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STEM at Home Improves Students' Creative Thinking Skills on The Topic of Simple Machines

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Abstract: *Creative thinking skills are one of the 21st-century skills that students must have to utilize their knowledge well and easily adapt to the times. However, science learning in schools still rarely uses the right learning media to stimulate students' creative thinking skills. Therefore, efforts are needed from science educators to facilitate students with effective learning media to train students' creative thinking skills. This research aims to examine the effectiveness of using the STEM at Home Kit in learning simple machine in improving students' creative thinking skills. The research used quasi-experimental method with posttest-only control group design. The research subjects were VIII-grade students of SMP Negeri 13 Pekanbaru consisting of two classes: the experimental class using the STEM at Home KIT and the control class using the SMP science standard KIT. The instrument used was creative thinking skills test. The results showed that the average creative thinking skills of students in the experimental class increased significantly compared to the control class. The use of the STEM at Home KIT trains students to understand the concept of simple machine contextually and can train students' creative thinking skills. Students' responses to learning with the STEM at Home KIT were also very positive, because they were considered interesting, easy to use, and relevant to the concepts taught. This research concludes that the STEM at Home KIT is effectively used in learning simple machine to improve students' creative thinking skills, as well as providing a more meaningful and enjoyable learning experience.*

Keywords: *STEM at Home, learning media, creative thinking, simple machine.*

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STEM at Home Meningkatkan Keterampilan Berpikir Kreatif Siswa pada Topik Pesawat Sederhana

Abstrak: *Keterampilan berpikir kreatif merupakan salah satu keterampilan abad 21 yang harus dimiliki siswa agar dapat memanfaatkan pengetahuannya dengan baik dan mudah beradaptasi dengan perkembangan zaman. Akan tetapi, pembelajaran IPA di sekolah masih jarang menggunakan media pembelajaran yang tepat untuk menstimulasi keterampilan berpikir kreatif siswa. Oleh karena itu, diperlukan usaha dari para pendidik IPA untuk memfasilitasi siswa dengan media pembelajaran yang efektif demi melatih keterampilan berpikir kreatif siswa. Penelitian ini bertujuan untuk menguji efektivitas penggunaan KIT STEM at Home dalam pembelajaran pesawat sederhana terhadap peningkatan keterampilan berpikir kreatif siswa. Penelitian menggunakan metode quasi-eksperimen dengan desain posttest only control group design. Subjek penelitian adalah siswa kelas VIII SMP Negeri 13 Pekanbaru yang terdiri dari dua kelas, yaitu kelas eksperimen yang menggunakan KIT STEM at Home dan kelas kontrol menggunakan KIT standar IPA SMP. Instrumen yang digunakan adalah tes keterampilan berpikir kreatif. Hasil penelitian menunjukkan bahwa rata-rata keterampilan berpikir kreatif siswa pada kelas eksperimen meningkat secara signifikan dibandingkan dengan kelas kontrol. Penggunaan KIT STEM at Home melatih siswa memahami konsep pesawat sederhana secara kontekstual dan dapat melatih keterampilan berpikir kreatif siswa. Respon siswa terhadap pembelajaran dengan KIT STEM at Home juga sangat positif, karena dianggap menarik, mudah digunakan, dan relevan dengan konsep yang diajarkan. Kesimpulan penelitian ini adalah KIT STEM at Home efektif digunakan dalam pembelajaran pesawat sederhana untuk meningkatkan keterampilan berpikir kreatif siswa, serta memberikan pengalaman belajar yang lebih bermakna dan menyenangkan.*

Kata kunci: *STEM at Home, media pembelajaran, berpikir kreatif, pesawat sederhana.*

Introduction

The era of the Industrial Revolution 4.0 is an era with information technology that is developing rapidly and coloring every human life. The era of the Industrial Revolution 4.0 is characterized by the development of the internet of things that fills various fields of people's lives today, one of which is in the field of education (Nastiti & 'Abdu, 2020). The 21st century, which is centered on the development of the Industrial Revolution 4.0, puts forward knowledge as the main spear. However, knowledge alone is not enough to realize the Era of the Industrial Revolution 4.0 because there needs to be a balance between knowledge and skills as the basis of quality human resources to face the development of increasingly sophisticated times (Mardhiyah et al., 2021). Therefore, the next generation of the nation must have 21st-century skills to easily adapt and innovate to the times. These skills are an important component needed in various aspects of life and must be embedded early in students. These skills are known as 4C skills, which consist of creativity, critical thinking, communication, and collaboration. These four skills must be applied in learning so that students' skills can be trained,

honed, and developed continuously, so that they become potential in the future to be able to compete in the world of work.

In learning, teachers should consider the selection of learning methods and models that will be used to find out the characteristics and abilities of different students. There are still many uses of conventional learning methods using the lecture method which results in a teacher-centered learning process, so that one-way communication occurs. Therefore, a teacher should use a scientific approach in learning physics so that students are encouraged to be more active and creative in learning (Rehani & Mustofa, 2023).

To improve students' creative thinking skills, appropriate learning is needed to stimulate students' creative thinking skills. Students' creative thinking skills can be trained by using scientific learning and STEM. In Indonesia, in general, STEM is still not familiar to teachers and students in teaching science or science clumps including physics. The majority of teachers find it difficult to apply STEM in the learning process. This is due to several barrier factors such as the lack of supply of qualified STEM teachers, the unavailability of STEM learning facilities, the difficulty in coming up with creative ideas for STEM projects, the lack of time in preparing STEM project learning plans and the lack of STEM socialization so that teachers' understanding of STEM is minimal (Wati et al., 2021). Nevertheless, efforts to cultivate STEM in schools must continue, this aims to create a creative generation to face the challenges of the 21st century.

One of the solutions implemented is to use the STEM at Home KIT. This KIT is specifically designed to support student learning at home by providing KITs that contain tools and materials to create projects that are equipped with guidebooks needed to conduct experiments and projects related to STEM concepts. Early research conducted by Zulirfan et al. (2020) on the application of KIT STEM at Home for learning showed some significant positive perceptions of students between students using KIT STEM at Home and students using conventional methods. KIT STEM at Home is also relevant to the research of Zulirfan et al. (2018), regarding the KIT take home experiment, which shows a significant effect of using THE KIT. Students can learn independently with the STEM at Home KIT so that it is more effective and efficient than conducting experiments at school, which will spend a lot of learning time. The use of this KIT is expected to increase students' learning motivation and encourage the development of creative thinking skills in students. With this background, the research was conducted by implementing learning using KIT STEM at Home as one of the effective efforts in training and improving the creative thinking skills of junior high school students on simple machine materials.

Research Methods

This research uses a type of quasi-experimental research, where experimental research looks for the effect of something that is given treatment on others under conditions that can be controlled (Sugiyono, 2013). This research design uses a non-

equivalent posttest only control group design, which is divided into 2 groups, namely the experimental class and the control class as shown in Table 1.

Table 1. Research with posttest-only nonequivalent control group design

Class Group	Treatment	Posttest
Experiment	X	Y
Control	-	Y

This research was conducted in two classes with different treatments. The experimental class was treated with learning using the STEM at Home KIT, while the control class used learning using the standard SMP Science KIT. The research was conducted at SMP Negeri 13 Pekanbaru in the odd semester of the 2024/2025 school year. The population of this research was VIII-grade students of SMP Negeri 13 Pekanbaru in the 2024/2025 school year, totaling 10 classes. To determine the sample, homogeneity test was conducted between the classes. Before the homogeneity test, the normality test was first carried out on the daily test scores of the material before simple machine, which in this case is the material of the structure and function of the organs of living things. After the normality and homogeneity tests were carried out, the sample was determined using random sampling.

Data collection in this research used written tests in the form of essay questions. The questions were given to the experimental class and the control class after completing the research on simple machine material. The purpose of this posttest is to measure the improvement of students' creative thinking skills on simple machine material. The research instrument used was a written test on simple machine material to assess students' creative thinking skills. The test consists of 8 essay questions. The questions were developed based on aspects of creative thinking skills.

The data analysis techniques used are descriptive analysis and inferential analysis. Descriptive analysis is a technique used to describe or describe the data that has been collected as it is, without attempting to make conclusions or generalizations (Sugiyono, 2013). In this research, descriptive analysis was used to compare students' creative thinking skills.

Table 2. Criteria for interpreting the level of creative thinking skills

Interval	Criteria
3,3-4	Very Creative
2,5-3,2	Creative
1,7-2,4	Creative Enough
0,9 -1,6	Less Creative
0-0,8	Not Creative

Descriptive analysis in this research is to get an overview of the creative thinking skills of students at SMPN 13 Pekanbaru in groups of students who apply learning using KIT STEM at Home and groups of students who apply learning using school science KITs on simple machine material. After obtaining the results of the calculation of the

average score, to determine the level of students' creative thinking skills, an interpretation criteria scale is needed. The criteria for interpreting the level of creative thinking can be seen in Table 2.

Results and Discussion

Presentation of data regarding the effectiveness of learning using the STEM at Home KIT on simple machine material in training creative thinking skills of students in class VIII SMP Negeri 13 Pekanbaru. There were two classes involved in data collection, namely class VIII.1 and VIII.2 as research samples. Class VIII.2 was selected as the experimental class and Class VIII.1 as the control class. The data collection process was carried out after the learning process on simple machine material for 5 meetings (10 lesson hours), both in the experimental and control classes. The experimental class used the STEM at Home Kit learning media while the control class used the SMP Science KIT learning media.

After the learning was completed, a creative thinking skills posttest was conducted with 8 essay questions designed based on aspects of creative thinking skills as a research instrument. Students were given about 45 minutes to complete the posttest. The distribution of posttest scores for students in both sample classes is presented in Table 3.

Table 3. Frequency distribution of creative thinking skills

Interval	Experiment Class		Control Class		Category
	Total	Percentage (%)	Total	Percentage (%)	
3,3-4	6	15	1	2	Very Creative
2,5-3,2	23	56	21	51	Creative
1,7-2,4	11	27	16	39	Creative Enough
0,9 -1,6	1	2	3	7	Less Creative
0-0,8	0	0	0	0	Not Creative

Based on Table 3, the experimental class obtained a higher posttest score compared to the control class. Therefore, it can be concluded that the STEM at Home KIT has a positive impact on students, increasing creative thinking skills, especially with simple machine materials.

Table 4 shows the average score data and the percentage of posttest creative thinking skills of students in both groups, namely the experimental group by applying learning using KIT STEM at Home and the control group applying learning using junior high school science KITs on simple machine material. For each indicator, there is a difference in the average score of students' creative thinking skills. Students' creative thinking skills in the experimental class were higher than the control class.

The fluency aspect in this research is related to how students build ideas. Fluency refers to the variety of correct answers given by students to a problem (Yanti et al., 2019). The fluency aspect questions in this research consisted of two items: the first

question students were asked to provide an explanation of the location of the clothesline that might be made in a house in a densely populated area, and the second question students were asked to explain the simple machine on the stairs in the hills. A comparison of the results of the achievement of students' creative thinking skills in both groups for each aspect question can be seen in Table 4.

Table 4. Analysis of student creative thinking skills results

No	Aspects of Creative Thinking	Experiment Class		Control Class	
		Score	Category	Score	Category
1	Fluency	2.46	Creative	2.30	Creative Enough
2	Flexibility	2.50	Creative	2.39	Creative Enough
3	Originality	3.02	Creative	2.60	Creative
4	Elaboration	2.72	Creative	2.39	Creative Enough
Average score		2.68		2.42	
Standard Deviation		0.42		0.54	
Category		Creative		Creative	

It can be seen through Table 4 in the fluency aspect, the achievement of creative thinking skills in the experimental group and control group for both questions is not much different. Only a slight difference for both questions. It can be said that more than half in both groups are sufficient in understanding the material. However, the experimental group was superior to the control group, but the difference between the two groups was not too far.

Based on the research data, the achievement results in the fluency aspect in the experimental group reached the creative category with a value of 2.71, while the control group reached the moderately creative category with a value of 2.30. This indicates that experimental group students are superior in providing many alternative answers and ideas related to the questions given. By applying learning using the STEM at Home KIT, students fluently generate ideas to answer questions and can understand the concept of simple machine.

Although descriptively the average posttest of the experimental group is superior to the control group, there are still some students who answer incorrectly and incorrectly related to the problems given, this is because some students have not been able to understand the concept of simple machine material in a real context. This is in line with Kraeng's research (2021) that students have not been able to understand the concept, and students are also not careful in reading the questions so they do not know the meaning of the questions. Most students answered only one answer, students did not provide more than one answer.

The flexibility aspect in this research is that students can find many alternative ideas, answers, or questions that vary and can see problems from different perspectives (Utami et al., 2020). The questions about the flexibility aspect in this research consisted of two items: the first question related to the simple machine used to make clothespins in a narrow place, and the second question about what happens if the stairs on the hills are made steep.

Through Table 4 in the flexibility aspect, the achievement of creative thinking skills in the experimental group and control group for both questions is not much different. The experimental group was superior to the control group, but the difference between the two groups was not too far.

Based on the research data, the achievement results on the flexibility aspect in the experimental group reached the creative category with an average score of 2.50, while the control group reached the moderately creative category with a value of 2.39. This indicates that experimental group students are superior in providing many alternative answers and ideas related to the questions given.

Students who apply learning using the STEM at Home KIT can make various forms of statues depending on the level they want to use, so that students are more flexible in conducting experiments and projects on simple machine material. Students have the freedom to design, build, and modify models according to student understanding. This can encourage students to think flexibly because they have to adjust their ideas to the limitations of tools and materials. The STEM at Home KIT provides an interactive and problem-solving-based learning experience. This supports the development of flexible thinking in improving students' creative thinking skills.

The aspect of originality in this research is a key characteristic of creativity. This aspect relates to the ability of students to think in unusual ways, providing innovative and unique ideas or ideas, where the ideas flow freely in a short time (Ackerman & Thompson, 2017). Innovative is defined as a new idea or a pre-existing idea that is then developed into something different but is still conceptually acceptable and has true value (Zamzam & Ambarawati, 2023). The question of the originality aspect in this research consists of two items: the first question related to the design of clothespins in a narrow house that can be used optimally, and the second question about the design of a tool to carry heavy and large items up the hill using a simple machine.

Based on Table 4, an average score of 3.02 was obtained for the experimental group in the creative category and 2.60 for the control group in the creative category. Although both are classified as creative categories in this aspect, the experimental group has a higher average percentage score than the control group, with a very significant difference. This is because the use of projects and LKPD used in the experimental group makes students more fluent and active in bringing up new ideas or ideas about a problem in a real context. In addition, students are able to produce unique and innovative answers.

The achievement of creative thinking skills for both questions in the originality aspect of the experimental group is superior to the control group, especially in the second question. This is due to the application of KIT STEM at Home learning carried out in the experimental group, making students accustomed to bringing up ideas, creative and critical solutions to a project, making it easier to solve a problem. In the control class, learning using standard science kits was also applied, where students also applied experimental and project learning. However, some students in the control class had a little difficulty because they were not used to using the Science KIT. In the experimental class, learning was implemented using the STEM at Home KIT, which is

smaller in size and easy to assemble. In addition, the STEM at Home KIT is also suitable for project learning and has an attractive shape so that it can train students' creative thinking skills in the aspect of originality. This result is in line with the research of Sularmi et al. (2018) that project-based learning can create student learning activity and motivation, and can foster students' thinking skills to find ways to solve problems.

The elaboration aspect in the research is related to students' ability to enrich and develop an idea or product, as well as add or detail the details of an object, idea or situation to make it more interesting (Nurfadilah & Siswanto, 2020). The question on the aspect of detail in this research consists of two items: the first question related to the design of clothespins and the second question about explaining how the large and heavy goods carrier works on the hill that has been previously designed.

Based on Table 4 on the elaboration aspect, the experimental group has a higher average value of 2.72 with a creative category than the control group of 2.39 with a fairly creative category. the experimental group has a higher average than the control group, with a very significant difference.

The achievement of creative thinking skills for both questions in the elaboration aspect of the experimental group is superior to the control group, especially in the first question. This is because the experimental group given learning using the STEM at Home KIT is accustomed to using their detailing skills in making a product, so students can apply it to a problem. Although descriptively the average score of the two questions on the elaboration aspect of the experimental group is high, there are still many students who answer incorrectly and incorrectly related to the problems given, this is because students are less able to solve a problem with detailed steps. This is in line with the research of Novitasari et al. (2021) that students are less able to solve problems because they cannot provide detailed reasons for solving the problem.

This finding is also supported by the results of research by Jawad et al. (2021), that STEM-based learning can be a good choice for improving students' mathematical achievement and creative thinking skills. Another study conducted by Wakhid et al. (2023) also showed that learning with a project-based STEM approach can bring out their creative thinking skills. This is because STEM project-based learning can create an active and interesting learning atmosphere, and can increase student motivation to learn, be creative, and innovate. This STEM project-based learning can also provide opportunities for students to make products based on solving concepts according to the challenges given by the teacher.

Conclusion

Based on the research conducted at SMP Negeri 13 Pekanbaru, the creative thinking skills of students who apply learning using the STEM at Home KIT on the topic of simple machine score relatively better than using the standard science KIT for all aspects. In terms of originality, there is a fairly significant difference. This is because students are used to thinking creatively when working on projects using the STEM at Home KIT. Based on

these results, learning using the STEM at Home KIT on simple machine material is effective in training the creative thinking skills of students in grade VIII SMP Negeri 13 Pekanbaru.

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