CHAPTER 1
INTRODUCTION

This chapter focuses on the research background, research problems, research questions, purposes of the study, conceptual framework, significance of the study, contributions of the study

A. Research Background

Reading is one of the most essential skills in language learning, as it serves as a gateway to understanding ideas, expanding vocabulary, and developing critical thinking. For students learning English as a foreign language, reading becomes even more crucial, especially when they are expected to comprehend specific genres like biological terms. However, reading poses a significant challenge for many Indonesian students.

According to the Programme for International Student Assessment (PISA), Indonesia's reading literacy scores have shown inconsistent trends over the past two decades, with a troubling recent decline. In 2009, Indonesia achieved its highest reading score of 402, but this performance has gradually decreased, reaching only 359 in 2022, the lowest score recorded in the observed period (Goodstats, 2023). This alarming decline raises concerns about the effectiveness of current reading instruction methods and underscores the need for more engaging and effective approaches. To provide a clearer picture of the state of Indonesian students' reading abilities, the graph below presents the trend in reading literacy scores based on the results of the PISA study from 2000 to 2022.
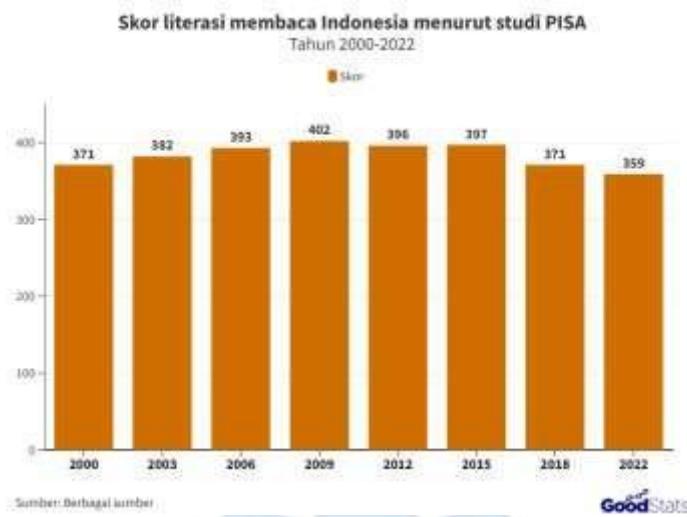
Figure 1. 1 Literacy scores based on the results of the PISA study from 2000 to 2022.

This study investigates the effectiveness of Augmented Reality (AR) as an innovative tool for enhancing vocabulary learning through interactive experiences at SMA PGRI 1 Bandung. Specifically, this research explores learning using Augmented Reality (AR) with some interesting and effective ways to learn vocabulary for a richer learning experience. Johnson et al (2011) indicated that augmented reality (AR) has become mainstream in higher education since AR is used in a real-world setting among senior high school students.

The development of digital media in modern classrooms is considered effective in improving vocabulary skills, especially in English. Students can further improve their creativity in order to have better vocabulary acquisition activities that are suitable for their style. AR as an application like Quiver creates an immersive hybrid learning environment in which students can interact with virtual objects in a physical world and, at the same time, enhance their perceptions and understanding of targeted learning objects (Dunleavy & Dede, 2014).

Innovation-based learning media is required with an end goal of confronting the time of the Industrial Revolution 4.0 and Society 5.0 (Aquilani et al., 2020; Fukuda, 2020). The innovations at present are growing quickly. One innovation that is presently being created is AR. AR refers to technology that blends a real-world context with virtual elements such as texts, pictures, videos, 3D models and

animations (Klopfer & Sheldon, 2010; Saleeb & Dafoulas, 2013). Unlike virtual reality (VR), which creates a totally virtual environment, students experience a real environment using AR, because it enables students to use their mobile phones to identify objects or environments around them.

There are only some augmented reality programs that have Senior High School appropriate material. One of these applications, Quiver, is suitable for this purpose. The Quiver application is a unique augmented reality application that can be run on smart mobile devices with coloring pages containing various topics and visuals. After printing, the coloring pages are matched with the mobile device, and the coloring colors appear exactly the same on the mobile device screen.

Moreover, AR offers an engaging and enjoyable learning experience by allowing students to actively participate in the educational process. As a result, AR represents an educational tool that effectively integrates technology with language acquisition, offering innovative possibilities for educators to enhance their teaching methodologies. Specifically, this research focuses on AR that allows students to visualize and interact with vocabulary in context, which aids in comprehension and application. This contextualization helps learners connect their real words to their artificial environment, fostering deeper understanding through vocabulary meanings. There are only a few augmented reality applications that have relevant content for the senior high school in Indonesia. One of these applications, Quiver, can be used for this study. Quiver application is an augmented reality application that can be run on smart mobile devices with colouring pages containing various topics and visuals. Once completed, it can be scanned to reveal 3D animations. Students can interact with these animations and provide a hands-on learning experience.

Implementing AR-based technology in classes improves the students' language learning and learning achievement (Hadid et al., 2019 & (Hwang et al., 2016). Moreover, the most recorded advantage of AR is enhanced learning achievement (A & Akçayı, 2017). From the previous research, we can determine that Augmented Reality, as shown in education, has benefits for enhancing learning motivation, fostering collaboration and interaction among students, and improving

learning performance (A & Akçayı, 2017). Preliminary observations were conducted through informal interviews with English teachers at the target school. During the discussions, the teacher expressed concern that many students still struggle with mastering English vocabulary, particularly in understanding subject-specific texts such as biological terms for reading. This lack of vocabulary proficiency was seen as a major barrier to developing effective reading comprehension skills. Based on the explanation, one of the primary motivations for conducting this research. The aim is to increase students' vocabulary acquisition in a more engaging and contextual way by integrating Augmented Reality (AR) as an interactive learning tool, consequently enhancing their reading comprehension skills, particularly in health-related materials.

B. Research Problems

This research aims to address the gap in understanding the influence of Augmented Reality (AR) on vocabulary learning and its role in accelerating students' reading comprehension in biological terms. By conducting research at SMA PGRI 1 Bandung with 10th-1 grade students, focusing on this specialized context, the study seeks to explore how AR can overcome challenges related to technical and discipline-specific vocabulary, which are often difficult to master through traditional methods.

Although educators can currently utilize learning media creatively, this does not inherently meet the criteria as a special educational learning tool for language learning purposes (Abdulrahaman et al., 2020). Nowadays, students often overlay digital information into their real life. Thus, offering an engaging and interactive experience for students, the primary focus of AR remains on the ability of a device or system to enhance the student's attention and focus through interaction.

Conducted with students engaging in health-related education, this research investigates the potential of AR to create interactive and immersive learning environments, offering insights into innovative approaches for improving vocabulary acquisition and reading skills in complex academic texts, in this case, biological terms.

C. Research Questions

The purpose of this study is to comprehensively understand the aspects of AR in vocabulary learning with an interactive learning experience by students at SMA PGRI 1 Bandung. This study explores more deeply the improvement in vocabulary using AR. Moreover, this study formulates three research questions related to vocabulary learning with an interactive experience by students at SMA PGRI 1 Bandung.

1. How are students' reading skills before using AR in vocabulary learning on biological terms?
2. How is the treatment of using AR in vocabulary learning on biological terms implemented?
3. How are students' reading skills after using AR in vocabulary learning on biological terms?
4. Is there any significant improvement in students' reading skills through vocabulary learning using AR in biological terms?

D. Purposes of The Study

This study intends to explore the effectiveness of AR as an innovative tool for enhancing vocabulary learning through interactive experiences at SMA PGRI 1 Bandung. As a result, three research objectives have been developed for this study.

1. To assess the students' reading skills before using AR in vocabulary learning on biological terms.
2. To describe the implementation of AR in vocabulary learning on biological terms.
3. To assess the students' reading skills after using AR in vocabulary learning on biological terms.
4. To identify the significant improvement in students' reading skills through vocabulary learning using AR in biological terms.

E. Conceptual Framework

Integrating Augmented Reality (AR) in teaching English vocabulary offers innovative opportunities to enhance students' reading skills, particularly in specialized contexts such as biological terms. This literature review aims to explore the impact of AR on vocabulary acquisition, its role in accelerating reading skills, and the challenges and strategies associated with its implementation.

1. Understanding Augmented Reality in Language Learning

Augmented Reality (AR) is an advanced technology that superimposes digital information onto the physical environment, facilitating immersive and interactive educational experiences. AR increases student engagement in language learning by enabling them to practice vocabulary and visualize concepts in real-world environments. According to AlGerafi et al (2023) looks closely at how AR and VR can motivate students, improve their learning results, and make learning more enjoyable. By using these technologies, students can have a more hands-on approach to education, which can lead to better understanding and retention of information that improves their cognitive and linguistic skills. Furthermore, Schorr et al (2024), despite its potential, AR is not yet widely adopted in the educational field due to its novelty and the slow pace of change in this area. Studies on the impact of augmented reality on language acquisition have shown that this immersive approach not only motivates students but also aids in retention and comprehension.

Recent studies highlight the increasing role of Augmented Reality (AR) in language learning, particularly in enhancing vocabulary acquisition and contextual understanding. AlGerafi et al (2023), by reviewing various studies from different educational levels, including K-12 schools, universities, and professional training, researcher found that AR-based tools help students remember information better and develop new skills. Y.-H. Hung, C.-H. Chen (2016) found that AR applications provide interactive and intuitive representations of language content, enabling learners to grasp abstract concepts and reduce the time needed for understanding new words. Furthermore, Hiranrakpattana (2023) emphasized that AR facilitates contextual learning by integrating real-life scenarios into language education,

which deepens comprehension and extends vocabulary acquisition beyond rote memorization. These findings highlight AR's potential to create engaging and effective learning environments for language learners.

Understanding augmented reality (AR) in language learning involves exploring its revolutionary potential for creating immersive, interactive, and contextually rich experiences. Ma et al (2021) highlight that AR overlays digital information in a real-world environment, enabling learners to associate vocabulary and grammar with real-world contexts, which enhances retention and comprehension. For example, learners can interact with virtual objects labelled in the target language, which promotes vocabulary acquisition through multimodal engagement. Furthermore, Yennelly (2023) emphasize that AR facilitates lower cognitive-level tasks like identifying words and understanding meanings but has the potential to support higher-order skills such as reading and writing when effectively designed. These features make AR a viable tool for individualized and interesting language learning.

Augmented Reality (AR) has developed as a transformative technology for language learning, combining digital and real settings to create immersive educational experiences. According to Lee & Park (2019), who emphasizes AR's ability to associate learning with specific contexts, enabling situated learning opportunities. Furthermore, Atti et al (2025) highlight the hands-on interaction facilitated by AR, allowing learners to engage with physical materials while receiving immediate digital feedback, fostering deeper comprehension and retention. Furthermore, Procel et al (2024) underscores the potential of AR to simulate real-world scenarios, such as virtual conversations with native speakers, offering learners practical and engaging contexts for language acquisition.

Overall, recent literature emphasizes the transformative potential of AR in language acquisition, focusing on its ability to build an immersive and interactive environment. According to Lee & Park (2019), AR's unique capabilities, such as overlaying digital information on physical things, improve learners' concentration on relevant visual-audio cues, resulting in more engaging and successful vocabulary acquisition. Furthermore, Lee & Park (2019) AR facilitates contextual learning by

linking language practice to specific real-world settings. It allows students to interact with virtual objects and immersive scenarios in meaningful and relevant ways, which improves the practicality, memorability, and general efficacy of vocabulary acquisition and language use. Yennelly (2023) also points out that AR apps primarily target core language abilities, such as word identification and pronunciation, but urge for expanding their use to higher-order skills like reading and writing. While challenges remain in incorporating AR into varied language courses, this research collectively highlights its potential to transform vocabulary learning and comprehension in a real-world context.

2. Challenges in Teaching Vocabulary and Reading Skills Using AR

Teaching vocabulary and reading skills with AR technology presents unique challenges due to the complexity of language acquisition and the technological demands of AR tools. An important challenge is the cognitive overload that learners experience while interacting with AR environments, which might impair their ability to focus on new vocabulary and reading comprehension exercises. Integrating AR seamlessly into the existing curriculum is another major challenge. Teachers need adequate training and support to effectively use AR in their classrooms. A study by Kerawalla et al (2008) highlighted the importance of teacher professional development in the successful implementation of technology-enhanced learning. Without proper integration, AR may be seen as an add-on rather than an integral part of the learning process.

Students in an AR learning environment may experience cognitive overload due to the abundance of information, many technology gadgets, and challenging activities. Dunleavy et al (2009) reported that students often felt overwhelmed and confused when they were engaged in a multi-user AR simulation because they had to deal with unfamiliar technologies as well as complex tasks. AR tasks may demand students to apply difficult abilities such as spatial navigation, teamwork, problem-solving, technology manipulation, and quantitative estimation (Dunleavy et al., 2009). Previous research indicated that one reason for students' learning challenges in AR environments lies in a lack of these essential skills (Klopfer & Squire, 2008). Also, students' inability to maintain focus during AR-based lessons

negatively impacts their capacity to follow the flow of discussions, understand questions, and provide coherent and relevant responses, which are critical skills in reading comprehension.

3. Strategies for Effective Integration of AR in Vocabulary Learning

The Enhancing Education Through Technology Act of 2001 Bakia et al., (2009), a component of NCLB, mandates that schools and teachers utilize technology in the educational process. Schools should use technology to teach reading skills and improve students' knowledge acquisition while reading. One effective technique is to harness AR's visual and spatial clues to create contextualized and memorable learning experiences. The cognitive theory of multimedia learning (CTML) according to E. Mayer (2005) is based on three cognitive science principles of learning: the human information processing system includes dual channels for visual/pictorial and auditory/verbal processing (ie, dual-channels assumption); each channel has limited capacity for processing (ie, limited capacity assumption); and active learning entails carrying out a coordinated set of cognitive processes during learning (ie, active processing assumption). The cognitive theory of multimedia learning specifies five cogni-tive processes in multimedia learning: selecting relevant words from the presented text or narration, selecting relevant images from the presented illustrations, organizing the selected words into a coherent verbal representation, organizing selected images into a coherent pictorial representation, and integrating the pictorial and verbal representations and prior knowledge. Multimedia instructional messages should be designed to prime these processes. Adopting multimedia in vocabulary teaching has produced promising findings highlighting the usefulness of a holistic approach to vocabulary acquisition. For example,(Hasram et al (2021) investigated the impact of online gaming on vocabulary learning. The control group learned the same content on paper in the study, while the experimental group engaged in online vocabulary exercises. The study revealed that the experimental group performed better than the control group.

AR-based vocabulary activities that combine digital objects with real-world environments greatly enhance students' capacity to correlate words with their meanings using spatial anchoring. Some scholars highlighted that AR has three main characteristics: (a) a mixture of physical and digital worlds, (b) real-time engagement, and (c) precise three-dimensional (3D) authorisation of virtual and physical objects (Carmigniani et al., 2011). Augmented reality (AR) integrates virtual features with real-world feelings. Several studies show that participants enjoy and are willing to practice AR exercises.

Several vocabulary study experiments have examined the effects of AR on EFL students (Tsai, 2020). For instance, He et al (2014) investigated the impacts of AR on EFL vocabulary among preschool children. The authors developed a mobile software for EFL students that presents vocabulary using virtual images, phrase descriptions, and phonetics. The study included pre-test, treatments, and post-test with the instructor. The AR group showed higher post-test scores and engagement levels compared to the control group. There is a strong connection between AR and academic motivation.

The following framework of thinking presents the conceptual foundation of this study, systematically illustrating the interrelationship between key variables, theoretical perspectives, and the research process. This framework is designed to provide a clear and structured visualization of how the research problem is approached.

| The Influence Of Augmented Reality (AR) In Learning English Vocabulary to Accelerate Students' Reading Skills In Biological Terms |

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| Students' skills Before the Use of AR (Pre-test) |

⇩

| Treatment/Implementation | → | Augmented Reality (AR) |

⇩ ⇩

| Students' Skills After the Use of AR (Post-test) | | English Vocabulary |

⇩ ⇩

| Improvement | → | Students' Reading Skills in Biological Terms |
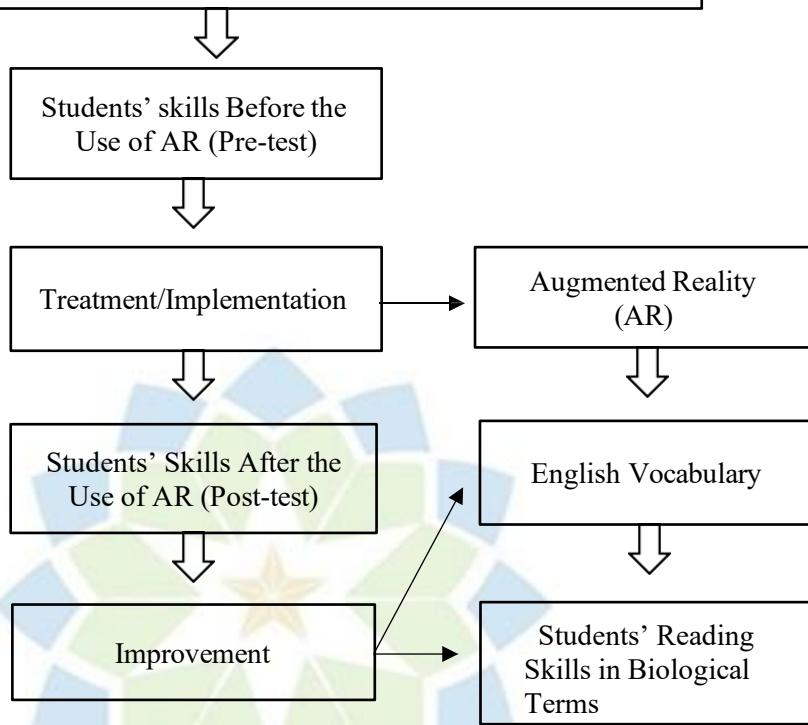
Figure 1. 2 Framework of Thinking

F. Significance of the Study

This study strives to investigate and fully comprehend the engagement of students in learning English as a foreign language using AR-based vocabulary learning with interactive experience. This study contributes to the theoretical and practical significance for teachers, students, and other researchers.

Theoretically, this study applies Azuma (2014) perspective of AR technology, combining real-world objects with virtual objects, involving interactions in real-time, and registering the combinations of real-world and virtual objects in 3D space. Furthermore, as for the practical aspect, the insights gained from this study can guide educators in effectively implementing AR-based activities in their teaching.

Empirically, by providing recommendations based on research findings, the research serves as a resource for teachers to enhance their vocabulary instruction

through interactive and immersive experiences. The findings also inform educators' pedagogical implications of AR to enhance vocabulary.

G. Contributions of the Study

Additionally, the findings benefit the students by providing them with engaging and interactive learning experiences that can improve their language acquisition and retention. Therefore, the findings of this research offer meaningful contributions:

1. **For Teachers**

The practical outcomes of this research can assist teachers in creating innovative and effective teaching strategies aimed at enhancing students' English reading skills. All activities emphasize a student-centered learning. This change from teacher-centered to students-centered teaching promotes motivation and critical thinking, which are necessary components of successful language acquisition. The benefit of this research for teachers can offer an in-depth analysis of technology-based teaching methods, such as AR, to enhance students' reading skills through vocabulary learning with AR. The findings of this research can be utilized by teachers to develop more effective educational policies, focusing on both curriculum development and the integration of technology in the teaching and learning process. As such, this study contributes to efforts to improve the quality of English education at the national level while assisting teachers in making informed decisions that align with modern educational needs.

2. **For Students**

Students engage in a more captivating and enjoyable learning experience through direct interaction with educational content using Augmented Reality (AR). By using AR technology, learners can enhance their vocabulary and language ability in a more realistic and practical context. Students can use the application after formal classes. This flexibility encourages self-directed education, in which students take more responsibility for their own improvement. As a result, students are more likely to remember new vocabulary and use it effectively for reading skills in biological terms.