CHAPTER I
INTRODUCTION

1.1 Background

The rapid development of science and technology emphasizes the need to improve the quality of education. Improving the quality of education can be achieved by changing the paradigm underlying curriculum implementation, which can facilitate the development of learning media. However, many teachers still lack the ability to develop effective and efficient learning media (Siregar et al., 2024). According to Law No. 20 of 2003 concerning the National Education System, education is a conscious and planned effort to realize one's potential for religious and spiritual strength, self-control, personality, intelligence, noble character, and the skills needed by oneself, society, nation, and state.

The effort to develop quality human resources in education requires student's interest in learning through the learning process. Good learning can be seen from how interested the students are in learning. If students have a high level of interest in learning, the quality of education will also be good, which can indirectly develop quality human resources. On the other hand, if students have a low level of interest in learning, the quality of education will not be good, meaning that the quality of education affects student's interest in learning. (Gaho, 2023). The student's interest in learning is an important part of the

teaching and learning process. Technology has become an essential tool in learning activities. However, the use of technology in education as a learning medium is still minimal compared to other aspects. The learning media usually used in schools only read books as the primary medium. The lack of innovation and creativity in learning media makes learning dull and less interactive (Dewi et al., 2025). Technology also plays an important role in influencing student's interest in learning. Technology-based learning media can make the material taught more interactive, engaging, and easily understood. The right learning media can also increase knowledge and attract student's attention (Halawa, 2022). One of the subjects that greatly benefits from interactive and engaging media is biology, due to its complex and abstract nature. Other studies have shown that teacher-centered instruction, which relies solely on textbooks, can lower student interest, motivation, and understanding(Agustini et al., 2023).

To ensure the effectiveness of such learning media, especially those that integrate technology, it is essential that the content, approaches, and methods used align with the applicable curriculum. The curriculum serves as the main reference in formulating learning objectives, core materials, and competencies that students must achieve. Therefore, technology-based learning media must be developed in line with the structure and learning outcomes outlined in the curriculum to ensure optimal results (Ekaningtiass et al., 2023). The development of technological media such as Augmented Reality must also refer to the core and basic competencies established in the curriculum, so that it is not only visually appealing but also pedagogically targeted and appropriate.

This is especially important in the context of biology education. Biology is a branch of science that studies life, from the most minor structures to global ecosystems. Students need to be interested in studying biology because this science not only provides an understanding of life around us but also teaches the basic principles of the interaction of organisms with their environment and their role in ecosystems. Biology education at the senior high school level often faces challenges related to student's understanding of the subject matter. Complex and abstract biological concepts require students to have a deep understanding and critical thinking skills. Previous research has shown that several factors influence student's academic achievement, including interpersonal intelligence and interest in learning (Pratiwi et al., 2023). Therefore, biology education at the senior high school level is important in shaping student's understanding of various basic biology concepts (Setiawan et al., 2022).

According to an interview about biology learning in grade XI with the biology teacher, the biology teacher revealed that classroom learning uses effective teaching techniques. A case study approach is relevant to student's daily lives and is considered a very supportive method for improving student's understanding of biology material. The main challenge for teachers is delivering the material clearly and interestingly, especially in overcoming student's difficulties in understanding scientific terms, which are often considered rote learning. Using easy to understand virtual objects and Augmented Reality visual media is also important to help students better understand complex concepts in

the material, especially on nervous system and motion system. According to the interview, the teacher also said that implementing Augmented Reality in this material will significantly help students understand the material. The material on the nervous system and motion system in humans requires media that can be moved or added to the real world or in real time through mobile devices or cell phones.

The learning media used in biology learning, especially at SMA Negeri 2 Amlapura, uses learning media such as textbooks, PowerPoint presentations, and teacher explanations. In addition, teachers also use group discussion methods in their teaching and learning activities. The lack of visualization and interactivity in this method makes it difficult for students to understand the dynamics and complexity of the nervous system and motion system (Azrai et al., 2024). Of course, issues related to learning media are a significant concern because an inadequate understanding of the material can hinder student's progress in biology. The lack of visualization and interactivity in traditional learning methods is often the leading cause of student's difficulties understanding this concept. Textbooks and two-dimensional image do not provide a clear picture of the dynamics and complexity of the material being taught (Azrai et al., 2024). This method does not provide enough visualization, making it hard for students to understand complex concepts (Mertayasa et al., 2022). These limitations in learning media are a significant concern, as they can hinder students' understanding and ultimately affect their academic progress in biology. The use of static media like textbooks and two-dimensional images

fails to provide a comprehensive and tangible representation of complex biological processes, which are better understood through dynamic and interactive visuals.

Although many digital learning resources, such as educational videos on platforms like YouTube, are readily available, most of this content is unidirectional and lacks active student involvement. YouTube videos typically do not offer features for direct interaction, such as practice questions, feedback, or self-exploration. As a result, students often become passive recipients of information, which can reduce the effectiveness of learning especially when dealing with abstract or complex materials like those found in biology (Pratiwi et al., 2021). Therefore, there is a growing need for learning media that is not only informative but also interactive, in order to foster active engagement and improve students' conceptual understanding.

This need is further supported by a survey conducted among 36 students at SMA Negeri 2 Amlapura, which revealed diverse experiences and perceptions regarding biology learning. While 67.5% of students managed to score above the minimum passing grade, 59.5% felt that the current teaching media were ineffective due to an overemphasis on theory and a lack of practical activities. Moreover, 75.7% of students identified excessive memorization as a major challenge, while 54.1% reported insufficient hands-on practice, both of which hinder deeper understanding. Interestingly, 75.7% of students stated that animated videos helped them understand biology materials better, even though the most frequently used method by teachers was group discussion (81.1%).

This mismatch suggests that the current teaching strategies do not fully meet students' learning preferences or support optimal comprehension. Although most students pass, there is clear room for improvement. Integrating Augmented Reality (AR) technology into learning media presents a promising solution, as it enables visual and interactive delivery of material, helping to overcome obstacles related to memorization and lack of practice, and ultimately supporting better learning outcomes.

Students' understanding of the nervous system and motion system also varies greatly. As many as 62.1% of students found the material on the nervous system and motion system very interesting, but 37.8% of students found the learning process uninteresting, indicating a need for improvement in the learning media used by teachers. Students want learning that is more interesting and easier to understand. Students expect learning media that uses visuals and in-depth explanations, reflecting their desire to improve their understanding and attention to the material in biology learning. One technology that can potentially increase student interest in learning is Augmented Reality (AR), which can provide a more realistic and immersive learning experience.

Augmented Reality is a visual technology that projects computer-generated information into view. This technology can also integrate a virtual environment, including virtual 3D objects so that it appears as if it is real (Socrates et al., 2022). Another definition of Augmented Reality is the incorporation of cyberspace into objects in the form of text, image, and animations into the real world. In the world of education, Augmented Reality is an innovation that is

attractive to teachers and students because Augmented Reality is considered capable of positively impacting student learning success (Baihaki et al., 2023). Learning media is one of the supporting factors for success in learning. The same is true in biology learning, which is fairly difficult and requires innovation in learning media that can help students understand the material taught.

Augmented Reality (AR) has advantages that make it better than other learning media. Its interactivity greatly supports the learning process, allowing students to interact directly with virtual objects displayed in the real world. Augmented Reality displays 3D objects that can be rotated and observed from various angles, providing a more immersive learning experience (Masruroh et al., 2023). Augmented Reality offers attractive visualization with more realistic 3D objects, helping students better understand abstract concepts. Augmented Reality technology is equipped with animation and audio to support it, making learning more interesting and enjoyable. Augmented Reality can enhance students' conceptual and biomotor skills (Darmawan et al., 2024). Indeed, the application of AR is not confined to academic environments but has also been demonstrated to be effective in other contexts (Agustini et al., 2023). Beyond these advantages, Augmented Reality is consistent with broader educational efforts to transition toward more relevant, competency-based approaches (Wahyuni, 2021). In addition, Augmented Reality enhances student's imagination and creativity by projecting learning materials into a more concrete form, thus stimulating student's exploration and creativity.

The effectiveness of learning with Augmented Reality can improve student's understanding because information is presented simultaneously in the form of text, image, video, and audio. The learning process becomes more active and interactive, which can increase student engagement. Augmented Reality can help visualize abstract biology concepts, thus improving student's understanding of the material. Augmented Reality technology in learning can help students understand the material more realistically (Alfitriani et al., 2021).

Based on the explanation of problems in biology learning, which is still conventional, the lack of technology utilization, and students' difficulty in understanding abstract concepts, the researcher is interested in developing learning media titled "Development of Augmented Reality Learning Media for the Nervous System and Motion System for Grade XI Students at SMA Negeri 2 Amlapura", intended as a medium to interactively build students' understanding of the nervous system and motion system material in biology subjects. The expected outcome of this development is an improved learning experience and a positive impact on students' academic achievement, as reflected in their learning outcomes.

1.2 Problem Identification

Based on the background description above, the problem identification is described as follows:

1. The learning media used in classroom learning activities is not yet interactive.

2. Learning media is needed to facilitate students and teachers in teaching and learning activities in more detail.

3. The human motion and nervous system topics are complex for students to visualize due to their abstract nature, involving internal structures such as neurons, bones, and joints that cannot be directly observed, and containing complex terminology that requires simultaneous understanding of structure and function, which makes conventional media like textbooks or group discussion insufficient to support comprehension hence, more interactive, visual, and technology-based learning tools are needed to deliver the material in a more concrete and meaningful way.

1.3 Problem Formulation

1. How is the Development of Augmented Reality Learning Media for the nervous system and motion system for XI grade students at SMA Negeri 2 Amlapura?

2. How is the result of the analysis of students' and teachers' responses toward the development of Augmented Reality learning media on the nervous and motion systems for grade XI students at SMA Negeri 2 Amlapura?

1.4 Research Objectives

Based on the formulation of the problem, the objectives to be achieved are as follows:

1. To produce an Augmented Reality Learning Media product on the nervous system and motion system for XI grade students at SMA Negeri 2 Amlapura.

2. To analyze the results of student's and teacher's responses to the Augmented Reality learning media on the nervous system and motion system for grade XI students at SMA Negeri 2 Amlapura.

1.5 Problem Limitations

The limitations of the research entitled Development of Augmented Reality (AR) on the subject of Nervous System and Motion System for XI Grade Students at SMA Negeri 2 Amlapura:

1. This research focuses on the development of Augmented Reality-based learning media for 11th-grade biology material, specifically on the motion system and nervous system topics. This research not use specific instruments to measure students' visuospatial and mental imagery abilities. Therefore, the influence of those cognitive abilities on the effectiveness of the media is not analyzed in this research.

1.6 Research Benefits

Augmented Reality, the nervous system and motion system, is expected to provide the following benefits:

1. **Theoretical Benefits**

   This research is expected to provide innovation in the world of technology to help implement Augmented Reality for learning media.

2. **Practical Benefits**

   a. Benefits for Students

   As a learning resource, it makes it easier for students to understand the material in the learning process and increases their interest in learning.

   b. Benefits for Teachers

   It is hoped that it will make it easier for teachers to teach biology subjects, especially nervous system and motion system, more interestingly and creatively.

   c. Benefits for Schools

   This research aims to provide helpful knowledge for educational institutions to choose learning content that interests students. It also aims to increase student's interest in learning to produce high-quality education.

   d. Benefits for Researchers

   This research is expected to broaden researcher's knowledge regarding the development of Augmented Reality nervous system and motion system, which can be used as a learning medium for students by utilizing the knowledge gained during their studies at Universitas Pendidikan Ganesha.