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STEM-Based Straight Motion Learning to Improve Creative Thinking Skills STEM-Based Straight Motion Learning to Improve Creative Thinking Skills for Class VIII Students

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Abstrak

Kemampuan berpikir kreatif merupakan salah satu aspek yang memegang peranan penting dalam mempersiapkan peserta didik menghadapi tantangan zaman modern. Tujuan penelitian ini adalah untuk mendeskripsikan pembelajaran gerak lurus dengan pendekatan STEM yang dapat meningkatkan keterampilan berpikir kreatif peserta didik. Penelitian ini merupakan Penelitian Tindakan Kelas (PTK). Teknik analisis data yang digunakan yaitu teknik analisis kuantitatif untuk menganalisis skor penilaian dan teknik analisis kualitatif untuk merangkum dan mendeskripsikan hasil penelitian melalui observasi pengamatan. Hasil penelitian menunjukkan bahwa dalam proses pembelajaran peserta didik cukup antusias mengemukan pendapatnya dan peserta didik juga cukup kreatif pada setiap indikator berfikir kreatif. Selain itu, dilihat berdasarkan dari nilai tes dan laporan peserta didik. Untuk persentase peserta didik yang nilainya diatas KKM pada siklus I mencapai 56,25 % pada tes. Namun, jika dilihat pada laporan mencapai 50 %, sehingga belum mencapai kreteria keberhasilan penelitian. Pada siklus II akan dilakukan perbaikan pada siklus I sehingga persentase nilai peserta didik yang diatas KKM pada siklus II meningkat. Pada tes meningkat menjadi 93,75% dan pada laporan meningkat menjadi 81,25%. Bersumber pada hasil penelitian serta ulasan bisa dikatakan bahwa pembelajaran gerak lurus berbasis STEM di UPT SMP Negeri 3 Pangsid dapat meningkatkan keterampilan berpikir kreatif peserta didik.

Kata Kunci: *Pembelajaran Gerak Lurus, Pendekatan STEM, Keterampilan berpikir kreatif*

Abstract

The ability to think creatively is one aspect that plays an important role in preparing students to face the challenges of modern times. The purpose of this study was to describe learning in straight motion with a STEM approach that could improve students' creative thinking skills. This research is a Classroom Action Research (CAR). The data analysis technique used is quantitative analysis technique to analyze the assessment score and qualitative analysis technique to summarize and describe the research results through observational observations. The results showed that in the learning process students were quite enthusiastic in expressing their opinions and students were also quite creative in each

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indicator of creative thinking. In addition, it is seen based on test scores and student reports. For the percentage of students whose scores are above the KKM in the first cycle, it reaches 56.25% on the test. However, if it is seen in the report, it reaches 50%, so it has not reached the criteria for research success. In the second cycle, improvements will be made in the first cycle so that the percentage of students' scores above the KKM in the second cycle will increase. On the test it increased to 93.75% and on the report it increased to 81.25%. Based on research results and reviews, it can be said that STEM-based straight motion learning at UPT SMP Negeri 3 Pangsid can improve students' creative thinking skills.

***Keywords**: Straight Motion Learning, STEM Approach, Creative thinking skills*

Introduction

The progress of a country can be seen from how many innovations are born. The following table shows Indonesia's ranking over the last three years, noting that the availability and changes in the model framework of The Global Innovation Index (GII) affect the comparison of the GII from year to year. The statistical confidence interval for Indonesia's ranking in GII 2021 is between 80 and 87 (Dutta et al., 2021).

Table 1. The Global Innovation Index (GII) Ranking for 2019-2021

Years	GII	Input Innovation	Output Innovation
2021	87	87	84
2020	85	91	76
2019	85	87	78

Source: The Global Innovation Index Report (Dutta et al., 2021).

Innovation and creativity are two sides that cannot be separated. Innovation is born from creativity in order to solve the problems of human life. Human quality can be seen from the human ability to achieve goals to develop creative abilities (Cahyani et al., 2022; Mufiannoor et al., 2017). Creativity is the process of using creative thinking naturally to solve problems. Creative thinking is the unity of a whole series of individual cognitive activities in developing imagination, intelligence, insight and ideas to face problems in finding something new (Agustina et al., 2021; Birgili, 2015). Students need creative thinking skills to find appropriate answers based on existing data and information, and develop new ideas (Fatmawati & Wulandari, 2020).

At this time students' creative thinking skills, especially in science subjects, are less prominent in students because schools, in this case, teachers are less able to facilitate students to be able to think creatively(Tumurun et al., 2016). Teachers only provide direct knowledge to students without providing opportunities for students to actively participate in learning. Because of this, the creative thinking skills of students become less honed. The science learning process is still traditional and the teacher tries to innovate in the use of media and learning procedures. So one alternative to hone students' creative thinking is to use the STEM approach in the science learning process in the classroom. The STEM approach for students is not just memorizing concepts, but rather how students understand science concepts and their relation in everyday life, so that students can construct their own

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knowledge in solving problems and seeking various solutions that encourage students to think creatively (Ariani et al., 2019).

Science, Technology, Engineering and Mathematics abbreviated as STEM is one approach that is quite important in learning. Because technological developments in the Revolution 4.0 era require students to be familiar with the use of technology, science and mathematics. STEM can be applied to one of the science learning materials, namely straight motion material. Straight motion is included in Science, technology is in straight motion, namely designing (simple machines) car media, Engineering is in straight motion, namely how the car moves, and Mathematics is in straight motion in the form of questions that use mathematical formulas such as how many meters is the speed of a car.

Creative thinking needs to be developed in science learning, because basically science lessons lead to practice, especially science material that contains mathematical formulas such as straight motion material. In this study, researchers discussed the concept of straight motion by combining it with STEM-based education. When combined with STEM-based education. Can make lessons more fun and less complicated for students to recognize. where straight motion is included in science material, where technology is in straight motion, namely designing (simple machines) car media, engineering is in straight motion, namely how the car moves, and mathematics is in straight motion in the form of questions that use mathematical formulas such as how many meters is the speed of the car. .

The current situation of straight motion learning that is mostly done is teacher centered learning. So that the straight motion material that has been studied makes it difficult for students to understand it. This will affect the ability to think. The low creative thinking power of students can be caused by various factors, including them still do not understand the concept of straight motion being taught. There are students who think that learning straight motion only produces boring complex formulas, and are unable to connect material with phenomena in life.

The advantage of learning the concept of straight motion is that students can communicate with the teacher, students can learn different things. The results of interviews with science teachers at SMPN 3 Pangsid, it turns out that they have never done STEM-based science learning. So far, they have only used traditional learning and during the pandemic, only doing distance learning by implementing the Classroom application, and giving assignments via WhatsApp. Therefore, the researchers applied STEM-based straight motion learning. This learning is able to improve students' creative thinking skills.

Methodology

This research uses classroom action research. This study aims to solve a problem with an action (Efron & Ravid, 2013). This type of research was carried out in two cycles with two meetings in each cycle. The subjects in this study were class VIII students with a total of 15 students at SMP Negeri 3 Pangsid Sidrap. The research procedure consists of four

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stages of planning, implementation, observation and reflection. Data collection techniques are carried out by means of observations related to creative thinking. The observed aspects are the skills to issue ideas (fluency), the skills to make straight motion reports (flexibility), the skills to make balloon-powered car media (details), the skills to design media (authenticity), and the skills to present the created media (thinking metaphors). While the understanding of the concept of straight motion is measured by a test. The data analysis technique in this study is a descriptive technique that obtains data from observation sheets and tests that are recorded and reported in the form of tables, graphs, frequencies and percentages. The indicator of the success of this action is to think creatively, there are 80% of students who achieve a score of 76 and for understanding the concept of straight motion, there are 80% who achieve a Minimum Completeness Criteria or Kriteria Ketuntasan Minimal (KKM) score of 76.

Findings and Discussion

A. Initial Conditions of Participants

Based on the results of observations that have been made by researchers, it was found that students were slow when learning, students were less motivated in learning, students did not participate in classroom learning and students were less creative in understanding the material. Based on the results of an interview with one of the class VIII science teachers, he said that most of the students were silent, making the teacher restless. Teachers still always use the lecture method. The low activity of students in the teaching and learning process has an impact on competitiveness and creativity in learning and makes students accept the material as it is. From the results of the initial test, it shows that the average grade of the class is 68.68 with the highest score of 80 and the lowest being 40. Class VIII A students who have met the KKM which is 76 there are 3 students (18.75%). Students who have not reached the KKM that is < 76 there are 13 students (81.25%), as shown in table 2 below.

Table 2. Pre-Action Description

KKM	Frequency	Percentage
< 76	13	81.25%
≥ 76	3	18.75%

There were 13 students who did not complete and only 3 students who completed the initial conditions of the learning test results. The results of the initial conditions of creative thinking and the results of the learning test can be concluded that creative thinking is still not visible and learning outcomes have not been maximized. So the researcher has an achievement target for students' creative thinking and students' learning test results by doing STEM-based straight motion learning which lasts for 2 cycles.

B. Cycle I

Data obtained at the pre-action stage or data obtained from science subject teachers are used as a reference in carrying out actions in the first cycle, with the aim of obtaining an increased understanding of STEM-based straight motion learning.

1. Planning

Researchers before conducting research, first determine the competency standards and basic competencies used to conduct research. After being determined, the researcher made learning tools in the form of lesson plans, LKPD, and evaluation

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test questions. Researchers also made observation sheets to see students' creative thinking skills during the teaching and learning process.

2. Action

This research was conducted with 2 teaching meetings with an allocation of 90 minutes.

a. The first meeting

The implementation of the first cycle of the first meeting was carried out with a learning implementation plan (RPP). This first meeting discussed material about basic competencies. 3.2 Analyzing straight motion, the effect of force on motion based on Newton's laws, and its application to the motion of objects.

After giving apperception, the teacher provides explanations related to the STEM approach and introduces the concept of straight motion and various types of straight motion and provides an overview of what will be done in analyzing straight motion learning using the STEM approach. Then the researcher divided the students into several groups, after the students sat down with their group friends. The researcher shows the media of a balloon-powered car made by the researcher. Students seem enthusiastic about asking about the media that will be made. The number of questions indicates that students are quite interested in the material of straight motion. After understanding what will be made. Then students are distributed practicum instructions, worksheets, and prepare tools and materials, which are carried out for STEM-based straight motion learning experiments by utilizing the created media.

At the end of the activity, students with the guidance of the researcher conclude the activities that have been studied and provide opportunities for each group to ask questions about the material that has been studied, and reflect on how students understand related to the researcher's explanation regarding the concept of straight motion and STEM-based straight motion learning that will be prepared. After that, at the end of this lesson, students are also given the task of bringing tools and materials in groups to be brought to the next meeting.

b. Second meeting

The second meeting discussed the experiment of uniform straight motion and uniform changing straight motion, measuring speed and acceleration, analyzing the relationship between daily lives. The initial activities carried out were greetings, praying and attending. The teacher does not forget to also convey the objectives and explore the knowledge of students about various types of straight motion and their experiments or applications in everyday life and how to measure speed and acceleration in straight motion material.

After that, the teacher asks students to sit with their group friends and students make media based on the worksheets that have been prepared with the guidance of the researcher, it is hoped that students will find it easier to know directly the effect of force on objects by utilizing the powered car media made. After the experiment was completed by the students, then each group tested the results of whether the media made was moving or not and gave conclusions on the results of their work. With the guidance of the researcher, each selected group volunteered to present the results of their experiments that had been made and the other groups listened. Other groups may ask the presenting group, so that there is a discussion between the groups. Furthermore, researchers provide motivation to students to be enthusiastic in learning. At the end of the activity, the students together with the guidance of the researcher conclude the activities that have been studied so that mistakes do not

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occur. Researchers also reflect by strengthening the material by giving assignments in the form of reports made individually related to the media created.

The results of quantitative descriptive analysis on student reports show that the average score obtained by all students in the first cycle evaluation reached 71.062 with the highest score of 89 and the lowest score of 40. Meanwhile, the student KKM table can be seen as follows.

Table 3. Report Description

KKM	Frequency	Percentage
< 76	8	50 %
≥ 76	8	50 %

Based on Table 3 above, it can be seen that class VIII.A students who have met the minimum completeness criteria (KKM) which is 76, there are 8 students who have completed with a percentage of 50%, while those who have not reached the minimum completeness criteria (KKM) are 8 students with a percentage of 50%.

c. Third meeting

After the initial activities there are core activities delivered, the teacher gives students the opportunity to explain why there are successful and unsuccessful media and provide conclusions on the results of their work. After that, students are given the opportunity to ask questions that are not clear, also conclude about the material being taught. At the end of the first cycle, an evaluation was carried out to see the level of achievement of student learning outcomes. Measurement of student learning outcomes is done by giving evaluation questions which contain 5 description questions (the questions are in the appendix). Students work on individual evaluation questions. Meanwhile, the researcher went around seeing the students doing the assignment. After the evaluation results are collected. The researcher closed the lesson by praying. Furthermore, the researchers corrected the results of the students' work. From the test results, it was found that the students' learning outcomes regarding the scores obtained by each student. The results of the quantitative descriptive analysis show that the average score obtained by all students in the first cycle evaluation reached 75.68 with the highest score of 83 and the lowest score of 65. Meanwhile, the student KKM description table can be seen as follows.

Table 4. Description of the Test in Cycle I

KKM	Frequency	Percentage
< 76	7	43.75 %
≥ 76	9	56.25 %

Based on table 4 above, it can be seen that for class VIII.A students who have met the KKM, namely 76, there are 9 students who have completed with a percentage of 56.25%, while those who have not reached the KKM are there are 7 students with a percentage of 43.75%. Based on the above criteria, the description or graph of the achievement of learning outcomes in straight motion in the first cycle is as follows.

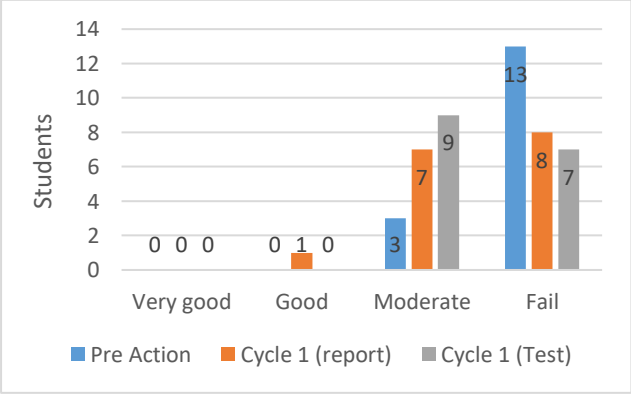

Figure 2. Pre-Action Score and Cycle I

Based on the data above, it can be seen that the results of the 1st cycle test which were attended by 16 students, the average grade of the class when viewed

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from the test has reached 75.68. This means that there is an increase in the results of pre-action with an average number of 68.68 and when viewed from the results of student reports, it reaches 71.06 results. From these data, the criteria for the success of the class average have not been met. Looking at the presentation of completeness for all students, 80% of the total students got a score of 76 which has not been fulfilled. In cycle 1 the percentage of completeness reached 56.25%. Of the 16 students, whose scores have met the minimum completeness criteria, 9 students, while 7 other students have not met the KKM. Meanwhile, if it is seen from the results of student reports, it reaches 50%. Of the 16 students, whose scores have met the minimum completeness criteria, 8 students, while 8 other students have not met the KKM. Comparison of values between pre-action and cycle I can be seen in the following table.

Table 5. Comparison of Scores between Pre Action and Cycle

Observed aspects	**Pre action**	**Cycle 1**	
		Report	**Test**
Highest Score	80	89	83
Lowest Score	40	40	65
Mean	68.68	71.06	75.68
Number of students who have not reached the KKM	13	8	7
Number of students who have reached the KKM	3	8	9
Percentage of students who have reached the KKM	18.75 %	50 %	56.25 %
Percentage of students who have not reached the KKM	81.25%	50 %	43.75 %

From the data above, it can be concluded that after the first cycle of action there was an increase seen from the results of student reports and tests. The average value of the pre-action class was 68.68 while the average value in cycle 1 was 71.06 on the report and 75.68 on the test. In the pre-action, students' completeness reached 18.75% while in cycle 1 it reached 50% when viewed from the results of the report and reached 56.25% when viewed from the test results. In cycle 1 the mean scores of the class has not met the KKM, as well as the percentage of completeness has not reached 80% so the research continues to cycle II.

3. Observation

This observation was conducted to determine the creative thinking ability of class VIII UPT SMP Negeri 3 Pangsid students during teaching and learning activities. This observation is done by filling out the creative thinking observation sheet that has been made. The creative thinking observation sheet includes indicators, namely: Skills in issuing ideas Fluency, Skills in making reports Straight motion Flexibility, skills in making balloon-powered car media Details (Elaboration), skills in designing media Novelty/Originality, skills in presenting media made. Thinking metaphorically (metaphorical thinking).

The process of observing students was obtained through the results of observations made by the researchers themselves with the help of the teacher. During the observation of students' creative thinking conducted by researchers at the first meeting and the second meeting when teaching and learning activities took place using the STEM approach. The observation process is carried out when students move to carry out STEM experiments in accordance with existing indicators. If the student's behavior is in accordance with the indicators, the researcher gives a tick if it is appropriate, but if it is not, the researcher will adjust the score for each indicator.

Based on the indicators above, the picture or graph of improving students'

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creative thinking skills in STEM-based straight motion learning can be seen as follows.

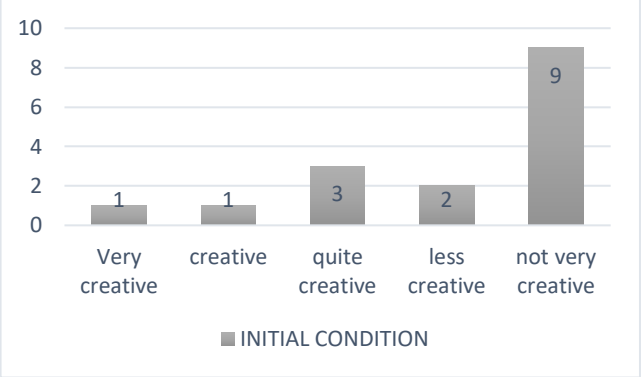

Figure 2. Initial Conditions of Creative Thinking

Figure 2 is the initial data for creative thinking of students, in the picture there is data on student criteria, the first for very creative criteria is 1 student, creative criteria is 1 student, moderately creative criteria are 3 students, less creative criteria are 2 students, and very less creative criteria there are 9 students. The number of students who reached a minimum of creative enough was 5 students with a percentage of 31%, while the creative thinking ability of all indicators of students got a class average of 54.86. From these data, the criteria for the average success of the class have not been met, 80% is quite creative. There are still many students who fall into the criteria of being very less creative.

If the data is analyzed according to the indicators, the first indicator gets an average score of 1.81 with a percentage of 68%, the second indicator averages 2.75 with a percentage of 87%, the third indicator averages 2.37 with a percentage of 87%, the indicator the fourth average of 2.06 with a percentage of 62%, the fifth indicator an average of 0.875 with 25%. Based on these indicators, it can be said that the fifth indicator, media presentation skills made Metaphorical thinking. The lowest with a percentage of 25% while the highest indicator is the second indicator. Skills in making straight motion reports, Flexibility, and the third skill in making balloon-powered car media detail (Elaboration) with a percentage of 87%.

4. Reflection

After carrying out the activities in cycle I, the researcher can reflect on the activities that have been carried out. The reflection carried out by the researcher is regarding the reflection on the learning process and the reflection on the results of the evaluation of students. The reflection is as follows:

a. Learning Process

Based on observations regarding the skills of students to use the media. Researchers have provided motivation and conveyed the objectives learned at each meeting. This activity has been carried out in accordance with the RPP that has been made by the researcher. This activity has not run smoothly, this is because time is still left but some groups of students are not confident in presenting their work, groups of students are chosen randomly so that there is no collaboration with other students so that the media they make seem random and not neat. And only 2 groups with mobile media and 2 groups whose media did not move, because they were still afraid and embarrassed to ask questions so that the experimental learning did not run smoothly. The weakness of this STEM approach makes students focus on the 4 subjects contained in STEM only, so they don't appreciate other lessons. This means that when science learning hours are over, students always solve problems by making media. So that teachers who teach after learning science are no longer considered because they always want to find out. However, overall the implementation of STEM-based straight motion learning is quite effective because it increases students' creativity and learning outcomes. In addition, the

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effectiveness of the STEM approach has an impact on students because students can rely on their way of thinking by solving problems collaboratively so that learning becomes more effective and arouses student curiosity.

b. Creative Thinking of students

The students' creative thinking data was taken from the results of observations made by students in the first cycle of the first and second meetings. From the data in the first cycle, the results of good creative thinking skills have not been obtained or it can be said that they are still low and have not reached the target of 80% creative enough. When the observations were made, there were still many students who were categorized as very less creative, which was seen based on the indicators of creative thinking skills. There are still many students who are shy to express their opinions in groups. There are still many of them only see their friends when doing experiments. So the results of this creative thinking have not been satisfactory and need to be held a follow-up cycle.

c. Student learning achievement

Data from the test results and reports were obtained by testing the evaluation questions in cycle I. Learning achievement in cycle I was still relatively low because there were still about 7 students who had not achieved the KKM score and in the report there were 8 students who had not achieved the KKM score. So, a follow-up cycle should be held, namely cycle II.

So from the learning process, the results of creative thinking skills and student learning achievements need to be implemented in cycle II. In the learning process, it still did not run smoothly because students were still embarrassed to ask questions during the experiment. The results of this creative thinking ability are also still not satisfactory because students have not done the experiment well, for example when there is a group experiment, only people see it, don't want to ask the teacher even though it is still not clear. For self-study results, the value of students is still low. There are still many who have not reached the KKM.

B. CYCLE II

Learning achievement in cycle 1 illustrates that the percentage of students who have reached the KKM has only reached 50% when viewed from the report and 56.25% when viewed from the test results and in accordance with the results of reflection in cycle I, it is necessary to take the next action, namely the cycle II, with the aim that the results obtained by students can meet the success criteria set, namely at least 80% of the number of students getting a score of 76. Activities carried out in cycle II include:

1. Planning

Planning carried out by researchers is to prepare something needed when doing research. Preparations that must be done are to prepare RPP, LKPD, and assessment guidelines. The researcher also compiled an observation sheet on creative thinking to assess the creativity of students according to the observation sheet that had been made. The material presented in this cycle is in accordance with basic competence 4.2, which is to present the results of an investigation of the effect of force on the motion of objects.

2. Action

In general, the implementation of the second cycle has similarities with the implementation of the first cycle, namely making media, but this time the media was changed, in cycle I, making balloon-powered car media and in cycle II, making rubber-powered car media. However, the mistakes made in the first cycle were corrected in the second cycle, such as the group division was determined by the

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students themselves by choosing friends in order to create good cooperation. The students were quite enthusiastic in this activity, some of them even wanted to make their own media. The class was quite excited because of the many questions asked by the students. This proves that they already quite understand the working principle of straight motion learning by utilizing the car media they have made. To further clarify seen from the results of student reports.

The results of the quantitative descriptive analysis on student reports show the average score obtained by all students in the second cycle evaluation reached 81.82 with the highest score of 93 and the lowest score of 57. Meanwhile, the student KKM description table can be seen as follows.

Table 6. Description of the Report in Cycle II

KKM	Frequency	Percentage
< 76	3	18.75%
≥ 76	13	81.25 %

Based on table 6 above, it can be seen that class VIII.A students who have met the minimum completeness criteria (KKM) i.e. 76, there are 13 students who have completed with a percentage of 81.25%, while those who have not reached the minimum completeness criteria (KKM) are there are 3 students with a percentage of 18, 75%. Based on the above criteria, the graphic description of the achievement of learning outcomes in the report in cycle II is as follows:

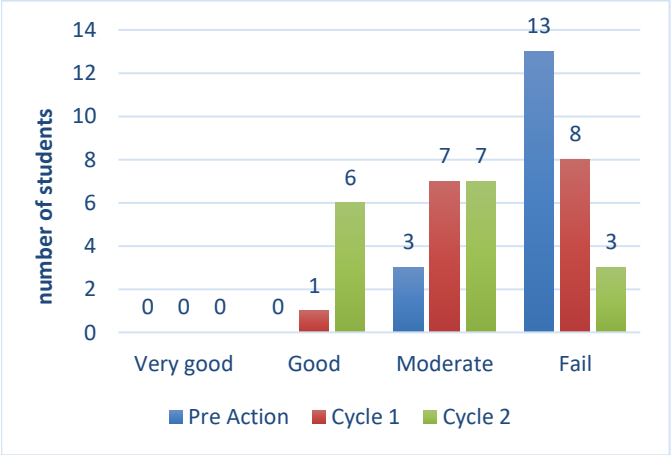

Figure 3. Pre-Action Values in Cycles I and II

Based on the data above, it can be seen that the results of the report which was attended by 16 students, the average grade of the class has reached 81.82. From these data, the criteria for average success in cycle II have been met, because based on the initial agreement the average grade value that must be met is 76. By looking at the percentage of completeness for all students, namely at least 80% of the total number of students who getting a value of 76 has been fulfilled in cycle II. The percentage of completeness of students who meet the KKM reaches 81.25% or there are 13 students from 16 students.

Furthermore, for the second meeting of cycle II, or the end of cycle II to see the level of achievement of learning outcomes, students are given evaluation questions (the questions are in the appendix). Students work on individual evaluation questions. Meanwhile, the researcher went around seeing the students doing the assignment. However, in cycle II, the researcher worked with the science teacher to tighten the classroom situation by dividing the students. Researchers observed female students and science teachers observed male students. The goal is to get valid results. After the evaluation results are collected. The researcher closed the lesson by praying. Furthermore, the researchers corrected the results of the students' work. From the

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test results, it was found that the students' learning outcomes regarding the scores obtained by each student. The results of quantitative descriptive analysis show the average score obtained by all students in the second cycle evaluation reached 83.81 with the highest score of 95 and the lowest score of 70. So for students who have met the KKM 76 there are 15 students or 93.75% below the table.

Table 6. Description of Test Results in Cycle II

KKM	Frequency	Percentage
< 76	1	6.25 %
≥ 76	15	93.75 %

Based on the criteria above, the description or graph of the achievement of learning outcomes in straight motion in cycle II is as follows.

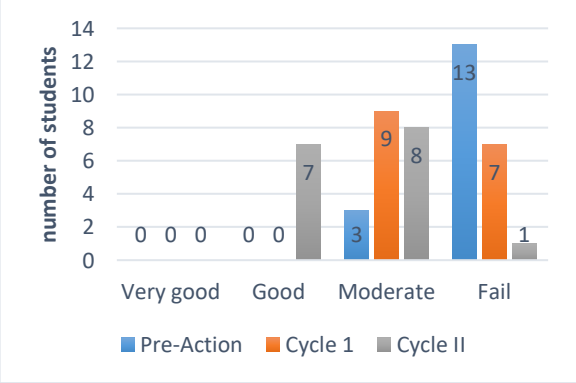

Figure 4. Pre-Action Test Scores, Cycles I and II

Based on the data above, it can be seen that the results of the second cycle test which was participated by 16 students, the class average score has reached 83.81. From these data, the criteria for the average success of the class in cycle II have been met. Because based on the initial agreement, the average class value that must be met is 76. By looking at the percentage of completeness for all students, at least 80% of the total number of students getting a score of 76 has been fulfilled in cycle II. The percentage of completeness of students who meet the KKM reaches 93.75% or there are 15 students from 16 students. Comparison of values between pre-action, cycle I, cycle II can be seen in the following table.

Table 7. Comparison Score of Pre Action, Cycle I and II

Observed aspects	Pre action	Cycle I		Cycle II	
		Report	Test	Report	Test
Highest Score	80	89	83	93	95
Lowest Score	40	40	65	57	70
Mean	68.68	71.06	75.68	81.82	83.81
Number of students who have not reached the KKM	13	8	7	3	1
Number of students who have reached the KKM	3	8	9	13	15
Percentage of students who have reached the KKM	18.75 %	50 %	56.25 %	81.25 %	93.75 %
Percentage of students who have not reached the KKM	81.25%	50 %	43.75 %	18.75 %	6.25 %

From the data above, it can be concluded that the value of students in pre-action, cycle I and cycle II has increased. The average value of the pre-action class was 68.68 in the first cycle reaching 71.06 in the report and 75.68 in the test and in the second cycle it reached 81.82 in the report and 83.81 in the test. The percentage of completeness of students who have met the KKM of all students has also increased. In the pre-action, students' completeness reached 18.75%, in cycle 1 it reached 50% when viewed from the results of the report and reached 56.25% when viewed from the test results. While in Cycle II it reached 81.25% when viewed from the results of the report and reached 93.75% when viewed from the test results. These results have met the criteria for research success, so they are not continued in the next cycle.

a. Observation

The creative thinking data is supported by observation activities carried out by observers during teaching and learning activities. The creative thinking observation sheet includes indicators,

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namely: Skills in issuing ideas Fluency, Skills in making reports Straight motion Flexibility, skills in making balloon-powered car media Details (Elaboration), skills in designing media originality, skills in presenting media made. Thinking metaphorically (metaphorical thinking).

Based on the indicators above, the picture or graph of improving students' creative thinking skills in STEM-based straight motion learning can be seen as follows.

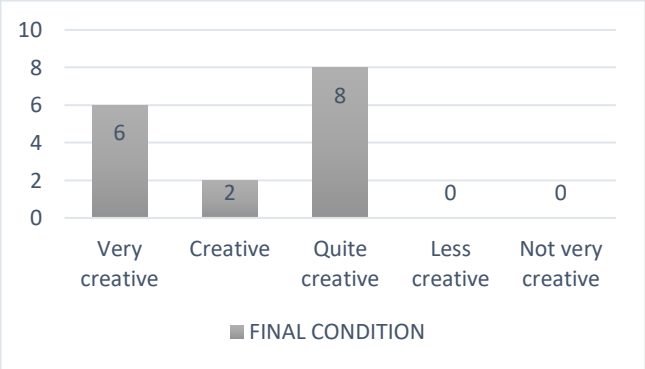

Figure 5. Final Conditions of Creative Thinking

Figure 5 is the final data on students' creative thinking, in the image there is data on the first student criteria for very creative criteria there are 6 students, creative criteria are 2 students, quite creative criteria are 8 students, less creative criteria and very creative criteria less creative is 0. The number of students who reach a minimum of creative enough is 16 students with a percentage of 100%, while the creative thinking ability of all indicators of students gets an average value of 83.34. Seeing the average value of 83.34, the data has reached the criteria for success, the average class has been met 80%

If the data is analyzed according to the indicators, the first indicator gets an average score of 3.19 with a percentage of 100%, the second indicator averages 3.8 with a percentage of 100%, the third indicator averages 3.31 with a percentage of 100%, the indicator the fourth average is 3.13 with a percentage of 100%, the fifth indicator is an average of 1.5 with 50%. Based on these indicators, it can be said that the fifth indicator, media presentation skills made Metaphorical thinking. The lowest with a percentage of 50% while for the four indicators it has reached 100%. Based on the data obtained, to find out STEM-based straight motion learning can improve creative thinking skills. It can be seen in the following trends.

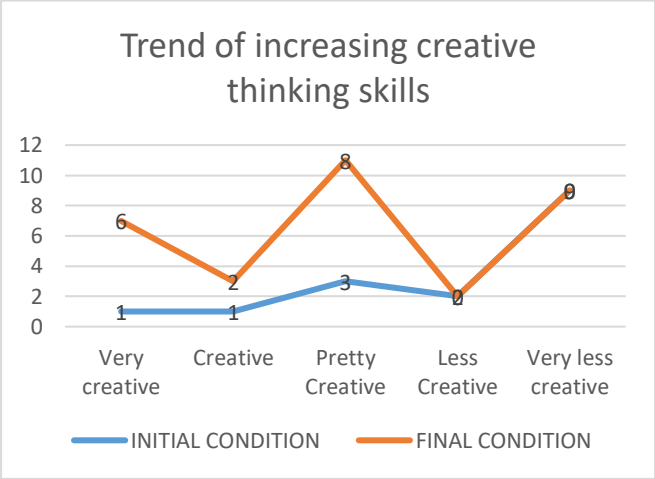

Figure 6. Trend of Improving Creative Thinking Skills

The creative thinking observation sheet includes indicators, namely: Skills in issuing ideas Fluency, Skills in making reports Straight motion Flexibility, skills in making balloon-powered car media Details (Elaboration), skills in designing media Novelty/Originality, skills in presenting media made. Thinking metaphorically (metaphorical thinking). The initial conditions included in the criteria of being creative enough were 5 students and there were several points of decline in the criteria of being less creative and very less creative as many as 11 students caused by one of the indicators not reaching the criteria. In the final condition, STEM-based straight motion learning experienced an increasing trend which was marked by the

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presence of 16 students who entered the criteria for being quite creative. the results of the five indicators of creative thinking obtained data, in the initial conditions 31% of students who completed the minimum limit of students were quite creative with an average of 54.86. As for the final condition, the data obtained is 100%, which means that all students are declared complete from the minimum limit of students being creative enough with an average value of 83.34.

3. Reflection

After the second cycle has been completed, the researcher reflects on the activities that have been carried out. The reflection carried out by the researcher includes the following.

a. Learning Process

In general, the implementation of activities in cycle II did not find any real obstacles, because the implementation of cycle II was a refinement of the proposal from the teacher as a collaborator. Based on the results of the reflection in cycle II, it can be said that almost every step in the preparation of the RPP that has been prepared has been carried out well. This activity is quite effective. Because the selection of groups is determined by the students themselves so that good collaboration / cooperation is created in each group. And in each group, it is quite active to ask questions if it is not known and the media made by students is quite creative even though the media they make move fast, slow and medium. So that it provokes the curiosity of students. And among them there are those who make cardboard car media, which was originally planned to make a powerful rubber car, although it is not neat, but this indicates that there is enthusiasm for learning. The weakness of this STEM approach is that it takes a lot of time because when the media is finished, the tools and materials are scattered and students have to clean the class so that they are calm in learning. However, basically STEM-based straight motion learning can provide students with an understanding not only based on theory but directly applied in everyday life. In addition, it can increase the creativity and learning outcomes of students.

b. Creative Thinking of students

The students' creative thinking data is taken from the results of observations. Creative thinking in the second cycle has been very satisfying, has reached the target indicator of success, so there is no need for a follow-up cycle.

c. Learner's Learning Achievement

Learning achievement in the second cycle was obtained from the evaluation of the second meeting of the third meeting of the evaluation questions. Learning achievement in the second cycle has greatly improved from the initial conditions and the first cycle, so that in this cycle it is very extraordinary and there is no need for a follow-up cycle because it is right on target.

Discussion

In the first cycle of learning the average value of the first cycle of learning classes showed an increase when compared to pre-action. The increase in science learning outcomes in cycle I was caused by the STEM approach used by researchers to be applied in straight motion learning. This means that STEM education-based learning can be packaged into a collaborative learning model to improve academic abilities, creativity, and problem solving skills (Permanasari, 2016). Learning outcomes when applying a STEM approach to learning critical thinking skills have been shown to be superior to those applying a traditional learning approach (Nuangchalerm et al., 2020).

Improvement of STEM-based learning will create the character of students who can recognize a concept or

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knowledge (science) and apply that knowledge using the skills (technology) they master to form or design a method (engineering) with analysis and based on mathematical data calculations (math) in order to obtain a solution for solving a problem so that human work becomes more practical. STEM is widely used for learning. This situation has shown that the use of STEM can improve students' academic and non-academic performance (Garner et al., 2018). This is in line with the results of Wahyuni (2021) research on improving learning achievement when looking at the level of change in grades in each learning cycle. The increase in the percentage score in each cycle shows that students can follow the learning well and optimally using the STEM approach.

Furthermore, STEM-based straight motion learning can improve creative thinking skills. Seen based on indicators of fluency, flexibility, elaboration, originality, metaphorical thinking. The creative thinking observation sheet compiled by the researcher includes indicators, namely: Skills in issuing ideas fluency, skills in making reports Straight motion Flexibility, skills in making balloon-powered car media Elaboration, skills in designing novelty media (Originality), presentation skills Media made Metaphorical thinking and adjusted for very creative, creative, moderately creative, less creative, very less creative categories which then add up how many students are at least creative enough on each indicator. In addition, it is also seen based on student reports.

The results of the study prove that STEM-based straight motion learning can improve students' creative thinking skills. This is in accordance with research (Sumarni et al., 2019) which shows that the STEM approach can improve students' thinking and creative thinking skills. In his research, students can see the value of creativity when they try to relate the mathematical concepts they have acquired to their use in everyday life and their use in technology, science, and other disciplines. This shows that students respond well to the STEM approach. This shows that drawing with the STEM approach can also increase students' creativity (Muthmainnah et al., 2019). The STEM approach also helps students change their mathematical attitudes emotionally and psychometrically. Students can learn to be more active, become more motivated to help each other, be confident, and respect themselves and others. STEM tends to invite students to be flexible, supportive, and collaborate with others. This is supported by short-term and long-term project assignments that require intensive communication between students and other students (Fatmawati & Wulandari, 2020).

Based on interviews with one of the new students, STEM-based straight motion learning is quite difficult to understand because it contains mathematical formulas in it, but to increase the enthusiasm for learning, in STEM students are required to design media so as to increase students' learning interest so that the value that can be obtained is quite satisfactory and achieve the target.

Meanwhile, to find out whether creative thinking skills have increased, it can be seen based on the initial and final conditions in making car media that are made, everything can be said to be moving, although there are some media made by students that move fast, slow, and medium. This is said to be successful because all of the media made by students have all moved and reached the target as seen from the 5 indicators of creative thinking skills, namely the Skills in issuing ideas Fluency, Skills in making reports Straight motion Flexibility, skills in making balloon-powered car media Details (Elaboration), skills in designing media

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Novelty/Originality, skills in presenting created media Thinking metaphorically and adjusted for categories very creative, creative, quite creative, less creative, very less creative which is then added up by the minimum number of students quite creative on each indicator.

Conclusion

The results of the study in terms of teacher observations showed that the STEM approach gave positive results to students, such as student learning outcomes, as well as students' creativity in understanding the material. In addition, STEM learning is considered interesting because students can learn while playing. In addition, if viewed from the results of interviews with one of the students of STEM-based straight motion learning, it is quite difficult to understand because it contains mathematical formulas. However, if it is accompanied by media, it will increase students' learning interest so that the value is quite satisfactory and achieves the target.

Meanwhile, the percentage of students whose scores were above the KKM in the first cycle reached 56.25% on the test. However, if it is seen in the report, it reaches 50%, so it has not reached the criteria for research success. In the second cycle, improvements were made that needed to be improved in the first cycle. So that the percentage of students' scores above the KKM in the second cycle increased. On the test it increased to 93.75% and on the report it increased to 81.25%. Based on the results of the research and discussion, it can be concluded that STEM-based straight motion learning can improve the creative thinking skills of students at SMP Negeri 3 Pangsid seen from initial to final conditions by counting the number of students who are at least creative enough on each indicator.

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