Harnessing Technology: Enhancing Literacy Development for ESL Secondary School Students

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Abstract

This paper examines the innovative integration of technology in literacy development for English as a Second Language (ESL) learners, focusing specifically on secondary school students in Malaysia. As educational practices shift from traditional methods of the 20th century to advanced technologies such as Artificial Intelligence (AI), ESL students encounter unprecedented opportunities to engage more effectively with the English language. Employing a comprehensive literature review and thematic analysis methodology, this study identifies emerging themes in technology integration within ESL education. Key themes explored include the effectiveness of gamification, AI-assisted tools, and multimodal literacy, as well as the challenges posed by the digital divide, particularly concerning disparities in resource access between urban and rural areas. The findings highlight the urgent need for equitable access to technology and tailored interventions to support literacy development among all ESL learners. By prioritizing enhancements in technological infrastructure and fostering personalized learning experiences, educators and policymakers can bridge the literacy development gap. This paper advocates for a balanced approach to technology integration that promotes critical thinking, collaboration, and human interaction, ensuring that every student has the opportunity to fully leverage technology in their literacy development journey.

Keywords: literacy development, English as a second language (ESL), secondary school students, technology, Artificial Intelligence (AI)

1. Introduction

This paper examines the innovative integration of technology in literacy development for English as a Second Language (ESL) learners, highlighting its crucial role in enhancing educational outcomes. As technology continues to evolve, it offers unprecedented opportunities for ESL students to engage with the English language more effectively (Diallo, 2014; Lee, Kuo, Xu, & Hu, 2020). The challenges of mastering English, particularly its nuances, can be daunting for second language learners. However, the utilization of interactive platforms such as Duolingo and Quizlet has been shown to significantly boost engagement and motivation among these learners (Kashif, Ahmed, & Farooqui, 2024).

The secondary school stage is particularly crucial for ESL learners, as it marks the transition from foundational language acquisition to the practical application of English skills essential for academic and real-world success. Throughout their educational journey, Malaysian students are introduced to the English language from preschool to tertiary education, laying a foundation for understanding the language (Azman, 2016). The implementation of the Common European Framework of Reference (CEFR) in Malaysia aims to standardize English language proficiency, ensuring that students meet the expected competency levels (Jamain & Jamaludin, 2023). In this context, secondary school students are required to achieve proficiency levels of B1 and B2, necessitating the mastery of basic literacy skills for academic success and effective communication (Awang et al., 2023).

Despite the increasing integration of technology in Malaysia's educational landscape, its specific impact on literacy development among secondary ESL learners requires more attention. Existing studies primarily focus on literacy outcomes for primary and tertiary students, leaving a significant gap in understanding the unique challenges faced by secondary learners. Moreover, the long-term effects of technology on literacy acquisition within this demographic warrant comprehensive exploration. Therefore, this paper aims to address these gaps by analyzing the role of technology in fostering literacy development among secondary school students, ultimately contributing to a more equitable educational landscape.

2. Literature Review

The evolution of technology from the 20th to the 21st century has fundamentally transformed the landscape of education. The pedagogical shifts between these centuries highlight the necessity of integrating technology into educational practices to meet the demands of contemporary learning environments. Ali (2022) asserts that the internet and 21st-century learning are inextricably linked, making language learning an essential component for students to engage collaboratively. This underscores the importance of developing robust literacy skills for effective communication in the digital age.

In the 20th century, educational technology primarily encompassed tools such as radio, television, films, and videos. Researchers have long argued that failing to incorporate these technological advancements into pedagogy results in a significant waste of educational resources (Dunkel, 1987, as cited in Salaberry, 2001). Furthermore, Wipf advocates for the utilization of shortwave broadcasts in education, highlighting benefits such as exposure to a broader range of L2 expressions, natural grammar instruction, improved listening skills, heightened motivation, global awareness, and greater autonomy in learning (Wipf, 1984, as cited in Salaberry, 2001). However, the limitations of telephones and radios in fostering literacy development were stark compared to the capabilities offered by 21st-century technologies.

The 21st century has ushered in an era of collaborative learning, significantly enhancing opportunities for literacy development. The Malaysian Education Blueprint (2013-2025) emphasizes leveraging Information and Communication Technology (ICT) in schools across Malaysia. A study by Arriffin and Yaacoob (2014) revealed that the use of Blogs Assisted Language Learning (BALL) dramatically improved students' literacy development; notably, 75% of participants reported increased collaboration and confidence in language use as they had time to construct sentences before posting on their group blogs.

Moreover, the concept of multimodal literacy is increasingly relevant in the 21st century. Multimodal literacy is the process of creating meaning through engagement with various multimedia and digital texts (Walsh, 2010, as cited in Heo & Avadhanam, 2021). According to Wu (2023), Swiss psychologist Jean Piaget provided a new perspective on cognitive-schema theory regarding the use of multimodal approaches in enhancing the contextual application of English teaching. Ganapathy and Seetharam (2016) found that students struggled to interpret texts without visual aids, highlighting the necessity for multimodal approaches to enhance understanding. Students indicated that this approach broadened their vocabulary, improved reading skills, and strengthened their listening and speaking abilities (Sutrisno, Abidin, Pambudi, Aydawati, & Sallu, 2023).

Access to online content has become seamless in the digital age, enabling students to explore both local and global information. As digital natives, students effectively navigate online platforms, which enhances their exposure to diverse reading materials. According to Yunus, Nordin, H. Salehi, Embi, & Z. Salehi (2014), 21st-century learners utilize instant messaging, text messaging, Twitter, email, and social media for classroom assignments, thereby increasing motivation through the integration of familiar technologies. Additionally, a study indicates that with the aid of digital applications, students showcased a fair level of confidence in problem-solving, demonstrated by their ability to effectively gather information (Pandian, Baboo, & Yi, 2020). This illustrates how technology is being integrated into students' learning experiences.

The integration of technology has led to notable changes and improvements in literacy development. While the 20th century emphasized independent learning, which often hampered critical thinking skills, the 21st century offers numerous opportunities for collaborative literacy development, especially among secondary school students. This evolution includes enhanced access to collaborative learning, the promotion of multimodal literacy, and exposure to diverse content.

3. Methodology

This paper utilized secondary data sources in order to corroborate the discussion and ensure that the analysis is supported by credible and scholarly sources. Data sources are chosen based on their relevance on the topics of technology and artificial intelligence (AI) in Malaysian secondary schools. A systematic search strategy was implemented by using a combination of keywords across three main categories: (a) terms related to technology and AI (artificial intelligence, educational technology, ICT, digital tools, computer technology, mobile learning); (b) terms associated with education (secondary school education, Malaysian education system, 21st-century learning skills, literacy development); (c) terms related to student perspectives (student engagement, academic performance, digital literacy). Therefore, the chosen sources laid out the foundation in identifying the emerging themes for the analysis.

Building on the emerging themes identified in the literature review regarding the integration of technology in ESL education, this paper employs a thematic analysis methodology to explore these themes in greater depth. In identifying

recurring themes and patterns, the analysis begins with collecting sources that involved a detailed examination of their content. By conducting a comprehensive literature review, the paper synthesizes findings from various research studies, reports, and educational frameworks that examine the role of technology in enhancing literacy development among ESL learners. Key themes identified in the literature include the impact of interactive platforms on student engagement, the effectiveness of gamification and AI-assisted tools in promoting personalized learning, and the challenges posed by the digital divide, particularly between urban and rural educational contexts.

By categorizing and analyzing these themes, the paper aims to highlight gaps in the existing literature, particularly concerning secondary school students, and to provide insights into the potential benefits and limitations of technology in ESL education. This approach not only facilitates a deeper understanding of how technology can be leveraged to support literacy development but also informs recommendations for future research and practice.

4. Discussion

This section delves into the implications of integrating technology and AI in literacy development for ESL secondary school students in Malaysia. The discussion is organized into three sub-themes: the influence of AI and technology on literacy development, access and equity in literacy development with a focus on urban and rural disparities, and the role of technology and AI in enhancing learning experiences. Each sub-theme underscores the significance of technology in shaping educational practices and outcomes, while also addressing the challenges that need to be navigated to ensure equitable access to learning resources.

a. The Influence of AI and Technology on Literacy Development

The advent of Artificial Intelligence (AI) and technological advancements has significantly transformed the education system. The increasing use of AI tools in educational contexts reflects this modernization (Chen et al., 2020). The rise of AI has sparked debate among educators regarding its implications for teaching and learning. Numerous studies highlight the benefits of AI, such as enhancing students' problem-solving and critical thinking skills (Dosmaganbetova, 2025; Kakina, 2025). Additionally, research by Karatzas and Zogopoulous (2024) indicates that students perceive AI as a positive influence on teaching methods and learning outcomes, thereby enhancing student engagement and presenting new opportunities for educators.

AI-assisted tools are designed to enhance literacy skills among learners. ESL students often struggle with reading texts due to challenges of the reading process such as effective reading strategies, word recognition, and decoding methods, creating challenges in comprehending texts naturally (Chandran and Shah, 2019). Conversely, Aineh and Ngui (2024) study demonstrated that using AI tools like ChatGPT facilitates instant feedback, leading to improvements in students' writing skills, including grammar and vocabulary. Moreover, personalizing learning experiences through AI has significantly enhanced students' motivation, resulting in improved reading comprehension scores (Sudin & Swanto, 2024).

To further develop critical thinking skills, a metacognitive approach to literacy is essential. Methods that enable students to reflect on and manage their learning processes are crucial. Gamification and Augmented Reality (AR) have emerged as effective strategies to motivate students and deepen their engagement with educational materials. Rafiq and Hashim (2018) emphasize the close connection between critical thinking and problem-solving skills, which are often cultivated through Alternate Reality Games (ARGs).

Implementing gamification in lesson plans can enhance student engagement with the subject matter. The mastery of the four English skills which are reading, writing, listening and speaking is essential for language learning (Abu Bakar, Esa, Ationg, & Jawing, 2021). Therefore, proficiency in these four skills is vital for mastering the language. However, ESL learners face challenges in vocabulary acquisition (Rafiq, Pazilah, Tong, Yunus & Hashim, 2020). The integration of gamification has shown to significantly impact students' literacy development; for example, Nordin (2023) found that using Quizziz to enhance vocabulary skills resulted in positive pre-test and post-test outcomes.

Additionally, the potential of AR in educational settings should not be overlooked. Salmee and Majid (2022) note that traditional teaching methods have often led to disengagement and poor learning outcomes. By incorporating AR, which merges three-dimensional virtual objects with real-life contexts, educators can create innovative learning experiences (Yusof, Jima'ain, Rahim, & Abuhassna, 2022). A study by Mohamed Jamrus and Razali (2021) indicates that Malaysian secondary school teachers exhibit high level of acceptance to the uses of AR in their English reading classes. In addition, ESL teachers also mentioned how the implementation of AR can support learners from different English language levels (Mohd Nabil, Nordin, Ab Rahman, 2024). Therefore, with the positive perceptions toward AI among teachers, it could bring benefits in facilitating students' learnings.

The emergence of AI and the advancement of technology have ignited significant discussions regarding their

implications for education. The incorporation of gamification and AR has proven beneficial in fostering student engagement and enhancing learning outcomes. By leveraging these technologies, educators can support the development of metacognitive strategies, create tailored learning materials, and promote independent learning among students.

b. Access and Equity in Literacy Development: Urban and Rural Disparities

Access to technology significantly varies between urban and rural secondary schools in Malaysia, leading to disparities in students' literacy development. This digital divide poses substantial challenges for equity in educational experiences and literacy growth. According to Govindan and Hussin (2024), the lack of internet access varies based on geographical strata across Peninsular and East Malaysia, resulting in interruptions that disproportionately affect rural students. This inequity not only affects immediate learning opportunities but also contributes to long-term disparities in educational outcomes, limiting future opportunities for rural students.

The impact of the COVID-19 pandemic further illuminated these disparities in digital resources. Ahmad, Zainal Abidin, and Ismail (2022) found that students in remote areas faced considerable obstacles in online learning due to inadequate infrastructure. The limited access to technology and reliable internet connections created stress for secondary school students in Sabah, hindering their ability to adapt to new online learning environments (Wider, Chua, Mutang, & Pan, 2023). This situation was compounded by the lack of training for both students and teachers in utilizing online platforms effectively, which left many students feeling isolated and unsupported. Consequently, the poor quality of these online experiences has led to a deterioration in comprehension skills, adversely affecting academic performance. In contrast, urban students experienced fewer resource-related barriers but struggled with motivation during the transition to online education. This contrast highlights that while urban students may have better access to resources, they still face unique challenges that can impede their learning.

Post-pandemic, the inequities in technology access persist, particularly for learners in rural areas. Many students continue to encounter challenges in their English language classrooms due to factors such as limited motivation and insufficient technological support (Zulkefly & Razali, 2019). Relying predominantly on teachers and available school materials for engagement with the English language raises concerns about English language anxiety, which can further impede learning. Idrus and Hamid (2021) reported that students in selected rural schools in Selangor experience moderate to high levels of anxiety across all four language skills, except for writing, where anxiety levels were reported as low to medium. This anxiety can hinder participation in classroom activities, leading to a cycle of underachievement that affects students' overall confidence in using English.

Conversely, urban students benefit from significantly greater exposure to the English language, which is evident in the educational resources available to them. Zulkefly and Razali (2019) emphasize that rural students often lack the necessary exposure to English, exacerbating their proficiency challenges. Additionally, the instability of internet access and computer availability in rural schools positions these students at a disadvantage compared to their urban peers (Kasdiah, Amdan, & Janius, 2024). Research by Hasin and Nasir (2021) further underscores that ICT facilities in rural secondary schools are often unsatisfactory and unresponsive compared to those in urban settings. This discrepancy not only impacts on the quality of instruction but also limits students' ability to engage with modern language learning resources that are increasingly essential in today's globalized world.

Addressing these disparities is crucial for fostering equitable learning environments that support literacy development among all ESL learners in Malaysia. Policymakers must prioritize enhancing technological infrastructure in rural areas while developing targeted interventions that improve student motivation and engagement in both urban and rural contexts. For instance, initiatives could include providing professional development for teachers in rural schools to better utilize technology in their teaching and creating partnerships with local organizations to facilitate access to digital resources. By creating more equitable access to resources, we can help bridge the gap in literacy development and ensure that all students have the opportunity to succeed in their language learning journeys.

c. The Role of Technology and AI in Literacy Development for ESL Secondary School Students

In the 20th century, technologies like radio and television played a crucial role in shaping future generations' perceptions of technology's importance in education. Additionally, as a result of the existence of television, it has brought back the use of it for education in the 21st century due to the pandemic. For instance, on 17 February 2021, the Malaysian education system implemented an initiative where a special Education TV channel (Didik TV KPM) was introduced (Ni, 2022). This made the initiative more accessible and exciting for parents and students in rural areas who lack adequate resources to cater to online learning. These early innovations laid the groundwork for the digital tools we utilize today, illustrating the evolution of educational technology. The broader impacts include increased access to

collaborative work, which is vital for enhancing cognitive skills and teamwork—skills that secondary school students must cultivate for success in tertiary education and the workforce.

Moreover, the rise of multimodal literacy has facilitated personalized learning experiences, enabling students to engage with diverse formats of information. This global connectivity, particularly through social media as an educational tool, helps students understand and practice English as their second language. Based on the study of Lim, Zakaria, Zawawi, & Sulaiman (2023), messaging apps such as WhatsApp and Telegram are favored by students in one of the Malaysian national secondary schools in Perak for language learning. However, there is a growing concern that students may become overly dependent on technology to facilitate their learning experiences. While collaboration through digital means is beneficial, it is equally important to foster physical interactions among students to enhance their literacy development, as face-to-face communication is critical for building social and linguistic skills.

The influence of AI and technology is rapidly expanding among younger generations, particularly in academic contexts. As the use of these tools becomes a trend, it brings practical implications for personalized learning. AI can assist in organizing students' thoughts and providing real-time feedback, which is crucial for effective learning. According to Aineh and Ngui (2024), a teacher observed that ChatGPT promotes critical thinking by requiring students to develop their queries to get specific answers. By streamlining the process of obtaining information, AI allows students to focus on critical thinking and comprehension rather than merely searching for answers. Additionally, the incorporation of gamification within AI tools enhances metacognitive strategies, encouraging students to reflect on their learning processes and engage in self-directed learning. Likewise, AI can also serve as an invaluable resource for educators by assisting with administrative tasks, thus allowing them to devote more time to instructional planning and student engagement.

Not only that, the role of technology and AI has brought impact to the development of literacy in ESL secondary school students. The research of Ling Jen and Hj Salam (2024) constitutes that the use of AI tools such as Gemini (formerly known as Google Bard) has significantly improved Malaysian secondary school students' writing abilities. The pre-test and post-test results from the study showcased that 95% of the students felt they had enhanced their essay writing skills after utilizing Google Bard. In addition, acquiring new vocabulary and ideas had been mentioned by students on how the tool has helped them effectively. This in result showcases how technology such as AI could be a tool that facilitate not only content generation but also language development for students.

Conversely, an over-reliance on AI presents its own set of risks, such as the potential for exposure to non-factual information. The accuracy of AI-generated content is not completely reliable, as it aggregates data from various online sources, some of which may be misleading or incorrect. According to Rahman et al. (2023), there are potential outcomes and risks when using AI for decision-making as it requires thorough evaluation to ensure awareness and preparedness for any possible consequences. This situation highlights the necessity for critical evaluation of AI outputs and reinforces the role of educators in guiding students to discern credible information. The role of technology in literacy development for ESL secondary school students is evident through the invention and implementation of tools such as AI and other technological resources. The impact of these tools on education enables teachers to foster student-centered learning, encouraging students to work independently, collaboratively, and participate actively in class. However, it is crucial to acknowledge the limitations of technology in education, which require ongoing attention and improvement.

The lack of access and equity between urban and rural areas creates divergent opportunities for secondary school students. Rural schools face significant challenges due to inadequate information technology infrastructure, which limits the potential for using technology to engage students and foster interest in English lessons (Renganathan, 2021). Students in rural areas often have limited exposure to the English language compared to their urban counterparts, leading to disparities in engagement and access to resources, including reliable internet connections. Furthermore, the lack of technological resources such as computers, tablets, and smartphones in rural schools impedes seamless integration of ICT into English Language Learning (ELL) programs (Dunstan & Ismail, 2024). These differences can hinder the ability of rural students to fully participate in technology-enhanced learning environments. While AI and technology offer significant advantages for secondary school students, providing personalized learning experiences and opportunities for collaborative engagement, it is imperative that rural areas receive the same equitable access to these resources. Equity in technology, access is not merely a matter of fairness; it is essential for ensuring that all students can thrive in an increasingly digital world.

5. Conclusion

In conclusion, the integration of technology and Artificial Intelligence (AI) in education represents a pivotal advancement in fostering literacy development among English as a Second Language (ESL) secondary school students. As we have explored, the evolution of educational technology from the 20th century to the present has transformed learning environments, making access to information more interactive and collaborative. These advancements not only

enhance students' cognitive skills and teamwork but also promote personalized learning experiences that cater to the diverse needs of learners.

However, significant disparities remain, particularly between urban and rural areas in Malaysia, where access to technology and resources is uneven. This digital divide poses fundamental challenges to achieving equity in literacy development, impeding the ability of rural students to fully engage in technology-enhanced learning. Therefore, it is imperative that educators and policymakers work collaboratively to address these inequities by improving technological infrastructure in rural areas and ensuring that all students have access to the tools and resources necessary for success in a digital age.

Not only that, but effective implementation of AI also called for careful consideration. To reap the benefits of AI tools, comprehensive training and professional development should be provided to educators. With the aim of integrating AI and creating interactive teaching methods seamlessly into lesson plans, the use of AI can be a guide for educators. Moreover, emphasizing AI as a tool to facilitate and guide learning journey should be emphasized to students in order to avoid plagiarism and understanding the limitations of AI-generated content. This in return will foster a culture of digital literacy and integrity.

In essence, while the benefits of AI and technology in education are substantial, it is crucial to maintain a balanced approach that encourages critical thinking and human interaction. Educators play a vital role in guiding students to navigate the complexities of technology while fostering an environment that emphasizes collaboration and effective communication. By prioritizing equitable access to technology and creating supportive learning environments, we can empower all ESL learners to thrive academically and develop the essential skills needed for their future endeavors. As we move forward, it is our collective responsibility to ensure that every student, regardless of their background, has the opportunity to harness the full potential of technology in their literacy development journey.

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