

CHAPTER I

INTRODUCTION

1.1 Background of the Problem

Education has a crucial role in forming the next generation of a nation that is qualified, productive, innovative, creative, has character, and contributes to the life of society, nation, and state in today's modern era. There is a need to improve the quality of education that can be adjusted to the development of science and technology, which has entered the 21st century (Tipani et al., 2019). The development of the 21st century demands that everyone has various skills to produce quality human resources and compete in the increasingly rapid changes of times (Septiani et al., 2019). Students must possess educational skills in the 21st century, including critical thinking skills, collaboration, communication, and creativity, or 4C (Zubaidah, 2019).

Critical thinking skills are one of the 21st century skills that students need to have to deal with various problems and challenges in life (Nuryanti et al., 2018). This is in line with what was conveyed by the Partnership for 21st Century Skills (P21), Assessment & Teaching of 21st Century Skills (ATCS21S), and UNESCO that critical thinking skills are recommended to be developed in students to gain meaningful knowledge (Billah et al., 2021). Critical thinking is reasonable and reflective thinking that focuses on deciding what to believe or do (Ennis, 1985).

Critical thinking skills are thoughts that are always curious about existing information to achieve a deep understanding (Yustyan, Widodo & Pantiwati, 2015). Critical thinking skills need to be developed and possessed in students because, through critical thinking skills, students can deal with various problems, formulate, be innovative, and design appropriate solutions to the problems they face (Aini, 2020). In line with that, Tiruneh et al., (2018) also stated that students who have critical thinking skills could help the success of learning because critical thinking, apart from involving processes, also involves thinking skills such as predicting, analyzing, synthesizing, evaluating, reasoning so that students can achieve learning objectives.

Natural Sciences is a science closely related to everyday life, which helps students solve problems related to the natural surroundings. Science learning in the 21st century, based on the National Science Teacher Association, must be able to prepare students with critical thinking skills (Bybee, 2013). The critical attitude of students is the key to success for learning outcomes and benefits for the surroundings. The natural science dimension consists of processes, products, and attitudes related to critical thinking, whereas there are processes related to scientific methods, such as observing and exploring (Ramdani et al., 2020). Critical thinking plays a role in science learning to provide opportunities for students to increase criticism, arguments, and questions that train scientific thinking; encourage students to criticize or review existing knowledge; critically compare evidence; and dare to give feedback. Armed with critical thinking skills, teachers have helped prepare students for their future (Rahmawati et al., 2019).

In fact, the science learning process in Indonesia still needs to direct students to improve their critical thinking skills. Several international survey results prove that the critical thinking skills of Indonesian students are still relatively low. The 2018 PISA (Program for International Student Assessment) results for math ability and science ability, Indonesia is ranked 73rd and 71st out of 79 PISA participating countries (Organisation for Economic Co-operation and Development, 2019). The questions used in the PISA study consist of contextual problems in everyday life that require critical thinking skills to answer these questions (Suprayitno, 2019). Furthermore, in the 2015 TIMSS (Trend In International Mathematics and Science Study) research, Indonesia ranks 69th out of 76 TIMSS participating countries. TIMSS is an international study of mathematics and science achievement for junior high school students coordinated by The International Association for the Evaluation of Educational Achievement (Hadi & Novaliyosi, 2019).

Based on the results of pre-research conducted by researchers with results of observations and interviews with one of the science subject teachers on October 5, 2022, at SMP Negeri 37 Medan, it was found that students critical thinking skills had not been seen and were still relatively low. The results of observations and interviews obtained from the teaching and learning activities carried out by the teacher are: 1) the science learning process which is carried out is still dominant using the lecture method,

which makes students sit and listen to the material, tends to be passive and must always be directed by the teacher; 2) students have not been able to provide a simple explanation of the material; 3) students have not been able to answer the teacher's questions with their thoughts and only focus on memorizing theory; 4) students are less active in looking for other sources of information, the learning resources they use are only focused on textbooks so that the ability to find and process information is less trained. 5) learning with group activities has yet to be seen, learning is only teacher-centered and does not implement learning models in class 6) the students' low critical thinking skills, as seen from the acquisition of cognitive learning outcomes, the daily test scores for science subjects in 8th grade are still below the average, where the KKM (Kriteria Ketuntasan Minimal) for science subjects is 75. The average daily test scores for science subjects in classes VIII-A and VIII-B are 50 and 40.

The problems above indicate that the classroom learning process has yet to foster students' critical thinking. Based on research by Afifah et al., (2019), the lecture method, which only sits, listens, and is silent, makes students less able to absorb information obtained from the teacher and does not optimize students' roles in learning so that students are not actively developing and honing. Being active does not mean only having the courage to express opinions, but students have a basis for the opinions or questions submitted (Dywan & Airlanda, 2020). In addition, conventional learning methods do not use technology; this is not by the nature of science, which includes attitudes, processes, products, and applications (Hamdani et al., 2019). According to Fitriyani et al., (2020), learning that is still training in rote learning makes it easy for students to forget the material they have learned. Students will find it difficult to answer questions different from the example questions in their textbooks. As a result, when they repeat, they need help to answer the test questions correctly. Low learning outcomes indicate that students' critical thinking skills are also still low (Wahyuni, 2018).

Human Excretion System material is one of the materials contained in science subjects for class 8th grade in Junior High School. Human Excretion System material is abstract, where observations cannot be made directly, so students need an overview. Students can easily understand abstract material if the teacher uses tools such as visual aids or others that can provide an overview of the material being studied. In addition,

the Human Excretion System material requires thinking skills to understand the structure and function of each organ included in the human excretion system (Ratnasari et al., 2018). Based on the description of the problems above, efforts must be made to stimulate students' critical thinking skills. Choosing a suitable learning model can foster students' critical thinking skills. One learning model that can involve students actively in the learning process is the Project based Learning (PjBL) model (Rahmania, 2021).

The PjBL model is a learning model that starts with project planning and development by producing work as a product that can be presented and published (Patton, 2012). The PjBL model is one of the innovative learning models that have the characteristics of 21st-century education, namely critical thinking skills because it can activate a process that allows students to participate and find experiences that are different from before so that students can reflect opinions critically (Afifah et al., 2019). In addition, this learning model is suitable for use on abstract material such as Human Excretion System material because it can produce products in the form of teaching aids that can provide a direct description of the material being studied. Students will be able to analyze problems, provide critical responses to problems, and find solutions to these problems (Febriani et al., 2017). This learning model encourages students to be collaboratively responsible for accessing and managing information in solving problems (Rahmania, 2021).

In addition to the PjBL model, current learning needs to keep up with globalization by integrating Science, Technology, Engineering, and Mathematics (STEM) in building 21st-century skills (Kaleci et al., 2018). STEM is an interdisciplinary approach related to science, technology, engineering, and mathematics that can make students more actively involved in learning and develop an understanding of concepts (Badriyah et al., 2020). The habit of critical thinking can be done through learning that applies a scientific approach and studies teaching materials in an integrated manner, one of which is through the STEM learning approach (Zamista, 2018). The research results of Afifah et al., (2019) also state that the STEM learning approach that integrates the four sciences can logically improve students' thinking skills through the approach's characteristics.

This STEM approach fits the PjBL model (Fitriyani, 2020). Through the PjBL learning model, students will better understand the concept through making products. In contrast, through learning using the STEM approach, the design process will provide direct experience in making products and make students produce their best products (Tipani et al., 2019). The PjBL model combined with STEM can improve conceptual understanding and make students more actively involved in learning (Asri, 2021). Furthermore, Ruhimat's (2020) research results show that the PjBL model with the STEM approach can help improve problem sensitivity, deductive reasoning, inductive reasoning, mathematical reasoning, number facilitation, perceptual, speed, and precision control skills, which are applied to learning at school. The results of research conducted by Beier et al. (2018) explain that students' critical thinking skills will increase if teaching in schools is carried out using the PjBL model with an integrated STEM approach.

Based on the background of the problems above, the writer is interested in conducting research with the title **“The Effect of Project Based Learning Model with STEM Approach to Students' Critical Thinking Skill on Human Excretion System at SMP Negeri 37 Medan”**

1.2 Identification of Problem

Based on the background of the problems above, researchers can identify problems:

1. Learning with the teacher-centred method does not involve participants participating actively during teaching and learning activities in progress, does not use technology, and is not by the nature of science, which includes attitudes, processes, products, and applications.
2. Students' low critical thinking skills impact student learning outcomes which are still far below the KKM, where the KKM score for Natural Science is 75.
3. Students have yet to be able to explain answers to questions given by the teacher with their thoughts, only focused on memorizing the theory in the book.
4. During learning activities, learning with group learning activities has yet to be seen, so students quickly feel bored and sleepy.

1.3 Scope of Problem

The scope of the problem in this research is the influence of critical thinking skills using the PjBL model with the STEM approach on Human Excretion System at SMP Negeri 37 Medan.

1.4 Problem of Limitation

So that this research is more focused and not widened, the problem is limited to things:

1. The learning model used is the PjBL model with the STEM approach.
2. The variable measured in this study is students' critical thinking skill.
3. The subject matter studied is the Human Excretion System in the Even Semester of 8th grade at SMP Negeri 37 Medan.

1.5 Problem Formulation

Based on the background above, the formulation of the problem in this research:

1. Is there any effect of the PjBL model with the STEM approach to students' critical thinking skill on Human Excretion System at SMP Negeri 37 Medan?
2. How much effect does the PjBL model with the STEM approach to students' critical thinking skill on Human Excretion System at SMP Negeri 37 Medan?

1.6 Research Purposes

Based on the formulation of the problem above, the purpose of this research:

1. To determine the effect of the PjBL model with the STEM approach to students' critical thinking skill on Human Excretion System at SMP Negeri 37 Medan.
2. To determine how much effect of the PjBL model with the STEM approach to students' critical thinking skill on Human Excretion System at SMP Negeri 37 Medan.

1.7 Benefits of Research

The benefits of this research are:

a) For Teachers:

1. Can be used as an improvement in the process of teaching and learning activities so that learning outcomes are as expected.
2. Motivating teachers to apply a variety of learning models so that learning materials become more interesting.
3. Provide information to teachers about the benefits of the PjBL model with the STEM approach as a good learning model to be applied especially in science subjects.

b) For Students:

1. The PjBL model with a STEM approach can help stimulate students' critical thinking skills in science learning, especially the material of the Human Excretion System.
2. The PjBL model with the STEM approach provides new experiences and trains students to develop their critical thinking skills through the process of making products in learning.

c) For Researcher:

1. Get an overview of the application of the PjBL model with the STEM approach to students' critical thinking skill.
2. Gain experience in testing learning models in schools.
3. Get the opportunity to apply the knowledge gained in the world of education later.

d) For Other Researchers:

1. As a contribution of ideas for lecturers and managers of educational institutions in improving the quality of education, especially in science learning.
2. As a material consideration for other researchers in researching problems related to this research.