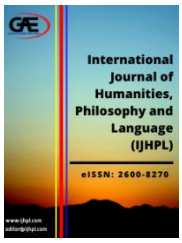
International Journal of Humanities, Philosophy and Language
IJHPL
EISSN : 2600-8270
Volume 8 Issue 30 (June 2025) PP. 01-16
DOI 10.35631/IJHPL.830001



INTERNATIONAL JOURNAL OF HUMANITIES, PHILOSOPHY AND LANGUAGE (IJHPL)
www.ijhpl.com

AUGMENTED REALITY IN VOCABULARY LEARNING: AN INVESTIGATION ON ITS USEFULNESS AND PUPILS' PERCEPTION

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Article Info:

Article history:
Received date: 12.02.2025
Revised date: 30.03.2025
Accepted date: 24.04.2025
Published date: 10.06.2025

To cite this document:

Lau, A. J., & Abdul Aziz, A. (2025). Augmented Reality In Vocabulary Learning: An Investigation On Its Usefulness And Pupils' Perception. *International Journal of Humanities, Philosophy and Language, 8* (30), 01-16.

DOI: 10.35631/IJHPL.830001.

Abstract:

The formation of the Fourth Industrial Revolution (IR 4.0) is ushering in a new era of technology advancement, artificial intelligence, automation and Internet of Things (IoT), which is making impact not only to the field of manufacturing and industries, but also to education. This new revolution has impacted the advancement in English learning. Learning English is not only about the four skills: listening, speaking, reading and writing; but also, vocabulary learning. However, young learners who are at the initial stage of language and vocabulary acquisition often faced significant challenges such as unattractive teaching and learning, which cause disengagement in the classroom activities. Hence, in this study, Augmented Reality, AR had been actively integrated in the vocabulary acquisition process to improve pupils' vocabulary learning. This study aims to explore the usefulness of AR flashcards in Year 1 ESL pupils' vocabulary learning as well as their perceptions towards the use of AR flashcards in their vocabulary learning. The data was collected through action research method. Qualitative data from reflective journal and semi-structured interview were collected and analysed to answer the research questions. The findings of the study revealed that the AR flashcards are useful in sparking pupils' learning interest and encouraging pupils' engagement in the lesson. The pupils also showed positive response and expressed their satisfaction towards the use of AR flashcards in their lessons. Finally, the research implications and recommendations were discussed.

Keywords:

Augmented Reality (AR), Learning, Perception, Usefulness, Vocabulary, Young Learners

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Introduction

In this era of globalisation, the industrial revolution is digitalised and thus shaping the Fourth Industrial Revolution (IR 4.0). IR 4.0 is ushering in a new era of technology advancement, artificial intelligence, automation and Internet of Things (IoT) (George, 2024). IR 4.0 has transformed the world of education towards Education 4.0 with the integration of technologies and automation, such as Metaverse (MR), Virtual Reality (VR), Artificial Intelligence (AI), and Augmented Reality (AR). Education 4.0 is a technique of cyberlearning with the emerging of advanced technology to enrich the learners' learning experience as well as fostering live long learning (Miranda et al., 2021).

The emergence of Education 4.0 has eventually smoothen the attainment of the Sustainable Development Goals (SDGs) proposed by United Nations (UN) in 2015. One of the goals in SDGs is to ensure the inclusive and quality education for all as well as to promote lifelong learning, which is the SDG 4. Along with the aim of having "quality education" in SDG 4, an element of "lifelong learning for all" has been implemented in the educational system across the world (Kioupi & Voulvoulis, 2019). According to Poquet and de Laat (2021), intelligent technologies are playing vital roles in bringing fruitful impact towards lifelong learning.

In order to keep pace on the advancement of intelligent technologies in this new era of globalisation, English, is playing a significant role (Ly, 2022). On account of that, Malaysia Education Blueprint (PPPM) 2013-2025 has made shifts to ensure every child is proficient in Bahasa Malaysia and English language (Ministry of Education Malaysia, 2013). Hence, in order to improve the learners' proficiency level in English, Common European Framework of References for language (CEFR) is introduced and implemented. It is a framework that is used to assess learners' language ability based on different skills (Kaur & Jian, 2022).

According to Simamora and Oktaviani (2020), learning English is not only about the four skills: listening, speaking, reading and writing; but also, the three components: grammar, vocabulary and pronunciation. Vocabulary learning is fundamental for English as Second Language (ESL) learners to master English. A research by Kiew and Shah (2020) also proved that 56% of the pupils agreed that limited vocabulary affected their comprehension in reading. Aziz and Kashinathan (2021) mentioned that learners with limited vocabulary often struggle in listening and speaking skills. This is further supported by Rosyada-AS and Apoko (2023), saying that learners with insufficient vocabulary may impede their daily communication and language learning. Their study revealed that pupils faced difficulties in acquiring vocabulary. On account of that, flashcards had been employed as vocabularies learning media and materials. Previous studies proved that flashcards are effective in advancing pupils' vocabulary learning (Atmaja & Sonia, 2020; Amiruddin & Razaq, 2022; Rachmadi et al., 2023).

However, according to Waluyo and Bucol (2021), traditional vocabulary teaching methods, which rely heavily on memorization and repetitive drilling, are tedious and disengaging. Moreover, there are also students who found 2D flashcards boring and less attractive (Yaacob et al., 2019). This is because the traditional flashcards are lack of interactivity and seems disconnected from this world of globalisation where everything is digitalised. As learners are increasingly immersed in the world of digital technologies, the static nature of 2D flashcards is lack of immersive qualities (Fattahillah, 2019), which fails to capture their interest and engagement. This disengagement can result in slower vocabulary acquisition and retention.

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Augmented reality (AR), on the other hand, has big potential in creating immersive and interactive 3D flashcards, which eventually helps in providing dynamic and engaging learning environment (Mardiani et al., 2024). Hence, in this study, the researchers incorporate AR technology in creating the 3D flashcards, with the aim to explore the potential of AR and its realm in impacting pupils' vocabulary learning.

On account of that, this study aims to explore the usefulness of AR flashcards in Year 1 ESL pupils' vocabulary learning as well as their perceptions towards the use of AR flashcards in their vocabulary learning.

The objectives of this study:
i) To explore the usefulness of AR flashcards in Year 1 ESL pupils' vocabulary learning
ii) To investigate Year 1 ESL pupils' perceptions towards the use of AR flashcards in their vocabulary learning

Literature Review

Key concepts were defined and past studies were explored to identify the gaps. The related theory was explained.

Augmented Reality (AR) in Education

Augmented reality (AR) is a digital tool that enhances the learning experience by blending the virtual objects in the real-world context (Kovalenko et al., 2022). According to Suzanna and Goal (2021), AR provides interactive and immersive learning environment that can enhance teaching and learning process. This is because AR incorporate 3D visuals that enables learners to interact with the abstract concepts in tangible ways (Lai & Chang, 2021).

AR is also effective in catering to different learning needs and style because it is able to create a dynamic and interactive learning environment (Marienko et al., 2020). In ESL education context, AR helps to engage the learners in authentic language learning environment through real-world stimulation (Azuma, 2017). By interacting with the virtual objects, learners can make a connection between the topic learnt with the real-world situations (Yaacob et al., 2019).

In a past study by Ibrahim et al. (2018) stated that AR were able to encourage learners' engagement in the learning process by creating immersive learning environment. Apart from that, Voreopoulou et al. (2024) proved that AR helped to enhance learners' receptive and productive skills in English through deep and meaningful language learning experience. Jalaluddin et al. (2021) also reported that AR helped to improve English learning among the low achiever students.

AR Flashcards in English as Second Language (ESL) Vocabulary Learning

Flashcards are commonly used in the language learning settings are as a learning tool to drill learners' vocabulary retention through repetitions (Matruty and Que, 2021). The learners can practice and memorise new vocabulary items, and thus reinforce their vocabulary learning. Nowadays, the advent of AR has revolutionized traditional flashcards by adding an interactive and immersive dimension (Zainuddin et al., 2018). AR flashcards combined the benefits of traditional 2D flashcards with the advantages of AR technology.

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AR flashcards are innovative tools that combines traditional flashcards with augmented reality technology. The static images and text in the traditional flashcards were replaced with the interactive digital content such as 3D visuals. Hence, the vocabulary in the flashcards can be learnt vividly and interactively (Parmaxi & Demetriou, 2020). With the help of the visuals, pupils' visual literacy skills are enhanced, which consequently foster their deeper understanding.

A past study by Tsai (2020) showed that AR flashcards demonstrated more effective results as compared to the traditional vocabulary teaching methods. Yaacob et al. (2019) also proved that AR flashcards were able to maintain pupils' motivation and engagement in learning. Nursabra et al. (2023) proved that AR flashcards could effectively enhance pupils' vocabulary learning through enjoyable learning process.

Visual Literacy in AR Technology

Visual literacy is the ability to interpret meaning from an image to gain useful information (Guney, 2019). Visual literacy is an essential skill in this digital age, particularly in education settings. It is because visual literacy skills allow learners to effectively analyse and comprehend a concept in visual content (Guntara et al., 2023).

According to Kholiq (2020), AR creates 3D images that look real and integrates the images into the real world. This is essential for the learners to interpret the complex visual information vividly. Through dynamic and immersive visual experience, learners' visual skills can be enhanced (Papanastasiou et al., 2019).

In the past study, Yangin Ersanli (2023) evidenced that AR was effective in improving vocabulary learning and retention among young learners by enhancing their visual literacy skills. Moreover, Korosidou (2024) revealed that the visual representations in AR were highly appealing and motivating on pupils' vocabulary learning.

Affective Filter Hypothesis

The 3D images and AI voiceover in the AR flashcards are useful in engaging pupils deeply in the learning process. Unlike the traditional flashcards that contains only static 2D images, the interactive 3D visuals are able to create supportive and motivating learning environment. This environment could reduce pupils' learning anxiety and thus increase their motivation (Ho et al., 2019). With the reduced anxiety and increasing motivation in learning, their affective filter is lowered. Hence, their vocabulary learning is enhanced.

In addition, Tsai (2018) stated that AR flashcards are able to promote social interaction and collaboration among learners. Pupils can collaborate and share their thoughts with their peers about the vocabulary that they learn in the AR flashcards. This can definitely enhance learner-centered learning environment. Moreover, with the active discussion among learners, inclusive and collaborative classroom environment can be enhanced. According to Rezai et al. (2025), this can help to reduce learning anxiety and at the same time foster autonomy and confidence in language learning.

In the past study by Ji and Shin (2019), AR helped to improve vocabulary acquisition by enhancing young learners' motivation and engagement in learning. Apart from that, Hashim et al. (2022) proved that AR managed to spark pupils' learning interest through engaging and

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interactive ways. Mamani-Calapuja et al. (2023) proved that AR were able to effectively complement traditional vocabulary learning by creating interactive and fun experiences.

Conceptual framework

The conceptual framework of this study was present.

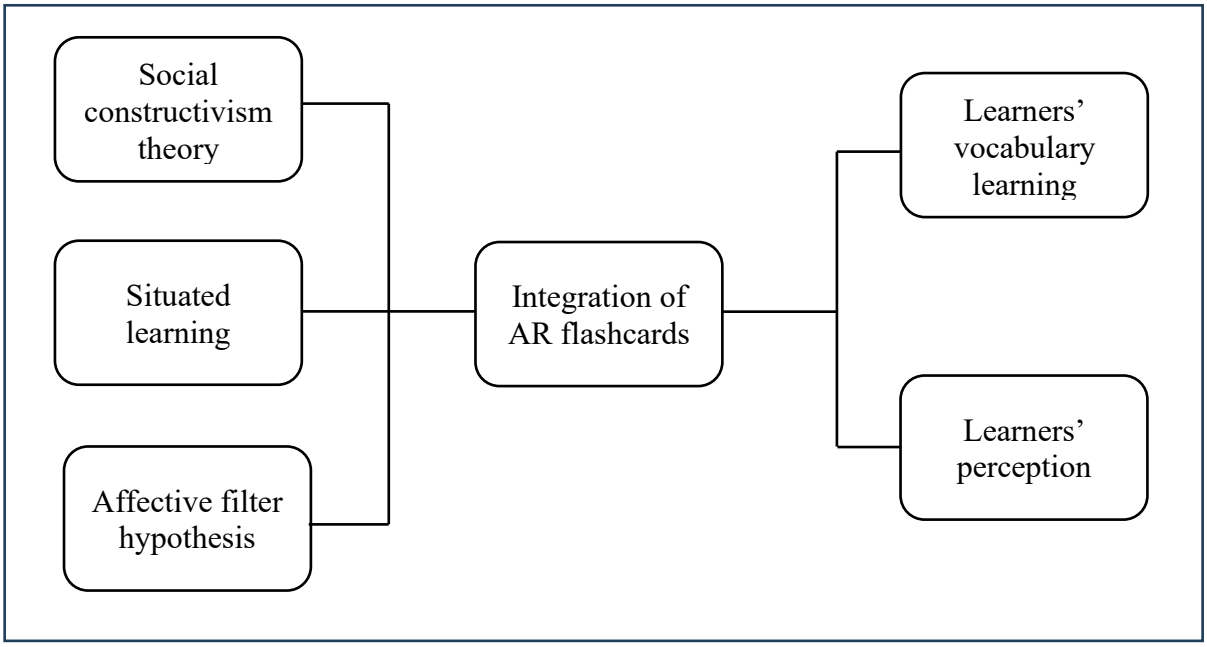

Figure 1: Conceptual Framework Of The Study

Social constructivism theory, situated learning theory and affective filter hypothesis were integrated. These theoretical perspectives informed the design and implementation of the study, which aimed to use AR flashcards to improve vocabulary learning among Year 1 pupils.

Social constructivism theory, as proposed by Lev Vygotsky, highlighted the crucial role of social interaction in the learning process. According to this theory, learning occurs through active engagement and collaboration with others (Qureshi et al., 2021). Hence, this AR flashcards were designed to encourage the learners to learn collaboratively among each other. By sharing their knowledge and experiences about the vocabulary, learners could enhance their understanding through peer interaction.

Besides that, situated learning theory posited that learning should be carried out within authentic contexts and real-world situations (Li et al., 2022). In this study, situated learning theory guided the development of the AR flashcards content and activities that immersed the learners in authentic language environments. The 3D images displayed from the AR flashcards enabled the learners to engage with the vocabulary in real-world contexts, within the classroom. This helped to enhance their understanding and retention of the vocabulary.

Moreover, the AR flashcards was also designed according to the affective filter hypothesis, which addressed the role of emotional factors, such as anxiety and motivation in language learning (Li & Zhou, 2023). According to this hypothesis, learners with high anxiety levels had an elevated affective filter that impedes their language learning, which includes vocabulary

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acquisition. Consequently, the AR flashcards used in this research aimed to reduce the anxiety and increase motivation among the Year 1 ESL pupils through supportive and enjoyable learning environment. Through the use of AR flashcards, pupils were engaged in an interactive and enjoyable learning experience that foster a sense of autonomy and confidence in their vocabulary learning journey (Wang, 2020).

The integration of these three theories, social constructivism theory, situated learning theory and affective filter hypothesis, provided a comprehensive framework for this study on using AR flashcards to improve the Year 1 ESL pupils' vocabulary learning. By drawing upon the perspectives of these theories, this study intended to create a learning environment that fosters social interaction, real-world experiential learning experiences and positive affective learning states that ultimately enhance learners' vocabulary learning.

Methodology

The research design, research site and samples were discussed to contextualize the study. Research instruments were listed out along with the validity and reliability. Data collection method, data analysis procedure, trustworthiness and rigour, as well as the ethical considerations were addressed.

Research Design

This study employed a qualitative method to comprehensively assess the usefulness of AR flashcards and the perceptions of the pupils towards the use of AR flashcards in their vocabulary learning. This study was conducted over a period of six weeks. Kemmis and McTaggart's Action Research Model was employed in this study. According to Oranga and Gisore (2023), this research design is often used in the educational settings to help the educators gain reflective and systematic perspectives to address educational issues and improve teaching.

Research Sites and Samples

The study was conducted in a Chinese vernacular school (SJKC) located in a suburban area of Perlis. The targeted population in this study is the Year 1 ESL pupils, aged 7, who are in the early stage of ESL acquisition. These pupils had varied English proficiency level, ranging from advanced, intermediate, to low. Non probability sampling was used to select the samples, in which 15 participants were selected through purposive sampling. Purposive sampling was used to select the participants based on their English proficiency level with the aim to collect detailed data (Mweshi & Sakyi, 2020) about the usefulness of AR flashcards towards pupils with various proficiency level.

Research Instruments

The research instruments used were reflective journals and semi-structured interview.

Reflective Journal

Reflective journal was employed to record the ongoing observations and reflections throughout the study. The journal was updated immediately after each lesson to capture the fresh and accurate reflections. In the journal, the observations on pupils' engagement and interaction with the AR flashcards were documented carefully. While writing the journal, a structured format, including observations, reflections on its usefulness and plans for adjustments in subsequent sessions, were followed to ensure consistency of documentation. The reflective journals would

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provide insights into pupils' engagements and their interactions while using the AR flashcards, helping to answer the first research question.

Semi-Structured Interview

In addition, semi-structured interview was employed to gauge pupils' perception towards AR flashcards. The semi-structured interview protocol was reviewed by the school principal to make sure it adhered to MOE rules. To suit the English proficiency level of the Year 1 pupils, the questions of the interview were translated to their mother tongue when conducting the interview. The interview questions consisted five open-ended questions adopted from Ebadi and Ashrafabadi (2022). The questions were adapted to suit the proficiency level of the participants. These five questions were aimed to determine the participants' perceptions of this AR flashcards.

Validity and Reliability

The semi-structured interview protocol and the structured format of reflective journals were reviewed by both the head of English department and the principal to ensure their appropriateness. The translations of semi-structured interview protocol were also reviewed by the experienced Malay and Mandarin teachers to ensure its accuracy and clarity. In order to ensure the reliability of the semi-structured interview, the responses were audio-recorded. The audio recording was also to ensure the accuracy of the transcript. The reflective journals were also documented immediately after each lesson to ensure the accurate observations and reflections.

Data Collection Method

This study employed qualitative data collection method, which were reflective journals and semi-structured interviews. Reflective journals were utilised to evaluate the usefulness of AR flashcards in Year 1 ESL pupils' vocabulary learning. Meanwhile, semi-structured interview was used to gauge the participants' perceptions towards the use of AR flashcards in their vocabulary learning. The data collection process was conducted over a period of six weeks, including three stages, which are observations, implementation of AR flashcards and semi-structured interview process. Below is the flowchart of the process.

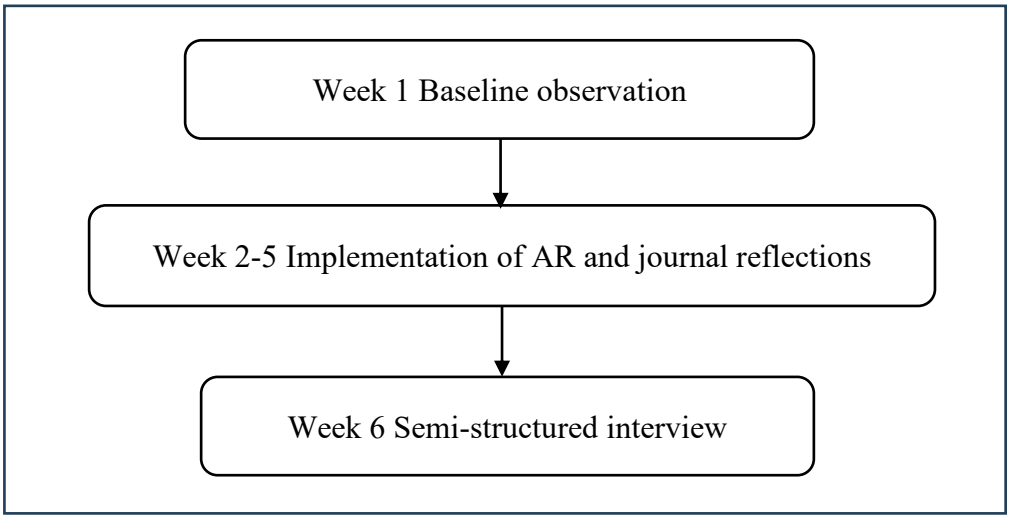

Figure 2: Flowchart Of The Study's Process

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Data Analysis Procedure

The data analysis technique employed in the qualitative study was thematic analysis. Firstly, significant observations from the reflective journals were extracted to be analysed. The contents were then coded and grouped into themes according to the keywords. Each theme was reviewed and explained. Then, coding method was also employed to analyse the semi-structured interview. The responses were recorded, transcribed and analysed using thematic analysis. Thematic analysis was utilised to identify the patterns and themes across a data set (Ruslin et al., 2022).

Trustworthiness and Rigor

Triangulation in research methodology involves integration of diverse data resources to enhance credibility and dependability of the findings (Noble & Heale, 2019). In this study, data triangulation involved reflective journal and semi-structured interview. Furthermore, member checking was done to ensure the credibility of the findings. The participants reviewed the transcripts of the interview to ensure that their responses were being interpreted accurately.

Apart from that, audit trail was maintained to ensure the process was being documented systematically and can be traced consistently. Hence, the dependability of the study was improved. Additionally, the reflective journals were reviewed by an experienced English teacher to ensure no biases and assumptions were recorded. This peer review process can enhance the rigor of this study.

Research Ethics

To ensure the research process and protect the rights of the participants in a research, ethical considerations are important. Firstly, ethical review and approval were obtained from the school and State Education Department through Educational Research Application System (eRAS 2.0) before commencing the study. The research protocols, guidelines and regulations were properly followed. Next, informed consent was obtained from the participants prior to data collection and analysis. Clear and understandable information about the purpose of the study, benefits and participants' rights were informed to ensure that they were participating the study voluntarily. Besides that, the confidentiality and anonymity of the participants were ensured. The participants were well assured that their responses in this study were safely handled for privacy.

Findings

The findings of this study were triangulated to explore the usefulness of AR flashcards and pupils' perception towards AR flashcards in their vocabulary learning. Three themes were derived from the semi-structured interview and reflective journals analysis. A summary of the themes and their keywords were presented in a table.

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Table 1: Summary of Themes and Keywords

Research Questions	1. What are the usefulness of AR flashcards in Year 1 ESL pupils' vocabulary learning? 2. What are the perceptions of the pupils towards the use of AR flashcards in their vocabulary learning?		
Themes	Theme 1: Enjoyment and motivation	Theme 2: Practicality of the AR flashcards	Theme 3: Pupils' Engagement and participation
Keywords	Positive feeling, Enthusiasm, interest	Vocabulary retention, Vocabulary improvement	Interactivity, Active participation,

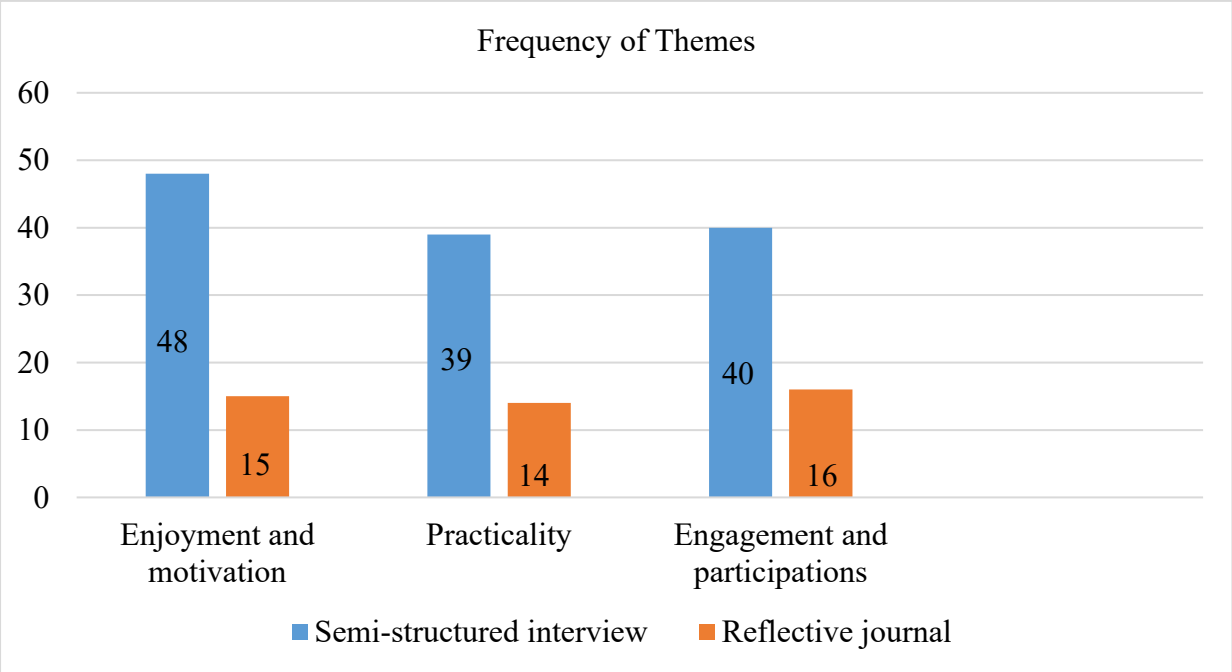

Figure 3: Frequency of Themes

A bar chart was created to illustrate the frequency of three key themes derived through the thematic analysis of data collected from the reflective journal and semi-structured interviews. The theme 'enjoyment and motivation' was identified from the keywords such as 'fun' and 'exciting'. Meanwhile the theme 'practicality' was derived from keywords such as 'remember', 'spelling' and 'understand'. Lastly, 'engagement and participations' were derived from 'interactive' and 'active participation'.

Enjoyment and Motivation

The first theme that has been analysed are the enjoyment and motivation fostered through AR flashcards towards pupils. The keyword in this theme is the positive feeling of the pupils when using the AR flashcards, in which all participants agreed that they enjoyed themselves a lot when using the AR flashcards. DW mentioned, "I enjoyed the AR flashcards so much." He added that the flashcards make him feel exciting and happy, "I feel exciting! And happy! And I love them!", with high-pitched intonation. The excitement and happiness triggered helped to keep the pupils stay attentive and motivated in learning. Several pupils responded that they felt

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fun because of the background audio. KZ mentioned, "They are so fun. … the sound of the monster! They are so fun!" He repeatedly mentioned fun in a single response, indicating that he is having strong feeling of 'fun'.

From the reflective journal, it is recorded that pupils showed high interest in using the AR flashcards "They were showing great interest in trying when they were allowed to experience by themselves". The autonomy gained helped to foster motivation in learning. Their attention was captured by the interactive visuals and the sound of the animals that they had never heard before. "They were particularly curious to see the 'moving' animals…The sounds helped to capture their attention." The AR flashcards managed to 'bring' the wildlife into the classroom, creating an immersive learning experience. In addition, AR flashcards also allowed pupils to relate the vocabulary that they had learnt to their real-life experience. "They became even more excited when they saw the AR visuals of the food in 3D". They were motivated to acquire the vocabulary because the it is highly relatable to their daily life.

Practicality of AR flashcards

The second theme identified is the practicality of AR flashcards in pupils' vocabulary learning. Some pupils explained that the 3D visuals in the AR flashcards helped them in vocabulary retention. YX said, "I kinda remember the 3D moving pictures when I see the words. And the spelling just pops out from my head.". Furthermore, the AI voiceover included in the AR flashcards helped the pupils to learn the pronunciation of the words. QL agreed that AR is helpful in remembering the spelling of the vocabulary by saying, "The pictures in the phone have got sound that teach us how to read and spell, so I can remember." The pupils can recognise and remember the spelling of the words through the visuals and audio embedded.

Apart from that, the pupils also showed improvement in their vocabulary learning after using AR flashcards. The 3D visuals in the AR flashcards enabled pupils to visualise the words and their meaning easily, which consequently enhance their understanding of the vocabulary. "Pupils are able to visualise the vocabulary vividly, hence enhance better understanding." The advanced pupils were able to complete the worksheet independently and spelled all the words accurately. "The advanced pupils are able to spell all the words correctly." Besides that, the weak pupils were also able to remember more vocabulary of the pictures and the spelling of the words. "The weak ones especially Pupil G were able to spell more vocabulary …, they can also tell the name of the food by looking at the picture." This showed that the AR flashcards helped in vocabulary recognition, understanding and retention.

Pupils' Engagement and Participation

The last theme identified are the pupils' engagement and participation in the lesson through the use of AR flashcards. The keyword of the theme is interactivity, which aligned with the novelty and interactive nature of AR. Throughout the interview, the words 'moving' and 'real-looking' are frequently mentioned by the pupils. CC mentioned, "They can move… they look very real." Other than that, SY used the word 'scary' to describe the moving 3D visuals, saying, "The spider! I thought it is coming out to my hand already!". These moving animations presented the dynamic and interactive nature of AR flashcards, allowing them to immerse themselves in the sense of real-world interaction. Hence, their learning experiences would consequently be more engaging and meaningful.

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In the reflective journal, it is recorded that the AR flashcards successfully engaged the pupils and encouraged their active participation throughout the lessons. Some keywords identified in the reflective journals were active participation, interaction and discussion. The pupils collaborated in groups and actively exchanged their thoughts about the vocabulary learned. “They are able to collaborate with one another and exchange their thoughts actively." The interactive features of AR flashcards like 3D visuals and AI voiceover prompted pupils’ interest in active discussion, including the introvert pupils. “Some introverts started to join the discussion and showed active participation during the session.” The AR flashcards sparked pupils’ curiosity, leading them to actively contribute their thoughts and ask many questions that are beyond the topic. “This also sparked their curiosity and they started to ask many questions.” The meaningful discussion enhanced pupils’ learning experience, and thus improve their vocabulary learning.

Discussion

The results of semi-structured interview and reflective journal that were being analysed, were used to answer the research question 1 and research question 2 in discussion.

Usefulness of AR Flashcards in Helping Year 1 ESL Pupils to Improve Their Vocabulary

The 3D-moving pictures and sound effects in the AR flashcards managed to facilitate pupils’ vocabulary recognition and retention. As suppported by Yangin Ersanli (2023), pupils’ visual literacy skills were enhanced through the visual, audio and interactive features in the AR flashcards. Thus, this made vocabulary learning more relatable, engaging and contextualized, as mentioned by Papanastasiou et al. (2019). Their vocabulary understanding was aided, allowing them to remember the words vividly. This highlighted the potential of AR flashcards in creating tangible and meaningful learning process, which aligns with findings from Korosidou (2024) and Jalaluddin et al. (2021) that said AR tools significantly improved pupils’ ability to internalize and apply new vocabulary.

Apart from that, AR flashcards encouraged peer interaction and enhanced engagement in pupils’ vocabulary learning. The interactive nature of AR managed to capture pupils’ curiosity and interest in learning. With the increasing interest and lowered anxiety in learning, pupils showed active participation in group activities and collaboration with peers, including the weak and introverted pupils. It is relevant to Krashen’s Affective Filter Hypothesis. The reduced anxiety encouraged pupils to internalise new vocabulary actively. This eventually created an inclusive learning environment which could foster autonomy in learning among pupils. This was consistent with the findings of the study by Ibrahim (2018) that stated the effectiveness of AR in enhancing pupils’ engagement through immersive environment.

Learners’ Perceptions Towards the Use of AR Flashcards in Their Vocabulary Learning

AR flashcards successfully generated pupils’ intrinsic motivation in learning, in which the struggling and introverted pupils showed satisfying interaction and results after using AR flashcards in the lessons. This result is aligned with Affective Filter Hypothesis by Krashen (1982) that emphasize the importance of reducing anxiety and creating positive language learning environment. It is consistent with the previous study by Yangin Ersanli (2023) that said the interactive and visually appealing features embedded in the AR flashcards diminished the boredom in the conventional traditional vocabulary learning lessons, making the learning process enjoyable and stimulating. This finding also corroborated the study by Ji and Shin

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(2019) that proposed that this dynamic and visually engaging technology, such as AR is helpful in reducing the learning anxiety, which is beneficial especially to the low-achieving learners.

The excitements and interest cultivated by the AR flashcards among the pupils allows them to enjoy the fun vocabulary learning process, making the lessons less intimidating and more engaging. This brings into line with Mamani-Calapuja et al. (2023) that said AR was able to increase pupils' engagement and satisfaction in learning. According to Hashim et al. (2022) and Yaacob et al. (2019), AR helped to foster pupils' interest and enthusiasm in learning through interactive 3D features. As a result, their learning anxiety was reduced, and thus lowered their affective filter. This is also aligned with Krashen's Affective Filter Hypothesis that highlights the importance of reduced anxiety and increasing satisfaction in learning in order to make learning happens. This consequently results in better vocabulary retention and learning.

Implication Of Study

With the meaningful outcomes obtained from the qualitative data, it was believed that augmented reality (AR) emerged highly promising potential as an education transformative tool, especially to the young learners. Therefore, the research's implications could be extended to all relevant stakeholders, including education policymakers, curriculum designers, school administrators, educators, parents and learners. Firstly, the education policymakers and curriculum designers should acknowledge the importance of AR in education by designing curriculum that encouraged the integration of AR in learning. Apart from that, the school administrators should acknowledge and support teachers' abilities and knowledge in integrating advanced technology in their lessons. Professional development, workshops and supportive environment should be provided to enhance teachers' skills in utilising the AR tools effectively. Teachers should also make use of the knowledge gained from the workshops and design AR-integrated lesson plans with some AR-based classroom activities and assessment practices that align with their teaching objectives. Lastly, parents and learners should utilise the AR tools wisely at home and thus foster an AR- based home learning environment.

Suggestions For Future Studies

While this research provides valuable insights to all stakeholders, there are also some improvements and further exploration that can be carried out in future studies. Firstly, future studies are suggested to expand the sample size to include a larger and more diverse population, with different age groups and cultural backgrounds. This would help to determine the effectiveness of AR interventions towards broader range of learners and to generalise the findings effectively. Besides that, future studies can be carried out to determine teachers' perspectives on the AR technology. As this study obtaining findings from pupils' point of view, teachers, who are the implementors of this AR technology, should be given opportunity to express their perspectives from their point of view. This can help to diversify the findings from different perspective, which is then helpful for the curriculum designers and education policy makers to design a curriculum that suits the needs of teachers and pupils.

Conclusion

In conclusion, this study explored the usefulness of AR flashcards in improving Year 1 ESL pupils' vocabulary learning as well as their perceptions towards AR flashcards in the vocabulary learning process. The objectives of this study were achieved positively. The findings from this study indicated that the AR flashcards are bringing useful impact in pupils'

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vocabulary learning and retention. Additionally, pupils also showed positive attitudes towards the use of AR flashcards in the vocabulary learning lessons. The visual, audio and contextualised learning experiences allowed the pupils to lower their affective filter in learning and increase their motivation in learning. These findings provide insights into the potential of AR flashcards in enhancing young learners' vocabulary learning. With the meaningful outcomes obtained from the qualitative data, it is believed augmented reality (AR) emerges highly promising potential as an education transformative tool, especially to the young learners. The education policymakers should acknowledge the importance of AR in education and encourage the integration of AR in education system. However, there is a significant limitation in this study, which is the inability to generalize the findings. It is because this study employed qualitative research design. The findings are context-specified and cannot be generalised to a broader population. Hence, future studies are suggested to expand the sample size to include a larger and more diverse population, with different age groups and cultural backgrounds. By this, AR's versatility and impact can be determined boarder in terms of educational impacts.

Acknowledgements
The author would like to express gratitude to the school administrators, teachers and pupils who participated in this study.

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