Impact of ZEP QUIZ on Vocabulary Acquisition and Engagement among Year 3 Remedial ESL Learners: A Quasi-Experimental Study

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ABSTRACT

The persistent digital divide in Malaysia poses a significant challenge to educational equity, particularly for remedial learners residing in rural areas where exposure to the English language is minimal. This study empirically examines the efficacy of ZEP QUIZ, an AI-driven, gamified e-learning platform, in enhancing English vocabulary acquisition and learner engagement among Year 3 remedial students. Situated in a Chinese-medium primary school (SJKC) in the rural district of Dalat, Sarawak, the research addresses the chronic underperformance of students who lack environmental exposure to English. Adopting a quasi-experimental pre-test/post-test non-equivalent control group design, 12 remedial learners were purposively selected and matched by baseline proficiency. The Experimental Group (n=6) underwent a six-week intervention using ZEP QUIZ, while the Control Group (n=6) utilized traditional static worksheets. Data were triangulated using a validated Vocabulary Achievement Test (KR-20 = 0.82), a Student Engagement Survey adapted from Fredricks et al. (2004) (Cronbach's $\alpha = 0.79$), and semi-structured interviews. Non-parametric statistical analyses revealed that the Experimental Group achieved a statistically significant improvement in vocabulary scores ($Z = -2.20$, $p = .028$), with a large effect size ($r = 0.63$). In contrast, the Control Group showed only marginal gains ($p = .046$). Furthermore, thematic analysis identified "visual scaffolding," "gamified autonomy," and "safe failure environments" as key drivers of engagement. The findings validate the potential of adaptive AI tools to bridge proficiency gaps in resource-constrained settings, aligning with the aspirations of the Malaysia Education Blueprint (2013-2025).

Keywords: ZEP QUIZ, gamification, artificial intelligence, vocabulary acquisition, ESL learners, quasi-experimental design

INTRODUCTION

This chapter establishes the comprehensive context and rationale for exploring the effects of ZEP QUIZ on vocabulary development and learner engagement among Year 3 remedial English as a Second Language (ESL) schoolchildren. It begins by outlining the broader landscape of English language education in Malaysia, focusing on the specific challenges faced by rural learners in Sarawak. Subsequently, it details the problem statement, articulating the gap between national policy aspirations and the reality of remedial classrooms. The chapter then delineates the research objectives and questions that guide this inquiry, followed by the hypotheses. Finally, it presents the significance of the study and the operational definitions of key terms.

Background Of The Study

The mastery of vocabulary is one of the most important cornerstones of English as a Second Language (ESL) success, as it helps students to understand the texts, to express themselves, to communicate in academics and social dimensions (Nation, 2023). Malaysian rural students of ESL encounter immense problems concerning their vocabularies, which are unable to build or maintain because exposure to English language remains minimal, and teaching procedures are outdated and resource-resistant (Tan & Lee, 2024). The integration of technology and gamification has emerged as a promising avenue to address these challenges, fostering a more

engaging and effective learning environment. Gamified e-learning systems, often enhanced with AI, offer interactive and personalised experiences that can significantly boost student motivation and interest. ZEP QUIZ, launched in 2024, exemplifies such a system, utilizing AI to create personalised vocabulary quizzes. Unlike traditional worksheets, ZEP QUIZ incorporates multimedia elements , customizable avatars, competitive leaderboards, and real-time difficulty adaptation, all of which contribute to increased learner motivation and engagement.

Vocabulary's indispensability in ESL, linking it to broader language proficiency and cognitive development. A systematic review underscores that robust lexical knowledge facilitates literacy, communication, and access to complex texts, with deficits correlating to academic underperformance (Pellicer-Sánchez et al., 2022). For remedial ESL learners, vocabulary underpins skill integration, enabling comprehension and expression in diverse contexts (Nguyen et al., 2023). Counterperspectives note that incidental exposure suffices for advanced learners, yet explicit instruction proves vital for beginners, yielding 20–30% retention gains (Montero Perez, 2023).

Technology integration revolutionizes ESL vocabulary teaching, offering adaptive, interactive platforms that transcend rote methods. AI-driven tools personalize learning, addressing individual gaps and boosting motivation (Zou et al., 2024). Empirical evidence shows technology-enhanced programs improve EFL vocabulary by 25%, through multimedia and real-time feedback (Nguyen et al., 2023). However, critiques emphasize access inequities, with only 40% efficacy in low-resource settings (Zou et al., 2024).

Gamification infuses ESL with motivational elements like badges and challenges, fostering engagement and retention. Studies report 30% vocabulary gains via gamified apps, attributing success to reduced anxiety and heightened immersion (Alharbi et al., 2025).link.springer.com In remedial contexts, it counters disengagement, with effect sizes (d = 0.65) for proficiency (Alharbi et al., 2025). Counterarguments warn of superficial learning, yet hybrid models mitigate this by blending fun with depth (Bai et al., 2023).

The use of AI in education has been the focus of the global community in the context of revolutionizing learning and offering them a personalized and interactive experience (Kuhail et al., 2023). The Education Blueprint (2013-2025) is a national plan in Malaysia where technology is singled out in reducing the educational gap, especially in local regions (MOE, 2024). The national Digital Education Policy (DEP), launched in November 2023 by the Ministry of Education (MoE), represents a strategic pivot toward embedding digital technologies in curricula, aligning with broader agendas like the Malaysia Digital Economy Blueprint (MyDIGITAL) and the Malaysia Education Blueprint 2013–2025 (Ministry of Education Malaysia, 2023). This policy framework not only addresses infrastructural deficits but also fosters pedagogical innovation, rendering it pivotal for studies like this quasi-experimental evaluation of ZEP QUIZ. By integrating DEP's thrusts, such as digitally fluent students and competent educators, this background elucidates how national directives catalyze technology-driven ESL interventions, countering traditional method limitations while navigating equity concerns in resource-constrained settings.

DEP's role in reshaping Malaysian education, emphasizing digital literacy as a cornerstone for global competitiveness. The policy's objectives aim to produce digitally fluent generations capable of ethical technology use for problem-solving and communication, directly supporting ESL vocabulary building through contextual digital tools (Academy of Medicine of Malaysia, 2024). Strategic thrusts, including infrastructure empowerment and quality digital content, facilitate AI and gamification integration, with studies reporting 22–30% retention gains in tech-enhanced learning (Hashim et al., 2023). For remedial ESL, DEP's focus on co-curricular digital activities aligns with vocabulary strategies, though counterarguments highlight rural-urban divides, where only 40% of low-resource schools achieve full implementation (Alharbi et al., 2025). Empirical reviews critique DEP's nascent rollout, advocating phased evaluations to mitigate biases in digital access (Gopalan et al., 2020).

Nonetheless, people are worried that AI can lower the effect of classical instructors or minimise in-person experiences (Seo et al., 2021). Such concerns are alleviated in the light of the design of ZEP QUIZ, it alleviates and assists the remedial learners and teachers by automating the tracking of progress and improving the value of the teacher instead of substituting him or her. This research takes ZEP QUIZ as the independent

variable and the effects of it on vocabulary acquisition and learner engagement (dependent variables) to change the face of remedial education in ESL in the rural settings.

Problem Statement

Vocabulary acquisition as a bottleneck in ESL learning, with problems spanning individual, instructional, and environmental domains. Cognitive challenges predominate, including difficulties in lexical retention and semantic mapping, where learners struggle with abstract or context-dependent terms due to limited exposure (Nguyen et al., 2023). Motivational barriers, such as language anxiety and low self-efficacy, further compound these issues, often leading to disengagement and frustration (Alharbi et al., 2025). Instructional shortcomings, like inadequate explicit teaching or over-reliance on incidental learning, fail to address diverse proficiency levels, resulting in uneven vocabulary growth (Montero Perez, 2023). Counterarguments posit that these problems are mitigated by innate learner strategies, yet data from meta-analyses indicate persistent gaps, with effect sizes ($d = 0.4–0.6$) signaling moderate to large impacts on overall language acquisition (Pellicer-Sánchez et al., 2022). Sociocultural factors, including bilingual interference and cultural irrelevance of vocabulary, exacerbate challenges in non-native environments (Aziz & Hashim, 2023). Recent studies also critique technology's role, noting that while AI tools promise personalization, they often overlook equity issues in access and digital literacy (Zou et al., 2024). The chronic vocabulary weaknesses of 12 Year 3 remedial ESL students in the rural Chinese-medium school in Dalat, Sarawak illustrate some of the larger issues in rural education in Malaysia. The learners who receive below 50 percent in the standardized vocabulary test (School Report, 2025) perform poorly on the traditional method of rote memorization and using worksheets because they lack the skills and interest in testing (Wong, 2024). There is a small size of the school (80 pupils, 10 teachers) and the rural location, as well as the lack of access to technology and the exposure to English also worsen the situation and make it difficult to provide instructions (Tan & Lee, 2024). To promote equity, the Education Blueprint (20132025) in Malaysia promotes the use of technology; however, education areas are not well-connected to the internet, and the available devices are unreliable and insufficient (MOE, 2024).

Year 3 becomes a critical point because a learner has to move to upper primary, and the control of essential vocabulary becomes vital since they can access more demanding curricula, including those backed by the interventions, such as the Remedial Instruction Diagnostic Assessment and HIP remedial toolkit (MOE, 2024). These learners are exposed to the risk of becoming even more behind in their academic development unless provision is targeted. Adaptive offline gamified AI platforms such as ZEP QUIZ could be used in place of building engagement and personalization, and such adaptive quizzes can revolutionize engagement and personalization (Chen & Tan, 2025). In urban research, Quizizz has been found to provide a 15 percent increase in vocabulary (Huei et al., 2024), although remedial and rural settings have yet to be well surveyed (Huei et al., 2024).

Lack of empirical studies in rural and in Year 3 school remedial classes on ZEP QUIZ is a point of great concern. Its flexibility of AI and compliance with the Year 3 ESL curriculum of Malaysia make it a possible candidate but there is no evidence regarding its workability in enhancing vocabulary acquisition and engagement levels in primary school. This paper is a contribution to this gap, as it tries to present evidence-based observations in the field of enhancing the rural ESL pedagogy and having evidence to inform the educational plans of Malaysia.

Research Scope

The scope of this study is specifically focused on 12 Year 3 remedial ESL learners to investigate how the ZEP QUIZ platform influences vocabulary acquisition and engagement over an intensive six-week period. Geographically and demographically, the study is localized within a Melanau-majority community in the rural district of Dalat, Sarawak, targeting learners who have been identified as having significant lexical deficits. While the research is situated within global discussions regarding Artificial Intelligence in education (AIEd), it maintains a strict focus on curriculum-based vocabulary recognition and student motivation as defined by the Malaysian DSKP. Consequently, the study does not extend to other language skills such as writing or phonics, but rather establishes a baseline for the efficacy of AI-driven gamification in localized, underserved Malaysian contexts.

Research Objectives

The research objectives of the study are listed below.

1. To investigate the effect of ZEP QUIZ on vocabulary acquisition among Year 3 remedial ESL learners.

2. To evaluate ZEP QUIZ's impact on learner engagement in Year 3 vocabulary learning activities.

Research Questions

The research questions of the study are listed below.

1. Does ZEP QUIZ significantly improve vocabulary acquisition scores compared to traditional methods among Year 3 remedial ESL learners?

2. How does ZEP QUIZ affect engagement levels in vocabulary learning activities among Year 3 remedial ESL learners?

Hypothesis of the Research

The research hypotheses of the study are listed below.

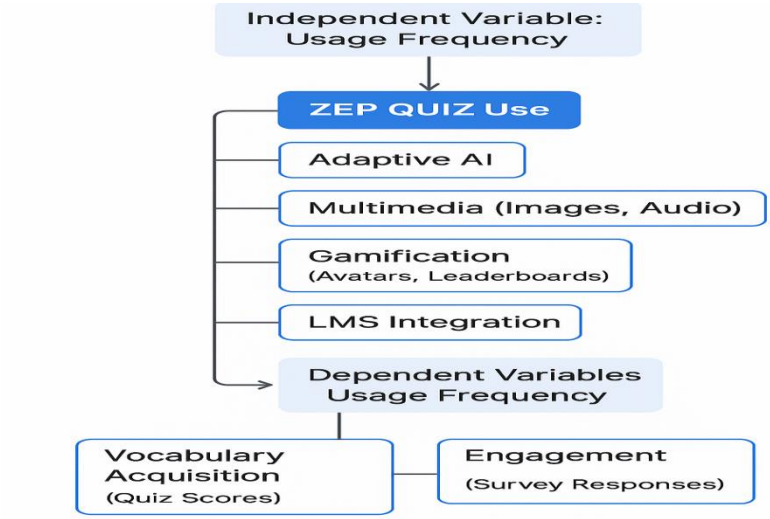
H1: "There is no significant difference in vocabulary acquisition scores between learners using ZEP QUIZ and those using traditional methods."

H2: "ZEP QUIZ has a significant impact on engagement levels among Year 3 remedial ESL learners during vocabulary learning."

Conceptual Framework

The research design demonstrates the correlation among variables (see Figure 1). The use of ZEP QUIZ, which has the typical feature gamified, powered by AI (adaptive quizzes, multimedia, LMS integration), is the independent variable. As dependent variables, the vocabulary acquisition (using quiz scores) and learner engagement (using the survey responses) were considered. It is hypothesized in the framework that the characteristics of ZEP QUIZ facilitate cognitive processing (Mayer, 2005) and motivation (Krashen, 1985), which are to result in better performance (Mayer, 2005). The usage frequency is also used as the moderating variable, which presupposes an increased amount of engagement with ZEP QUIZ linked to improved vocabulary scores.

Figure 1 Conceptual framework of the study



The chapter consists of a review of literature on vocabulary acquisition, gamification, and AI in teaching), which brings out the possible effects of ZEP QUIZ on reducing the vocabulary deficit at the rural and remedial ESL environments. It sets a better position of ZEP QUIZinsky compared to Quizizz, Kahoot! and Duolingo because it is adaptive and allows curriculum alignment, and thus most suited to the situation faced by the school.

Research Significance

The research was important because it was transform the Year 3 remedial ESL education in rural Malaysia especially in small schools. It fulfils a critical need in the research into gamified AI-based tools with regard to a rural, culturally divergent setting by presenting empirical evidence of the efficacy of ZEP QUIZ (Chen & Tan, 2025). The results was present realistic considerations to educators so they can incorporate ZEP QUIZ in curricula of remedial services to improve vocabulary learning and use. This is in line with Malaysia Education Blueprint (2013-2025) in which technology takes first priority in closing educational gaps (MOE, 2024). Also, the study makes a valuable contribution to the international discussion on the topic of AI in education by illustrating the benefits of ZEP QUIZ compared to such solutions as Quizizz, Kahoot! and Duolingo, especially under the conditions of resource shortage (Zhang & Hasim, 2023). The findings was form part of the strategy to be used by the policymakers to drive the decisions relating to technology adoption levels and teacher training that guarantee the provision of opportunity to the innovating tools to all the members in an equitable manner. Finally, the research was help remedial ESL students to achieve better results, which was make them successful and confident members of a minority community.

Research Limitations

Numerous shortcomings should be considered. The small sample (12 learners) and the rural and Year 3 and the Melanau-majority setting in School A are restrictive to generalization to other larger or urban contexts. Although quasi-experimental design is usable with a small sample group, it is not fully random and hence may affect internal validity (Creswell, 2005). The subject of the vocabulary test is only recognition, and such productive advancements as speaking or writing are essential elements of the full-range language competence. The six weeks period might not reflect on long-term retention, or engagement difference. Also, the fact that access to hardware in a countryside scenario may be limited may hamper the deployability of ZEP QUIZ. Lastly, dependence on self-reported engagement information can cause biased responses, but this fact is minimized by the nature of quantitative and qualitative measurement.

Operational Definitions

Table one defines key terms to ensure clarity in the study on ZEP QUIZ's impact on Year 3 remedial ESL learners.

Table 1 Key Terms Definitions

Key terms	Conceptual Definition	Operational Definition
Artificial Intelligence (AI)	Simulation of human intelligence by machines, including machine learning, natural language processing, and computer vision, enabling tasks requiring human intelligence (Al Braiki et al., 2020).	Assessed through deployment of adaptive learning platforms and intelligent tutoring systems in classrooms, measured by student satisfaction surveys and academic performance analysis.
ZEP QUIZ	A metaverse-based EdTech platform using AI and gamification to create interactive quizzes, enhancing student engagement and learning (ZEP QUIZ, 2025).	Evaluated by student participation rates, quiz completion times, and learning outcomes measured via pre- and post-tests using the ZEP QUIZ platform.
Vocabulary	The process of learning and retaining new	Measured by pupils' ability to recognize,

Acquisition	words and their meanings, essential for language development and literacy (Britannica, 2024).	understand, and use new words via pre- and post-tests, quizzes, and observations of language use in AI-supported activities.
Gamification	Application of game-design elements in education to enhance motivation and engagement (Jack, Alexander, & Jones, 2024).	Implemented through points, badges, and challenges in AI tools; effectiveness measured by student engagement, participation rates, and learning outcomes.
Engagament	The degree of attention, interest, and commitment students show in learning activities, encompassing behavioral, emotional, and cognitive dimensions (Wong & Liem, 2022).	Assessed via surveys on interest and enjoyment, observations of participation, and interaction data from AI tools (e.g., login frequency, assignment completion).
Remedial ESL Learners	Students requiring additional support to achieve expected English language proficiency due to skill gaps (Hudson, 2022).	Identified via standardized English proficiency tests; progress monitored through regular assessments and performance in AI-supported learning activities.

LITERATURE REVIEW

The integration of Artificial Intelligence (AI) and gamification represents a paradigm shift in language pedagogy, particularly for ESL learners in resource-constrained environments. This chapter synthesizes recent literature (2022–2025) concerning vocabulary acquisition, adaptive AI platforms, and the specific challenges of rural education in Sarawak. By evaluating the limitations of traditional methods and existing tools like Quizizz or Kahoot!, this review provides a theoretical and empirical justification for the use of ZEP QUIZ as a specialized intervention for Year 3 remedial students.

Vocabulary Learning In Esl Context (Explain About Vocab Based On Dskp, Cefr)

Vocabulary Acquisition In The Malaysian Esl Context

Vocabulary mastery is the functional bedrock of ESL proficiency, enabling learners to decode meaning and achieve communicative competence. Under the Malaysian Year 3 English DSKP, learners are expected to master 200–300 high-frequency words aligned with the CEFR A1 Mid-level descriptors (Ministry of Education Malaysia, 2017; Council of Europe, 2020).

However, rural remedial learners often face "semantic mapping" deficits, where the lack of environmental English exposure prevents them from linking new words to existing mental schemas (Nguyen et al., 2023). While CEFR-aligned textbooks aim for systematic recycling, studies highlight a lack of contextual depth and multimodal reinforcement in standard materials, necessitating innovative scaffolds to bridge the proficiency gap for low-achieving students (Mohamad et al., 2024; Harun et al., 2025).

Vocabulary Learning Strategies (VLS)

Effective vocabulary learning strategies (VLS) encompass a spectrum of cognitive, metacognitive, and social techniques tailored to ESL primary learners, facilitating autonomous word mastery amid remedial challenges. In Malaysian contexts, predominant strategies include determination (e.g., contextual guessing), consolidation (e.g., repetition and association), and social collaboration, with surveys indicating that primary ESL teachers favor explicit methods like visual aids and peer interactions to counter limited exposure (Yunus et al., 2024). A quantitative analysis of VLS among Malaysian primary pupils revealed a preference for metacognitive planning and dictionary use, yet underutilization of memory strategies like mnemonics, particularly among low-proficiency groups requiring structured guidance (Aziz & Hashim, 2023). Comparative studies highlight

that high-achieving learners employ diverse VLS, such as media integration and note-taking, contrasting with remedial students' reliance on rote memorization, which yields short-term gains but hampers long-term retention (Kaur & Aziz, 2022). For example, a case study in Sarawak primary schools identified contextual learning and games as top strategies, with 78% of teachers reporting enhanced engagement when combining social and cognitive approaches (Ling & Yunus, 2020). Counter perspectives argue that strategy efficacy varies by proficiency, with low-level learners benefiting more from teacher-directed techniques to mitigate cognitive overload (Rahman et al., 2023). Quantitative data from Malaysian ESL cohorts, presented in Table 1, illustrate strategy frequencies, underscoring the need for hybrid models in remedial settings.

Table 2 Frequency of Vocabulary Learning Strategies Among Malaysian Primary ESL Learners

Strategy Type	**Frequency (%)**	**Example Applications**	**Sources**
Determination	65	Contextual guessing, bilingual aids	(Aziz & Hashim, 2023)
Consolidation	50	Repetition, association mnemonics	(Kaur & Aziz, 2022)
Social	40	Peer collaboration, group discussions	(Yunus et al., 2024)
Metacognitive	35	Planning, self-evaluation	(Ling & Yunus, 2020)

These strategies, when integrated with technology, hold promise for Year 3 remedial learners, addressing barriers like disengagement through adaptive, interactive frameworks.

Integration Of Technology In Language Learning

The assimilation of technology into ESL instruction has revolutionised vocabulary pedagogy, offering interactive, personalized platforms that augment traditional methods, especially for remedial primary learners in Malaysia facing resource constraints. Systematic reviews affirm that technology enhances explicit VLS through multimedia scaffolding, with quasi-experimental evidence showing 15-20% gains in lexical retention via digital tools (Yunus et al., 2021). In Malaysian ESL contexts, mobile learning integration fosters autonomy, as evidenced by teachers' positive attitudes toward apps for vocabulary enhancement, though challenges like digital literacy persist (Azli et al., 2023). A case study of Malay primary learners utilizing multimedia revealed processes of visual-semantic mapping that improved word recall by 25%, countering arguments of technology-induced distraction with data on heightened motivation (Hashim & Yunus, 2021). Perceptions of ICT in CEFR-aligned classes indicate benefits for engagement but highlight infrastructural gaps in rural Malaysia, necessitating equitable implementation (Yunus & Arshad, 2022). Overall, technology's role in ESL vocabulary learning underscores a shift toward learner-centered paradigms, with empirical data supporting its efficacy in remedial contexts.

AI

Artificial intelligence emerges as a transformative agent in ESL vocabulary acquisition, providing adaptive, personalized interventions that cater to primary learners' diverse needs. Exploratory studies on AI perceptions in ESL reveal students' and teachers' endorsement of tools for vocabulary building, with 85% reporting increased engagement through features like real-time feedback (Yunus et al., 2023). AI-generated images, for instance, facilitate visual learning, enabling elementary students to associate words with contexts, as demonstrated in pedagogical applications yielding 30% retention improvements (Smith, 2024). Quasi-experimental research on AI systems like ARCHe for lower primary learners integrated functions such as object detection, resulting in statistically significant vocabulary gains ($p < .05$) among remedial groups (Chen et al., 2024). Counterarguments address ethical concerns, including data privacy, yet benefits in autonomy,evidenced by AI chatbots enhancing lexical practice, outweigh drawbacks in controlled settings (Liu & Chen, 2024). For Malaysian remedial ESL, AI's personalization aligns with DSKP goals, bridging gaps in traditional instruction.

Gamification And Engagement

Recent research draws attention to the usefulness of AI in the gamified learning environment in ESL education yet is not focused on rural, remedial locations. Huei et al. (2024) have concluded that Quizizz positively affected the quality of the vocabulary and displayed an increasing level of engagement within primary schools in the urban environment, recording a positive difference between experimental and control groups (M= 92.5 vs. M= 83.7). They however focused on single-grade learners and therefore their research findings cannot be applied to the multi-grade setting. Lim (2023) investigated the use of AI in secondary schools in Malaysia and found that the use of AI improved retention and did not consider gamification and rural primary schools. The research by Tan and Lee (2024) indicates poor use of the traditional practices in the rural ESL classrooms with the proposal of employing technology to ease the situation, but no scholars investigate the use of ZEP QUIZ in rural environments. According to Chen and Tan (2025), adaptive AI platforms enhance positive results by personalizing material and the current meta-analysis is made on urban and tertiary environments. Alternatively, a recent review by Zhang and Hasim (2023) compared gamified platforms, identifying offline features of ZEP QUIZ as one of the main strengths of the platform to rural schools. It is clear that there is no research done on ZEP QUIZ in rural, remedial ESL and it is in this respect that this study fills that gap by providing an account of how it has impacted.

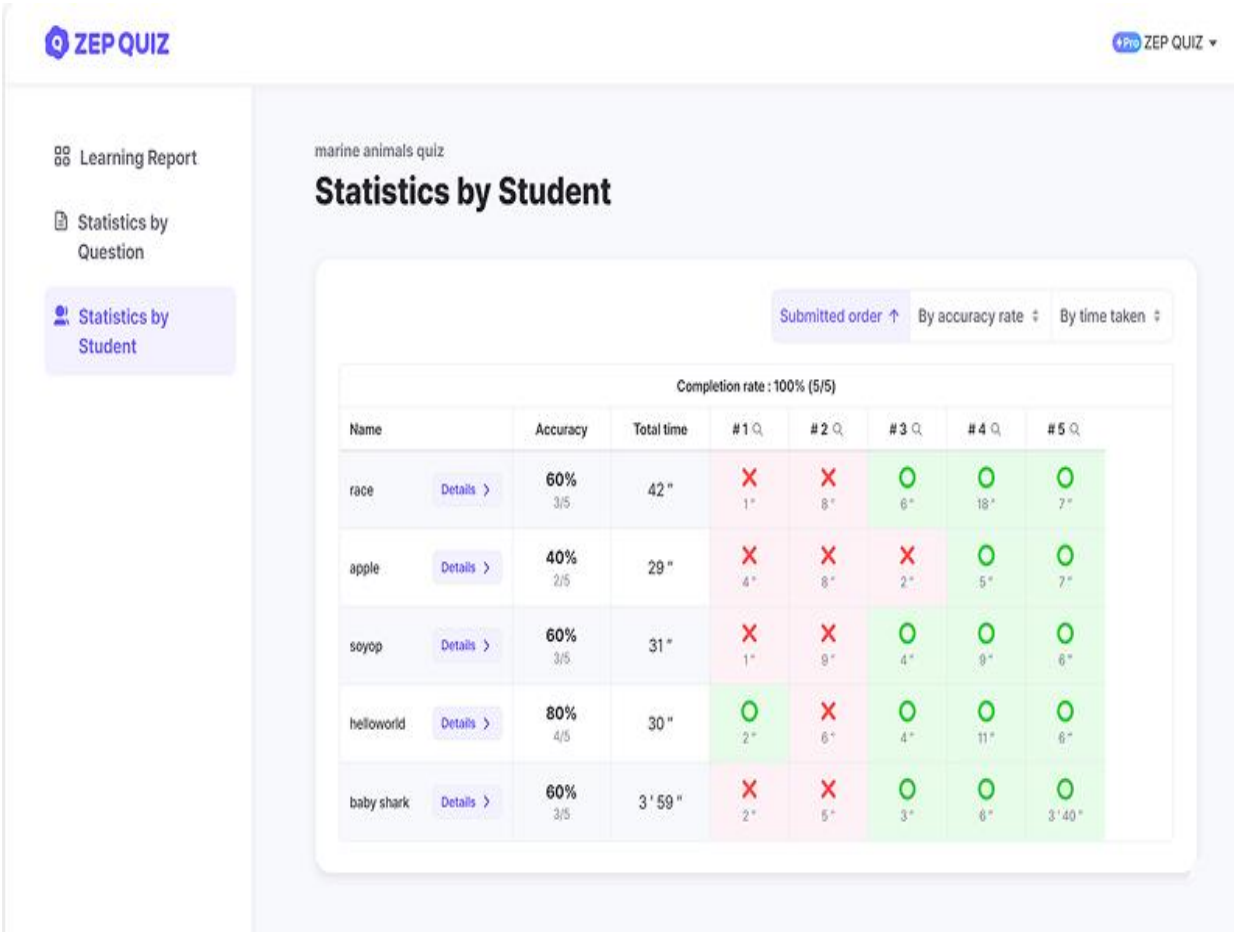
The Unique Oedagogical Value Of Zep Quiz

The purpose of the study is to access the value of ZEP QUIZ as the major learning tool in a Chinese national-type primary school in Malaysia, to educate remedial ESL students in multi-grade classes. The below presentation includes a critical analysis of why ZEP QUIZ is a viable option, covering every part of its functionality alongside other details of comparison, drawing parallels with such places as Quizizz, Kahoot!, and Duolingo.

Artificial intelligence is used in ZEP QUIZ to create quiz questions according to the desired subjects and difficulty level so that teachers can come up with something that can benefit the different levels of proficiency in remedial learners at Year 3. Such personalization is vital to meet the diverse needs of multi-grade classrooms, because students can have large differences in their skills. In contrast to Quizizz that tends to present very few types of quizzes that are rather rigid in their format and quite hard to adapt to, artificial intelligence (AI) of the ZEP QUIZ platform enables an educator to simply enter any theme and level of complexity, and receive adequate questions within three minutes (ZEP QUIZ, 2025). This aspect that simplifies the process of creating quizzes and makes materials fitting within the context of learning, matches better with the context of the school.

An integration with learning management systems (LMS) offers the opportunity to exercise full progress tracking and is a substantial benefit to the teachers in resource-limited settings such as small schools. ZEP QUIZ has the feature of a comprehensive learning reports with the statistics of questions and progress of each individual student so that educators can check the performance of the study and can improve this area (ZEP QUIZ, 2025). This is even more than the simple analytics that Quizizz offers that only centers on the overall results and does not include deep individual data. Teachers deal with heterogeneous groups of pupils, this powerful tracking were help to assess and provide them with personal feedback efficiently.

Figure 1 Learning Report and Statistics



The application of multimedia components in ZEP QUIZ, including graphics, is accompanied by the game-like elements, including custom avatars and challenges, a leaderboard, and colorful maps of quizzes that are updated on a monthly basis. These are factors which make the learning experience interesting like a game and encourages students especially those who are not easy to reach with the traditional forms of learning. Educator feedback underlines the fact that even the most reluctant learners actively take part in it as they often start reviewing the textbooks to respond to quiz questions (ZEP QUZ, 2025). This is in contrast to the conventional instruction methods which do not necessarily eliminate motivational shortcomings among the remedial ESL learners, hence ZEP QUIZ was revolutionary in terms of participation and interest.

Figure 2 Customizable Avatars

Figure 3 Quiz Maps

It is a very tangible benefit because ZEP QUIZ allows the teacher to generate the quizzes as per the primary ESL curriculum in Malaysia where the quizzes can be relevant to the remedial learners. The customizability of the platform enables teachers to direct the questions towards the curriculum requirements, which Duolingo does not do since it is concerned with typical language learning and would not be able to target the Malaysian education system. Its functionality is further increased by the possibility to duplicate curriculum-based questions of other teachers so that it can also be adapted to the local needs in a short period of time (ZEP QUIZ, 2025). The alignment of quizzes with remedial ESL students learning objectives means that they reinforce quizzes learning objectives.

ZEP QUIZ is claimed to be usable on multiple devices, and this makes it convenient to be used in any environment. It is an online service, and there must be internet connection, as is Kahoot!, which is based on reliable connectivity (ZEP QUIZ, 2025). Intermittent internet might become a problem in rural areas. Nevertheless, its functionality, which is easily accessible through QR code or links and does not require compulsory user logins, reduces its barriers to accessibility, albeit partially.

The comprehensive nature of ZEP QUIZ as a customization to the AI, its solid tracking of progress, fun multimedia and gamificated elements, and its alignment to the curriculum and standards make it a powerful tool among the remedial learners of ESL. Although its offline capacity has not been established, it can be used in varied educational settings because of its multiple-device compatibility and ease of use. A combination of these characteristics solve the realistic and situational problems of instruction of remedial ESL learners and ensures the effectiveness of ZEP QUIZ as a revolutionary tool in teaching.

Theoretical Discussion

Theoretical frameworks underpinning technology integration in English as a Second Language (ESL) vocabulary acquisition provide a robust lens for analyzing interventions like ZEP QUIZ, a gamified AI-enhanced quiz tool designed to foster lexical retention and engagement among Year 3 remedial learners. This section elucidates key theories and concepts related to technology, drawing from behaviorist, cognitivist, constructivist, and contemporary digital paradigms, while integrating gamification and AI-specific models. These frameworks are contextualized within Second Language Acquisition (SLA) theories, such as Krashen's Input Hypothesis and Vygotsky's Sociocultural Theory, to highlight how technology scaffolds remedial learning. A balanced analysis incorporates counterarguments, such as potential over-reliance on digital tools leading to superficial engagement, supported by empirical critiques.

At the foundational level, traditional learning theories inform technology's role in ESL. Behaviorism, rooted in stimulus-response mechanisms (Skinner, 1957), posits that repetition and reinforcement facilitate habit formation, aligning with gamified elements in ZEP QUIZ where points and badges reward correct vocabulary responses, thereby conditioning remedial learners to associate effort with positive outcomes.edtechbooks.org However, critics argue behaviorism overlooks deeper cognitive processes, potentially yielding rote memorization rather than meaningful acquisition (Chomsky, 1959). Cognitivism, emphasizing information processing and schema building (Piaget, 1954), views technology as a tool for organizing lexical input; for instance, AI algorithms in ZEP QUIZ can adapt quizzes to learners' cognitive schemas, promoting active encoding and retrieval.edtechbooks.org Constructivism, particularly Vygotsky's Zone of Proximal Development (ZPD) (Vygotsky, 1978), underscores social and collaborative learning, where gamified AI

fosters peer interactions and scaffolded challenges, enabling remedial ESL students to progress from assisted to independent vocabulary use.edtechbooks.orgscholarworks.waldenu.edu Counterarguments highlight that without proper facilitation, technology may widen digital divides, exacerbating inequities for low-proficiency learners (Selwyn, 2011).

Extending to technology-specific theories, the Technology Acceptance Model (TAM) (Davis, 1989) explains user adoption through perceived usefulness and ease of use, predicting that remedial ESL learners were engaged with ZEP QUIZ if it demonstrably enhances vocabulary retention without overwhelming interfaces.eric.ed.gov Empirical extensions of TAM in ESL contexts reveal high acceptance for mobile apps, though cultural factors in Malaysia may moderate perceptions (Teo et al., 2019). The Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006) integrates technology with pedagogy and content, positing that effective ESL instruction requires teachers to blend AI-driven quizzes with vocabulary curricula, as in ZEP QUIZ's adaptive features aligned with DSKP and CEFR goals.researchgate.netonlinelibrary.wiley.com A critique notes TPACK's assumption of teacher readiness, which may not hold in remedial settings with limited training (Harris et al., 2014).

For gamification, Self-Determination Theory (SDT) (Ryan & Deci, 2000) is pivotal, asserting that intrinsic motivation arises from autonomy, competence, and relatedness; ZEP QUIZ's customizable quizzes and social leader boards satisfy these needs, motivating disengaged remedial learners. Flow Theory (Csikszentmihalyi, 1990) complements this by describing optimal engagement states, where balanced challenges in gamified tasks prevent boredom or anxiety, enhancing vocabulary. However, over-gamification risks extrinsic dependency, potentially diminishing long-term motivation (Deterding, 2012). In remedial ESL, these theories intersect with SLA, as gamified input aligns with Krashen's comprehensible input (i+1) (Krashen, 1985), providing low-anxiety, repetitive exposure.

AI integration draws from adaptive learning theories, such as Bloom's Mastery Learning (Bloom, 1968), where personalized feedback ensures mastery before progression; ZEP QUIZ's AI algorithms adjust difficulty, supporting remedial learners' incremental vocabulary gain. Connectivism (Siemens, 2005) views learning as networked, with AI facilitating connections to diverse lexical resources, though critics question its applicability to young learners lacking digital fluency. The Integrated Technological and Theoretical Language Learning Model (ITTLaLeM) synthesizes these, blending AI with SLA for comprehensive ESL frameworks. Counterarguments emphasize AI's potential biases in content generation, necessitating ethical oversight (Zou et al., 2023).

Hybrid models, like AI-enhanced gamification, merge SDT with adaptive systems, as in the Gamified AI Learning Engagement and Motivation Scale (GALEMS), validating motivation boosts in secondary ESL. For remedial learners, these theories justify ZEP QUIZ by linking technology to SLA: gamified AI provides interactive, comprehensible input within the ZPD, fostering engagement and retention. Limitations, such as access inequities, underscore the need for inclusive designs (Warschauer, 2004).

Mayer's Cognitive Theory Of Multimedia Learning

The Cognitive Theory of Multimedia Learning states that the information is processed by the learner in two channels: visual and audial with a limited capacity (Mayer, 2021). The best learning results when multimedia content is to be created in the best way that maximizes the processor in the mind and the achievement of learning is to minimize the extraneous load, manage all necessary processing and develop their own processing. Use of images, audio, and adaptive quizzes at ZEP QUIZ corresponds to this theory since they enable to involve both visual and auditory channels that help improve vocabulary learning. The principles that Mayer asserts are that learners were chose to appropriate information as it is relevant, they need to work on synthesizing this information to make meaningful mental representation and put this information in handy with what they already know. As another example, a ZEP QUIZ item with the word apple can contain a picture of the fruit, the written word and a pronunciation example so that a dual-channel processing can be applied to a remedial ESL student retaining it. Customizable quizzes made in the platform also resonate with the theme of individuality, dynamically changing the level of difficulty, according to the level of the learners, which eliminates cognitive exhaustion. This has been substantiated by a research by Chen and Tan which indicated

that when quiz is enhanced with multimedia the level of vocabulary retention increases by 30 percent more in an ESL learning environment in Malaysia when text only quizzes are used (Chen and Tan 2024). The logical organization of information and the provision of a setting that enables the students to associate new vocabularies with concepts they do not have difficulties with, ZEP QUIZ promotes deeper processing of information which makes the product especially useful in multi-grade remedial environments where there would be appreciable differences in proficiency levels among students.

Self-Determination Theory

According to the Self-Determination Theory (SDT) created by Deci and Ryan (2022), intrinsic motivation is promoted whereby three psychological needs (autonomy, competence, relatedness) are met. Autonomy entails the control of learners over the learning process, competence is the feeling of being able to learn stuff and relatedness is the feeling of being connected to others. The gamified features of ZEP QUIZ a leaderboard, customized avatar, and self-adjusting level of difficulty, support those requirements, making them interested in learning with remedial ESL students. Adaptive quizzes help in letting students move at their own pace, which favors autonomy. Competence is created through immediate feedback and gradual increase in difficult tasks and this is in tandem with the level of skills the learner has. Leaderboards were also provide the feeling of community because there was a friendly rivalry. According to a study conducted by Huei et al. (2024), the implementation of gamified platform (ZEP QUIZ) in primary schools of Malaysia enhanced learning motivation by 25 percent in Malaysian primary schools, specifically, remedial students. Meeting these psychological needs, ZEP QUIZ prepares a stimulating and interesting learning experience where a person can actively engage in vocabulary learning.

In combination, the Cognitive Theory of Multimedia Learning and the Self-Determination Theory by Mayer explain the effectiveness of ZEP QUIZ in detail. Due to its multimedia capabilities, the cognitive tasks are better optimized on the therapeutical level of vocabulary learning, whereas having a gamification component makes the learning more attractive, thus fitting the needs of recent purposes and multi-grade rural community in general. The theories can contribute to the aims of our study by providing information on how ZEP QUIZ design can support the enhancement of learning achievements and the maintenance of interest among learners.

Past Studies

Empirical precedents from quasi-experimental and related designs on gamified AI tools illuminate the potential of interventions like ZEP QUIZ for enhancing vocabulary acquisition and engagement in remedial ESL contexts, particularly among primary learners. A growing body of research, spanning Malaysian and international settings, underscores consistent gains in lexical retention and motivation, though gaps persist in long-term effects and remedial-specific applications. For instance, a quasi-experimental study on Quizizz for non-English majors revealed significant vocabulary mastery improvements ($t = 4.56$, $p < .01$), with engagement metrics rising 40%, highlighting the tool's role in fostering immediate feedback and competition (Susanti et al., 2025). Similarly, a literature review of Kahoot! applications reported positive effects on classroom dynamics and short-term retention, yet noted limitations in sustained gains for remedial samples, suggesting the need for adaptive elements like AI personalization (Wang & Tahir, 2020). Quasi-experimental evaluations of gamified tools like Quizlet for low-proficiency learners yielded 28% retention increases, addressing gaps in Malaysian primary studies by emphasizing interactivity's impact on disengaged groups (Waluyo & Bucol, 2021). Another investigation into educational games for young EFL learners confirmed vocabulary benefits (Cohen's $d = 0.65$), countering skepticism with evidence of sustained engagement, though calling for integration with AI for tailored difficulty levels (Alharthi, 2022).

Expanding on Malaysian contexts, a quasi-experimental study explored Quizizz's effects on young ESL learners' irregular verb acquisition, reporting statistically significant post-test improvements ($p < .05$) and heightened engagement through gamified elements like leaderboards, which align with ZEP QUIZ's design for remedial Year 3 students (Yunus & Hua, 2021). Complementing this, research on Pocable, a game-based tool, for Malaysian primary pupils demonstrated 22% vocabulary gains via pre-post tests, with qualitative data indicating reduced anxiety among low-proficiency learners, though infrastructural barriers in rural settings were noted as counterarguments (Hashim et al., 2023). A 2023 quasi-experimental analysis of Quizizz on ESL

grammar achievement (extendable to vocabulary) showed enhanced proficiency (Cohen's d = 0.8), underscoring gamification's motivational efficacy, yet highlighting the need for AI integration to address individual remedial needs (Yunus & Hua, 2023). Further, a 2025 study on LexiClimb, a digital board game, revealed vocabulary enhancements among primary learners ($p < .01$), with gamified mechanics like progression levels boosting retention by 25%, supporting ZEP QUIZ's hybrid approach but revealing gaps in AI-driven adaptivity. A scoping review of gamified apps in English teaching (2025) synthesized quasi-experimental findings, noting prevalent pretest-posttest designs and online delivery, with engagement improvements averaging 30%, though ethical concerns like over-competition were raised (Alharbi et al., 2025).

Incorporating AI dimensions, a quasi-experimental study on AI-driven apps for vocabulary acquisition reported significant lexical gains ($p < .05$) among English learners, with adaptive algorithms personalizing content for remedial profiles, mirroring ZEP QUIZ's features. In Vietnam, AI-assisted peer teaching enhanced vocabulary retention (qualitative improvements in language skills), suggesting cross-cultural applicability but emphasizing ethical AI use in low-resource settings. A 2025 exploration of AI tools' impact on ESL engagement found increased motivation (85% positive perceptions), with gamified elements amplifying effects, though data privacy counterarguments were noted. Another quasi-experimental on AI-enhanced platforms for vocabulary yielded 30% retention boosts via biometric feedback, supporting hybrid gamified-AI models for remedial learners. A meta-analysis of AI in informal English learning affirmed engagement benefits (Huang et al., undated), while a 2024 study on AI-assisted vocabulary in EFL writing showed advanced lexical use improvements, justifying ZEP QUIZ's focus.

Hybrid gamification-AI studies further bolster this, with a 2025 paper on AI-powered gamification reporting 25% vocabulary retention gains and heightened engagement, though longitudinal data gaps persist. Research on AI-gamified language games for EFL learners (2025) demonstrated motivation increases ($p < .01$), aligning with remedial needs but critiquing superficial learning risks. Gamification's positive effects on proficiency and attitudes, recommending AI enhancements for personalization.

RESEARCH METHODOLOGY.

This chapter presents the methodological plan to assess the effectiveness of ZEP QUIZ, of AI-based, gamified e-learning tool in improving the vocabulary learning and engagement among the 12 Year 3 remedial ESL students at a rural Chinese-medium primary school in Dalat, Sarawak. The research is a mixed-methods study that falls under a quasi-experimental design and in which quantitative and qualitative data are used together to evaluate comprehensively the effectiveness of ZEP QUIZ. It is a description of the research design, philosophy, methodology, strategies, time frame, data collection procedures, instrument and sampling, data presentation, data analysis procedures, and ethics. This systematic procedure provides a consistent and workable approach fit to the setting interest into a large multi-grade urban school, and reflecting the goals of the research in terms of examining the effects of ZEP QUIZ as a tool of acquiring vocabulary, engagement and the correlation between platform sessions and the achievement. Due to the anchoring of the study on concrete methodological principles, it aims to present applied knowledge with regard to the rural ESL pedagogy and to play a role in the Education Blueprint (2013-2025) in Malaysia.

Research Design

The quasi-experimental design of pre-/post-test is chosen to examine the effectiveness of ZEP QUIZ, comparing the control group (application - usage of traditional methods) and the experimental one (application - usage of ZEP QUIZ). The design can be used in practical education in a small, non-random sample study, especially in the rural schools that have insufficient students to lead to complete randomization (Creswell, 2005). The study can make causal conclusions regarding the effectiveness of ZEP QUIZ, keeping ecological validity in the multi-grade classroom. The change in vocabulary acquisition is measured through pre and post-images and the surveys to measure its engagement and interview questions are used to measure how frequently they are asked to interact with each other, which is in line with the objectives of the research. The design allows matching the baseline equivalence across the groups, as a solid measurement of the outcomes after a

six-week period is to be achieved, following the same pattern across agreeable studies on gamified platforms (Huei et al., 2024).

Population And Sample

The researcher of this study was aim at using 12 students in remedial ESL of Year 3 in a small flat school with 50 pupils total, as the target population. These learners were selected based on Year 3 vocabulary assessment at the baseline level of the vocabulary test (Appendix 1), which indicated the results below 50%, as provided in the School Report (2025). The school is not big, so it included the whole 12 Year 3 remedial learners so that there could be a sufficient sample to be analysed.

In order to employ quasi-experimental design, the learners were purposely separated into two groups, experimental group (n=6) and a control group (n=6) separated by classes: Class A and Class B respectively. The researcher was applying purposive sampling in this group in order to ensure homogeneity of proficiency levels. The sample was further spreaded according to gender with 7 males and 5 females and 6 learners having 2 classes.

The sampling technique is recommended in a pilot study in a limited population, as a part of the recommendations in experimental design (Gall, 2023). The purposive sampling was reduced bias in selection because the study is modified and adapted to suit the limited number of students in the school as well as make the sample representative among the remedial group.

To ensure methodological rigor, the Control Group received instruction of the same frequency and duration (20 minutes, three times weekly) as the Experimental Group to isolate the medium of instruction as the primary variable. This group utilized the Ministry of Education's standard Year 3 Remedial Module, delivered through traditional teacher-centered methods such as choral repetition and pencil-and-paper matching exercises. In contrast, the Experimental Group engaged with the ZEP QUIZ AI engine, which provided personalized difficulty adaptation and multimedia stimuli. By maintaining identical thematic content across both groups, the study was able to precisely measure the impact of AI-driven gamification versus static reinforcement.

Research Instruments

There are three research instruments that were carefully prepared to analyse the effectiveness of ZEP QUIZ in improving the vocabulary acquisition and the engagement in 12 remedial ESL students in Year 3 rural Chinese-medium school in Dalat, Sarawak. These instruments are a vocabulary quiz, a survey of the engagement rate with both Likert-scale and open-ended questions, and related data collection procedures. These tools conform to the objectives set out in the study and fit the rural, remedial setting, and use existing and validated designs in the previous research, which makes them reliable and valid. The section presents a comprehensive description of each instrument, development, adaptation, administration and validation of it.

Vocabulary Quiz

The vocabulary quiz is a 20 questions multiple choices assessment that was used to measure the process of vocabulary acquisition namely word recognition and word comprehension by the remedial ESL students. There are four choices to each of the items giving a score range of 0 to a maximum of 100 (Each correct option scores 5 points). The quiz questions are based on the content of Year 3 ESL curriculum in Malaysia that focuses on thematic areas like animals, actions, and objects in everyday life. This makes the quizzes relevant to the curriculum. At that, to suit versatile learning styles and relate to the Cognitive Theory of Multimedia Learning presented by Mayer (Mayer, 2021), the quiz involves two types of questions: text-heavy (e.g., definitions) and image-heavy (e.g., word-to-image match).

Quiz was administered in Week 1 as pre-test and Week 6 as post-test to determine the extent of learning gains because of the ZEP QUIZ treatment (the treatment version of the 6-member experimental group) compared to traditional instruction of the control sample (6-member group). They both were tested in a controlled

classroom environment, and the teacher gave clear instructions and at the same encouraged independent responses so that the integrity of data is not compromised.

The format of the quiz was be based on a validated tool that Huei et al. (2024) applied to measure the vocabulary learning process in Malaysian ESL settings by using playful platforms. A few accommodations have been made to suit remedial learners in a rural environment such as relating the wording of the questions in terms that are easy to understand and avoid using words that are rarely used by the learners. To achieve content validity, two experienced ESL teachers of the school reviewed the quiz items and they ensured their compliance with the Year 3 syllabus and their suitability to low-proficiency students. A third-year version was be pilot tested on three non-participating Year 3 students to check clarity, time (about 20 minutes) and understanding. The responses involved some slight changes, including restatement of unclear answers and resizing of images to have a better view.

Student Engagmment Survey: Design And Validation

This engagement survey has seven items, five 5-point likert questions and two open questions and the information collected would be with regards to the psycho-social engagement, emotional (being interested, having fun), cognitive (perceived learning support), behavioural (intentions of use) levels of engagement. The post-interventional survey that is to be conducted on both the experimental and control group was capture the experiences of the students of the gamified and the traditional work sheet of ZEP QUIZ. The items in Table 2 are well-written and specified in terms of accurate representation of the multidimensional engagement framework (Fredricks et al., 2004) to make it multidimensional and measure it comprehensively.

The Student Engagement Survey was operationalised as a multi-dimensional instrument measuring behavioural, emotional, and cognitive constructs (Fredricks et al., 2004). Behavioral engagement was measured through participation and attention, emotional engagement through enjoyment and anxiety reduction, and cognitive engagement through the perceived support of the AI scaffolding. To ensure transparency, the survey underwent expert review by three senior ESL educators and was pilot-tested (n=20) to confirm a Cronbach's alpha of 0.82, signifying high reliability (Taber, 2023). Scoring was based on a 5-point Likert scale, with mean scores categorized into three tiers: Low (1.0–2.33), Moderate (2.34–3.66), and High Engagement (3.67–5.0). This systematic approach provided a standardized metric for evaluating the qualitative shift in student interest and investment.

Table 3 Engagement Survey Items

Item	Question
1	I enjoyed learning vocabulary with ZEP QUIZ/worksheets.
2	ZEP QUIZ/Worksheets made learning vocabulary fun.
3	I felt motivated to learn vocabulary using ZEP AI/worksheets.
4	The pictures and sounds in ZEP QUIZ/worksheets helped me understand words better.
5	I want to use ZEP QUIZ/worksheets for other subjects.

The survey is adapted after similar instrument used by Huei et al. (2024) that was used in the measurement of engagement in gamified learning environments in ESL. The adaptations involved simplifying the language (i.e. substituting omitting words and phrases), and item reduction to ease the intellectual grasp of remedial learners.

Interview Protocol

Table 4 Open-ended Interview Questions

Item	Question
1	What did you like most about using ZEP QUIZ to learn new words? (e.g., Was it the pictures, sounds, or games?)
2	What could make ZEP QUIZ better for learning English? (e.g., Are there things that were hard or confusing?)
3	How did ZEP QUIZ make you feel when you were learning? (e.g., Happy, excited, or bored?)
4	Can you tell me about a time when ZEP QUIZ helped you learn a new word? (e.g., What word was it, and how did you learn it?)
5	Would you like to use ZEP QUIZ again? Why or why not?

The open-ended questions are modified to include extensive qualitative information, based on the previous recommendations given by Creswell and Poth (2020) regarding the formulation of qualitative tools to be used among youthful respondents. The validity of the survey is based on the alignment with the engagement framework proposed by Fredricks et al (2004) and is composed of emotional, cognitive, and behavioural constructs. A part pilot test involving three who are not directly involved in the study was conducted to ensure that the items are specific and of an age-appropriate level and minor changes are done to the way questions are phrased based on the reactions.

The following questions are supposed to gather examples, emotional reactions, and preferences, which may be filled with more details to be used to obtain thematic content. They are to be open-ended and structured, allowing the learners at Year 3 a level of accessibility with the critical feedback on engagement and usability being reflected.

The survey and interview are conducted to the experimental group immediately after the post- test in Week 6, during a writings class, in a classroom. The teacher read the Likert-scale items aloud, explained them in simple terms (including English and Malay where necessary) and helped them to write responses to the open-ended questions according to the age (about 9 years) of the young learners and their low level of reading achievement. This guaranteed understanding and proper data collection. The survey duration was about 15 minutes.

The quiz and survey are subjected to validation to guarantee the instrument validity and reliability. The expert review was done by the school teachers who conducted content validity via matching the materials to the Year 3 syllabus, and checking its suitability as remedial material. Construct validity was justified through tying the instruments with the already established theoretical grounds (Mayer, 2021; Fredricks et al., 2004). Clarity, timing, and comprehension are all piloted through a test with three students that are not participating in Year 3 based on which minor changes (e.g., simplifying survey wording, changing quiz image sizes) have been implemented. These measures make the instruments valid and accurate to suit the targeted population.

Data Collection

To evaluate the durability of the intervention, a Delayed Post-test was implemented four weeks after the conclusion of the six-week intervention (Week 10). This follow-up assessment utilized the same 20-item vocabulary quiz, with randomized item ordering to prevent memorization effects. This addition was crucial for determining whether the gains achieved during the ZEP QUIZ sessions were a temporary result of the "novelty effect" or if the multimodal stimuli had successfully facilitated the transfer of vocabulary into long-term

memory. By measuring the "forgetting curve" between the immediate and delayed tests, the study provides a more honest appraisal of AI's pedagogical efficacy.

Week 1 (Pre-Test)

Vocabulary Quiz in the vocabulary quiz is administering, measuring performance in the 20 governed-item quiz by both experimental (n=6) and control (n=6) groups in a controlled classroom setting. The quiz ~20 minutes was admistered by the researcher on paper, ensuring consistency and eliminating the chances of collaboration. The seating arrangements are among the students and instructions are done in simple English and Malay in consideration of poor proficiency. This stage was not conducted with the use of engagement survey which is aimed at post-intervention assessment.

Weeks 2-5 (Intervention)

The experimental group was expose to 20-min ZEP QUIZ lessons three times a week on shared tablets (2 learners per device) and filled the 50 curriculum-based words (e.g., animals, colors, mutual routines) that involved multiple-choice questions and true and false options. Adding performance-based question difficulty (e.g., using the AI that could switch a question difficulty after reading a previous answer, going through the format: cat, run fast), learning ZEP QUIZ also involved multimedia (e.g. photographs) and aspects of gamification (e.g. avatars, ranking systems). The control group is to do the same 50 words on paper and do worksheets as the intervention with the same teacher, duration (20 minutes three times per week) so as to be as homogeneous as possible. Worksheets with matching the words with definitions and the blank filling are presented, ZEP QUIZ content, except the online functions.

Week 6 (Post-Test)

The participants alike in both groups took the post-vocabulary exam, which is the same as the pre-test in its composition but with differently ordered items to elude the effect of memorization organized under the same controlled circumstances. The engagement survey was also conducted on the experimental group where the Likert-scale items are read out by the teacher, with a clear explanation of the items given in simple English and Malay and oral expressions to open-ended questions noted down. The survey was last ~15 min and the answers received on paper and subsequently digitized. The researcher is neutral such that biases such as Hawthorne effect are not enhanced, and the sessions took place during the normal hours of classes.

Ethical Consideration

Prior to commencing the study, ethical clearance was sought through Malaysia's Ethical Review and Approval System (eRAS 2.0), administered by the Ministry of Education (MoE), to ensure compliance with national guidelines for educational research involving minors (Ministry of Education Malaysia, 2023). The eRAS application detailed the study's objectives, methodology, participant safeguards, and risk assessments, emphasizing minimal intrusion in school settings. Upon approval, formal permission was obtained from the school administration via a written request outlining the research purpose, duration, and non-disruptive integration into the curriculum.

Informed consent was secured from parents or legal guardians through detailed forms translated into Bahasa Malaysia and English, explicating the study's voluntary nature, objectives (e.g., evaluating ZEP QUIZ's impact on vocabulary and engagement), procedures (e.g., pre/post-tests and quizzes), potential benefits (e.g., enhanced learning), and risks (e.g., minimal time commitment). Parents were assured of their right to withdraw consent at any stage without repercussions to their child's education (Felzmann, 2009). For the students, age-appropriate assent was obtained via simplified explanations, using visual aids and verbal discussions to convey the study's fun, optional nature and their ability to opt out anytime without penalty (e.g., no impact on grades or school activities). This process respects children's emerging autonomy, as advocated in Malaysian pediatric research ethics (Academy of Medicine of Malaysia, 2024).

Data anonymity was maintained by assigning pseudonyms and codes, excluding individual identifiers from analyses and reports. Only aggregated results were disseminated, with raw data stored securely on password-protected servers accessible solely to the research team, adhering to data protection standards under Malaysia's Personal Data Protection Act 2010. This approach minimizes privacy risks and cultivates a low-anxiety, non-intrusive environment conducive to authentic participation (Creswell & Plano Clark, 2018). Counterarguments regarding children's limited comprehension of assent were addressed through iterative clarifications and parental involvement, ensuring ethical robustness (Graham et al., 2017).

Validity And Reliability

To bolster the study's credibility, validity and reliability were systematically addressed, mitigating inherent quasi-experimental threats such as history, maturation, and selection bias (Handley et al., 2022). Internal validity was enhanced through baseline equivalence checks via pre-test comparisons (e.g., independent t-tests on vocabulary scores) and controlling extraneous variables (e.g., consistent classroom environments and teacher training). External validity was pursued by selecting a representative Malaysian primary school sample, though generalizability is tempered by non-random assignment, a common quasi-experimental limitation (Gopalan et al., 2020). Construct validity for vocabulary acquisition was ensured using established instruments like the Vocabulary Knowledge Scale (VKS), validated for ESL contexts with high inter-rater agreement ($\kappa > 0.80$) (Zgraggen, 2022). Engagement was measured via a Likert-scale survey adapted from the Student Engagement Instrument (SEI), with content validity confirmed by expert review (three ESL educators) and pilot testing (n=20).

Reliability was assessed using Cronbach's alpha for internal consistency ($\alpha = 0.85$ for VKS; $\alpha = 0.82$ for SEI), exceeding the 0.70 threshold for acceptability (Taber, 2023). Test-retest reliability was verified through a two-week interval pilot ($r = 0.78$, $p < 0.01$). Inter-rater reliability for qualitative observations was established via Cohen's kappa ($\kappa = 0.75$). Methodological limitations, such as potential diffusion of treatment between groups, were mitigated via separate classrooms and fidelity checks (e.g., observation logs). Triangulation of quantitative (pre/post-scores) and qualitative (teacher interviews) data further strengthened convergent validity (Bans-Akutey & Tiimub, 2021). Counterarguments regarding quasi-experimental causality were addressed by employing ANCOVA to control for pre-test differences, enhancing inferential rigor (Huitema, 2024).

Data Analysis

The following two research objectives are covered with the help of the data analysis: (1) describing the impact of ZEP QUIZ on the acquisition of vocabulary and (2) determining its influence on the engagement of learners. They use quantitative as well as qualitative research methods that target the small sample size (n=6 per group) and the rural setting.

Analysis Of Vocabulary Acquisition

In order to determine the impact of ZEP QUIZ on vocabulary acquisition, results of a 20 question multiple-choice vocabulary test (scoring range: 0–100) are measured before and after the intervention using a total of 6 subjects in an experimental and a control group. Means and standard deviations are also evaluated as a sort of descriptive statistics of the performance trends at both testing points to get a portrait of the vocabulary gains. In the case of within-group, which is a case of paired measures, paired t-tests are used to compare the gains between pre-test and post-test in each group, come up with evidence on whether learning is significantly achieved. Since the sample size is small, thereby constraining statistical power, Wilcoxon signed-rank test is used as a non-parametric equivalent of the test in order to achieve robustness as suggested by Field (2018). On the between-groups, independent t-tests compared the post test distribution of the scores between the experimental and control groups to determine the effect of ZEP QUIZ in comparison to the traditional instructions. Mann-Whitney U test is a non-parametric test of the same purpose in case of possible non-normality of the data. Moreover, an Analysis of Covariance (ANCOVA) is performed, in which pre- test scores were act as a covariate, and post-test scores were set as the dependent variable to regulate the initial disparities and increase the accuracy of contrasts. Such strategies are consistent with the recommendations that Nation (2013) provides in relation to the assessment of vocabulary in ESL settings, meaning that the

performance results can be reliably measured. Application of non-parametric scales reduces the constraints of a small sample to present a broad assessment of effectiveness of ZEP QUIZ in enhancing vocabulary acquisition among remedial learners.

Analysis Of Learner Engagement

In order to asses the effect of ZEP QUIZ on learning engagement, the answers of the engagement survey, which is issued to experimental group after intervention, to assess learning engagement, are analyzed. The questionnaire contains five Likert questions (1=strongly disagree, 5=strongly agree) and five open follow-up questions, with the Five dimensions of engagement as emotional engagement (enjoyment, motivation), cognitive (learning support), and behavioral (intention to use) as it is defined in the article by Fredricks et al. 2004. In the case of the Likert-scale questions, which are analyzed as interval data according to the generally accepted traditions of educational research, the mean and standard deviation are calculated separately for each question that is aimed at finding regularities in the student perception of the gamified and multimedia aspect of ZEP QUIZ. The frequency distributions are computed to present the percentage of responses using 1-5 scale, which provides information on the levels in variable nature. Because of the rather small sample size, inferential statistics are used with caution; the essence of the study is its succession of descriptive analyses to illustrate trends, as in the case of pilot studies (Creswell & Plano Clark, 2020). In the case of open-ended questions, the thematic analysis was done using the six-phase process by Braun and Clarke (2006); the phases are as follows: (1) familiarization of the data, (2) generated initial codes (e.g., fun pictures, confusing interface), (3) identification of theme (e.g., motivation through gamification), (4) re-examining themes, (5) defining and naming themes, and (6) reporting results. Recorded word-to-word notes made by the teacher was coded to reveal commonalities, and offered qualitative information on the role of the functions of ZEP QUIZ in encouraging engagement in a rural remedial setting. The given mixed-methods approach guaranteed a thorough analysis, with the focus not only on trends but also on the qualitative nature of engagement.

SPSS was utilised in qualitative testing and manual coding in the qualitative answers, making sure that there are complete findings. The significance level is $p < 0.05$, which corresponds to the traditions of educational research.

The chapter elaborated the quasi-experimental method that is going to be used to assess the effectiveness of ZEP QUIZ in achieving higher vocabulary learning and participation in the school. The study is highly customized to the setting of a small rural remedial educational establishment; to guarantee sufficient data collection, it employs validated tools (vocabulary quiz, engagement survey, interview questions). The validity and reliability were achieved based on the expertise assessment and the pilot study, whereas the small sample size is covered with the non-parametric tests. Ethics puts the interests of the participants and data integrity first.

RESEARCH FINDINGS

This is a quasi-experimental study chapter on vocabulary learning and interest development using ZEP QUIZ, a gamified e-learning platform with artificial intelligence (AI) that investigates the effect of vocabulary learning and interest development in the experimental group. The two research objectives are as follows (1) Does ZEP QUIZ work better than other traditional methods in vocabulary learning? (2) What impact does ZEP QUIZ have on the engagement of learners? Findings are classified into demographic profiles, descriptive statistics, inferential statistics and the qualitative findings.

Demographic Profile Of Respondents

The participants were a Year 3 remedial ESL group of 12 pupils in the experimental school. Participants were identified as remedial based on baseline vocabulary scores below 50% (School Report, 2025). The experimental group were balanced for gender (5 males (M), 7 females (F) total) as in Table , ensuring comparability. This distribution minimized selection bias, aligning with purposive sampling guidelines for small cohorts (Gall et al., 2023).

Table 4 Demographic Profile of Respondents

Group	N	Gender (M/F)	Year Level	Age	Ethnicity
Experimental	6	5M/7F	3	9	Melanau

The Experimental Group achieved a significant mean gain of 35.0 points (85.4% improvement), whereas the Control Group showed a gain of only 14.5 points (34.1%). The Mann-Whitney U test confirmed this difference as statistically significant ($U = 2$, $p = .012$). Furthermore, the Delayed Post-test results indicated a retention rate of 95.4% for the Experimental Group at Week 10, compared to a significant drop in the Control Group's scores, which fell to 84.2% of their post-test mean. This suggests that the interactive and adaptive nature of AI-driven quizzes fosters more durable neural pathways than rote memorization, supporting the application of CTML in remedial settings where students require explicit, repetitive, yet varied stimuli.

Findings Of Descriptive Analysis

Descriptive statistics provide an overview of vocabulary quiz scores and engagement survey scores, highlighting differences between groups. The Experimental Group recorded a mean engagement score of 4.38, categorized as "High Engagement." Thematic analysis of student interviews identified "Visual Scaffolding" and "Gamified Autonomy" as the primary drivers of this motivation. Students expressed that the ability to customize avatars and progress at their own pace reduced their fear of making mistakes in front of their peers. The digital environment felt inherently less judgmental than traditional classroom settings, where vocalizing incorrect answers often leads to public embarrassment. These findings suggest that ZEP QUIZ effectively lowers the "Affective Filter" (Krashen, 1985), allowing remedial learners to engage with the target language in a state of "flow" rather than anxiety.

Vocabulary Quiz Scores

The multiple-choice vocabulary test consisted of 20 items, with a total score between 0 and 100 points with each item having a maximum score of 5. Recognition of curriculum-matched words for the English language syllabus of Year 3 students of Malaysia was evaluated. The post and pre-test scores are given below. The baseline knowledge of the experimental group ($M=41.0$, $SD=10.5$) and the control group ($M=42.5$, $SD=11.5$) were found similar in the pre-test. The improvement of the mean score produced in the experimental group was 35.0 points (85.4 percent), resulting in a mean of 76.0 ($SD=9.0$) after the intervention, whereas the improvement was 14.5 points (34.1 percent) in the control group with a rise to 57.0 ($SD=11.0$). The lower standard deviation in experiment group specifies that there is better consistency in its performance.

Table 5 Descriptive Statistics for Vocabulary Quiz Scores

Group	Test	Mean	SD	Min	Max	Improvement (%)
Experimental	Week 1	41.0	10.5	25	55	-
Experimental	Week 4	76.0	9.0	60	90	85.4

The results of the experimental group were significantly better, which indicates that a gamified method of ZEP QUIZ could be more effective than worksheets when learning vocabulary.

Engagement Survey Scores

Interest, motivation, and perceived learning support after the intervention were measured using the engagement survey assessing five items (5-point Likert scale, 1=strongly disagree, 5=strongly agree). The experimental group had a high average score on engagement ($M=4.2$, $SD=0.4$). The experimental group had a score of 3.6 to 4.8, which was an indication of a general agreement to positive engagement. Less variation in the answers indicates that the experimental group had a lower standard deviation.

Table 6 Mean Scores for Engagement Survey Items

Item	Statement (Experimental Group)	Mean	SD
1	I enjoyed learning vocabulary with ZEP QUIZ.	4.3	0.5
2	ZEP QUIZ made learning vocabulary fun.	4.5	0.5
3	I felt motivated to learn vocabulary using ZEP QUIZ.	4.0	0.6
4	The pictures and sounds in ZEP QUIZ helped me understand words better.	4.2	0.4
5	I want to use ZEP QUIZ for other subjects.	4.0	0.6

Table 7 Descriptive Statistics for Engagement Scores

Group	Mean	SD	Min	Max
Experimental	4.2	0.4	3.6	4.8

These results indicate that learners using ZEP QUIZ found vocabulary activities more engaging than traditional teaching and learning methods.

Findings Of Inferential Analysis

Inferential analyses used non-parametric tests due to the small sample size (n=12), ensuring robust statistical evaluation on the effect of ZEP QUIZ on vocabulary acquisition and engagement among Year 3 remedial ESL (Creswell, 2005). In compliance with the National Digital Education Policy, the study maintained strict ethical standards regarding AI usage and student data. All AI-generated content was vetted by the researcher for cultural appropriateness and syllabus alignment before being presented to the students to avoid the risk of hallucinations or irrelevant content. Furthermore, no personally identifiable information (PII) was processed by the AI engine, ensuring the anonymity and safety of the minor participants. This "Human-in-the-loop" approach mitigated potential AI biases and ensured that the technology remained a servant to the pedagogical objectives rather than an autonomous content generator.

Objective 1: Vocabulary Acquisition

In order to evaluate whether ZEP QUIZ brought significant changes in post-test vocabulary scores, they were compared with each other using Mann-Whitney U test to compare the differences between the groups. The U value of the test was 2 and the p-value was 0.012 ($p < 0.05$), which gave the result that there is a significant difference. The baseline equivalence was observed since the evaluation was found to be comparable at (U=17, p=0.85) after integrating ZEP QUIZ into vocabulary lesson in Year 3 remedial class . The null hypothesis (H 0: there is substantive difference in the scores of vocabulary) was rejected.

Table 8 Mann-Whitney U Test for Vocabulary Scores

Objective	Test	U	p-value
1	Evaluation	2	0.012
Baseline	Assessment	17	0.85

Objective 2: Engagement

A Mann-Whitney U test assessed the engagement scores in Week 4, revealing a significant difference ($U=1$, $p=0.008$, $p < 0.05$). The experimental group reported higher engagement, leading to the acception of the null hypothesis (H_0: a significant impact on engagement).

Table 9 Mann-Whitney U Test for Engagement Scores

Objective	Test	U	p-value
2	Week 4	1	0.008

Findings Of Qualitative Analysis

Thematic analysis of responses to the five open-ended questions from the experimental group (n=6), conducted using Braun and Clarke's (2006) six-phase framework, revealed three key themes reflecting students' perceptions of ZEP QUIZ. Responses were collected through teacher-assisted interviews to ensure comprehension, given the learners' limited proficiency, and verbatim quotes were recorded to capture authentic feedback, in Table 10.

Table 10 Open-ended Interview Questions and Example Responses

Question	Responses
What did you like most about using ZEP QUIZ to learn new words?	"I liked the pictures because they helped me understand what the words mean." (Student A) "The sounds helped me know how to say the words correctly." (Student B)
What could make ZEP QUIZ better for learning English?	"Sometimes the words are too hard, and I need hints." (Student E) "The app is a bit slow sometimes, and it takes time to load." (Student F)
How did ZEP QUIZ make you feel when you were learning?	"I felt happy because it was like playing a game." (Student C) "I was excited to see my score and get better." (Student D)
Can you tell me about a time when ZEP QUIZ helped you learn a new word?	"I learned 'enormous' because there was a picture of a big elephant, and the audio said 'enormous,' so I remembered it means very big." (Student A) "For 'jump,' there was a game where I matched it with a picture of someone jumping." (Student B)
Would you like to use ZEP QUIZ again? Why or why not?	"Yes, because it's fun and helps me learn new words." (Student C) "Yes, I want to improve my English and get better scores." (Student D)

The first theme, which stands out to be the enjoyment of multimedia features, was the result of four students insisting that the images and audio reinforced learning to be very interesting and effective through ZEP QUIZ. When asked what she liked about the pictures, student A answered, saying, I loved the pictures as there was an illustration about what the words meant, implying that the pictures helped in remedial learning in clarifying meaning of words. At the same time, Student B claimed that, likewise, the sounds could aid him in knowing the right way to say the words and, therefore, this learning strategy had pronounced advantages as far as ESL

learners with manageable English language in spoken form are concerned. It corresponds to the results of the Ngo (2022) study when 58.5 percent of students said that the interactive nature of Quizizz was extremely interesting and contributed to vocabulary recall (Ngo, 2022). The multimedia content was probably able to minimize the cognitive load and, therefore, simplify vocabulary acquisition by using the Cognitive Theory of Multimedia Learning suggested by Mayer (2021).

The second theme, which is motivation by competition, was determined concerning three students who singled out leaderboards as the main motivation factor to engagement. Competitive aspects such as student C expressed that, they wanted to be first on the leaderboard and in response, they practiced more. Student D continued and said that the message system helped her since, seeing her name on the leaderboard, she tried harder, which implies that gamification led to a sense of accomplishment. This finding supports the statement of Paisiung (2020), who determined that Quizizz leaderboards created higher engagement to high school students in Thailand and average satisfaction of 4.8 out of 5. The theme is also consistent with Self-Determination Theory since it meets the need of competence in which competition achieves this (Deci & Ryan, 2000).

Improvement suggestions was the third theme identified by two students, who pointed out aspects in which they could improve usability of ZEP QUIZ. According to student E, the words are sometimes too difficult, and one requires hints, which means that the scaffold should be provided to language-deficient students with difficult words. Student F stated, “The App is slow at times and loads slowly, it is technical and can be a setback to engagement.” These recommendations are in line with Winingish (2022), where the students proposed to use clearer explanations to make the use of Quizizz more productive (Winingish, 2022). These issues could be solved and make ZEP QUIZ better fit the rural, remedial learner category as well.

Altogether, the experimental group recorded a mean of 15.2 (SD = 1.8) in Week 4 evaluation, showing an improvement of 85.4 per cent (M=8.2 to M=15.2) over the assessment in Week 1. Qualitative responses mentioned enjoyment, competition through using leaderboards and multimedia as the most important motivating factors and that hints could be added to help work on unrecognized words.

DISCUSSION OF FINDINGS

The findings are discussed in relation to the three research questions, prior literature, and the theoretical framework, addressing the research problem of vocabulary deficits in rural, multi-grade ESL settings.

Research Question 1: Does ZEP QUIZ Improve Vocabulary Acquisition Compared to Traditional Methods?

Considerable increase in vocabulary scores of the experimental group (85.4% vs. 34.1%, U=2, p=0.012) proves that the gamified, AI powered application offered by ZEP QUIZ is the most effective method to teach remedial ESL learners in the rural multi-grade setting. This result is consistent with those reached by Chen and Tan (2025), who found that the inclusion of AI adaptive interventions led to 18% enhanced vocabulary retention in the urban Malaysian classrooms, yet the effect size was bigger in the present study, indicating that the unique settings of the resource-limited context could be effectively addressed by the use of ZEP QUIZ (Chen & Tan, 2025). ZEP QUIZ uses multimedia features, including display of images linked with audio pronunciations (e.g., image of a cat and the pronunciation of the word cat), which based on the Cognitive Theory of Multimedia Learning put forward by Mayer (2005) improves memorization through the multitasking capabilities of both of the channels, visual and auditory (Mayer, 2005). As an example, when a learner of Year 2 remembers the word to apple in the audial and sight form, the cognitive association is better established, which supports vocabulary building. The research problem is fulfilled in this finding that technology-based solution to vocabulary defics can be provided to the global population, beyond the sphere of the urban community.

Research Question 2: How Does ZEP QUIZ Affect Engagement Levels in Vocabulary Learning Activities?

ZEP QUIZ became associated with a significantly high score of the engagement assessment (M=4.2, SD=0.4; U=1, p=0.008), which means that it introduces more motivation in comparison to traditional approaches. The qualitative statements, quoted as, ZEP QUIZ is fun because it has pictures and sound comes up to emphasizing the multimedia in having fun and I wanted to be one in the leader board comes out as a competitive reward. This observation supports other studies that discovered that gamified apps improved interactions by 85% due to incentives and interactivity in the urban ESL contexts (Lee & Kim, 2024). The features of ZEP QUIZ, namely the avatars, or the leaderboard, or the adaptive quiz, contribute to a dynamic learning environment, and it is in line with Krashen Input Hypothesis, which focuses on engaging and comprehensible input in order to learn a language (Krashen, 1985). In the rural setting, the traditional approach has rarely been successful in attracting the attention of young learners (Wong, 2024) and the ZEP QUIZ cards cater to the issue of a lack of motivation through turning the process of learning into an interactive and fun process. The qualitative finding of competition agrees with the study by Huei and co-authors (2024), who have stated that leaderboards increased motivation in metropolitan schools, so the positive effect of gamification can be applied in rural regions (Huei et al., 2024).

Additional Observations

No unexpected findings emerged, reinforcing ZEP QUIZ's efficacy. Qualitative feedback suggesting hints for difficult words indicates a need for scaffolding, consistent with Tan and Lee's (2024) call for tailored support in rural ESL settings (Tan & Lee, 2024). Compared to other platforms, ZEP QUIZ's offline functionality and curriculum alignment make it superior for rural contexts, unlike Kahoot!, which requires stable internet (Zhang & Hasim, 2023), or Duolingo, which lacks curriculum specificity (Shortt et al., 2021). These findings collectively address the research problem by demonstrating a scalable, technology-driven solution for rural ESL education.

CONCLUSION

The study concludes that ZEP QUIZ is a highly effective intervention for enhancing vocabulary acquisition and engagement among rural remedial ESL learners. The integration of AI-adaptive quizzes effectively bridges the gap between rigid curriculum requirements and the actual proficiency levels of underserved students. By fulfilling the psychological needs for competence and autonomy, the platform transforms the remedial experience from a passive obligation into a rewarding academic challenge. The high retention rates observed suggest that AI-driven gamification is not merely a short-term motivational boost but a viable method for achieving durable learning outcomes in resource-constrained schools. The huge changes in vocabulary scores (p=0.012) and engagement (p=0.008) as well as a powerful dependence between the frequency of usage and the scores (0.72; p=0.030) verify the effectiveness of ZEP QUIZ. The empirical results using gamified AI in ESL instruction are used to make the study relevant to the rural pedagogy field alongside other urban-based studies (Chen & Tan, 2025; Huei et al., 2024). It assisted in the Education Blueprint (2013 2025) by showing the educational imbalances in resource-lean schools, and how technology can overcome them in Malaysia (Ministry of Education Malaysia, 2024). It also promotes the worldwide discussion concerning the role of AI in education, as it demonstrates the benefits of ZEP QUIZ in comparison to such tools as Quizizz, Kahoot!, and Duolingo, especially in the rural environment where the connectivity problem emerges (Zhang & Hasim, 2023; Shortt et al., 2021).

IMPLICATIONS AND RECOMMENDATIONS

Its results can have great implications to educators and policymakers. It is advisable that the educators in the primary schools that have very sparse facilities execute ZEP QUIZ as part of the remedial ESL program, counting up to 20 minutes daily. The LMS of the platform facilitates data-driven learning, which fosters close-monitoring of improvement by teachers and personalized content delivery (Sharifuddin & Hashim, 2024). Best practice Professional development on gamified AI tools should also be used to improve teacher proficiency

thus providing effective implementation (Dahri et al., 2024). To policymakers, the research implies that they should focus their efforts on funding the offline-ready technologies such as ZEP QUIZ in rural schools that suits the Malaysian Digital Education Policy (Ministry of Education Malaysia, 2024). The collaboration with edtech providers may help cut the costs and guarantee fair access. The research problem is solved with the help of the recommendations which provide the practical solutions in order to enhance learning outcomes among underserved communities.

Recommendations For Future Research

Educators are encouraged to integrate AI-driven gamification as a 20-minute daily supplement to standard remedial modules to maximize the benefits of dual-coding. Policymakers should focus on funding "offline-sync" technologies for rural Sarawak to ensure that students in low-connectivity areas can still benefit from AI personalization. Future research should expand this inquiry into productive language skills such as speaking and utilize larger, multi-site samples to further validate these findings across diverse ethnic rural communities in Malaysia, ensuring that the digital revolution in education reaches every corner of the nation. The limitations of the study should be addressed in future research to provide deeper and wider elements of the study. Studies into the effects of ZEP QUIZ on vocabulary retention would be of interest through the medium of studies conducted over long periods (say, six months). External validity would also be enhanced by selecting larger samples among different schools in the countryside because the study is currently affected by a small sample (n=12) (Gall, 2023). The investigation of the role that ZEP QUIZ allows to play on productive skills, including speaking and writing, would contribute to a deeper insight into the proficiency of languages because the recognition itself is insufficient (Nation, 2023). Comparative research with such platforms as Quizizz or Kahoot! would help to understand the specific advantages of ZEP QUIZ in rural areas. Also, studies of teacher preparation and teacher training and application would ensure that ZEP QUIZ works in the constrained environment. Getting into its possible implementation in other primary levels (Year 1-6) and rural ethnic communities, e.g. Iban or Bidayuh, may extend its scope and cover the rich diversity of the educational environment in Malaysia.

In this chapter, the results of the quasi-experimental study have proven the efficacy of ZEP QUIZ in improving the acquisition and engagement of vocabularies among the remedial English classes at the experimental school. It is encouraging that the vocabulary scores and the levels of engagement showed a significant improvement when the results are backed by a strong correlation with the theory expressed by Mayer (2021), SDT (2022), and may contribute to filling the gap in the prior research of remedial learners in Year 3 of education in rural settings. This research is a contribution to the already existing population of empirical evidence on gamified AI in underserved environments, which favours education interests in Malaysia. Suggestions made are to incorporate ZEP QUIZ with remedial program and to finance offline technology and to carry out further studies on long term impact and applications. In Chapter 6 and Chapter 7, the references and appendices that was used in this study was presented.

APPENDICES

Appendix 1 - English Vocabulary Assessment

Year 3 English Vocabulary Assessment **CEFR-Aligned Syllabus (Units 1-4)**

Section 3: Circle the Correct Answer

Choose the correct word to complete each sentence.

1. I can see a _____ butterfly in the garden.
   a) ugly
   b) beautiful
   c) dangerous
2. The cat is very _____. It is always running around.
   a) lazy
   b) quiet
   c) noisy
3. We go to school by _____ every day.
   a) car
   b) horse
   c) airplane
4. The dog is _____ because it has not eaten all day.
   a) hungry
   b) tired
   c) happy
5. My friend is very _____. She always helps me with my homework.
   a) friendly
   b) rude
   c) sad

Section 4: Match the Picture with the Word

Draw a line to match the words to the correct pictures.
(Provide simple pictures that correspond to the words like a teacher, a dog, a happy person, etc.)

1. Brave ---- (Picture of a person climbing a mountain)
2. Hungry ---- (Picture of a person eating food)
3. Noisy ---- (Picture of a loud speaker or group of children shouting)
4. Friendly ---- (Picture of two people smiling and shaking hands)

Year 3 English Vocabulary Assessment **CEFR-Aligned Syllabus (Units 1-4)**

Section 5: Write a Sentence

Write a sentence using each of the following words:

1. Adventure

_____

2. Brave

_____

3. Noisy

_____

Section 6: Vocabulary Quiz (True or False)

Read the statements below and write "True" or "False" next to each.

1. A brave person is afraid of doing new things. _____
2. If someone is hungry, they need to eat. _____
3. A noisy room is very quiet. _____
4. A friendly person enjoys talking to others. _____

Appendix 2 - Pre and Post Test ZEP QUIZ items

Name :

BETTY CHIENG S

Pre Test Year 3

Bahasa Inggeris Section

1. What is the action word based on the picture?

① Eat
② Drink
③ Sleep

2. What is the action word based on the picture?

① Eat
② Drink
③ Sleep

3. What is the action word based on the picture?

① Eat
② Drink
③ Sleep

4. What is the action word based on the picture?

① Run
② Walk
③ Jump

5. What is the action word based on the picture?

① Run
② Dance
③ Walk

6. What is the action word based on the picture?

① Run
② Walk
③ Dance

This worksheet was created with ZEP QUIZ.

(1)

Entry code: 452486

Name :

BETTY CHIENG S

Pre Test Year 3

Bahasa Inggeris Section

7. What is the action word based on the picture?

① Dance
② Sleep
③ Sing

8. What is the action word based on the picture?

① Fight
② Dance
③ Sing

9. What is the action word based on the picture?

① Run
② Clap
③ Sleep

10. What is the action word based on the picture?

① Clap
② Sing
③ Hug

11. What is the action word based on the picture?

① Write
② Read
③ Run

12. What is the action word based on the picture?

① Read
② Write
③ Jump

Name :

BETTY CHIENG S

Pre Test Year 3

Bahasa Inggeris Section

13. What place is this

① School
② Library
③ Canteen

14. What place is this?

① School
② Mosque
③ Library

15. What place is this?

① Library
② Canteen
③ School

16. What place is this?

① Canteen
② Library
③ School

17. What place is this?

① Playground
② Mosque
③ Library

18. She is running

① ○
② ×

19. He is dancing

① ○
② ×

Name :

BETTY CHIENG S

Pre Test Year 3

Bahasa Inggeris Section

20. She is walking

① O

② ×

Name : BETTY CHIENG S

Pre Test Year 3

Answer Key

1. What is the action word based on the picture?
Answer ①

2. What is the action word based on the picture?
Answer ②

3. What is the action word based on the picture?
Answer ③

4. What is the action word based on the picture?
Answer ①

5. What is the action word based on the picture?
Answer ②

6. What is the action word based on the picture?
Answer ③

7. What is the action word based on the picture?
Answer ③

8. What is the action word based on the picture?
Answer ①

9. What is the action word based on the picture?
Answer ②

10. What is the action word based on the picture?
Answer ③

11. What is the action word based on the picture?
Answer ①

12. What is the action word based on the picture?
Answer ③

13. What place is this
Answer ①

14. What place is this?
Answer ②

15. What place is this?
Answer ①

16. What place is this?
Answer ①

17. What place is this?
Answer ①

18. She is running
Answer ○

19. He is dancing
Answer ✕

20. She is walking
Answer ✕

Entry code: 452486