The effect use of STEAM method on the classification ability in objects for children aged 4-5 years

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Abstract. This study determined the effect of using the STEAM method on classifying the ability of objects in children aged 4-5 years, using the quantitative and quasi-experimental design method with a non-equivalent control group design. Data was obtained from Class A Kindergarten Family Length 03 Ambarawa with A1 and A2 as the experimental and control groups respectively. In addition, the pretest and posttest methods were used to retrieve data which were analyzed using prerequisite, hypothesis and independent sample t-test. An average pretest of the experimental group of 5.45 and posttest of 9.60, were utilized and the data analysis showed a significance of 0.000 on the basis of decision making when \( \alpha > 0.05 \). The results of the study explained an influence on the use of the STEAM method to classify objects in children aged 4-5 years. This is evidenced by the significance level with the pretest and posttest greater and less than 0.05 respectively, which indicates difference.

1. Introduction
Early childhood is in the age range of 0-6 years, therefore, their treatment is different from adults. PAUD starts from the age of 4 to 6 years with the development of six values namely religious, moral, cognitive, language, social emotional and arts (Law Number 20 Year 2003 concerning the National Education System). Cognitive values are basically directed to improve children's ability to think critically, logically, and mathematically. Its development includes the ability of children to recognize, compare, connect, distinguish, solve problems, and have many ideas on simple concepts and symptoms existing in the surrounding environment [1].

Patmonodewo [2], stated that cognitive abilities have a broad understanding of thinking and observing, therefore, makes people to acquire knowledge. According to research, some children in Keluarga Panjang 03 Kindergarten Ambarawa have difficulty in classifying objects in accordance to the specified category. Most learning carried out in schools utilize worksheets, therefore, in accordance with Standard Level of Achievement of Child Development (STPPA), the Minister of Education and Culture Regulations Number 137 In 2014 classified objects based on the following indicators: (1) color, (2) size, (3) similar groups paired with 2 variations (color and size). Seefeldt [3], defined classification as the grouping of similar objects.

STEAM learning (Science, Technology, Engineering, Arts, and Mathematics) has the ability to integrate the hard and soft skills needed by children. It encourages children to build knowledge on the world around them through observation, investigation, and asking questions [4]. STEM is considered as valuable and meaningful learning tool for children by teachers and educators, which makes them
active and able to think critically in building their knowledge [5]. The addition of "Arts" provides opportunities for them to describe the STEM concept in creative and imaginative ways [6].

1.1. The Ability to Classify
According to Nugraha [7], classification is a systematic process used to organize objects according to similarities, properties and functions. In accordance with Standard Level of Achievement of Child Development with the Minister of Education and Culture Regulations Number 137 in 2014, this study classified objects based on the following indicators: (1) color, (2) size, (3) similar groups paired with 2 variations (color and size). Children between the ages of 3-5 years easily recognize and classify objects according to basic colors like red, yellow, green and blue [8]. Similarly, classification based on size, is one example of the relationship between big-small, high-short, far-short, wide-narrow, thick-thin, and shallow-deep [8].

Based on the above statement it is concluded that children between the ages of 4-5 years, tend to classify objects based on primary colors, and size, compared to the 2 variations. According to Bagiati, A., & Evangelou, D. [9] in their research Science, Technology, Engineering and Mathematics (STEM) play vital roles in early education with focus on engineering. This article shows the teacher's experience as they participate in the assignment of familiarizing themselves with new contents and using curriculum from US based university labs. More specifically, the article explains and analyzes collaboration between curriculum developers and teachers. The article also presents the facilities and obstacles identified by researchers and teachers, during application with reports on the various stakeholders for future research. In previous years, technical education was a growing academic discipline stemming from the need to understand and improve the way engineers were formally educated. Confidence in early experience acted as a determinant of later basic educational planning [10]. Therefore, this is important to identifying age and the exact way in which early childhood is part of technical education.

According to Ata Aktürk, A., Demircan, H. özlen, Şenyurt, E., & Çetin, M. [4] In this way, they tend to understand significant mathematical and scientific terms such as more, less, sooner, or later. In addition, 14 STEMs increases their vocabulary, and encourages collaboration, thereby, transmitting future experiences [11]. Furthermore, making contact with scientific languages increase their ability to think as scientists by willing to investigate the happening around them during the rest of their lives [12]. Therefore, the indicators and objectives in the curriculum related to other fields of development such as language, social-emotional, and motor development are enriched by considering STEM activities and practices towards these goals. In addition, it is used to concern on understanding the integrated nature of scientific, technological, engineering and mathematical disciplines along with their value in the long-term academic success of children, economic welfare [13], and community development [14]. The education includes grades from preschool to postdoctoral level and formal/informal learning arrangements such as classrooms and afterschool programs [15]. As an illustration, STEM education is described as an instructional approach to prepare children for the global economy and has been recognized in the US as a nessesary educational reform [16].

Draper, C. L., & Wood, S. [17], in their book explain on Children's Centers in the Caltech kindergarten defined it based on the STEM education curriculum. Topics covered include providing information on engineering design among parents and children. illustration of sensory experiences among babies to enhance their browsing abilities, and the use of toys to improve their architectural knowledge. Engineering integration is recommended by the Next Generation of Science Standards [18], due to its ability to provide the context for developing problem solving ability with the real world for learning mathematics and science.

According to Tippett, C. D., & Milford, T. M. [5], in their book explain that Science, technology, engineering and mathematics (STEM) in early childhood education is a field with low literature attention, which is because young people are natural engineers and scientists. Educators analyze, STEM as a useful approach to arrange activities that foster students' curiosity around them. It allows teachers to be more deliberate in facilitating the integration of the study fields. Students look
enthusiastic when they participate in STEM activities, and show a proper understanding of concepts with articulate questions related to this activity. Parents see STEM as an necessary aspect of their child's pre-school education [19]. More research is needed in additional settings, but the results of this study indicate that further investigation of STEM at the early childhood level is needed [20]. It also provides promote for the inclusion of STEM-based learning experiences for children.

2. Method

This research was carried out at TK Keluarga Panjang 03 Ambarawa due to the support of the teachers and schools which made it easier for researchers to obtain adequate information. The subjects were children in groups A1 and A2 in the first semester of the 2018/2019 academic year.

The research was conducted using a quasi experimental design which does not have strict limitations on randomisation. This research is a treatment applied to the experimental group with the aim to determine the STEAM effect on the child's ability to classify objects. The design is described as follows:

| R1 | O1 | X | O2 |
|----|----|---|----|

Information:
R1: Experimental Group
R2: Control Group
X: Treatment
O1: Pretest
O2: Posttest
(Adapted from Sugiyono, 2012)

The population in this study were 40 children of Group A TK Keluarga Panjang 03 Ambarawa in the 2018/2019 school year. The sample consists of 20 children each from class A1 and A2 in the experimental and control groups. The sampling technique in this study is saturated using all members of the population. The reason for using a saturated sample is due to the used number of population which is relatively small less than 30 people Sugiyono [21].

3. Results and Discussion

Description of the data in this study was conducted through a pretest, treatment, and ending with a posttest. The results of the data analysis which consists of distance, minimum and maximum value, mean, and standard deviation, are presented using descriptive analysis as shown in the following table. The results of the data description are presented in table 1 below:

| Test   | N | Range | Minimum | Maximum | Mean | Std. Deviation |
|--------|---|-------|---------|---------|------|----------------|
| Eksperimen | 2 | 5.00  | 3.00    | 8.00    | 5.45 | 1.30454        |
| Protokol | 2 | 5.00  | 3.00    | 8.00    | 5.35 | 1.22582        |
| Eksperimen | 2 | 5.00  | 7.00    | 12.00   | 9.60 | 1.46539        |
| Protokol | 2 | 5.00  | 4.00    | 9.00    | 6.20 | 1.28145        |
The data above shows the results of the calculation of pretest and posttest data conducted in children from the experimental and control groups. Pretest data conducted in the experimental group obtained a valid number of 20, with a minimum and maximum values of 3 and 8 respectively. The difference between the data from the largest value with the smallest is 5, with a mean above 5.45, and standard deviation of 1, 395. While the calculation results contained in the data before the pretest treatment in the control group was 20. In addition, the data obtained using minimum and maximum values of 3 and 8, is 5, with a mean value of 5.35, and an average standard deviation of 1, 226.

Based on the results of the pretest data calculation in the experimental and the control groups, no data was lost, therefore it is valid for further processing. The experimental and the control groups have the lowest (minimum) and highest values (maximum). The experimental and groups posttest and posttest data are found in Figures 1 and 2 below:

![Figure 1 Posttest Data Histogram of Experimental Group](image)

![Figure 2 Posttest Data Histogram of the Control Group](image)

The data above shows the minimum and maximum values in the experimental group as 7 and 12 respectively. The difference between the highest value data and the smallest is 5, with a mean value of 9.60, and standard deviation of 1, 465. The results of the data obtained by the control group is different from the experimental with a minimum and maximum values of 4 and 9 respectively. The mean value in the control group is 6, 20, and the standard deviation is 1, 281. The results of the data obtained above show that there are significant differences between the experimental and control groups, with a greater increase in the experimental group. This research was carried out using parametric statistical data analysis techniques with prerequisites analysis consisting of normality and homogeneity tests in parametric statistics. Shapiro Wilk assisted by SPSS 16 is used to test normality, while the homogeneity uses Levine for equality of variance. The details of the test are shown in table 2 below:
Table 2 Prerequisite Test Results

| Test     | Kelompok | Normalitas | Homogenitas | ρ     |
|----------|----------|------------|-------------|-------|
| Eksperimen | 0, 319   |            |             |       |
| Posttest | Kontrol  | 0, 333     | 0, 472      | p > 0.05 |
| Eksperimen | 0, 267   | 0, 463     |            |       |
| Posttest | Kontrol  | 0, 193     |            |       |

The normality test was conducted using the Shapiro Wilk formula assisted by SPSS 16 on the basis of decision making, and when > 0.05, the data is said to be normal. After testing in this study, the following results were obtained: (1) the significance value obtained from the pretest data in the experimental and control groups were 0.319 and 0.333, respectively. The significance value obtained from the posttest data conducted in the experimental group is 0.267 and the significance value carried out in the control class is 0.193.

The test results of the pretest and posttest were conducted by researchers and used to measure the classification ability in the experimental and control groups. This shows that the data obtained were normally distributed because the significance value $\rho > 0.05$, which represented the population.

Homogeneity test was conducted to determine data in the experimental and control groups. The analysis technique used in this study is Leven's Test for Equality of Variance on the basis of decision making and it is homogenous assuming the value $\rho > 0.05$. Based on the results of the homogeneity test on the pretest, and posttest show significance levels of 0.472 and 0.463 respectively with a significance of $\rho > 0.05$. Hypothesis testing conducted in this study was carried out using the Independent sample t-test to compare the results of the posttest conducted in the experimental and control groups. One of the requirements to use the t-test is the parametric data which has a normal and homogeneous distribution. The hypotheses in this study are as follows:

$H_0$: There is no effect in using the STEAM method to classify objects for children aged 4-5 years.

$H_1$: There is an effect in using the STEAM method to classify objects for children aged 4-5 years.

Based on the results of hypothesis, there is an effect of using the STEAM method on the ability to classify children aged 4-5 years. The mean value in the experimental group increased through the application of the use of the STEAM method when compared to the control.

It shows that the provision of treatment ability to classify objects in children increases compared with the initial condition before the use of the STEAM method. Therefore, its use affects the ability to classify children as evidenced by the pretest and posttest significant difference.

4. Conclusion
This study examines the influence of implementing the STEAM method on the ability to classify objects by children. From the data analysis results, there is a positive influence from the use of the STEAM method on the ability. This is indicated by the results of the mean value of the experimental group which received a higher treatment in the form of media compared to the control group. After the posttest, the mean value of the experimental and control groups were 9.60 and 6.20 respectively. Therefore, from the above results it is concluded that the use of the STEAM method affects the classification ability of children between the ages of 4-5 years.

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