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The effectiveness of lesson plan (RPP) in improving science generic skills through STEAM-based learning on human respiratory system material in junior high school

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Abstract

The STEAM (Science, Technology, Engineering, Art and Mathematics) learning model that links the fields of science, technology, engineering, art, and mathematics, so that students are given a holistic understanding. Collaboration, cooperation and communication will appear in the learning process because this approach is carried out in groups. This study aims to determine the effectiveness of the Lesson Plan in improving STEAM-based Science generic skills in the Human Respiratory System material for Class VIII Junior High School. The development of this lesson plan refers to an educational problem solving model which consists of five phases or stages, namely the initial investigation phase, the design phase, the realization phase, the test phase, evaluation, and revision and implementation. Trial of lesson plan products that have been developed and declared valid was carried out in class VIII of SMP Negeri 24 Banjarmasin as many as 16 students. The instrument for collecting data on students' generic science skills was a written test. The results showed that the five aspects of Students' Science Generic Skills include formulating skills problems, formulating hypotheses, designing experiments, analyzing data and making conclusions always increases at each meeting and the value obtained is in the High category. This result is reinforced by the teacher's response with very good category.

Abstrak

Model pembelajaran STEAM (Sains, Technology, Engineering, Art and Mathematic) yang mengaitkan bidang ilmu pengetahuan (sains), teknologi, teknik, seni, dan matematika, sehingga siswa diberikan pemahaman holistik. Kolaborasi, kerja sama dan komunikasi akan muncul dalam proses pembelajaran karena pendekatan ini dilakukan secara berkelompok. Penelitian ini bertujuan untuk mengetahui efektifitas Rencana Pelaksanaan Pembelajaran (RPP) dalam meningkatkan keterampilan generik Sains berbasis STEAM pada materi Sistem Pernafasan Manusia Kelas VIII SMP. Pengembangan RPP ini mengacu pada model pemecahan masalah pendidikan yang terdiri dari lima fase atau tahapan, yaitu fase investigasi awal, fase desain, fase realisasi, fase tes, evaluasi, dan revisi serta implementasi. Uji coba produk RPP yang telah dikembangkan dan dinyatakan valid dilakukan di kelas VIII SMP Negeri 24 Banjarmasin sebanyak 16 orang siswa. Instrumen pengumpulan data keterampilan generik sains siswa dengan tes tertulis. Hasil penelitian menunjukkan bahwa lima aspek Keterampilan Generik Sains Siswa meliputi keterampilan merumuskan masalah, merumuskan hipotesis, merancang percobaan, menganalisis data dan membuat kesimpulan selalu meningkat pada setiap pertemuan dan nilai yang diperoleh kategori tinggi. Hasil ini diperkuat dengan respon guru dengan kategori sangat baik.

A. Introduction

As in Permendikbud No 22 of 2016, Lesson Plan is learning's activity plan for one or more meetings in face to face. Lesson pland was developed from the syllabus to direct student learning activities in attempt to achieve Basic Competence (KD). Every educator in the education unit is obliged to compile a complete and systematic lesson plan so that learning progress interactively, inspiring, fun, challenging, efficient, motivating students to participate actively, also providing sufficient space for initiative, creativity, and independence in accordance with the talents, interests, and physical also psychological development of students. Lesson Plan is prepared based on KD or sub-themes which are held in one or more meetings. The objectives of the lesson plan are to: (1) simplify, expedite and improve the results of the teaching and learning process; (2) by compiling learning plans in a professionally, systematicly and efficiently, teacher will be able to see, observe, analyze, and predict learning programs as a logical and planned framework (Kunandar, 2011).

The importance of preparing lesson plans that are professionally, systematically, and efficient, can improve the ability of educators to see, observe, analyze, and predict learning programs as a logical and planned framework.

(Dwimayanti et al., 2020) On the other hand, through the lesson plan, the level of the teacher's ability to carry out his profession can also be known. The effectiveness of the learning process carried out is determined by how much planning we have compiled and perfected with learning methods that are in accordance with the components of the lesson unit to be delivered, so that the process of achieving these goals is more focused.

The STEAM (Science, Technology, Engineering, Art and Mathematical) learning model that links the fields of science, technology, engineering, art, and mathematics, so that students are given a holistic understanding. Learning with the STEAM approach is contextual learning, where students are invited to understand the phenomena that occur close to themselves. STEAM approach encourages students to learn to explore all their abilities, in their own way. STEAM will also bring out different and unexpected works from each individual or group. In addition, collaboration, cooperation and communication will appear in the learning process because this approach is carried out in groups (Tritiyatma, 2016). With the implementation of STEAM-based lesson plans, it is hoped that it will further encourage student participation in the learning process also result in higher student achievement. Therefore, researchers want to develop lesson plans that are suitable with the development of school curriculum in STEAM-based junior high schools (Science, Technology, Engineering, Art and Mathematics). The material that will be discussed in the development of this Lesson Plan is about the Human Respiratory System.

According to Puskur (2007) essentially the science learning process has aspects, scientific attitudes, scientific processes, scientific products, and science applications related to the application of scientific methods and scientific products in everyday life. This is confirmed according to 2013 curriculum which implies that the desired learning process is learning that prioritizes personal experience through observation (listening, seeing, reading, listening), association, asking, concluding and communicating. It is also stated that the desired learning process is a learner-centered learning process (student centered active learning) with a contextual nature of learning (Sudrajat, 2013). In line with that, Biological Science education is expected to be a vehicle for students to learn about themselves and their natural surroundings, which emphasizes providing direct experience so that students need to be trained to develop skills as a provision in exploring and understanding the natural surroundings.

According to Sunyono (2009) that basically the way of thinking and acting in studying various scientific concepts and solving problems, as well as learning theoretically in class and in practice is the same (following the Principles of the Triangle of Natural Studies), that is the principles regarding components -natural components studied in science. The principle of triangle's natural study is useful for determining natural indicators that indicate what principles/theories (formulas) that is being applied to a scientific problem, because there are generic competencies (Nefianthi, 2016). Generic competencies are competencies that are used in general in a variety of scientific work. Generic competencies are derived from process skills by combining these skills with natural components learned in science contained in the structure of the concept or principle of triangle's natural study. The characteristic of science learning through science generic skills is to provide students with generic science skills as the development of higher thinking skills.

Based on the identification of the problems described above, this research was conducted to obtain data on the effectiveness of lesson plans in improving generic science skills through steam-

based learning on the human respiratory system material in class VIII SMP. The development of STEAM-based Lesson Plans on the Human Respiratory System material is expected to be able to increase student activity, train students' skills, and improve students' effective, cognitive, and psychomotor abilities. This learning is expected to further turn on student participation in the learning process and produce higher student achievement.

B. Material and Method

Type of Research

Based on the problems and research objectives set, this research is a research and development or *Research and Development* (R & D), (Plomp, 1997). This research is more focused on knowing the effectiveness of the STEAM-based Lesson Plan in improving science generic skills in the Human Respiratory System material for Class VIII Junior High School. The development of this lesson plan refers to the Plomp educational problem solving model, (1997) which consists of five phases or stages, namely the initial investigation phase, the design phase, the realization phase, the test phase, evaluation, and revision also implementation.

Research Time and Place

The time of the research was carried out in March-May 2021. The research was carried out in class VIII of SMPN 24 Banjarmasin.

Data collection and data Analysis Techniques

The trial of the Lesson Plan product that was developed and declared valid with a validity value of 4.4 was carried out in class VIII of SMP Negeri 24 Banjarmasin as many as 16 students. The trial was conducted by teachers who teach science subjects. The instrument for collecting data on students' generic science skills was a written test. The data analysis technique of the effectiveness of the STEAM-based Lesson Plan is determined by the indicators of the Generic Science Skills of students being trained or increasing after participating in learning activities with a minimum criterion of High. And the teacher's positive response to the lesson plans used are at least good criteria. The score interval for determining the success rate of the research is categorized as follows.

Table 1 Interval & Category of Science Generic Skill Achievement

Interval	Category
0 ≤ TPS < 40	Very Low
40 ≤ TPS < 60	Low
60 ≤ TPS < 75	Middle
75 ≤ TPS < 90	High
90 ≤ TPS < 100	Very High

Table 2 Interval & Teacher Response's Category towards Lesson Plan

Interval	Category
0 ≤ Response ≤1	Very Poor
1 < Response ≤ 2	Poor
2< Response ≤ 3	Fairly Good
3 < Response ≤ 4	Good
4 < Response ≤ 5	Very Good

C. Results and Discussion

1. Result

Data on students' generic science skills for each indicator in each meeting are presented in Table 2 below.

Table 3 Summary of Students' Science Generic Skills Results

No.	Skill Indicator	Skores			
		P1	P2	P3	P4
1.	Formulate Problem	82,19	82,81	85,0	86,25
2	Formulate Hypotheses	82,19	83,75	82,5	83,75
3.	Designing Trial	82,81	80,31	83,12	83,44
4.	Analyze Data	80,94	82,50	84,06	85,0
5	Make Conclusion	80,31	82,19	82,50	83,31
Average		**81,81**	**82,31**	**83,44**	**84,35**
Category		**High**	**High**	**High**	**High**

Description:
P1 = Meeting 1; P2 = Meeting 2; P3 = Meeting 3; P4 = Meeting 4

The teacher's response data to the STEAM-based Lesson Plan used in the learning process is as shown in table 4 below.

No.	Rated Aspect	Meeting				Average
		P1	P2	P3	P4	
1.	Indicator	4.50	4.75	4.75	5.00	4.75
2	Content	4.67	4.83	4.83	5.00	4.83
3.	Language	5.00	5.00	5.00	5.00	5.00
4.	Time	5.00	5.00	5.00	5.00	5.00
5	Learning Method	5.00	5.00	5.00	5.00	5.00
6.	Closing	5.00	5.00	5.00	5.00	5.00
Average		**4.86**	**4.93**	**4.93**	**5.00**	**4.93**
Category		**SB**	**SB**	**SB**	**SB**	**SB**

Description:
P1 = Meeting 1; P2 = Meeting 2; P3 = Meeting 3; P4 = Meeting 4

2. Discussion

Based on Table 3 above, it is known that the Science Generic Skills data obtained in this study

indeed proves that the Lesson Plan used can improve students' generic science skills. This can be seen from the generic science skills of students from Meeting 1 to Meeting 4, which is seen from the indicators of Formulating Problems, Formulating Hypotheses, Formulating Experiments, Analyzing data, and Making Conclusions at Meeting 1 the value of each of these indicators is 82.19, 82.81, 82.81, 80.94, and 80.31. So that the average generic science skill of students is 81.81 with High criteria and the data continues to increase to an average of 82.31, then 83.44, and Meeting 4 is 84.35 all of which reach the High criteria.

At the first meeting, students' skills in analyzing data were only 80.94 and increased at the fourth meeting to 85. Likewise, making conclusions from 80.31 increased to 83.31 because the students are still not maximally trained to think critically in analyzing data and making conclusions from the experiments they have done. Meanwhile, in terms of designing the experiment, it decreased at the second meeting with a value of 80.31, because students were still not trained to understand how to measure or calculate respiratory volume capacity in humans, but increased again in the next meeting to 83.12 and 83.44. Hidayani's research (2017) that the STEAM model uses a method based on focusing on practical problems, not on theoretical problems. By doing practice, students understand better because they are directly involved in the project they are making. So the STEAM model can experience a significant increase in learning outcomes.

The characteristic of learning science through science generic skills is providing students with generic science skills as the development of higher order thinking skills. The results of this study are in line with research conducted by Zaini and Hidayati (2019) that students' critical thinking skills (formulating problems, formulating hypotheses, collecting data, analyzing data, and making conclusions) through design learning are good. PjBL-based STEAM learning has a significant effect on students' creative thinking and critical thinking skills (Fitriyah & Ramadani, 2021).

The results of previous research by Choiriah (2019) stated that there were significant differences in students' scientific attitudes and understanding between students who used STEAM-based learning and students who studied using conventional learning.

According to Tritiyatma (2016) the STEAM approach seeks students to build their own understanding of the learning process by integrating several fields of study in real life. STEAM also explores students' abilities using related technologies, which students can choose or prefer and communicate in an engaging way like art. Understanding of learning with STEAM can also be obtained by students through group work with inquiry. In this case, students learn to seek and find concepts that are being studied independently, both individually and in groups.

In development research in the field of learning, indicators to state that the implementation of the model is said to be effective, for example, can be seen from the components: (1) student learning outcomes; (2) student activities; and (3) the ability of students to master the material, such as creative thinking. These components can differ from one research to another depending on the definition (affirmation of terms) which is called effective in the study Nieveen, 1999 (dalam Rocmad 2012). As the data obtained in this study, one of the indicators of success is the increase in students' generic science skills from each meeting. This proves that the Lesson Plan used can develop students' generic science skills, at high criteria.

According to Nefianthi (2015) generic science skills as measured by written tests include skills; 1) formulating problems, 2) formulating hypotheses, 3) designing/implementing experiments, 4) analyzing data, and 5) making conclusions. Socio-cognitive and personal skills that are observed with observation sheets during the learning process of sociocognitive skills include collaboration, creativity, written communication, oral communication, personal skills including responsibility, initiative, and independence, can improve student learning outcomes.

The results of Nefianthi's research (2016) with the title "Assessing Students' Science Generic Skills Through the KNoS-KGS learning model" in this study, the assessment instrument is in the form of an assessment of science generic skills which includes indicators of science generic skills. Learning involves cognitive and social skills. Assessment is carried out using a test (written tests) and non-test (observation sheets). The results showed that all indicators of science generic skills assessed had increased and all indicators were measured as the data obtained from this study.

The generic competencies used in understanding concepts and solving formal problems are also used in conducting science experiments. One science process can consist of several generic competencies. For example, the observing process consists of identifying the phenomenon in question, dividing the phenomenon (if it is a complex phenomenon), identifying natural

indicators, and measuring the parameters that must be measured.

As explained in the Regulation of the Minister of Education and Culture (Permendikbud) Number 81A of 2013 concerning the implementation of a curriculum that emphasizes process skills, it consists of five main learning experiences, namely: (1) observing, (2) asking questions, (3) collecting information, (4) associate, and (5) communicate (Nurdiansyah, 2016). Learning that emphasizes student-centered process skills is proven to increase the achievement of learning objectives.

From Table 4 the data on the teacher's response to the Lesson Plan used from the first meeting to the fourth meeting, positive data was obtained, this can be seen from the average response given by the teacher on criterion 4.93, which is very good. From the positive response given by the teacher when using the Lesson Plan in the learning process. The teacher said that in using the lesson plan in the learning process, not only students who felt happy in participating in learning but the teacher also felt helped because in learning the teacher did not need to explain the material as in conventional learning, but students could master the material and grow a positive attitude and high-level skills in learning process.

The results of a similar study by Wahyuni (2021) that the application of STEM-based learning has the impact of creating a more active learning atmosphere, can increase student interest in learning so that it has an impact on improving learning outcomes.

According to Colker and Simon (in DeJarnette, 2018) STEAM is important because it can help teachers combine multiple disciplines at the same time and introduce learning experiences that allow children to explore, ask questions, research, discover, and practice innovative building skills. Incorporating art into the STEAM discipline came naturally because of STEAM's emphasis on creativity and design.

Sumantri (2016) asserts that the success of students' learning is largely determined by the plans made by the teacher. Therefore, the implementation of good learning requires good program planning.

The implementation of the STEAM learning model in online learning is able to develop children's ability to think critically, analytically, confidently, productively, responsible and creatively. And can be applied at various levels of education (Sa'ida, 2021).

D. Conclusion

Based on the data from the research and discussion that have been presented, and the criteria for the effectiveness of the STEAM-based Lesson Plan to improve science generic skills, as well as the positive response from the teacher, it can be concluded that the Lesson Plan can be said to be effective, this can be seen from the indicators of research achievement, which are the Generic Science Skills of Students who always increase at each meeting and the value obtained in the High category/criteria, as well as the data on the teacher's response to the Lesson Plan with an average value of 4.93, the criteria is very good.

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