CHAPTER I
INTRODUCTION

1.1.Background

Todays, we are entering the revolution industry 5.0 where technology could be replace almost every aspect of life especially science and technical things and its being reason of students' softskills and hardskills should be enhance (Muliani et al., 2022). In revolution industry 5.0, even from revolution industry 4.0, the 21st century skills is the most important skills. In the 21st century, education prioritizes both students' learning outcomes and the necessary skills to meet the needs of the time (Anggraeni &Suratno, 2021). The skills that include in 21st century skills are critical thinking, communication skills, creativity, problem solving, perseverance, collaboration, information literacy, technology skills and digital literacy, etc. 21st Century skills not only enhance academic accomplishment but also enable individuals to adapt and survive in a rapidly changing world (Stehle & Peters-Burton, 2019).

Due to the need to build 21st Century skills, Indonesian Government especially Ministry of education at 2022 made new curriculum which is "Kurikulum Merdeka" to be the solution. Kurikulum Merdeka is expected to be a solution to increase student learning motivation by provides freedom for students to learn according to their wishes and keep up with the times, then students will be more enthusiastic and more active in teaching and learning activities. But Indonesian students PISA result announced at December 2023 is below the world score average altought it is up 5-6 rank better than PISA result from 2018. Especially in science, students understanding is low because they have mindset that science is hard and the motivation to learn science is low.

Students understand that science is always related to their life, but students find it difficult to learn especially for physics. One of physics topic that students have very much misunderstanding is in the concept of electricity. Several studies report that students have serious difficulties analyzing and describing electrical phenomena (Chang & Shieh, 2018; Jiang et al., 2018; Manunure et al, 2020). Students found to have some misconception. Quezada-Espinoza, at al (2023)

founds most of student misconception because they are often confuse whether the elements are in series or parallel, even when those elements are not connected in series or parallel. These difficulties make their interpretation of the circuits harder.

In 21st century skill, science process skill (SPS) always related with science. Science has its own characteristics including various challenges in the process of learning it (Hadzigeorgiou & Schulz, 2019). According to (Putra, 2013), Science is a scientific discipline that explains various natural phenomena and can be obtained after a series of observation and research processes. Science has several branches of science that can generally be divided into physics, chemistry, and biology. In the process of learning science, students must not only understand science in its content, but must understand the process of a phenomenon and master the skills of investigation (Science Process Skills) (Hadzigeorgiou, 2019). Therefore, in the process of learning science students not only learn in the form of products but students also need to learn about the process aspects so that students can understand the material as a whole.

Several research about students' science process skill (SPS) in Indonesia found that Indonesian students' SPS is low (Astika, 2022; Irwanto, 2018; Noviani, 2019). Astika (2022) found in the aspects of formulating hypotheses and applying concepts are very low (28,2 and 26,8) and the other aspects showed medium category but almost all aspects were below 50. Other research discovered that 56.75 of the students could answer SPS questions, but two out of three biology classes, or roughly 42.98 of the students, had lower results (Erkol & Ugulu, 2014). Other research held by Rumalolas (2021) to 52 students in Papua. The result of the research is the students have low score in some indicator, such as observing, formulating problems, formulating hypothesis, measuring, communicating, and make conclusion. The studies conducted by Widdiana (2018) showed low results in the ability to design investigations even though other aspects showed high results. According to her, it is possible that this occurs because students are accustomed to conducting experiments according to the procedures given by the teacher but students are not used to designing their own investigations. Meanwhile, the science process skill (SPS) is an important skill for students in high school before entering next level studies.

Basically, students already have the ability to ask questions, make hypotheses, observe, investigate, and interpret which include into the science process skills. Science process skills does not appear by itself, activities are needed to trigger the emergence of these skills (Savitri, 2017). School can be one of the choice to improve students ability in science process skill.

The attitude of students in learning science is very important when entering higher levels. According to previous research conducted by Fulmer (2019), students give a positive response when learning science when a cooperative learning method is applied where students work in groups or make small-group projects. Students gave a very positive response in learning science when they are actively involved in learning activities so that learning with constructivist methods and inquiry-oriented teaching is suitable for learning science (Juuti, 2010). In study held by Tiryaki & Adiguzel (2021), students have more enjoyment in learning science using STEM based learning rather than theoritical knowledge.

In order for students to understand easier, teachers are expected to create a learning framework that is fun for students (Agranovich & Assaraf, 2013). Because many science concepts are difficult to understand when verbally explained, the use of various teaching aids to provide concrete images and to visualize the concept is important teaching strategy (Korganci, 2014). But in the field teachers only focus on applying concepts through transferring information by memorizing. Brok (2011) in his research showed that students' level of interest in science is related to what happens in the classroom (how teachers make students interested in learning), as well as student motivation.

Students will be motivated to learn if they are in certain conditions, such as when they feel that learning is related to their own lives, when they feel they have control over their assignments, and when they feel what they are doing is in accordance with their interests. One way for students to feel that they are in this situation is to create a creative project where they can make designs and products that suit their interests but are still within the limits of the material (still related to the material being taught). Suciu (2014) stated in his paper that Creative climate, comprised of group and mentor; collateral passions; any form of game; contradictory talks with one's coworkers; guaranteeing the quiet required for

meditation during periods of creative trance are some factors that stimulate someone creative process.

Besides, science is not just a set of theories containing facts, but it is a creative thinking that has abstract concepts and requires a series of observation activities to support learning. Creativity, which is underestimated in many traditional educational institutions, is required for innovative thinking in any area (Bhandari, 2022). Today's modern school associates student creativity with various possible pedagogical differences. Students with visual, audio, or kinesthetic learning styles; students with the power of thought on the left or right brain; right- or left-handed students; students with reproductive or creative thinking; analytical-synthetic; vertical-lateral; will all get the same opportunity to develop their creativity at school (Suciu, 2014)

Several studies that have been conducted show that students' creativity levels are relatively low. This is proven by research conducted by (Purwati, 2022) which used data collection techniques, namely distributing questionnaires to students. Data analysis is in the form of descriptive analysis. The results of the research show that the percentage acquisition of creative thinking skills T1 (very low) was 44.8 , T2 (low) was 35.4 , T3 (medium) was 10.7 , T4 (high) was 5.6 and T5 (very high) namely 3.4 . Based on these results, it can be concluded that students' creative thinking skills are still relatively low. Initial findings Pursitasari, et al. (2022) that the average creative thinking ability of students is 38.32 in the low category due to less innovative learning implementation.

Anggrella (2023) also conducted the same research with the MI Muhammadiyah Gonilan object with the results that 42.45 had an average level of creativity, 25 were quite creative, 21.70 were less creative and 9.91 were not creative. Athifah, et al. (2019) also showed the same results. The results of this study showed that students' overall initial creative thinking abilities with a percentage of 63.7 were in the low category. The lowest aspect is the original aspect with a percentage of 51.67 and the highest aspect is the evaluative thinking aspect with a percentage of 73.12 . Usmeldi (2018) obtained initial research results which showed that quite a lot of students were less creative and demanded that their research be project based to increase this level of creativity.

One of the important components in improving the teaching and learning process in improving the education system is creativity. Creativity cannot develop by itself, it requires tools or media that can be used as a trigger for the development of creativity accompanied by the right support and direction from the teacher or companion. Educators must prepare a space for students to promote their experiences and follow their dreams (Kasmaienezhadfard, 2015). Educators and other specialists must focus on increasing creative levels by employing some techniques that take into account students' individual spirit, ability, and culture. (Baldensperger, 2014).

Students will be interested in learning if they feel learning is fun. This kind of learning approach can certainly create a classroom atmosphere that is too monotonous and static, while students at middle school age are adolescents who are in a happy phase to explore new things. A monotonous learning approach can create a negative stigma where students think that learning science is difficult. Therefore, a more interesting learning approach is needed by involving students in the process (Osborne, 2001).

One learning approach that involves students in the science learning process is STEAM-based Learning. STEAM-based learning is an integrated learning of science, technology, engineering, arts, and mathematics diciplines (Sanz-camarero,2023).This is a learning approach that involves aspects that support the improvement of students' science process skills and creative thinking abilities. One of the learning methods that is often used in applying the STEAM approach is project-based learning. In project-based learning, teachers create a project that requires students to work with each other to find the solution to real-word questions and problems. The project-based learning approach creates dynamic learning where learning becomes student-centered and emphasizes long-term learning (Ahmad, 2020).

Numerous studies about STEAM based learning conducted. The outcome of the study proves that there is an outstanding improvement in the cognitive level of creativity, which refects on fexibility, originality, elaboration, title and total after implementing STEAM project based learning (Shih-Yun, 2021). Besides, STEAM project based learning invites children to develop their ochilhood cooperation.

Social development is seen when children design and make products and it can be found in the discovery and application stage. The aspect of social development appeared along with children's ability to collaborate with others or their groups (Harjanty,2022). STEAM project based learning can be applied at every stage of education. The improvement of students learning outcomes in science learning and the improvement of students ability in problem solving and critical thinking is the proves of STEAM influence to students' learning (Chistyakov, 2023). Other studies that conducted previously show results where students show an increase in science process skills and creative thinking after learning using STEAM based learning. In a study conducted (Suryaningsih, 2021), students gave a good response to learning with the STEAM project-based learning method as indicated by high category results in science thinking skills and creative thinking. Another study was conducted by Nuriani (2020) showed the results that 95 of students felt more interested in learning science after carrying out learning activities using this approach. STEAM project-based learning can be used as alternative teaching strategies in all levels of science education.

The aim of this study is to enhancing students' science process skills and creativity on electricity topic through STEAM based learning. This study choose to have a research in electricity topic because there are much misconception about electricity among students. The project that carried out in this project is simple house electrical instalation which students have to make a miniature of the house and the electrical intalation of it using 2 different circuit. The participant of this research are middle school students with assumsion that the students never use STEAM based learning in their learning activity. Therefore, the novelty in this research is students' science process skills was assesed for both basic and integrated science process skills based on the self-made test item and rubric that has been through validation. To assesed students' creativity, the project was evaluated using the instrument for creative product analysis matrix (CPAM) indicator, and the findings were also evaluated by the teacher. It subsequently emerged if students could increase their creativity or not. More specifically, this research initiative intends to bridge this gap and uncover unknown aspects by investigating how the

simple house electrical intalation project, project-based learning, and STEAM education might transform educational experiences.

1.2.Research Problem

Based on the description in the background, the problem is stated " How the implementation of STEAM based learning enhancing students' science process skills and creativity in electricity topic?". To lead and limit the research, the research question can be defined such as:

1. How does STEAM-based learning improve students' science process skills on electricity topic?
2. How does STEAM-based learning improve students' creativity on electricity topic?

1.3.Research Objective

In order for this research to remain in accordance with the problems formulated, it is necessary to formulate clear research objectives. The purpose of this research can be described as follows:

1. To enhance students' science process skills after learning through STEAM-based learning on electricity topic.
2. To enhance students' creativity after learning through STEAM-based learning on electricity topic.

1.4. Operational Definition

In this research there are several variable terms used. In order not to misunderstand, the following is the definition of the variables of this study:

1. STEAM Learning

STEAM is a learning that combines science, technology, engineering, arts, and mathematics in one approach (Sanz-Camarero,2023). The project that will be made by students in STEAM learning is to make a home electrical installation. This project is an implementation of students' understanding of electricity topics ranging from series and parallel circuits, ohm's law, and electric current. The assessment will be done from the recording of learning process, worksheet analysis, and photos during the learning process.

The learning stages that carried out in the whole meetings are using 5E-STEAM, they are engagement, exploration, explanation, elaboration and

Evaluation (Anggraeni &Suratno, 2021). In engagement stage, students are given the explanation about the project using the problem that given by the teacher. Then entered the exploration stages. Students using their science process skills to analyzing the phenomenon and find out the solution, information, and materials to make the project. In this stage, students start to use their SPS including observing, investigating, making hypotheses and communicating their finding with their peers. Third is explanation stage. In this stage, students try to explain their project enganging to the concepts from the topic using their own words and teacher confirm or clarify their explanation. Next is elaboration stage. Students testing their own project by applying the concepts. Testing the project results included the electrical circuit condition and assessments included the presentation and analysis of the simple house electrical instalation project's outcomes. Last is evaluation stage. After testing and presenting their project, students make revision to the project based on teacher and peers suggestion then in the last meeting, teacher provides feedback.

To assess the implementation of STEAM based learning in class, teacher make a notes from every stages in every meetings. After that, students have an undirect interview on how their feels to learn using STEAM based learning.

2. Science Process Skills (SPS).

There are several skills included in SPS and are classified into two types, namely basic science process skills and integrated science process skills. The basic science process skills are applicable in both scientific and non-scientific contexts, whereas the integrated skills are the working behaviors of scientists and technologists (Jack, 2013). Skills included in basic process skills are comparing, observing, classifying, and communicating. While the skills included in integrated science process skills are inferring, predicting, hypothesizing, and defining variables.

In this study, to measure the level of students' science process skills, a pre-test and post-test were conducted. The pre-test was conducted at the 1st meeting before students learned the material about electricity to measure students' skills before treatment. Then in the 2nd, 3rd, and 4th meetings, students learned about electricity and made projects about home electrical installations. And at the last

meeting or 5th meeting, students were given a pot-test to measure the improvement of their science process skills after getting treatment. Besides the result from pretest and posttest, there is a rubric to assess the science process skills **.**

3. Sudents creativity

Utami Munandar (Suyatmi, 2014) states that creativity can be divided into three meanings, namely: First, the ability to create new conditions based on data, information, and existing elements (creativity), second, the ability to use available data or information, and third, the ability to reflect fluency, flexibility, and purity (originality) in developing and enriching ideas.

In this study, students' creativity was measured by making a home electrical installation project using an simple home design. During the research, students made two presentations where in the first presentation students will show the results of their project and explain how the process of making the project and if there are obstacles, students can convey these obstacles and receive input from the teacher and other friends. In the second presentation, students show their final project.

Assessment was conducted to measure the increase in student creativity using the Creative Product Analysis Matrix (CPAM) indicator. In addition, the assessment was also carried out by the teacher and filling in the students' worksheet.

1.5.Limitation of Problem

1. STEAM Learning

STEAM learning is a learning approach that integrates several diciplines such as science, technology, engineering, arts, and mathematics (Sanz-Camarero, 2023). As an extension of STEM learning, STEAM learning incorporates arts into learning activities so that STEAM learning focuses on improving students' imagination and creativity. One of the learning models that is often used for STEAM approach learning is project-based learning. The project carried out in this research activity is a miniature of simple house electricity instalation.

2. Science Process Skills

Science Process Skills in science help students in conducting investigations so that students can understand the theory of basic. In this study, only some skills

were observed. From basic SPS, the skills observed are the ability to observe and communicate. While the skills included in integrated SPS are inferring, hypothesizing, and defining variables.

In the research activities, two instruments were used to evaluate students' abilities. First is the test-items in the pre-test and post-test. The pre-test is given when students have not received any treatment, while the post-test is given when students have received treatment so that it can be seen the effect of treatment on students' SPS from the difference in pre-test and post-test results. The second instrument is an observation sheet that refers to the assessment rubric. The assessment is carried out as long as students get treatment using STEAM-based learning which in this case uses a miniature of simple house electricity instalation.

3. Students' Creativity

Creativity is one of important skills in 21st century skills. There are many studies about the impact for students' creativity from implementing STEAM-based learning in the classroom. This studies will investigate the three dimensions of creativity, resolutions, collaborations, and novelty. Assessing creativity will conduct using a CPAM rubric by Besemer and Trefinger (1981).

4. Electricity

This study has limitation to focus the research in several things. In electricity topic, the study will focus on dinamic electricity which students learn about electric current, electric circuit, and Ohm's law. The lessons are adapted to the school curriculum which uses the "merdeka" curriculum so that the introduction of topics can be done for Junior High School grade 8.

1.6.Research Benefit

1. Teachers

This research can help teachers determine suiTable learning activities on the topic of electricity. This research can also help teachers to jointly improve students' science process skills and make students more creative through projects.

2. Researcher

This study is useful for researchers because it will provide findings and resources about students' science process skills and creativity in the Electricity topic through STEAM learning at the junior high school level, as well as renew the

scientific literacy of younger generations. Additionally, with the inclusion of the arts, student creativity is described as a skill.

3. Students

This study is beneficial for the students because students can practice their science process skll and more understanding about electricity topic while making their project and create student's creativity in Art design. Students can apply the project in their daily lives inside and outside of school.

1.7.Organization of Research Paper

This research paper will be consist of five chapter

1. CHAPTER I : Introduction

This chapter explain about background of the research, research problem, limitation of the research, research benefit for students, teachers, and researchers.

2. CHAPTER II : Literature Review

This chapter consists of the theory needed as the base of the research. In this chapter, the theory about research will be explained such as the theory of STEAM-based Learning , Science Process Skills (SPS), Students' creativity, simple house electricity instalation project, and previous research which explain the this research.

3. CHAPTER III : Research Methodology

This chapter describes the research method, research design, population and sample, research instruments, data analysis, data collecting, and research procedure utilized to finish the research article.

4. CHAPTER IV : Result and Discussion

In this chapter, the research findings are explained by answering the research questions and hypotheses. Factors that may have influenced the research results are also explained in this chapter.

5. CHAPTER V : Conclusion

This chapter contains conclusions which are a brief explanation of the research results that have been described in the previous chapter. In addition, this chapter also contains implications of how the research is applied as well as recommendations for further research development.