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Application of Stem in Improving Mastery of Mathematics Concept of Speed Materials at Elementary School Grade (Class) V

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Abstract. STEM is an approach that has recently become a hot topic to be discussed among academics, because STEM is believed to be able to solve problems that students will face in order to prepare themselves in 21st century life. The purpose of this study is to examine how far students have increased mastery of mathematical concepts after given STEM. In this study involved 25 students consisting of 9 male students and 16 female students. The method used is Classroom Action Research (PTK) by using 10 test item descriptions and data collection instruments using observation sheets and lesson plans. This study was conducted with the II cycle, from the initial data known to the number of students which completed a total of 13 students and who have not completed 12 students. After the action in cycle I with STEM The result showed an increase, which is 18 students that completed and who have not completed 7 students, then in cycle II that completed 21 students and who have not completed 4 students. After the students receive the learning treatment using STEM The research showed that there is an increase in the mastery of mathematical concepts marked by the achievement of Minimum Criteria Submission (KKM) stipulated in class V is 70. Thus, the implementation of STEM in mathematics learning at class V speed material at Cimanggung State Elementary school III can improve the mastery of student concept.

Keywords : Concept Mastery, STEM, WD 4 Mini Learning Media

INTRODUCTION ~ The 21st century is the century which is the main foundation for various aspects of modern human life. The development of the 21st century is marked by the use of technology, communication and information that is applied to everyday life. Since 2000, Indonesia has participated in international-level assessment programs that measure the level of ability and skills of students in dealing with real-world problems, the PISA (Program for International Student Assessment). PISA aims to provide indicators of the effectiveness and equality of the education system, education standards for international comparisons and monitoring of educational development (OECD 2015). Indonesia is one of the countries with the lowest scores, ranking 63 out of 72 participating countries in 2016 (OECD 2016). This shows the quality of Indonesia's education which is still low compared to other countries.

This is in line with the data obtained at one of the state elementary schools in the District of Cimanggung, Sumedang Regency, West Java, seen the mastery of mathematical concepts in low-speed material. The initial data taken is the data of mathematical concept mastery test results on the speed material conducted on 25 fifth grade students. The results of the test showed that as many as 13 students received grades ≥ 70 or 52% of students who could master the concepts and reach the minimum completeness criteria. While students who score <70 are 12 students or 48% for students who have not yet completed the minimum

completeness criteria, which are categorized as grades below the average. Based on the above problems, the formulation of the problem in this study is whether the application of STEM can improve the mastery of the concept of fifth grade students in elementary schools.

Based on the above problem formulation, the purpose of this study is to improve the mastery of mathematical concepts of student speed through the application of STEM (Sciece, technology, engineering, mathematics) to fifth grade students of elementary schools.

Mastery is the understanding or ability to use knowledge or intelligence (KBBI: 604), while the concept is a unit of meaning that represents a number of objects that have the same characteristics, people who have the concept of being able to make an abstraction of the objects facing Bahri (2008: 30) . From the description above it can be concluded that the mastery of concepts is the ability of a person in pouring ideas in abstract form to concrete matters, so as to make it easier to master certain material. Mastery of mathematical concepts, namely students understand mathematics, there are several concepts that must be understood, one of them is to calculate negative integer operations with positive integer count operations, as well as fractions and algebraic concepts and their applications have procedures and rules in answering mathematical problems. In this study students learn the relationship between the concepts of distance, namely speed, distance and time, which students have a way to rule the problem. Based on the explanation above, the solution that will be used is to use the application of STEM (Science, Technology, Engineering, Mathematics).

STEM is an acronym for Science, Technology, Engineering, and Mathematics (Epstein & Miller, 2011). Initially the application of STEM only increased student interest in learning, but along with the time the application of STEM was expanded. This is because STEM is able to improve the mastery of knowledge, apply knowledge in solving problems and encourage students to create something (Permanasari, 2016). STEM is also said to be the integration of several subjects. According to Sanders (2009) STEM investigates the teaching and learning process between two or more integrated learning. Komarudin continued (2016), STEM is an integrative approach because it combines two or more fields of science into a unified whole. In addition, Brown (2012) argues that in STEM education every science is not divided but treated as a dynamic science.

In the application of STEM is one method of learning that is suitable in teaching heat in elementary schools because STEM learning includes all the nature of science including products, attitudes and technology (trivena: 2018: 22). STEM learning has a very effective way of engaging students to have high order

thinking (HOT) and problem solving skills by placing mathematics and science in the context of engineering and science (Komaruddin, 2016). Through STEM learning students can also be directly confronted with real-world situations through design-based problem solving (William, 2011). In addition, STEM learning can also develop students' skills in critical thinking, creativity and innovation and can provide opportunities equally to students from various backgrounds (Meyrick, 2011, p. 4).

The results of previous studies show that by integrating several disciplines in learning can make students good problem solvers, show positive responses and feel motivated and improve student learning outcomes, especially in mathematics and science (Stinson, et al. 2000). Media is a component of learning resources or physical vehicles that contain instructional material in the student environment that can stimulate students to learn (Arsyad 2013). Basically the media is a tool to facilitate students in learning, the use of media also can construct material that is abstract to concrete. The use of media in this study uses a 4WD mini car. This media has existed since the era of 90s knowledge children produced by Japan, which is often used as a racing game for children and adults, when combined with mathematics learning, it will be a very interesting media to increase students' interest in learning. This study intends to integrate STEM into three parts, namely (mathematics, engineering and technology) shown in Figure I.

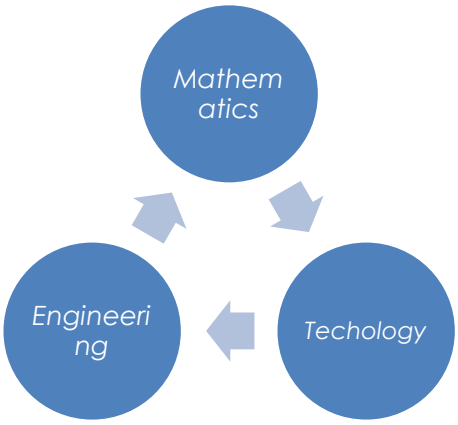

Figure 1. Integration of 3 STEM fields

The mathematics stage uses speed material as learning material, the engineering stage uses and designs the 4 WD mini car media, the technology stage uses media that support the engineering stage.

METHOD

This study uses classroom action research collaborated with grade V elementary school teachers in Sumedang Regency, West Java, carried out during the second cycle through a process consisting of four stages: planning, implementing actions, observing, and reflecting as shown in Figure 2. Classroom Action Research

Cycle Kemmis and Mc. Taggart (Akib, 2009)

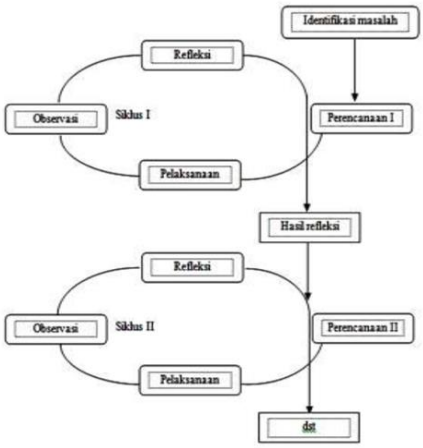

Figure 2. Classroom Action Research Cycle Kemmis and Mc. Taggart (Akib, 2009)

The research subjects were elementary school students in class V in Cimanggung District, Sumedang Regency, West Java Province, totaling 25 students consisting of 9 male students and 16 female students. The time of the research was carried out on 19-9 August 2019. The data collection technique is to use 10 test questions to find out an increase in mastery of concepts by filling in the questions given. Data analysis techniques use descriptive statistics, the results of research data are classified into five categories as shown in table I.

Table I. Categories The ability to understand concepts

No	Nilai	Kategori
1	86-100	Sangat Baik
2	71-85	Baik
3	56-70	Cukup
4	41-55	Kurang
5	< 40	Kurang Sekali

In this study the KKM (Minimum Completeness Criteria) is an indicator of the success of Classroom Action Research (CAR). The KKM has been set by the school, while the KKM score for mathematics is 70, meaning that students are said to be complete in mathematics if the score obtained by students is 70. If it does not reach, it cannot be declared complete. Whereas for the application of STEM it is said to be a classical success, if the value for mathematics lessons,

especially the mastery of concepts by 70 students, is 80%.

RESULTS AND DISCUSSION

The concept mastery test based on data analysis in cycle I shows that the number of students whose level of mastery of concepts in the good category is 18 students around 72% and students who understand the concepts below are good are 7 students around 28%.

This implementation requires tools (media) such as mini 4WD cars, and other concrete objects so that they can be implemented. In practice, through STEM, i.e. Students are first explained about speed material, then the teacher applies the concept of mathematical speed by constructing a mini 4WD learning media, then the teacher gives an instrument to measure mastery of concepts and learning outcomes.

The stages in learning to read fluently with the application of STEM carried out consisted of 4 stages: (1) the stage of the material is the students explore the material with the problems given by the teacher, (2) the engineering stage is the student constructs the learning media, (3) the stages of technology using media other than from major media such as audio visual etc. and (4) stages of learning outcomes in which students are able to apply concepts to the width of the available instruments.

By using STEM in cycle I, students' ability to read fluently is classified into five categories as shown in Table 2.

Table 2 Classification of Students' Understanding Ability Concepts on the Cycle

No	Nilai	Kategori	Frekuensi	Persentase
1	86-100	Sangat Baik	-	-
2	71-85	Baik	18	72
3	56-70	Cukup	5	20
4	41-55	Kurang	2	8
5	< 40	Kurang Sekali	-	
Jumlah			25	100

Based on the table above, the percentage of students' classical mastery learning in cycle I can be categorized based on the KKM applicable in the school where research for mathematics subjects can be seen in Table 3.

Table 3 classical mastery learning in cycle I

Nilai	Kategori	Frekuensi	Persen
≥ 70	Tuntas	18	72%
< 70	Belum tuntas	7	28%

Based on the completeness table above, the classical completeness based on KKM in the first cycle only reached 72% and has not reached the specified indicator that is 80%, so that it will be continued in the next. In cycle II the results of students' ability to read fluently are also classified as in cycle I can be seen in Table 4.

Table 4 Classification of Students' Understanding Ability Concepts on the Cycle

No	Nilai	Kategori	Frekuensi	Persentase
1	86-100	Sangat Baik	8	32
2	71-85	Baik	13	52
3	56-70	Cukup	4	16
4	41-55	Kurang	-	-
5	< 40	Kurang Sekali	-	-
Jumlah			25	100

Based on the above table, the percentage of students' classical mastery learning in cycle II can be categorized based on the KKM applicable at the school where research for mathematics subjects can be seen in Table 5.

Table 5 classical mastery learning in cycle I

Nilai	Kategori	Frekuensi	Persen
≥ 70	Tuntas	21	84%
< 70	Belum tuntas	4	16%

Based on the completeness table above, the classical completeness based on the KKM in the second cycle reached 84% already exceeding the specified indicator that is 80% so the study was stopped until the second cycle.

When compared to the average ability of students to read fluently through the application of STEM between cycle I and cycle II it can be seen in Figure 2.

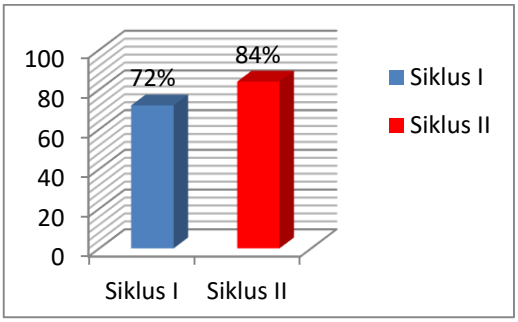

Figure 2 Comparison of Average Concept Mastery Test Results in Cycle I and Cycle II

Based on the picture above, it shows an increase in the average value of students' ability to read fluently in the first cycle, which is 72%, then increase in the second cycle to 84%.

Whereas the comparison of classical learning completeness in cycle I and cycle II can be seen in Figure 3.

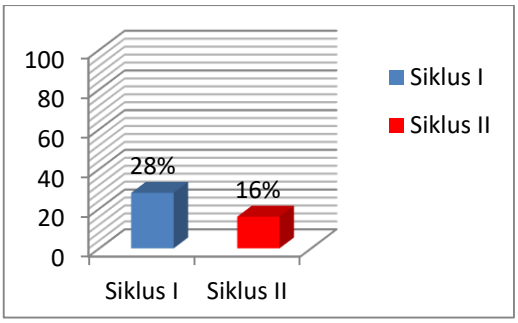

Figure 3 Comparison of Classical Learning Mastery in Cycle I and Cycle II

Learning outcomes in each cycle increase seen from the first cycle of students who are incomplete, 7 students 28%. in cycle 2 the number of unfinished students increased by 4 around 16%.

The initial knowledge of students in mathematics about 13 people around 52% who met the value of the minimum completeness criteria and 12 students who were incomplete were about 48%. In Cycle I there was an increase in the ability of concept understanding in students through STEM around 18 students or around 72%, and 7 students who were incomplete or about 28% were incomplete. Even though there is an increase of 44% but it has not fulfilled.

the achievement indicator which is 80% then it must be continued in the second cycle. The results in the second cycle increased the mastery of concepts with STEM in mathematics subjects, with 21 students around 84% and 4 people unfinished, around 16%.

Based on the data exposure of the research results above, it shows that the application of STEM can improve students' mastery of concept in class VI of Cimanggung III elementary school, Cimanggung District, Sumedang Regency. This can be seen from the understanding and learning outcomes after being given better treatment than before being given treatment.

In line with the results of the above research, the application of STEM is one of the learning methods that are suitable in teaching heat in elementary schools because STEM learning covers all the nature of science including products, attitudes and technology (trivena: 2018: 22). Aside from that, the advantages of STEM are the advantages of STEM learning, which are the engineering process (Torlakson, 2014). Engineering is part of designing and creating a product and supporting the problem solving and mathematical processes in STEM as a related science. (Firman, 2019), Engineering produces material information, energy and information while technology is the things that are seen as the result of engineering itself (Rustaman, 2016).

Learning media has the function of visualizing something that cannot be seen or difficult to see so that it appears clear and can cause understanding or improve one's perception (Sulaiman, 2018).

CONCLUSION

Based on the results of the research discussion, it can be concluded that the application of STEM can improve the mastery of the concept of fifth grade students in speed mathematics material at Cimanggung III elementary school, Cimanggung District, Sumedang Regency, West Java. The results are as follows. The indicator of learning success is determined the KKM value that has been determined is 70 for mathematics subjects.

The application of STEM can improve the ability of students to understand the concept of class V. This is seen from the average score of the results of the ability to apply the concept of students in the first cycle by 72%, increasing to 784% in the second cycle of the maximum score of 100.

As for the indicators of the success of students' mastery learning classically determined that 80% has been achieved in the amount of 80% students have achieved the KKM value in the second cycle.

Thus the application of STEM can improve the mastery of elementary school mathematical concepts in class V students.

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SUGGESTION

Based on the conclusion above, the researcher recommends that (1) STEM can be a solution in applying learning to prepare students for the 21st century; (2) can be used as a reference to develop students' mastery of concepts especially in speed mathematics; (3) the use of 4WD mini car media can motivate students to learn; (4) further research is recommended to use the fields of science and mathematics by using STEM in the next material.

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