Gifted Children's Mathematical Reasoning Abilities on Problem-Based Learning and Project-Based Learning Literacy

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Abstract. This article describes gifted children's mathematical reasoning abilities. They have a natural talent that must be facilitated, namely reasoning. In mathematics, problem-based learning, project-based learning literacy and Inquiry are learning models commonly used. Mathematics learning can improve the ability of mathematical reasoning because children are required to think logically. The research method was quantitative with the randomized pretest-posttest control group design. This research was conducted in three special classes of gifted children. The results showed that the reasoning of gifted children who obtained problem-based learning was better than gifted children who received other learning. It was caused by activities that always present problems contextually with everyday life. Then, gifted children were still required to be problem solvers by conducting in-depth investigations and collaborating with friends. Gifted children who get project-based learning literacy have good mathematical reasoning skills. It was because gifted children were required to make literacy work oriented to the mathematical problems presented. Furthermore, gifted children who obtain inquiry learning have a middle ability. Gifted children were asked to find mathematical concepts so that learning is meaningful.

1. Introduction

Every child has different characteristics, and each has advantages and disadvantages [1,2]. Likewise, with gifted children, they have advantages in IQ, thinking, reasoning and analysis. In determining gifted children, several requirements must be met, namely IQ above 130, high creativity and consistent learning and good learning readiness.

Gifted children have natural talent from birth that must be facilitated [3]. One of them is that they have good prior knowledge compared to other normal children because they have excellent reasoning skills. [4,5] defines prior knowledge as a combination of knowledge and skills. The influence of prior knowledge in the learning process is as a label category that influences new information to be added to existing knowledge structures, as an assimilation context in which new material will be interconnected so that it will be easier to construct knowledge through the elaboration process, and can increase access to knowledge during the process learning. So, prior knowledge is the knowledge that is built by students.
before the learning process. [6,7] state that prior knowledge plays an important role in problem-solving abilities. Students will have high problem-solving skills if having strong prior knowledge. Prior knowledge influences directly and indirectly in the learning process [8,9]. The direct impact in question is that prior knowledge can simplify the learning process and direct learning outcomes better. Indirect effect, namely prior knowledge, can optimize the clarity of subject matter and improve the efficient use of learning and learning time.

In learning, the teacher is the person who becomes the facilitator and mediator, so the teacher is assigned to design learning that can optimize students’ knowledge. One of them is by determining the learning model used in developing learning designs. The learning model is a plan that is used to shape the curriculum, make learning material, and become a learning guide [5,10]. Furthermore, the Model is translated into a broad unity of learning systems that contain specific philosophical foundations or theories of learning with pedagogical methods [11]. So the learning model is a conceptual framework used in learning.

Meaningful learning is learning that can facilitate students’ learning constructively, so that knowledge becomes retention stored in long term memory [12]. Some learning models that allow students to develop their concepts are the PJBL-Literacy Model and the Problem Based Learning Model. PJBL-Literacy can integrate mathematical content with everyday life content and other lessons to make students' level of understanding increase [13]. PJBL-Literacy is always a bridge between prior knowledge of students with the knowledge to be learned so that learning is very meaningful [14].

The Problem Based Learning model helps students get used to using reasoning skills to solve problems in learning [15]. Problem Based Learning makes students able to analyze and understand problems, then find solutions to problems, so students learn by integrating skills and cognitive [16]. Learning with Problem Based Learning can make children connect students’ knowledge and the context of everyday life well [17].

From all of these descriptions, no research focuses on PJBL-Literacy Model Learning and Problem Based Learning Models in Elementary Schools in Mathematics which focuses on facilitating the mathematical reasoning ability of gifted students. So in study will examine the Effectiveness of PJBL-Literacy learning model and Problem Based Learning Model in improving the mathematical reasoning ability of gifted students in elementary schools.

2. Method
This research is quantitative research with experimental research design. This study involved three sample groups, one group as a control group and two groups as an experimental group. According to [18], the true experimental research method consists of 4 types of designs, all of which have strengths and weaknesses. The research design used by researchers is a design that has a Randomized Pretest-Posttest Control Group Design. Before the pretest is given, random samples are first conducted to be examined, after that the pretest is done at the beginning before learning while the posttest is given at the end after all learning.

The population selected in this study were all students of class V CIBI Elementary School in the even semester of the 2017/2018 academic year in Bandung. The sample was not chosen randomly, but the sample was chosen based on incidental sampling technique. The selected elementary school is a private elementary school that has a gifted school program for gifted children. Also, the elementary school is a school that still uses and is consistent with applying the 2013 Curriculum and is an example School for the 2013 Curriculum Model.

The instrument used in this study is a test of mathematical reasoning ability of elementary school students compiled based on indicators from NCTM [19] and essential competencies of elementary school materials. The indicators used can be seen in Table 1 below:

| No | Indicator                                      |
|----|-----------------------------------------------|
| 1  | Making and investigating mathematical conjectures |
| 2  | Developing arguments and proof                |
Reason and think analytically tend to note patterns, structure, or regularities in both real-world and math situations.

The analysis technique used in the study contained several data analyzes that were adjusted to the formulation of the problem and its hypothesis. More clearly it can be seen in Table 2 below:

### Table 2. Data Analysis

| Research Question                                                                 | Analyze          | Information                          |
|----------------------------------------------------------------------------------|------------------|--------------------------------------|
| Which is the most effective way to improve students’ mathematical reasoning abilities that obtain problem-based learning, PJBL-Literacy or inquiry learning? | ANOVA one way test | Test assumptions: normality and homogeneity |

3. Result and Discussion

3.1. Result

The difference in increasing students' mathematical reasoning abilities can be known through data analysis using the Gain test by comparing the pretest and posttest scores. At this stage, a change or increase in the mathematical reasoning ability of each student in each class can be seen. The Gain data for each class can be seen in Table 3 below:

### Table 3. Gain score

| Class | N  | Minimum | Maximum | Sum | Mean   | Std. Deviation |
|-------|----|---------|---------|-----|--------|----------------|
| PJBL  | 24 | 58.3    | 100     | 1677| 69.87  | 9.9            |
| PBL   | 24 | 66.7    | 100     | 1904| 79.32  | 9.2            |
| Inquiry | 24 | 45.8    | 100     | 1372| 57.15  | 7.0            |

Based on Table 3, the improvement of students' abilities in PJBL classes, PBL classes and inquiry classes is different. The average gain score of the PJBL class was 69.87, the PBL class was 79.32, and the average score of the inquiry class was 57.15. Based on these data, it is seen that the average gain score of the PBL class is greater than the average gain score of other classes. Next, the prerequisite tests are normality and homogeneity.

### Table 4. Normality of Gain

| Kolmogorov-Smirnov | Decision | Information                          |
|--------------------|----------|--------------------------------------|
| Sig.               |          |                                      |
| PJBL               | .200     | H₀ rejected                           |
| PBL                | .200     | H₀ rejected                           |
| Inquiry            | .200     | H₀ rejected                           |

Because all classes are normally distributed, the next step was to do the One Way ANOVA Test.
Table 5. One Way Anova Test Result

| Sig. | Decision | Information                      |
|------|----------|----------------------------------|
| Between Group 0.000 | H0 rejected | There were differences in reasoning abilities |

Based on Table 5, it can be seen that the significance of the one way ANOVA test results is less than 0.05 (0.000> 0.05), then H0 is rejected. It can be assumed that increasing mathematical reasoning ability of the three groups is significantly different. As a follow up on the differences in reasoning enhancement, a posthoc test was performed to see a comparison between one Model and another.

Table 6. Posthoc test

| Sig. (2 tailed) | Sig. (1 tailed) | Decision | Information                      |
|----------------|----------------|----------|----------------------------------|
| PBL – PJBL 0.000 | 0.000 | H0 rejected | Increasing PBL reasoning ability is better than PJBL |
| PBL Inquiry – 0.000 | 0.000 | H0 rejected | Increasing PBL reasoning ability is better than Inquiry |
| PJBL Inquiry - 0.000 | 0.000 | H0 rejected | Increasing PJBL reasoning ability is better than Inquiry |

From Table 6, it can be concluded that classes with learning using the PBL Model are better than PJBL-Literacy and inquiry classes. Classes with learning using the PJBL-Literacy Model are better than inquiry classes.

3.2. Discussion

Good learning not only builds students' knowledge but also must be very meaningful and it always relates to everyday life [20]. PBL makes the context of everyday life a learning content so that students can reason adequately. PBL models can significantly improve students' mathematical reasoning abilities. That is because the PBL Model provides an opportunity for students to think analytically and collaborate with friends to solve a problem. Learning with the PBL Model can make students feel more deeply and learn to be very meaningful [21].

Based on observations, what significantly affects the increase in mathematical reasoning abilities is student activity during the learning process; in this PBL class student activities tend to be very enjoyable and students are very active in the process of sharing and discussing. PBL learning can significantly increase students' motivation to learn because of the fun discussion activities [17]. The discussion that occurs is very interactive and communicative because all students are required to be active and focus on the issues discussed.

The PJBL-Literacy Model also has a good influence in facilitating the improvement of students' mathematical reasoning abilities. Literacy is critical in learning mathematics because it can improve the skill and understanding of students in mastering the concepts of mathematical material [22]. Also, in the learning model with the PJBL Model-literacy students are delighted because students have projects that must be done. Students learn by linking mathematical material with real-life, linking mathematical concepts with other learning concepts with the activity of doing literacy projects [23].

In learning with the PJBL-Literacy Model students are greatly facilitated in mathematical reasoning abilities. It can be seen from the activities that are always demanding for reasoning ability in each stage of PJBL-Literacy learning, such as determining the mathematical concepts used in making pop up books. Literacy activities can increase students' sensitivity to the surrounding context and can improve students' understanding of mathematical material and its relation to daily life [24]. The inquiry model facilitates students well in mastering concepts but has not yet developed comprehensive problem-
solving [25]. Learning is not only a mastery of concepts, but there is also the strengthening of concepts by solving problems [26].

4. Conclusion
There are differences in mathematical reasoning abilities between gifted students who obtain problem-based learning, literacy-based learning projects and inquiry learning. Problem-based learning is the most effective Model compared to other learning models in facilitating mathematical reasoning abilities. That's because problem-based learning can present problems in the context of learning that requires higher-order thinking—thus training gifted students always connects mathematical concepts with problems in everyday life. Literacy project-based learning is very effective and better than Inquiry in facilitating reasoning skills. That is because gifted students do literacy works that connect mathematical concepts and application in everyday life. At the same time, inquiry learning is good enough in facilitating the reasoned ability of gifted students. However, students have not been allowed to use mathematical concepts in the context of everyday life. Students are only facilitated the reasoned ability of gifted students. However, students have not been facilitated to develop mathematical reasoning abilities.

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6. References
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