

CHAPTER I

INTRODUCTION

1.1 Background of the Problem

The contemporary era, often referred to as the 21st century, witnesses a profound transformation driven by advancements in science and technology. This period is marked by a convergence of technologies that blur the boundaries between physical, digital, and biological realms. Consequently, human efforts are increasingly transitioning from manual to digital modes. Central to the objectives of 21st century education is the preparation of students to navigate swiftly evolving landscapes, ensuring they possess the requisite skills to thrive amidst rapid changes (Andriani & Masykuri, 2021). Both students and educators are compelled to keep pace with the accelerating developments in science and technology, adapting curriculum themes, refining teaching materials, and embracing innovative learning media to align with contemporary trends (Putra & Susilowibowo, 2021).

Utilizing technology within the teaching and learning framework enables the creation of diverse content and learning resources that educators can leverage during instructional sessions. This includes conceptualizing and implementing electronic-based teaching materials tailored to enhance the learning experience. Such endeavors resonate with the ethos of independent learning curricula, which prioritize effectiveness and student-centeredness while integrating technology seamlessly into the learning journey. In times of crises such as the COVID-19 pandemic, teachers are further challenged to adeptly integrate technology into the educational landscape, particularly within subjects like biology.

Science, as a discipline, encompasses systematically acquired knowledge about natural phenomena and structures. Presently, the realm of science education faces the challenge of cultivating high-quality human resources proficient not only in science and technology but also equipped with logical, critical, and creative thinking abilities, along with scientific literacy necessary for problem-solving in everyday life (Nurjannati et al., 2016).

The Organization for Economic Cooperation and Development (OECD) is a global institution dedicated to advancing international education. Through initiatives like the Program for International Student Assessment (PISA), OECD regularly

evaluates various aspects of education worldwide, including students' scientific literacy. Indonesia actively participates in the PISA assessments, as it seeks to benchmark its educational performance on an international scale (Kimianti & Prasetyo, 2019).

Scientific literacy, as defined by PISA, refers to the capability to utilize scientific knowledge, identify problems, and draw conclusions based on evidence to comprehend and make decisions regarding natural phenomena and human-induced changes in nature. Proficiency in scientific literacy is paramount for students to address societal issues and scientific challenges effectively (Muzijah et al., 2020). It serves as a crucial cornerstone in enhancing the quality of human resources, particularly within the realm of education, thereby fostering competitiveness among students in the contemporary era.

Despite the significance of scientific literacy, the reality falls short of expectations. According to PISA data, Indonesian students' scientific literacy remains categorized as low from 2000 to 2018, as their scores consistently fall below the average PISA scores (OECD, 2018). In 2000, Indonesia ranked 39th among 41 participating countries in the PISA assessment.

Furthermore, in 2003 Indonesia again participated in the assessment carried out by PISA and after carrying out the test the results were not much different from the previous year, namely Indonesia's ranking remained at the bottom, as well as the following year until now after Indonesia's participation for eighteen years the assessment scores were being given PISA still requires Indonesia to improve its current education system and management because the PISA report for 2018 Indonesia is in 74th position out of 79 countries that participated in the assessment carried out by PISA (Hewi & Muh.Saleh, 2020).

PISA underscores the importance of selecting science content that revolves around real-life situations, ensuring its relevance and applicability for 15-year-olds or elementary school children (Putri et al., 2021). In the context of junior high school education, science holds significant relevance as it equips students with the tools to actively engage in the advancements of science and technology in the 21st century. Therefore, it is imperative for schools to integrate scientific expertise into their learning frameworks.

The low levels of scientific literacy among Indonesian students stem from various factors. Contributing factors include deficiencies in school infrastructure, curriculum design, availability of textbooks, teaching methods, learning models, and the quality of human resources, all of which influence students' scientific literacy abilities (Purwani, Sudargo & Surakusumah, 2018). Moreover, the learning environment in many middle schools fails to foster scientific literacy, as teachers predominantly rely on traditional teaching methods. Science education often emphasizes rote memorization of concepts, principles, and formulas, neglecting the development of problem-solving skills—a key component highlighted in the 2013 curriculum (Yusmar & Fadilah, 2023).

Teachers play a significant role in influencing students' scientific literacy abilities (Fakhriyah et al., 2017). Many educators rely on printed books or conventional teaching materials to deliver content, aiming for concise material that aligns closely with the curriculum. Engaging teaching materials are crucial in fostering students' enthusiasm for learning and acquiring new information (Rahmani, Mustadi & Senen, 2021). Previous studies, such as Astuti et al. (2021), have found that integrating E-Books into the learning process can generate a positive response, particularly in enhancing students' interest in learning and improving scientific literacy. Additionally, research by Ozturk (2021) suggests that E-Books have the potential to enhance children's language and literacy skills, including phonological awareness, word recognition, and learning fluency.

Science education plays a crucial role in cultivating students with scientific competence (Pratiwi et al., 2019). However, current scientific learning approaches often fail to effectively support the development of students' scientific competencies (Yuliati, 2017). Complex topics like the human digestive system pose challenges for students due to their abstract nature and difficulty in comprehension. Understanding the human digestive system entails designing processes, conducting experiments, recording data, and reporting results (Nainggolan et al., 2018). Mastery of this material requires students to analyze problems and contextual information related to the digestive system, there by linking theoretical concepts to practical applications during the learning process.

However, during the learning process students are unable to connect concepts with their daily application or lack scientific literacy skills in students, as well as difficulty understanding abstract concepts in the human digestive system material through the lecture method. This can be seen based on the results of observations that half of the students' grades did not meet the minimum completeness criteria (MCC). This is due to the lack of media that supports the implementation of more effective and efficient learning.

Therefore, to overcome this problem can be done by developing effective and efficient media. The solution proposed by researchers is the development of an E-Book based on Pedagogy Content Knowledge Technology (TPACK) which utilizes technological developments so that it is able to provide an overview of abstract material, making learning more interesting and interactive and increasing students' scientific literacy. Based on this, researchers developed an E-Book that can facilitate students to learn and train students' scientific literacy. The e-book developed in this research is a TPACK-Based E-Book.

E-Books, as described by Amalia and Kustijono (2019), are educational tools containing text and images aimed at delivering information to learners. To enhance interactivity, E-Books can be integrated with other digital media, incorporating elements like music, videos, slide shows, and photos (Mashfufah et al., 2019). This interactive approach to learning is likely to yield positive outcomes in terms of educational quality improvement (Latifah et al., 2020). Additionally, E-Books offer the potential to enhance students' scientific literacy skills and support independent learning initiatives, aligning with the principles of independent learning policies.

Various studies underscore the significance of employing teaching materials to enhance scientific literacy. Firdausy & Prasetyo (2020) found that interactive E-Books can effectively promote scientific literacy by offering engaging content that aids in the development of students' attitudes, determination, and depth of understanding. Moreover, interactive E-Books facilitate individualized learning experiences, thereby contributing to students' overall learning journey. Similarly, research conducted by Firdausy and Setiawan (2017) focused on developing Interactive Science E-Books aimed at boosting students' scientific literacy. These studies highlight the potential of

utilizing appropriate methods and media to augment students' literacy abilities in science.

The results showed that the increase in scientific literacy abilities occurred in the knowledge dimension by 51.5%, the competency dimension by 41.3% and the context dimension by 45.2% after testing the interactive E-Book developed by him on atomic, ion and molecular material. Both methods can improve students' scientific literacy skills. The same research was conducted by Hana Puspitasari et al (2021) by testing the effectiveness of interactive science E-Book in improving junior high school students' scientific literacy skills. The results show that interactive science E-Book are effective in improving students' scientific literacy skills (Puspitasari *et al*, 2021).

Flipbook is a type of E-Book that has the illusion of flipping the book. With unique flipbook features and diverse content, flipbooks can increase students' learning motivation (Andini, 2022). Flipbook media is a book resembling an album in digital form which contains learning material by combining text, images, colors and audio. Flipbooks are usually printed on paper and in physical form, but along with advances in science and technology, flipbooks can now be packaged and presented in digital format where there are multimedia elements that combine text, images, color, audio and animation (Puspitasari *et al*, 2021).

The advantage of this digital flipbook media is that it presents interesting material packaged beautifully in the form of words, images, colors and audio. The process of making and operating it is easy, it can be carried anywhere, and can increase student learning activities in a fun way. Apart from that, this digital flipbook media can provide a better visual experience and increase students' mastery of things that are abstract or cannot be presented in the classroom (Puspitasari *et al*, 2021).

Learning using interesting media certainly provides new experiences for students, apart from providing other meanings. Meaningful learning can occur if students are able to connect new knowledge from the surrounding environment with the knowledge gained at school. This is in line with Peaget's thinking, knowledge is the result of the human thinking process which is constructed from the process of experience. In science learning, students can gain meaningfulness if their scientific literacy skills show good results (Puspitasari *et al*, 2021).

According to several expert research results that have been described above and direct observations, in reality science learning, especially at junior high school level, still does not pay enough attention to processes in the knowledge aspect of explaining scientific phenomena, writing questions, investigating, and drawing conclusions based on existing facts so that it is still focused on read to understand the material, especially when learning online (Puspitasari et al, 2021).

Apart from digital teaching materials that will be applied to learning, there needs to be updates, for example in the approach used, one of which is the TPACK approach. TPACK integrates technology and the expertise possessed by a teacher to support the teaching and learning process related to pedagogy, content and knowledge. TPACK is oriented towards critical thinking skills in students and these skills must also be possessed by students, especially prospective teachers. These critical thinking skills are closely related to scientific literacy, because scientific literacy requires students to have these skills (Karira et al, 2022).

In the initial stage of the ADDIE model, known as data analysis, observations and interviews were conducted in the field. The findings revealed that the school implements an independent learning curriculum. However, the Appendix indicates low scores in Minimum Competency Assessment (AKM), suggesting inadequate scientific literacy among students. This deficiency can be attributed to teachers' reliance on traditional textbooks, lecture-based teaching methods, and insufficient availability of resources to support scientific literacy in the classroom. This observation aligns with Purwani et al., (2018) research, which highlights the lack of utilization of books, school infrastructure, curriculum, and effective learning methods as contributing factors to low scientific literacy levels.

In response to the identified challenges, the researcher has chosen to embark on a study aimed at developing TPACK-based E-Books as electronic teaching materials tailored to enhance students' scientific literacy in the area of the human digestive system. This development process will adhere to the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) model.

Development is carried out by analyzing constraints and needs, designing the product to be produced, developing the product, implementing it by conducting trials, and the final stage is evaluating the product produced. It is hoped that with the

development of TPACK-based E-Books, the resulting products will not only be able to improve students' low scientific literacy skills, but can become a guide for teachers in developing teaching materials that can be used in learning. These problems made researchers interested in conducting this research with the title “**Development of TPACK-Based E-Book on Human Digestive System Material to Achieve The Scientific Literacy of Students at SMP Negeri 41 Medan**”.

1.2 Problem Identification

Based on the background of the problem above, several problems can be identified as follows:

1. Students' scientific literacy abilities based on PISA and the 2022 general education report in junior high schools are still low.
2. Lack of practicality of conventional teaching materials in the form of printed books which are used as student learning resources.
3. Lack of development of electronic teaching materials to increase students' scientific literacy.
4. Science teachers still only use conventional teaching materials, namely printed books which are used as student learning resources.
5. Students have difficulty understanding the concept of the human digestive system.

1.3 Problem Limitations

In order for this research to be more focused, it is necessary to limit the research problem as follows:

1. The research method used is the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) development research method.
2. The scientific literacy competencies used are limited to 3 competencies, namely explaining scientific phenomena, evaluating and designing scientific investigations, and interpreting scientific data and evidence.
3. The evaluation stage of the effectiveness of TPACK-Based E-Book can only be seen from the N-gain results obtained.

1.4 Problem Formulation

The formulation of this research problem is as follows:

1. How is the feasibility of a TPACK-Based E-Book on material experts?
2. How is the feasibility of a TPACK-Based E-Book on media experts?

3. How is the feasibility of a TPACK-Based E-Book on learning design experts?
4. How is the feasibility of a TPACK-Based E-Book on language experts?
5. How is the practicality of the TPACK-Based E-Book on the responses of science teachers?
6. How is the practicality of TPACK-Based E-Book in implementing student responses?
7. How effective is the TPACK-Based E-Book on the human digestive system material for improving students' scientific literacy skills?

1.5 Research Objectives

In accordance with the problem formulation, the aim of this research is to find out:

1. Feasibility of TPACK-Based E-Book on material experts.
2. Feasibility of TPACK-Based E-Book on media experts.
3. Feasibility of TPACK-Based E-Book for learning design experts.
4. Feasibility of TPACK-Based E-Book on language experts.
5. Practicality of TPACK-Based E-Book on science teacher responses.
6. Practicality of TPACK-Based E-Book in terms of implementing student responses.
7. Effectiveness of TPACK-based E-Books on human digestive system material to improve students' scientific literacy skills.

1.6 Benefits of Research

The benefits or contributions obtained from this research can be described as follows:

1. Theoretical Contribution

It is hoped that the results of this research can increase and expand knowledge about scientific literacy in science learning, as well as increase knowledge about the importance of scientific literacy, especially in science subjects regarding the human digestive system.

2. Practical Contribution

- a. For students in this research, it is hoped that after learning using TPACK-based E-Book teaching materials, students can increase students' scientific literacy in the human digestive system material.

- b. For teachers, it is hoped that this research can be a reference in developing TPACK-based E-Book teaching materials to increase students' scientific literacy.
- c. For schools, it is hoped that this research can be used as material for evaluating learning in schools regarding the effectiveness of the teaching materials used by teachers in science learning, especially regarding the human digestive system.
- d. For researchers, this research provides direct experience in developing TPACK-Based E-Book to improve scientific literacy skills on human digestive system material in class VIII SMP.

1.7 Operational Definition

Operational definitions to understand the terms used in this research are as follows:

1. Scientific literacy is the ability to use scientific knowledge, identify problems and be able to draw conclusions based on evidence in order to understand and make decisions about nature and changes that occur in nature due to human activities..
2. Program International Student Assessment (PISA) is a study of international achievement in the fields of reading, mathematics and scientific literacy. The PISA program is implemented by the Organization for Economic Co-operation and Development (OECD).
3. One of the electronic-based teaching materials is electronic books (E-Books). E-Books are learning media that contain information/knowledge presented in the form of text and images and can be accessed digitally.
4. TPACK is a learning approach that integrates technological developments and pedagogy to develop content in the world of education.
5. TPACK-based E-Books are electronic learning media that integrate technological developments and material content pedagogy simultaneously.
6. The digestive system is one of the learning materials studied in science subjects in class VIII SMP, which contains the processes carried out by the entry or inclusion of living creatures, energy substances, and/or other components into the environment or changes in the living environment. structure by human activity. or due to natural processes, so that the quality of the environment decreases to a

certain extent which causes the environment to become less or no longer able to function according to its intended purpose.