated t-count (2949) greater than t-table (1992), or seen from the significance which has a value smaller than 0.05 that is 0.004, both are equally indicates that Ho was rejected. That is, there are differences in mathematics learning achievement of students taught using Electronic Puzzle with students taught without using Electronic Puzzle.

The abstract nature of mathematics can be concretized by using instructional media. Students will find it easier to learn and understand when the learning process seems real to them [13]. Loewenberg, et.al stated that students can learn math based on clear and visible facts when using teaching aids [14]. Research on the effectiveness of using mathematical manipulation supported by the use of concrete, pictorial, and virtual manipulatives positively influences students' manipulative learning [15]. Concrete mathematics learning objects have a positive impact on student learning processes [16]. Teachers who can transform abstract mathematical learning into concrete learning with actual and multimedia learning media are expected to improve student learning outcomes. The use of Electronic Puzzle is feasible, with the consideration that the use of technology will make it easier for students to do learning and students' boredom will be avoided [17]. This media provides play facilities as well as learning media, thus the use of technology makes the learning process becomes enjoyable [18]. Hence, Electronic Puzzle is a creative game tool that support children's thinking abilities. Practical methods
and innovative techniques for understanding information that connect visual knowledge and technology help students to be active in the learning environment [19]. Most teachers in France design learning innovations by utilizing online-based technology in the classroom to create interesting learning [20,21]. Besides, mathematics learning will be meaningful if adjusted to the level of cognitive development of children [22]. Learning media will attract more attention of students so that it can foster motivation to learn and improve learning achievement of a material can be reduced so that it is more easily understood by students [23]. Therefore, the learning process using media becomes more effective [24].

4. Conclusion
This research concludes that the Electronic Puzzle with the application I'm a Puzzle has various modes and levels of difficulty of the game that impact on increasing student learning achievement in two-dimensional shapes grouping lesson in class II students of SDN Gadang 01 Malang. Based on the results of the Independent Sample t test to test the average score of the two independent data groups using SPSS 21.0 for Windows, it was found that the use of the Electronic Puzzle with the application I'm a Puzzle influences the learning achievement of Grade II students of SDN Gadang 01 Malang on two-dimensional shapes grouping lesson. In addition, the learning achievement of students who were taught using Electronic Puzzle are better than students who were taught without using Electronic Puzzle. Through these results, it is expected that elementary school teachers can develop an electronic-based instructional media and teaching aids for their classroom learning.

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