CHAPTER I

INTRODUCTION

1.1 Background

Science education is a crucial subject in the modern education system as it promotes critical thinking, problem-solving, and technological literacy. Science education allows students to gain a better knowledge of how and why things function. The primary goal of science education is to instill a belief in the Almighty God based on His creation's existence, beauty, and order. This primary goal is continuously pursued through various strategies (Darmana, 2012). Science education is closely related to technology. Technology can assist and support the development of society. This condition makes it possible to integrate STEM (Science, Technology, Engineering, and Mathematics) in science education (Ariyatun & Octavianelis, 2020).

STEM education provides a comprehensive insight into science learning because it trains students' reasoning skills to enhance the higher-order thinking skills needed for 21st-century education (Djulia & Halim, 2021). STEM education can help students plan, build, and use technology effectively, which will enhance their affective, psychomotor, and cognitive abilities (Kapila & Iskander, 2014). Research results show that STEM can improve conceptual knowledge and high-level thinking skills (Cahyaningsih & Roektiningrum, 2018). Furthermore, research results also prove that the STEM approach maximizes students' active engagement in seeking and discovering the core of the taught material (Prismasari et al., 2019).

STEM learning requires students to innovate, discover or design new things, understand the topic by themselves, think logically, and master technology. Based on the 21st-century education paradigm, there are several competencies and skills that students must possess, including Critical Thinking, Creativity, Collaboration, and Communication. Especially in this era of the fourth industrial revolution, education is in an era of automation in almost all fields. Technology and new approaches that fundamentally combine the physical, digital, and biological worlds have changed human lifestyles and interactions. This is accompanied by an acceleration of knowledge growth (Djulia et al., 2021).

Teachers are the key to improving the quality of education, and the challenge for a teacher is to provide a learning system that will produce the best graduates by keeping up with the times, utilizing technological and scientific developments, and integrating their knowledge and skills while being competitive (Mardita et al., 2022). In line with this, the Ministry of Education and Culture emphasizes that the 21st-century learning paradigm is focused on students' ability to seek information from various sources, formulate problems, think analytically and collaboratively, and collaborate in problem-solving.

The achievement of learning goals can be seen through the improvement in students' learning outcomes and their self-efficacy. Students' learning outcomes refer to the academic achievements they attain through exams, assignments, and active participation in asking and answering questions that support the acquisition of these learning outcomes. In academic circles, there is often the notion that the success of education is not determined solely by the grades students receive on their report cards or diplomas, but rather, success in the cognitive domain can be determined through a student's learning outcomes (Dakhi, 2020).

Self-efficacy refers to an individual's belief in their ability to perform a certain behavior (Zagoto, 2019). According to Bandura, self-efficacy can drive engagement in learning activities that can influence levels of achievement and motivation. This perspective emphasizes that self-efficacy is an important factor that can support a student's academic achievement. Students who aim for high academic achievement must have high self-efficacy in learning because self-efficacy can affect their performance and resilience in completing tasks at school (Mukti, 2019).

Data from the 2018 PISA (Program for International Student Assessment) indicates a score of 396 for the science proficiency of Indonesian students, with 40 percent of Indonesian students still performing below the expected minimum proficiency level (PISA, 2019). Research by Nofiana and Julianto (2018) revealed that the science literacy of junior high school students in terms of content, process, and context aspects is relatively low.

Based on the results of observations and interviews with science teachers conducted at SMP Negeri 37 Medan, it has been found that in the actual implementation of science teaching, particularly in grade VIII, teachers are already

using a scientific approach in line with the 2013 curriculum. However, in practice, educators have not yet made students as the center of the learning process, which means that educators still dominate the teaching activities, leading to passive participation from students and a lack of initiative in developing their thinking and sharing their ideas.

The teaching models and approaches used by educators lack variety and do not effectively guide students in solving real-life problems, resulting in monotonous lessons. The translation of learning materials that need to be contextualized to everyday life phenomena also poses difficulties for many students in understanding the subject matter. As a result, students' learning outcomes and their self-confidence or self-efficacy are low. In the field, teachers have already introduced simple experiments in their lessons, accompanied by reference videos related to science and technology aspects. However, these lessons have not yet been connected to other science knowledge such as mathematics and engineering. There is a need for a more holistic and integrated approach to STEM (Science, Technology, Engineering, and Mathematics) education that incorporates all these elements to provide a well-rounded and engaging learning experience for students (Hasruddin & Evi, 2020).

The low science learning outcomes of students can be observed from their cognitive performance, specifically from daily science test scores that are below or unable to reach the Minimum Mastery Criteria (MMC) set at 75. Similarly, in terms of self-efficacy, students do not fully believe in their abilities. In terms of the level of difficulty or magnitude, students tend to prioritize solving questions they consider easy and may ignore difficult questions or not respond to challenging questions posed by the teacher. In terms of the self-efficacy level of the generality, many students prefer to remain silent during the learning process, even when the teacher provides opportunities for questions. This is due to the relatively low self-confidence of students. In terms of strength, students often request extensions for completing assignments and may seek ways to simplify tasks. For example, when the teacher asks students to draw the circulatory system mechanism, students may request to print out the picture from the internet instead.

The topic of the human circulatory system was chosen because it is one of the subjects in the 8th-grade science curriculum at SMP Negeri 37 Medan that requires a

practical approach related to everyday life issues. The human circulatory system involves numerous components, including circulatory organs, structures, functions, and the processes of blood circulation that occur within the body. These concepts are abstract and cannot be directly observed with the naked eye, which can lead to difficulties in comprehending the subject matter. As a result, students often struggle to understand the material, resulting in low scores on daily quizzes.

The low learning outcomes in daily quizzes on the human circulatory system might be attributed to the teaching methods delivered by the teacher, which might lack engagement due to the conventional and monotonous methods. Additionally, instructional strategies may not be fully optimized, and the utilization of teaching media may not be maximized. The use of conventional methods that do not encourage active student participation in the learning process can lead to a dull classroom atmosphere, and students may have difficulty understanding the subject matter effectively.

Building upon this issue, one of the efforts to improve learning outcomes and student self-efficacy is to create a supportive learning environment. Low learning outcomes in schools can be attributed to the lack of interaction between students and educators, in addition to the use of teaching models that lack variety, leading to a lack of enthusiasm among students to engage in the learning process. This can, in turn, trigger low self-efficacy among students, which has an impact on their learning outcomes.

One of the efforts that can be taken to solve the existing issues is the implementation of an appropriate learning model and the learning approach. Self-efficacy and learning outcomes can be enhanced by improving the quality of the learning process. Additionally, enhancing student learning outcomes in the classroom can be achieved through alternative forms or models of learning designed according to the conditions of the learners, thus reflecting active student engagement in the learning process (Cahyaningrum, et al 2019). To maximize learning, teachers can use a learning model based on constructivism, such as Problem-Based Learning (PBL). The PBL model requires students to cultivate the foundations of scientific thinking, train them to acquire knowledge, solve problems, develop their learning methods, and participate in teamwork and collaboration (Diani et al., 2019; Yuliati et al., 2018). PBL

has the potential to increase self-efficacy and learning outcomes because it is grounded in constructivism, where effective learning occurs when learners actively reconstruct their knowledge through learning experiences (Yolantia, et al., 2021). Moreover, PBL prepares learners to think critically and analytically, and to seek and utilize appropriate learning resources (Yulianti & Indra, 2019). PBL can enhance self-efficacy and learning outcomes as this learning model requires the active involvement of all students in the learning process. Learning through PBL modules will stimulate students to learn through experiences, providing them with sample opportunities to search, discover, and formulate concepts related to the learning material.

In addition to the selection of the learning model, the approach used to teach a subject is also important. One approach that teachers can use is the STEM (Science, Technology, Engineering, and Mathematics) approach. The integration of STEM into education is believed to have a positive impact on learning activities and outcomes (Madyani, et al., 2019). STEM learning provides students with deep insights, especially regarding technology. Interestingly, the STEM approach involves engineering within it. Students are trained to design, assemble, draw, and engage in other activities, so they understand the procedures for solving problems (Permanasari, 2016).

Activities in the STEM-PBL model (Science, Technology, Engineering, and Mathematics - Problem-Based Learning) are capable of developing cognitive learning outcomes and self-efficacy for students because these activities encourage students to utilize their thinking abilities in solving the presented problems (Cahyaningsih, et al 2018). The use of the PBL integrated with the STEM model can also enhance collaborative, complex problem-solving abilities (Bybee, 2013; Lin et al., 2015) Critical thinking, problem-solving skills, literacy, creativity, self-efficacy, and science learning outcomes can all be improved through effective science education. The application of the PBL integrated with the STEM model is currently considered an alternative in science education, from elementary to higher education, as it can help students develop their potential to face global competition.

Based on these considerations, the researcher is interested in the research title: "The Influence of Problem-Based Learning (PBL) with a STEM Approach on the

Improvement of Learning Outcomes and Self-Efficacy of Eighth-Grade Students at SMP Negeri 37 Medan on the Topic of the Human Circulatory System."

1.2 Problem Identification

Based on the background above, the identified problems are as follows:

1. Low student learning outcomes in the topic of the human circulatory system are caused by learning activities that do not concentrate on real-life problems., thus requiring a teaching model such as problem-based learning model that can help students solve everyday life issues and improve cognitive learning outcomes.
2. Science classrooms are deficient in interactivity and remain largely focused on the teacher, resulting in decreased student self-confidence when it comes to accomplishing tasks related to the human circulatory system topic. Therefore, the integration of STEM into the learning process is needed.

1.3 Scope of Problem

The scope of this study is the Learning Outcome and Self- Efficacy of students in the Human Circulatory System using the Problem-Based Learning model with the STEM approach in class VIII of SMP Negeri 37 Medan.

1.4 Problem Limitation

Based on the background and problem identification above, the research problem in this study is limited to:

1. The subjects of this study are eighth-grade students learning about the human circulatory system at SMP Negeri 37 Medan.
2. The teaching model used is the Problem-Based Learning (PBL) model integrated with the STEM approach, and its impact on improving students' learning outcomes and self-efficacy is examined.
3. Science learning outcomes measured are related to cognitive learning. The self-efficacy measured is related to the affective learning aspect.
4. The subjects of this study are eighth-grade students studying the human circulatory system at SMP Negeri 37 Medan.

1.5 Formulation of Problem

The research problem statements for this study are as follows:

1. Is there an influence of applying the Problem-Based Learning model integrated with STEM approach on the cognitive learning outcomes of eighth-grade students studying the human circulatory system at SMP Negeri 37 Medan?
2. Is there an influence of applying the Problem-Based Learning model integrated with STEM approach on the self-efficacy of eighth-grade students studying the human circulatory system at SMP Negeri 37 Medan?

1.6 Objective of Research

The research objectives of this study are as follows:

1. Determine the effect of the Problem-Based Learning (PBL) model with a STEM Approach on the Learning Outcomes of Eighth-Grade Students at SMP Negeri 37 Medan on the topic of the human circulatory system.
2. Determine the effect of the Problem-Based Learning (PBL) model with a STEM Approach on the Self-Efficacy of Eighth-Grade Students at SMP Negeri 37 Medan on the topic of the human circulatory system.

1.7 Benefits of Research

The contributions generated from this research are as follows:

a. Theoretical Contribution

The results of the research are expected to provide insights and information regarding cognitive learning outcomes and students' self-efficacy in science education, as well as contribute to the understanding of the importance of STEM integration, particularly in teaching topics related to the human circulatory system.

b. Practical Contribution

1. For Researcher

   This research contributes to the researcher's experience and knowledge from the field and serves as valuable information regarding the extent of improvement in students' learning outcomes and self-efficacy when using problem-based learning with STEM integration for understanding the Human Circulatory System.

2. For Teachers

   This research offers valuable insights and considerations for educators in implementing effective teaching methods to enhance students' learning outcomes and self-efficacy. It guides using problem-based learning with STEM integration

3. For Students

   Improving students' learning outcomes and self-efficacy while broadening their knowledge and learning experiences in eighth grade at SMP Negeri 37 Medan.

4. For Readers

   The results of this research serve as additional knowledge and a reference for readers interested in understanding the impact of problem-based learning with STEM integration on students' learning outcomes and self-efficacy.

5. For Medan State University

   The results of this research results are expected to contribute to and enrich the academic literature and references related to the influence of problem-based learning with STEM integration on learning outcomes and self-efficacy in understanding the Human Circulatory System.

Overall, this research has both theoretical and practical implications that can benefit researchers, educators, students, readers, and the academic community, particularly in the context of science education and the integration of STEM approaches for teaching topics related to the human circulatory system.