Judul Artikel: Relationship between self-efficacy and mathematical connection ability of junior high school students

Terbit di: Journal of Physics: Conference Series, Vol. 1320 [Proceedings of 2nd International Seminar on Innovation in Mathematics and Mathematics Education 2018], Tahun 2019

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Source details

Journal of Physics: Conference Series

Scopus coverage years: from 2005 to 2019

Publisher: Institute of Physics Publishing

ISSN: 1742-6588 E-ISSN: 1742-6596

Subject area: Physics and Astronomy: General Physics and Astronomy

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Publisher	Institute of Physics
Publication type	Journals
ISSN	17426588, 17426596
Coverage	2005-ongoing
Scope	The open access Journal of Physics: Conference Series (JPCS) provides a fast, versatile and cost-effective proceedings publication service.

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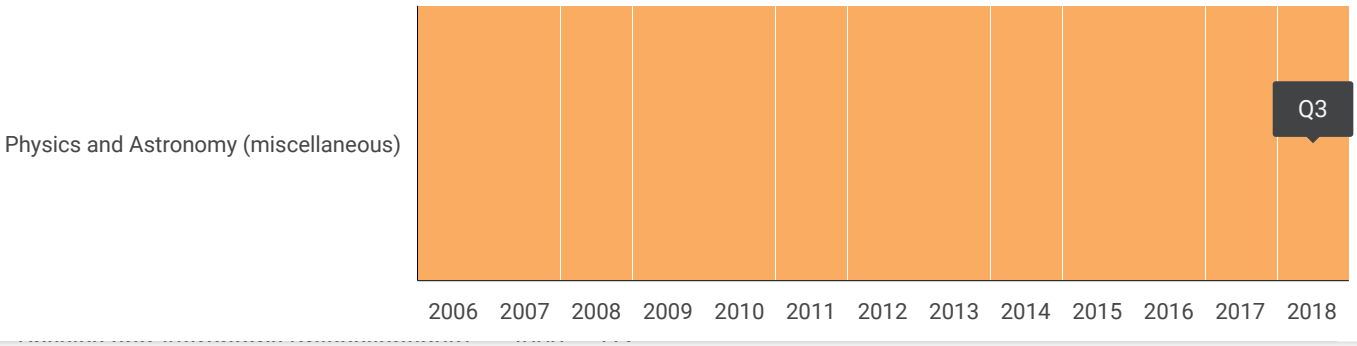

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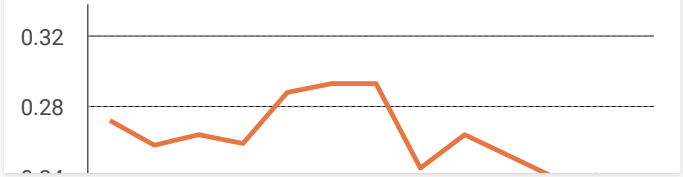

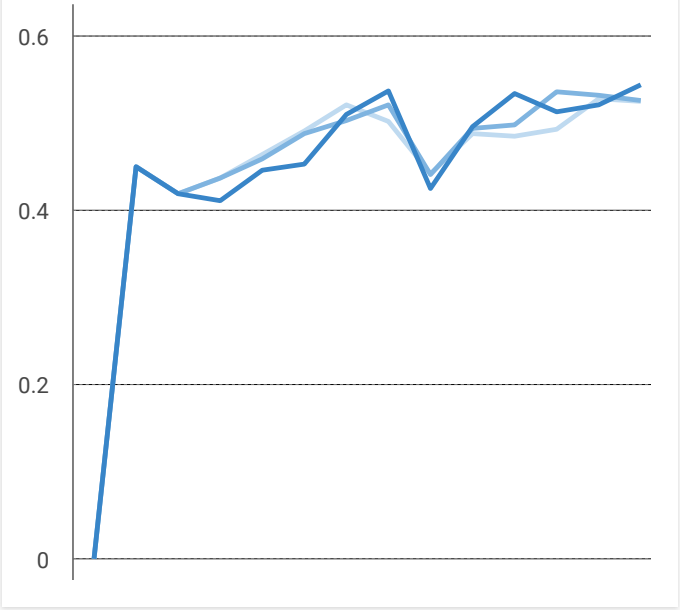

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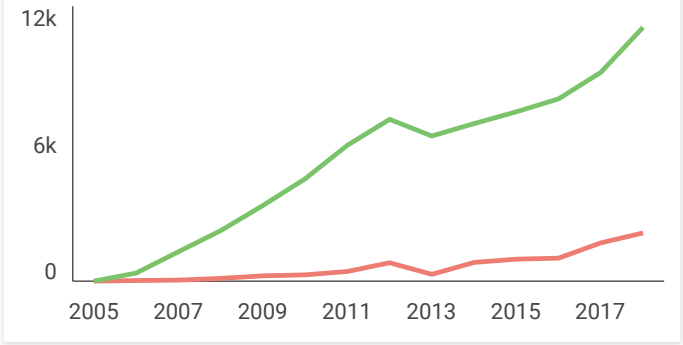

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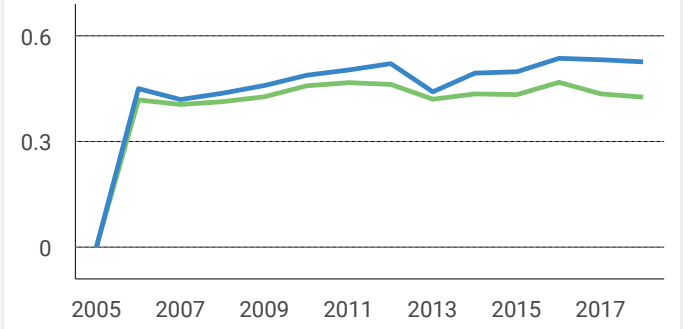

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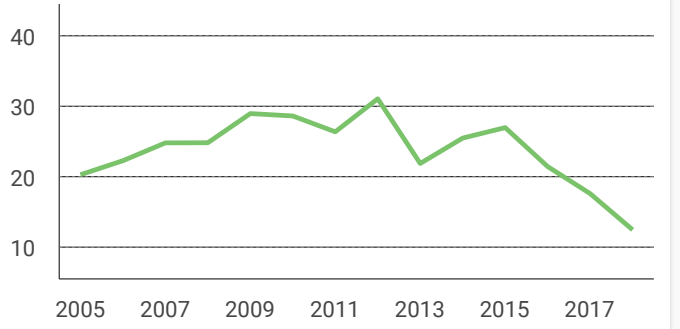

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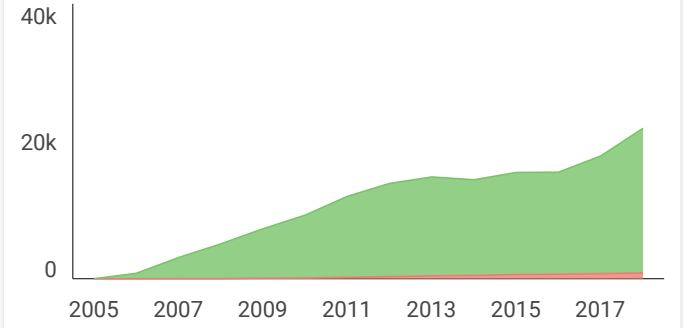

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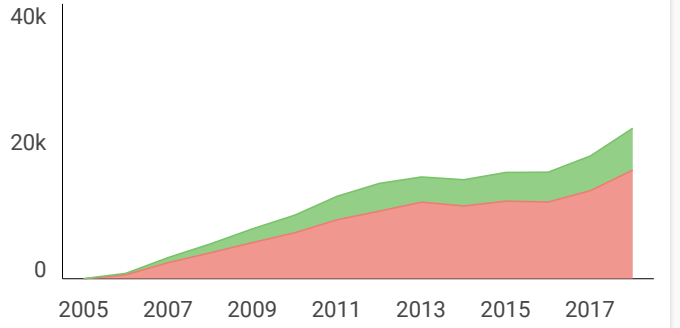

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IOP Conf. Series: Journal of Physics: Conf. Series **1320** (2019) 011001 doi:10.1088/1742-6596/1320/1/011001

The 2nd International Seminar on Innovation in Mathematics and Mathematics Education (ISIMMED 2018)

Universitas Negeri Yogyakarta, Indonesia

20-24 November 2018

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IOP Conf. Series: Journal of Physics: Conf. Series **1320** (2019) 011001 doi:10.1088/1742-6596/1320/1/011001

Preface: Proceedings of the 2nd International Seminar on Innovation in Mathematics and Mathematics Education 2018

A Wijaya[1], A M Abadi[1], and J A Vallejo[2]

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We are honored to present a collection of articles from the 2nd International Seminar on Innovation in Mathematics and Mathematics Education (ISIMMED 2018) which was conducted in Universitas Negeri Yogyakarta, Indonesia from 20 to 24 November 2018.

The theme of the conference was '*innovative technology in mathematics: new ways for learning, teaching, and researching mathematics'*. In the era of Industrial Revolution 4.0, the use and integration of technology into various aspects of everyday life is rapidly increasing. The availability and development of advanced technology have a great impact on the practices of educational research and classroom activities in the fields of mathematics and mathematics education. This situation becomes a great challenge and motivation for researchers and educators. Various technological innovations have been invented and developed to improve the quality of research and education in the field of mathematics. The advanced technological tools such as computer algebra systems (CAS), interactive and dynamic geometry software, and hand-held devices, have been enabling the effectiveness of mathematics teaching and learning.

During the ISIMMED 2018, scholars, educators, and researchers in the field of mathematics and mathematics education from many countries gathered to share their expertise and works. After a series of review process, 108 articles are selected to be published in this Scopus-indexed proceeding. The remaining articles are published in the regular proceeding.

The editors and the committees of ISIMMED 2018 would to thank the participants who have contributed and shared their scientific works in this proceeding. We also would to to express our gratitude to every committee member for organizing the conference and to Universitas Negeri Yogyakarta for the financial support.

15 March 2019

Editors

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The effect of changes in mathematics curriculum in improving students' reasoning skills and mathematical problem solving

IOP Conf. Series: Journal of Physics: Conf. Series **1320** (2019) 012108 doi:10.1088/1742-6596/1320/1/012108

The effect of changes in mathematics curriculum in improving students' reasoning skills and mathematical problem solving

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Abstract. This study aims to describe the effect of changes in mathematics curriculum on mathematical reasoning skills and problem solving for junior high school students in Bima, Indonesia. Curriculum changes in Indonesia are motivated by several factors, including because students still have not been able to maximize the power of reasoning and problem solving so that the previous applied mathematics curriculum is deemed necessary to be refined so that the power of reasoning and solving mathematical problems can be maximized by students. The data in this study were obtained through giving a test to the eighth grade junior high school students in Bima. The evidence of validity of instruments was obtained from an expert judgment in the form of agreement on the feasibility of the each item of instruments. The estimation of reliability of instruments using the Kuder-Richadson formula (KR-20) with the reliability coefficient for reasoning and problem solving instruments are respectively 0.72 and 0.73. The results showed that there were no significant differences in mean scores of mathematical reasoning and problem solving between students of The Previous Mathematics Curriculum group and students of The New Mathematics Curriculum group indicated by the F 0.02 value with a significance value of (p) 0.162 in the two test group MANOVA or there is no effect of changes in mathematics curriculum on students' reasoning abilities and mathematical problem solving. This study also found that students from both groups obtained the lowest average score on reasoning indicators drawing conclusions, while the lowest average score of the two groups of students in solving mathematical problems was on the aspect of understanding problem information.

1. Introduction

The principle of learning 21st century mathematics requires students to learn mathematics to understand and to apply mathematics [1]. Problem solving, reasoning, and argumentation are ways that can develop the quality of understanding in learning mathematics. A workshop by the National Committee on the Assessment of 21st Century Skills [2] mentions skills that must be possessed in the 21st century consisting of three major groups, namely cognitive skills (non-routine problem solving, systems of thinking and reasoning, creative thinking), interpersonal and intrapersonal. International studies that measure students' mathematical competencies such as TIMSS and PISA also provide an overview of trends in mathematical competence that students must master. TIMSS describes three cognitive dimensions of students in their assessment framework, namely knowing (remembering and recognizing

facts, procedures, and concepts), applying (focusing on problem solving), and reasoning (reasoning). PISA mentions seven competencies used in the assessment framework, namely communication, mathematical, representation, interpretation and argument, solving problems, using symbolic, formal and technical language and operations, as well as the use of mathematical tools. Reasoning and problem solving are two of the competencies or skills that students must master now in mathematics learning.

Reasoning is the ability to understand mathematical ideas deeper, observe data and understand implicit ideas, compile assumptions, analogies and generalizations [3]. Mathematical reasoning can be described as lines of thought, ways of thinking or actions adopted to achieve a conclusion / conclusion and can result in the assertion or justification of these conclusions / conclusions [4] [5] [6]. Reasoning in mathematics is one of the competencies recommended by NCTM. NCTM [1] states that reasoning is an integral part of mathematics, students must view that mathematics involves examining patterns and regularities in notes, making predictions about possible generalizations, and reevaluating conjectures. This can be interpreted that the success of students in the field of mathematics according to NCTM requires the ability of students to reason on various mathematical problems faced. Research by Adegoke [7] shows that success in mathematical reasoning abilities is believed to be able to predict the success of mathematical achievement. The results of this study indicate that reasoning can also be used by teachers to assess student performance in mathematics for the future. Therefore, the better the students' reasoning abilities, then it should be expected that the better the mathematics learning outcomes will be achieved.

In addition to reasoning, problem solving is an important skill for students to optimize in mathematics. Problem solving according to Mayer (1992) is the ability of students cognitively to change certain situations into goal situations when there is no clear method of settlement [8]. Mathematical problem solving is seen when students overcome obstacles in completing mathematical tasks [9] using a series of specific cognitive operations [10] which includes understanding and effort to solve [11]. Resolving a problem is a competence that requires students to have the skills and skills to use and organize their knowledge and understanding when trying to solve problems. Skills are shown when students involve understanding and mastering more complex strategies such as planning, monitoring, and evaluating and can interpret problems in the form of visual representations and memory work reasoning [12]. The problem in question is a problem that is not routine, unstructured, problems that cannot be immediately seen solutions [13] or solutions that require students to be able to understand and master strategies in solving problems [14], the structure of the problem is not defined [15] or has an indefinite solution space [16]. Therefore, developing students' mathematical problem solving skills should be something that is important to be facilitated in an effort to improve student performance in mathematics.

NCTM [1] states that middle-class students whose curriculum is based on high-level mathematical standards such as solving problem solving are useful for students in the form of independent and collaborative problem solving experiences. In solving problems, skills are needed to use and apply mathematical concepts and principles [17]. TIMSS in its assessment framework states "Problem solving is central to the applying domain" [18]. Applying domain in this case refers to the ability of students to make the relationship between certain mathematical concepts to various contexts outside mathematics, the context in question can be in the form of problems that must be resolved. Research by Bittler (1987) and Capper (1984) as cited by Suherman [19] shows that mathematics learning must lead to richer, deeper and broader student problem solving competencies. These things show that mathematics learning should be oriented to students' skills in solving problems. Therefore teachers should learn methods to develop students' skills in mathematical problem solving [20].

The importance of mathematical reasoning competencies and problem solving in learning mathematics should be realized and interpreted as an inseparable part of efforts to improve the quality of education, including in Indonesia. Manifestation of this is one of them by trying to develop a mathematics curriculum that can facilitate students to be able to optimize the power of reasoning and solving mathematical problems of students. The position of the mathematics curriculum provides guidance, as well as the direction that must be implemented in the practice of education in the field

because the Indonesian education system is guided by the national curriculum that is applied, including the mathematics curriculum in junior high schools. A good mathematics curriculum is a mathematics curriculum that can develop according to developments in each era, namely a mathematics curriculum that facilitates students to be able to compete both nationally and globally.

Since its inception, Indonesia has implemented various curricula to be implemented in a certain period or time, the last two are Kurikulum Tingkat Satuan Pendidikan (KTSP) and 2013 Curriculum. The KTSP or in this article can be named as The Previous Mathematics Curriculum is the education curriculum in Indonesia which was enacted in 2006. The 2013 Curriculum or in this article can be named as The New Mathematics Curriculum is a curriculum that came into effect in 2013 as an improvement or refinement of The Previous Mathematics Curriculum. Although it has been suggested to use The New Mathematics Curriculum, there are still many schools in Indonesia that have not used The New Mathematics Curriculum for certain reasons such as the readiness of school facilities and teacher readiness.

Mathematical curriculum changes in an effort to improve reasoning and solving mathematical problems as referred to in this study is that the curriculum explicitly regulates the role of teachers, the role of mathematics books on students' handbook, the role of mathematics books on teacher handbooks, and models of student mathematics learning outcomes. All of them specifically facilitate students to become skilled in high-level mathematical competencies, especially reasoning and mathematical problem solving. This is an effort to improve The Previous Mathematics Curriculum which is considered not optimal in facilitating students to be skilled in high-level mathematical competencies, especially in reasoning and mathematical problem solving. In fact, both The Previous Mathematics Curriculum and The New Mathematics Curriculum both placed reasoning competencies and students' mathematical problem solving as the goal of mathematics learning, but specifically in mathematics classes there were differences in achieving these goals in at least three things, namely: arrangements for how students learn and about how teachers teach; arrangements regarding the portion of student roles and the role of the teacher in the learning process; and arrangements regarding the role of teacher handbooks and the role of student handbooks, which are arranged in the framework of constructivism mathematical learning approaches. The following table 1 presents some differences of The Previous Mathematics Curriculum and The New Mathematics Curriculum based on the conceptual aspects.On the other hand, when referring to junior high school mathematics textbooks from both curriculum, The New Mathematics Curriculum and The Previous curriculum have differences as presented in table 2.

Although both use the student-centered learning paradigm and emphasize students' competence in reasoning and solving problems as learning goals in the classroom, there are differences in the way the learning atmosphere in the classroom is created from each curriculum as can be seen in Tables 1 and Tables 2. If It is assumed that mathematics learning in classrooms can follow the guidelines contained In The New Mathematics Curriculum with dialogical learning situations, focus on students 'critical thinking and thinking, always using contextual problem-based approaches, it can be assumed that The New Mathematics Curriculum group students' abilities in reasoning and solving mathematical problems better than the ability of The Previous Mathematics Curriculum group students to reason and solve mathematical problems. Therefore, this article will answer the question whether there are significant differences in the average ability of students' mathematical reasoning and problem solving between the two groups and will describe which aspects or indicators of reasoning and problem solving should be more optimized by students.

Table 1. The difference of The Previous Mathematics Curriculum and The New Mathematics Curriculum Based on The Conceptual Aspects

The New Mathematics Curriculum	The Previous Mathematics Curriculum
Emphasize aspects of competency in attitudes, skills, and knowledge in mathematics learning	More emphasis on aspects of knowledge
The number of hours of math lessons per week is more and the number of subjects is less than that of the 2006 Curriculum	The number of class hours is less and the number of subjects is more than the 2013 curriculum
The learning process is carried out with a scientific approach (scientific approach), namely the standard process in learning consists of Observing, Asking, Processing, Presenting, Summing up, and Creating.	The standard process in learning consists of Exploration, Elaboration, and Confirmation
ICT (Information and Communication Technology) not as subjects, but as learning media	ICT as a subject
The assessment standard uses authentic assessment, which measures all attitudes, skills and knowledge competencies based on processes and results.	The assessment is more dominant in the aspect of knowledge

Table 2. The difference of The Previous Mathematics Curriculum and The New Mathematics Curriculum based on the junior high school mathematics textbooks

The New Mathematics Curriculum	The Previous Mathematics Curriculum
Start observing concrete problems, then semi-concretely, and Finally problem abstraction.	Go straight into abstract material
The formulation is revealed by students	Many formulas must be memorized to solve problems (can only use).
Designed so that students must think critically to solve the problems raised.	Do not accustom students to critical thinking (only mechanistic).
Familiarize students with algorithmic thinking.	Unstructured problem solving methods.
The balance between mathematics and numbers and without numbers (pictures, graphics, patterns)	Mathematical problems are always associated with (reduced to) Number

2. Methods

This research is a survey research with comparative analysis carried out for two months throughout 2018. The sample in this study is divided into two groups of students namely groups of students who still use The Previous Mathematics Curriculum and groups of students who have used The New Mathematics Curriculum. Using proportionate stratified random sampling, 373 students were obtained from The New Mathematics Curriculum groups and 374 students from The Previous Mathematics Curriculum group. The number of samples of each group is the total number of students from each stratum A, stratum B, and stratum C for each group grouped based on the results of the 2017 mathematics national school examination.

Data were collected using written test techniques in the form of multiple choice questions. The form of multiple choice tests was chosen so that students' performance in reasoning and solving problems in each indicator that they want to measure from both variables is more objective and more measurable. The validity of the instrument is obtained from expert judgment. The validity of the instrument is obtained from expert judgment. Some improvements to the quality of the instrument were carried out until the instrument was judged feasible by two mathematical education experts to be used for research data collection. After being approved by experts, the instrument was tested and estimated reliability using the Kuder-Richadson 20 formula (KR-20). By using the Microsoft Excel program, the KR-20 value is shown in the table 4. After obtaining evidence of validity and estimating the reliability of the questions made, it was obtained 18 mathematical reasoning questions and 16 problem solving problems which would be used as instruments in this study.The time used by students to work on each test is 80 minutes. The test is supervised by direct researchers and mathematics teachers from each school.

Table 3. The KR-20 value

Variable	Value
Reasoning	0.72
Problem Solving	0.73

3. Results and discussion

In general, the results of the study present two discussions, namely the comparison of the average score of students from both groups and the description of students' scores on each indicator of reasoning and mathematical problem solving. Table 5 presents a description of the students' score data statistics in solving reasoning and mathematical problem solving problems.

Table 4. Statistical description of students' score data on reasoning and mathematical problem solving

Description	**Reasoning**		**Problem Solving**	
	The Previous Mathematics Curriculum	The New Mathematics Curriculum	The Previous Mathematics Curriculum	The New Mathematics Curriculum
Average	7.99	8.15	6.01	6.12
Standard deviation	2.28	3.61	2.26	2.31
Highest Score	14	15	12	12
Lowest Score	3	3	2	2
The Ideal Higher Score	18	18	16	16
The Ideal Lowest Score	0	0	0	0

The average score of students 'reasoning and problem solving as shown in table 5 shows that in general the average scores of students' reasoning and mathematical problem solving are still categorized as low. The average student of the previous mathematics curriculum group was only able to correctly do 44.39% of the total reasoning questions, while the students of the new curriculum group were only able to correctly answer 45.28% of the whole reasoning problem. In problem solving variables, the average student of The Previous Mathematics Curriculum group was only able to work correctly 37.56% of the whole problem solving problem, while the students of the new curriculum group were only able to answer 38.25% of the whole problem solving problem. To be able to test the difference in the average of the two groups, the data obtained were first tested for the assumption of data normality and the

assumption of homogeneity of the two groups. Scatter-plots of normality data on reasoning scores and mathematical problem solving for each group of students can be seen in figure 1 and figure 2.

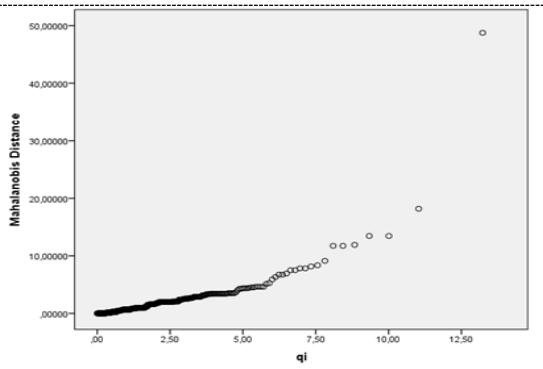

Figure 1. Scatter plot data normality of The Previous Mathematics Curriculum Groups

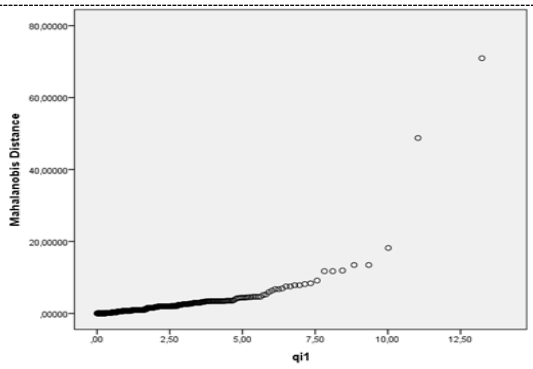

Figure 2. Scatter plot data normality of The New Mathematics Curriculum Groups

Box'M sig = 0.694 indicating that the variance-covariance matrix of both groups is homogeneous. The sig = 0.162 in the two group MANOVA test indicates that there is no significant difference in the average scores of reasoning and mathematical problem solving of students from both groups. On the other hand, this study also found the lowest scores of students from both groups based on each indicator of reasoning and the problem solving aspects that were measured. In reasoning, the lowest score of students of both groups is on the drawing conclusions indicator. In solving problems, the lowest score of students of both groups is on aspects of understanding information.

One of the assumptions in this study is that the change in The Previous Mathematics Curriculum into a new mathematics curriculum is based on the weakness of the ability of students to reason and solve problems or students can optimize the reasoning and mathematical problem solving. Therefore, it is assumed that curriculum changes should be able to improve students' ability or reasoning and mathematical problem solving as proof that students have been able to optimize reasoning and mathematical problem solving. The findings of this study indicate that efforts to maximize the power of reasoning and solving mathematical problems of students through changes or improvements in the mathematics curriculum in junior high school so far still need to be evaluated or need attention, and enhanced role or influence in realizing competent students in high level math skills. Primarily competence reasoning and problem solving. The attention in question can be in the form of evaluating how effective the implementation or implementation of the curriculum from various things, including how the teacher's efforts in facilitating students to observe, ask, process, present, conclude, and create ?; how does the teacher's effort involve technology as a medium of learning mathematics ?; how is the readiness of students to be in an atmosphere of learning with a scientific model or approach ?; or how is the school's effort to provide infrastructure that supports the implementation of the 2013 curriculum?.

In this case, the teacher plays an important role in efforts to improve students' mathematical performance including in reasoning and solving mathematical problems. Retnawati's study [21] found that teachers have difficulty in carrying out learning, difficulties related to learning devices, difficulties in activating students. The difficulties encountered can also affect students' achievement and understanding of mathematics, including in reasoning and problem solving. These difficulties can hinder the ability to improve students' mathematical performance, including in mathematical reasoning and problem solving as well as the purpose of changing or improving The New Mathematics Curriculum in junior high school.

As explained in the previous section, this study also found that the lowest score of students in reasoning was on the conclusions drawing indicator and the lowest score of students in solving problems was in the aspect of understanding information. Figure 3 shows an example of student error working on reasoning problems, especially on conclusions drawing indicators and Figure 4 shows an example of

students' mistakes working on problem solving problems, especially on aspects of understanding information. In many situations reasoning is closely related to drawing logical and analytical conclusions. Weak in making conclusions suggests weak in reasoning as many definitions mention that the central reasoning is the skill to draw conclusions [22] [23] [24]. On the other hand, failure to understand the context of the problem will cause students to fail to work on the problem solving correctly. These results are in line with the findings of Tambychik and Meerah [25] that the difficulty of understanding information and connecting between one information and other information is among the factors that cause student difficulties in working on problem solving problems. Wijaya [26] also found that quite a number of students experienced difficulties in transforming the problem context situation into mathematical problems.

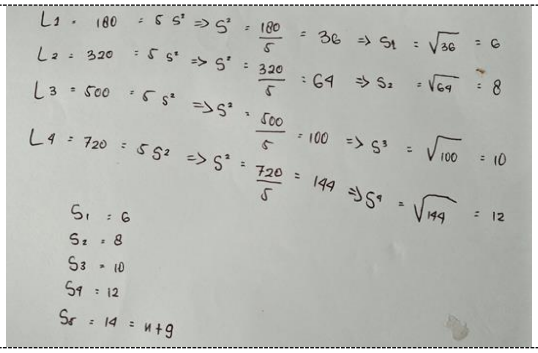

Figure 3. Examples of student errors answering questions that measure reasoning indicators draw conclusions

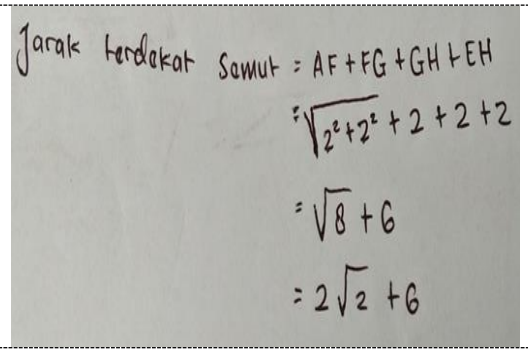

Figure 4. Examples of students' errors answering questions that measure problem solving aspects of understanding problems

The learning process relies heavily on the teacher's strategy while learning resources should support students' achievement in mathematics, especially in reasoning and solving problems. But this seems to have not optimally served. Wijaya et al, [27] found a relationship between student errors and content offered by textbooks. Thompson, et al [28] also found that only less than 6% of the exercises given to students involved reasoning related to evidence, which developed arguments and investigated conjectures as activities that often occur in mathematical reasoning. Developing students 'reasoning is to create a dialogical and argumentative learning process of mathematics [29] and encourage students to become active learners and play a role as a constructor in the development of mathematical knowledge is an effective way to develop students' reasoning skills [30] and mathematical problem solving.

4. Conclusion

Based on the results and discussion, it can be concluded that: (a) there is no effect of changes in the mathematics curriculum on mathematical reasoning and problem solving abilities (b) in answering mathematical reasoning questions, the students of both groups are still weak in the conclusion drawing (c) in answering Mathematical problem solving problems, students of both groups are still weak in understanding aspects of the problem. The hard work and skills of teachers in creating a dialogical, argumentative, problem-based learning atmosphere using constructive learning approaches are important and this is emphasized in The New Mathematics Curriculum so that students can optimize their reasoning skills and problem solving skills.

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