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# Mathematically Creative Thinking Abilities Students of Elementary School on Learning Inquiry Training Based on Learningstyle

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## Abstract

Elementary school students need to be taught mathematics to equip logical, analytical, systematic, critical, creative, and cooperative thinking skills. Result of the UNESCO 2016 survey found that the creative thinking ability of students in elementary education level in Indonesia is low. This study has two purposes. First, to analyze the effectiveness of the inquiry training model on the mathematical learning material counting integer operations. Second, to analyze the creative thinking ability of 5th grade students based on learning style. Mixed methods with concurrent triangulation strategy was carried out in 5B grade Islamic Elementary School Al Madina Semarang with the number of students are 29. The next step is selected the subject of research is 6 students by purposive sampling. The data analysis technique used is the assisted appeal SPSS 16.00. Data validity technique through qualitative method of verification and source triangulation. The results show that model inquiry training is effective at learning mathematics class 5B. This model is effective by fulfilling three conditions. First, the percentage of mastery in the model inquiry training class reached 86%. Second, the average ability of mathematical thinking in the class of inquiry training is higher than the average in mind mapping class. The mean of inquiry training is 81.61 and mind mapping is 76.35. Third, the implementation of inquiry training activities including good category. Students with kinesthetic learning styles included in the category of students are creative and creative enough. Students with visual learning styles included in the category of students are less creative and not creative. Students with auditory learning styles included in the category of creative and highly creative students. This research is useful to enrich the sense of insight of the application of inquiry training model and know the classification of students' mathematical creative thinking ability based on the learning style.



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## INTRODUCTION

The ability of mathematical creative thinking of Indonesian students who are still in elementary education is low, based on a global survey of The United Nations Educational, Scientific and Cultural Organization (UNESCO). Assistant Director General for Education of UNESCO at the launch of Global Education Monitoring (GEM) Report 2016 in Jakarta, Tuesday 6 September 2016 said that "the quality gap in education is still a constraint for many countries, especially Indonesia". The World Education Ranking published by the Organization for Economic Co-operation and Development (OECD) on December 6, 2016 shows that Indonesia ranked 63rd out of a total of 72 countries. According to the OECD report recorded in PISA 2015 Results (Volume I), Indonesia received a reading score of 397 originally 402 in 2009, 386 maths originally 375 in 2012. Table 1 is part of the mathematical performance ranking according to the Program for International Student Assessment (PISA).

**Table 1**. Indonesia's Education Rating by PISA 2015

| Participants | Mathematics scale | | | | | |
|---|---|---|---|---|---|---|
| | Mean score | 95% confidence interval | Range of ranks | | | |
| | | | OECD countries | | All countries/economies | |
| | | | Upper rank | Lower rank | Upper rank | Lower rank |
| Singapore | 564 | 561 – 567 | | | 1 | 1 |
| Hong Kong (Cina) | 548 | 542 – 554 | | | 2 | 3 |
| Quebec (Canada) | 544 | 535 – 553 | | | | |
| Macao (China) | 544 | 542 – 546 | | | 2 | 4 |
| Chinese Taipei | 542 | 536 – 548 | | | 2 | 4 |
| Japan | 532 | 527 – 538 | 1 | 1 | 5 | 6 |
| B-S-J-G (China) | 531 | 522 – 541 | | | 4 | 7 |
| Korea | 524 | 517 – 531 | 1 | 4 | 6 | 9 |
| British Columbia (Canada) | 522 | 512 – 531 | | | | |
| Ajman (UAE) | 387 | 374 – 400 | | | | |
| Peru | 387 | 381 – 392 | | | 61 | 64 |
| Indonesia | 386 | 380 – 392 | | | 61 | 64 |
| Umm Al Quwain (UAE) | 384 | 375 – 394 | | | | |
| Jordan | 380 | 375 – 385 | | | 63 | 65 |
| Peurto Rico2 | 378 | 367 – 389 | | | | |
| Brazil | 377 | 371 – 383 | | | 64 | 65 |

Source: PISA 2015 Results (Volume I)

Mathematics needs to be taught from elementary school (SD) to equip logical, analytical, systematic, critical, creative, and cooperative thinking skills. Basic Competencies of KI 1 and KI 2 Mathematics Class 5 themes 2 subthemes 2 pages 69 Buku Guru 5 SD/MI published by the Ministry of Education and Culture mentioned there are five basic competencies that must be achieved by students. One of them is showing the attitude of logical thinking, critical and creative. Learning will be more effective if a teacher concern with the learning styles of students while teaching in the classroom. Conner (2003) states that knowledge of learning style can increase the adaptability of teachers, inviting them to decentre and begin to see the learning process from the perspective of learners. Knowing the learning characteristics of each student in the classroom is part of the pedagogic competency domain that the teacher must possess. Wang (2017) states that pedagogical implications for using these teaching strategies in the instruction of critical thinking skill in Chinese EFL learners, which was inline with the results of the research.

Empirical observation at Al-Madina Semarang Islamic Primary School in class 5B and 5C found the fact that the mathematics learning that has been implemented by the teacher experienced several problems. Among the learning models that have been applied teachers have not been able to encourage the attitude of mathematical creative thinking from students. Students are seen still having difficulty in solving

the problem. Students are not confident in solving problems in their own way. The existence of students who only imitate the work of other friends in completing the task. Coughlan (2008) states that creative and critical thinking skills can benefit many areas of your life from problem solution to decision making. Creative thinking skills are as much about attitude and self-confidence as about talent.

This study inquiry training model was implemented in math learning. Students think creatively mathematically and carefully when identifying problems in learning mathematics. Siddiqui (2013) states in his research paper quoting Richard Suchman's inquiry training model as more emphasis on developing awareness of and mastering the inquiry process. Students can become conscious of learners to understand tentative emergency nature of knowledge and to appreciate alternative explanations. Model inquiry training can encourage and improve student achievement. Sari (2015) stated that students enthusiastically follow the learning with scientific approach and lead to increase the mathematical thinking ability. The inquiry training model encourages students to think creatively.

This study aims to analyze the effectiveness of inquiry training model in the 5th grade mathematics learning and describe the level of mathematical creative thinking ability of grade 5 students based on learning style. The benefits of this research are to obtain information about the creative thinking ability of 5B grade students in Al Madina Islamic elementary school based on learning style.

## METHODS

The type of research used is mixed methods research with the design of concurrent triangulation strategy. Sarwi & Rusilowati (2013) explains that in concurrent triangulation strategy, researchers collect quantitative and qualitative data concurrently (in one time), then compare two databases to determine whether there is convergence, differences, or some combination. Mixing occurs when researchers come to the stage of interpretation and discussion. The instruments used are observation sheets, tests, interviews, and documentation.

Analysis of data on the effectiveness of inquiry training model using right-handed test and proportion-assisted test of SPSS 16.00 application. The study was conducted in class 5B with a total of 29 students. The subjects were chosen by purposive sampling. The subject of research is 6 students consisting of 2 students as a representative of each type of learning style. Identification of the ability of mathematical creative thinking from research subjects using the level of the ability to think creatively according to Siswono. Siswono (2010) states that the ability to think creative skills can be done by using aspects of the ability of creative thinking. Creative thinking ability measured is fluency, flexibility, originality. The classification of the level of creative thinking according to Siswono divided into 5 which can be seen in Table 2.

**Table 2**. Summary of Characteristics of The Level of Creative Thinking Ability

| Components of Creative Thinking Ability | | | Level of Creative Thinking Ability | |
|---|---|---|---|---|
| Flexibility | Fluency | Originality | | |
| ✓ | ✓ | ✓ | Very creative | CTSL 4 |
| - | ✓ | ✓ | Very creative | |
| ✓ | - | ✓ | Creative | CTSL 3 |
| - | ✓ | ✓ | Creative | |
| - | - | ✓ | Quite creative | CTSL 2 |
| ✓ | - | - | Quite creative | |
| - | ✓ | - | Less creative | CTSL 1 |
| - | - | - | Not creative | CTSL 0 |

The data of level of creative thinking ability of students based on learning style to analyzed qualitatively then described and combined with data of interview result with student. The

research steps are: (1) designing learning with inquiry training model and doing learning style inventory; (2) give test of creative thinking ability and interview to subject of research; (3) analyzing the effectiveness of inquiry training model on mathematics learning and describing the level of mathematical thinking ability of research subject based on learning style.

## RESULTS AND DISCUSSION

### Learning with Inquiry Training Model and Learning Style Inventory

Researchers prepare syllabus instruments, lesson plan, materials, test questions of mathematical creative ability, answer key, learning style inventory sheet, observation sheet of learning activity, interview sheet to be validated by validator. The result of instrument validation is presented in Table 3.

**Table 3**. Instrument Validation Results

| Instrument | Score | | Score | Category |
|---|---|---|---|---|
| | Validator 1 | Validator 2 | | |
| Syllabus | 4.8 | 4.4 | 4.6 | Very good |
| Lesson plan | 4.6 | 4.4 | 4.5 | Very good |
| Tests of Creative Thinking Skills | 4.5 | 4.2 | 4.3 | Very good |
| Learning Observation Sheet | 4.6 | 4.6 | 4.6 | Very good |

Based on the conclusion of instrument validation results indicate that the instrument is categorized as excellent so it is worthy to be used in research. The result of learning style inventory in class 5B is presented in Table 4. The percentage of class 5B learning style classification presented in Figure 1.

### Mathematical Creative Thinking Ability in The Model Class of Inquiry Training and Mind Mapping Class

Prior to carrying out the test of mathematical creative thinking ability is done first inquiry training learning. The results of observation of learning activities is presented in Table 5.

**Table 4**. Classification of Class 5B Learning Style

| Initials | Learning styles | Initials | Learning styles |
|---|---|---|---|
| APP | Kinesthetic | MDH | Auditorial |
| ANS | Auditorial | MHRF | Auditorial |
| AN | Visual | MHA | Auditorial |
| AOR | Kinesthetic | N | Kinesthetic |
| ANA | Kinesthetic | NRR | Auditorial |
| AFF | Kinesthetic | RIA | Visual |
| BP | Auditorial | RSPH | Auditorial |
| DA | Auditorial | RA | Auditorial |
| DAM | Auditorial | RSW | Visual |
| FM | Kinesthetic | SFS | Kinesthetic |
| FA | Auditorial | SSF | Auditorial |
| HKD | Auditorial | SKB | Auditorial |
| IM | Auditorial | V | Auditorial |
| MDPK | Auditorial | WIAS | Kinesthetic |
| MDP | Auditorial | | |

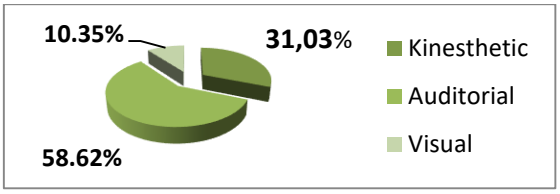


**Figure 1**. Percentage of Class 5B Learning Style Classification

**Table 5.** The Result of Observation of Inquiry Training Activity

| Observation | Score | | Results | Category |
|---|---|---|---|---|
| | Teacher activity | Student Activity | | |
| Lesson 1 | 4 | 3.25 | 3.6 | Good |
| Lesson 2 | 4.1 | 3.6 | 3.85 | Good |
| Lesson 3 | 4.4 | 3.7 | 4.05 | Good |
| Lesson 4 | 4.7 | 3.4 | 4.05 | Good |

The result of the test of the mathematical creative thinking ability of class 5B (inquiry training model) is presented in Figure 2. The results of the test of mathematical creative thinking in the 5C class (mind mapping class) is presented in Figure 3. Based on the data in Figures 2 and 3 can be done SPSS 16.00 assisted analysis. The results of SPSS 16.00 is presented in Table 6.

### Results of The Level of Ability of Mathematically Creative Thinking Research Subjects Based on Learning Styles

The study was conducted in class 5B with a total of 29 students. The subjects were chosen by purposive sampling. The subject of research is

6 students consisting of 2 students as a representative of each type of learning style. APP and SFS were selected as students representing kinesthetic learning styles. MDH and SSF are selected as students representing auditorial learning styles. RIA and AN were selected as students representing visual learning styles. The determination of the level of mathematical creative ability of the research subjects was assessed based on the achievement of fluency, flexibility and originality aspects of them. The result of mathematical thinking ability level of research subject presented in Table 7.

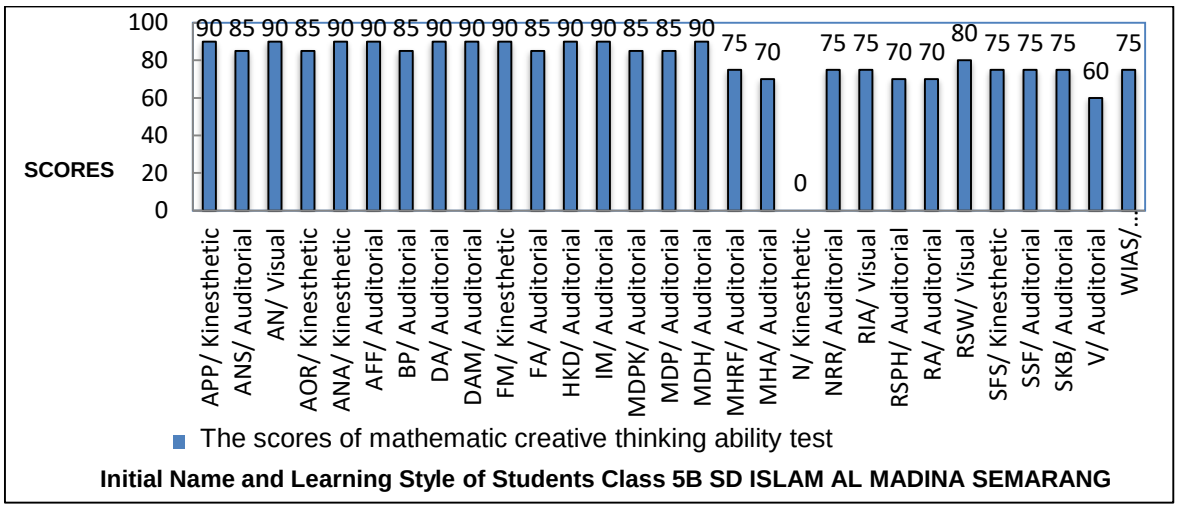


**Figure 2.** The Result of The 5B Class Mathematical Creative Thinking Ability Test

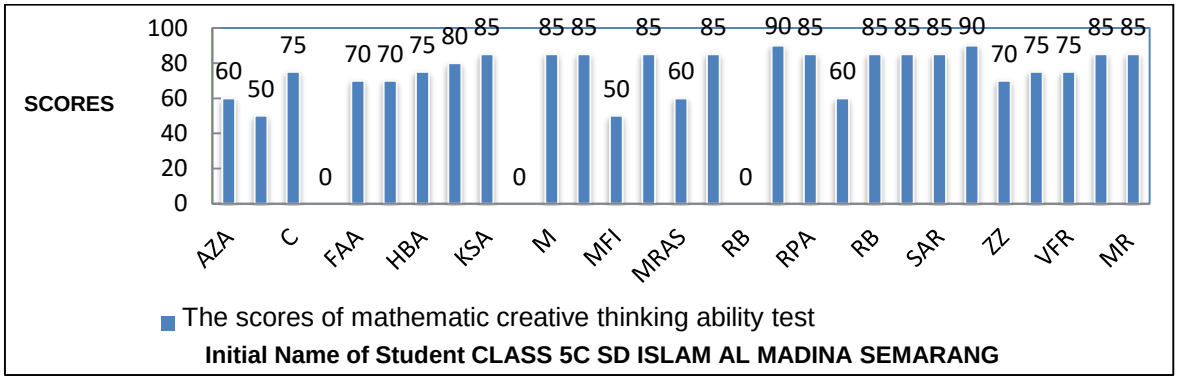


**Figure 3**. The Result of Mathematical Creative Thinking Ability of 5C Students

**The Effectiveness of The Inquiry Training Model on The 5th Grade Elementary School Mathematics Learning**

Based on data from Figure 2, it is found that the percentage of students' completeness in inquiry training class reaches 86%. This is in line with the conclusion of research Fitriani (2017) which states that students achieve mastery of 87.50%. Implementation of inquiry training model can achieve mastery of class above 80%. Surya (2017) also stated that the application of inquiry training model can improve the learning result of fourth grade students of SDN 002 Langgini and all students reach completeness. Inquiry training model is useful to encourage student motivation and improve student achievement. Wolf & Fraser (2008) states, that using an inquiry-based approach can encourage student motivation and increase academic achievement. This is in line with the statement Slameto (2010) that education or teaching on a regular basis can form creative humans.

**Table 6.** Results of Two-Sample Comparison with SPSS 16.00.

| | Class | N | Mean | Std. deviation | Std. error mean |
|---|---|---|---|---|---|
| Results of Ability of Mathematical Creative Thinking | Inquiry Training Class | 28 | 81.61 | 8.504 | 1.607 |
| | Class Mind Mapping | 26 | 76.35 | 11.879 | 2.330 |

Independent Samples Test

| | | Levene's Test for Equality of Variances | | t-test for Equality of Means | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | F | Sig. | T | Df | Sig. (2-tailed) | Mean Difference | Std. Error Difference | 95% Confidence Interval of the Difference | |
| | | | | | | | | | Lower | Upper |
| Results of Ability of Mathematic aCreative Thinking | Equal variances assumed | 2.411 | .127 | 1.882 | 52 | .065 | 5.261 | 2.796 | -.350 | 10.872 |
| | Equal variances not assumed | | | 1.859 | 45.017 | .070 | 5.261 | 2.830 | -.439 | 10.961 |

**Table 7**. Level of Mathematically Creative Thinking Ability Research Subjects

| Initials | Indicator of creative thinking ability | | | Learning styles | CTSL |
|---|---|---|---|---|---|
| | Fluency | Flexibility | Originality | | |
| APP | - | - | ✓ | Kinesthetic | Quite Creative |
| SFS | - | ✓ | ✓ | Kinesthetic | Creative |
| MDH | ✓ | ✓ | ✓ | Auditorial | Very creative |
| SSF | - | ✓ | ✓ | Auditorial | Creative |
| RIA | - | ✓ | - | Visual | Less Creative |
| AN | - | - | - | Visual | Not Creative |

Dimyati & Mudjiono (2009) stated that the inquiry training model is a teaching that requires students to process messages so as to gain knowledge, skills and values. According to Joyce (2009) the instructional model of inquiry training is aimed to help students in developing discipline and improving the intellectual skills needed to ask questions and find answers based on their curiosity. As has been suggested by experts, Ricard Suchman for example, who said that creativity is the ability of a person to find problems and make ideas or solutions with a curiosity impulse in him.

The results of one right-hand test obtained $t_{value} = 1.8585 > t_{tabel} = 1.671$. The results of the two-sample comparison test can be seen in Table 6. The homogeneity test shows that both groups are homogeneous, so the $t$ value used is seen in the column of equal variances assumed column. Based on the data in Table 6 shows that the value of sig = 0.127 = 12.7% > 5%. It can be concluded the average ability of students' mathematical creative thinking on learning model inquiry training is not equal to the ability to think creatively mathematically mind mapping students. $H_0$ is rejected and $H_1$ accepted, then further seen data in group statistics table shown in mean or mean column. The average in the inquiry training class is 81.61 higher than the mind mapping class which has a mean of 76.35. This shows that the result of creative thinking ability in class of inquiry training is better than mind mapping class. So it can be concluded that learning by model of inquiry training can give positive change so as to improve students' mathematical creative thinking ability.

Information from the Table 5 of observation results of inquiry training activities can be seen that the implementation of learning inquiry training including good category. This is in line with Kadir's (2017) assertion that the students gave positive response and engage well

in learning activities with the Open-Inquiry Approch. The implementation of OIA enhances learning activities. Na'im (2015) also stated in the conclusion of his research that there is an increase in the ability of creative thinking and there is a positive response on the implementation of inquiry training model. So it can be concluded that the model of inquiry training is effective for learning mathematics in grade 5 primary school.

Furthermore, about the level of ability to think mathematically creative research subjects based on learning styles. The subjects of this study consisted of 6 students selected by purposive sampling, composed of 2 students from each learning style category. APP and SFS were selected as representatives of the kinesthetic learning style. MDH and SSF were selected as representatives of the auditorial learning style. RIA and AN were selected as representatives of visual learning styles. Data on the ability level of mathematical creative thinking from study subjects based on learning style can be seen in Table 7. Based on the data from Table 7 shows that students with kinesthetic learning styles include the categories of students quite creative and creative students or reach CTSL 2 and CTSL 3. Students with learning styles auditorial including highly creative students and creative students or reach CTSL 4 and CTSL 3. Students with visual learning styles include categories of students less creative and not creative or reach CTSL 1 and CTSL 0. This is in accordance with the conclusion Pratama (2017) which states that creative thinking ability of the three subjects were different. Subjects with high mathematics ability can satisfied the indicators of fluency, flexibility, originality. Subjects with medum mathematics ability can satisfied the indicators of originality and flexibility. Subjects with low mathematics ability can satisfied the flexibility indicator. The inquiry training model is effective in assisting students with auditorial and kinesthetic learning styles to achieve an optimum level of creative thinking ability. Students with visual learning styles do not achieve the optimal level of creative thinking skills. This is in line with Pashler's (2009) assertion that the instructional method that proves most effective for students with a different learning style.

New thing found in this research, that in one type of learning style differences in the level of ability to think creatively mathematically. Students with kinesthetic and auditorial learning styles can achieve an optimal level of mathematical creative ability. Students with visual learning styles do not achieve the optimal level of mathematical creative ability.

## CONCLUSION

Mathematics learning with inquiry training model in 5B grade Islamic elementary school Al Madina Semarang is an effective learning. Based on the following 3 achievements: First, the percentage of completeness in the inquiry training model reaches 86%. Second, the average value of mathematical creative ability in the inquiry training class is higher than the average grade in mind mapping class. The average value of inquiry training class reached 81.61 and the average mind mapping grade reached 76.35. Third, the implementation of learning inquiry training is categorized well by achieving the average score of student and teacher activity 3.9.

Level of ability to think mathematically creative 5B grade Islamic Elementary School Al Madina Semarang based on learning styles of the results vary. Based on Table 7, it can be concluded that the level of creative thinking ability of students based on learning style is as follows: Students with kinesthetic learning style including quite creative student and creative students or achieve CTSL 2 and CTSL 3. Students with auditorial learning style including the category of students is very creative and creative or achieve CTSL 4 and CTSL 3. Students with visual learning styles including the category of students less creative and not creative or achieve CTSL 1 and CTSL 0.

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