KARYA ILHAM PUBLISHING
CONNECTING MINDS, BRIDGING IDEAS, INSPIRING READERS

ASEAN Artificial Intelligence Journal

Journal homepage:
https://karyailham.com.my/index.php/aaij/index
ISSN: 3083-9971

Leveraging Artificial Intelligence (AI) to Enhance Differentiated Learning Strategies in Malaysian ESL Learners: A Conceptual Paper

Marchsinda Jong[1], Ahmad Ruzaini[1,*], Sathiadevi Thulasy[1], Divya M Ravi[1], Wan Ainol Munirah[1], Melor Md Yunus[1], Harwati Hashim[1], Hadi Salehi[2]

[1] Faculty of Education, Universiti Kebangsaan Malaysia, Bangi, Malaysia
[2] English Department, Islamic Azad University, Najafabad, Iran

ARTICLE INFO

Article history:
Received 18 February 2025
Received in revised form 9 May 2025
Accepted 20 May 2025
Available online 3 June 2025

Keywords:
Differentiated strategy; AI integration; ESL methodology

ABSTRACT

In today's diverse educational landscape, integrating Artificial Intelligence (AI) into differentiated learning strategies offers a promising approach to enhancing English language instruction for Malaysian ESL learners. This conceptual paper looks into the promising potential of AI in transforming differentiated learning strategies for these students. It begins by highlighting the essential need for innovative approaches in ESL education, considering the varied linguistic and cultural backgrounds of Malaysian students. The paper then examines the various roles of AI in personalized learning, demonstrating how adaptive technologies can customize educational experiences to meet individual student needs. It reviews practical applications and tools, showcasing AI-driven platforms and methodologies that can be incorporated into the ESL curriculum. Additionally, the paper addresses the challenges of implementing AI-based strategies, such as technical limitations and resistance to change, and suggests solutions to overcome these obstacles. Future directions for AI in education are discussed, with an emphasis on the importance of ongoing research and development. The paper also focuses on AI's role in promoting equity and accessibility in the classroom, ensuring that all students have equal opportunities to succeed. Ethical concerns related to AI in education, including data privacy and algorithmic bias, are critically analyzed to ensure responsible use. The paper concludes with recommendations for future research, encouraging further exploration into the integration of AI in ESL education to improve learning outcomes and support diverse learner needs.

1. Introduction

In an era where globalization is driven by rapid technological advancements, English has emerged as the global lingua franca, essential for participation in international discourse, commerce, and education. As a multicultural and multilingual nation, Malaysia has prioritized English as a Second Language (ESL) to ensure its citizens can effectively engage on the world stage. However, the diversity

* *Corresponding author.*
E-mail address: p145965@siswa.ukm.edu.my

https://doi.org/10.37934/aaij.2.1.118

in language proficiency among Malaysian learners presents to be uniquely challenging and demands for innovative pedagogical approaches which tailored to individual needs. Differentiated learning strategies, which customize instructional methods to cater to diverse learners, have shown promise in addressing this issue. This point is further strengthened by a research study by Kadir *et al*., [1] as the study showed that with a combination of synchronous and asynchronous learning methods, along with the use of high-quality videos and other digital resources can enhance the learning experience for students in skill-based subjects. With the technology of AI keeps on advancing by days, there is a huge opportunity to progressively enhancing these strategies, establishing a more personalized and efficient learning environment. A study by Ruslim and Khalid., [2] focusing on teacher's perception of integrating AI in differentiated instruction classrooms indicates that there is a general confidence among the teachers in using AI in the classroom. They are found to be optimistic about completing tasks with the help of AI and understand the benefits of AI in adapting teaching material.

1.1 Problem Statement

Despite Malaysia's prioritization of English language education, Malaysian ESL learners face significant challenges due to their diverse linguistic and cultural backgrounds. Conventional teaching methods often falls short in addressing the varied proficiency levels and learning styles, thus resulting in subpar outcomes. Integrating Artificial Intelligence (AI) into differentiated learning strategies offers a promising solution by providing personalized and adaptable learning experiences catered to individualized learning needs. However, the implementation of AI in Malaysian ESL education can be considered still in its infancy, and there is a lack of localized research to guide effective integration. This paper aims to look into the potential of AI in enhancing differentiated learning strategies for Malaysian ESL learners, addressing challenges and proposing solutions for successful implementation.

1.1.1 Advantages of integrating ai into education

The integration of AI in the education fields is not a novel concept, but its application in differentiated learning for ESL learners is gaining traction. AI-powered tools and systems can analyze learners' strengths, weaknesses, and preferences to provide customized learning experiences. These types of technology consist of intelligent tutoring systems, customizable learning platforms, and natural language processing applications, all of which have the potential to transform ESL education in Malaysia. By utilizing AI, educators can offer targeted support, thereby improving learner outcomes and fostering a more inclusive and effective educational landscape. A study conducted by Jian and Omar [3] found that students who were put into AI personalized learning group were shown to improve significantly compared to those who were in the traditional learning group. The result suggested that AI tools provided a steadier learning curve. The majority of students agreed that AI tools made the learning more engaging and catered to their individual needs.

1.1.2 AI capability in processing extensive amounts of data

One key advantage of AI in differentiated learning is its capability to process extensive amounts of data to identify key patterns and insights that may not be visible or noticeable to human educators. This data-guided methodology allows for more precise tailoring of instructional content and methods to suit individual learners. For example, AI can track students' progress in real time, adjusting the

difficulty level of exercises and providing instant feedback. This ensures that each learner is challenged appropriately, neither overwhelmed nor disengaged, and can progress at their own pace. A study conducted by Muneeba [4] showed that Artificial Intelligence (AI) is potential in enhancing inclusivity in English Language Teaching (ELT). The result of the study indicated that AI helps in promoting individualized instruction, accessibilities to information as well as various differentiated learning experiences. Study by Tilepbergenovna [5] suggests that AI helps in personalized learning by offering intelligent tutoring systems, and data-driven insight so as to meet diverse students' needs and to enhance educational outcomes. Another study conducted by Murgayah *et al*., [6] shows a positive result of integrating ai in helping students develop their writing skill. The incorporation of ChatGPT as a feedback source into the six-weeks module proven to be fruitful as the findings of the study indicated that there was a distinct enhancement in students' vocabulary and writing skills when ChatGPT was introduced as a real-time correction and feedback source to the students. The results showed that writing accuracy among the participants involved in the study improved consistently with most of them reached 95% at the end of the module. The iterative feedback from ChatGPT ensured personalized and adaptive learning, addressing specific challenges faced by the students. Personalization and adaptability are essential in meeting different learner needs. AI tools should offer customized instructions and adjust dynamically to keep students within their optimal learning zone (ZPD) [7].

1.1.3 AI as differentiated learning facilitator

Moreover, AI can facilitate differentiated learning by offering a range of multimedia resources, such as interactive simulations, videos, and games, that accommodate to a variety of learning methods. Visual, auditory, and kinesthetic learners can profit from AI-driven content which aligns with their preferred modalities. AI-driven systems can incorporate assorted learning materials, for example, multimedia, interactive practices, and real-world scenarios to accommodate with various learning styles and likings [7]. Additionally, AI can support language acquisition through sophisticated natural language processing algorithms that enable more accurate pronunciation practice, grammar correction, and contextual language use. These features are particularly beneficial for ESL learners, who often require more nuanced and contextual language support.

The enhancement of differentiated learning strategies through AI may sounds promising and potential, there are challenges and considerations to address. There are certain ethical implications of AI use in education that are vital to be addressed, including data privacy and algorithmic bias, must be carefully managed to make sure that it is equally accessible to all learners. Educational institutions must follow a strict guideline to ensure the safety of their students' privacy and to prevent any unauthorized access to personal information. It is imperative to highlight the biases in AI algorithms to safeguard fairness and equality in an AI-driven educational system. Transparency and accountability are another factor to be considered in ensuring the AI algorithms fair, reliable and accountable [8]. Furthermore, educators need satisfactory level of training and support to efficiently integrating their teaching beliefs with AI tools. Partnership between policymakers, educators, and technologists is crucial to create an environment conducive to the successful implementation of AI-enhanced differentiated learning.

In conclusion, leveraging AI to enhance differentiated learning strategies offers a transformative potential for ESL education in Malaysia. By providing personalized, data-driven, and multimodal learning experiences, AI can help bridge the gap in language proficiency among Malaysian learners. However, careful consideration of ethical issues and comprehensive support for educators are essential to maximize the benefits of AI in education. As Malaysia continues to advance its

educational goals, the integration of AI into differentiated learning strategies represents a promising avenue for fostering a more inclusive and effective ESL learning environment.

1.2 Research Gap

Even though AI has shown a potential in enhancing personalized learning, its use in Malaysian ESL education is still new and not well-researched. There is a need for more studies focused on how AI can effectively address the unique linguistic and cultural challenges faced by Malaysian ESL students. This paper aims to explore the potential of AI to improve differentiated learning strategies for these learners, offering solutions for better implementation.

1.3 Objective of the Research

This paper explores how Artificial Intelligence (AI) can improve differentiated learning strategies for Malaysian ESL learners. It aims to tackle the challenges posed by students' diverse linguistic and cultural backgrounds, introducing innovative AI-based methods to enhance ESL education. By focusing on personalized learning, the study highlights how adaptive technologies can create tailored educational behaviours that meet all the requirements of an individual learner.

In addition, the paper reviews practical AI tools and applications that can be integrated into the ESL curriculum. It also delves into the obstacles faced during implementation, such as technical challenges and resistance to change. Looking ahead, the study emphasizes the importance of continuous research and development in leveraging AI for education. Ethical issues, including concerns about data privacy and algorithmic bias, are critically evaluated to ensure that AI is utilised responsibly. Lastly, the paper offers recommendations for future research to enhance learning outcomes and better address the diverse needs of students.

A conceptual paper primarily focuses on presenting theories, frameworks, and models rather than empirical data. Its purpose is to synthesize existing research and ideas, offering a comprehensive view of the topic and introducing new perspectives or hypotheses. This approach plays a crucial role in laying the groundwork for future empirical studies that can validate the proposed theories and models.

While empirical research is undeniably valuable, this paper is dedicated to making theoretical contributions. It aims to help educators, policymakers, and researchers better understand how AI can be synthesised into ESL education. By thoroughly examining existing literature, the paper establishes a solid foundation for exploring the advantages and challenges of AI in ESL classrooms.

Recognizing its limitations, this paper emphasizes the need for future empirical studies. Its goal is to guide subsequent research while reinforcing its importance as a conceptual study that paves the way for further exploration.

2. Diverse Linguistic and Cultural Needs

The integration of artificial intelligence (AI) in education has been transformative in recent years, particularly in addressing the diverse linguistic and cultural needs of English as a Second Language (ESL) learners. Malaysian ESL students represent a unique demographic characterized by varying levels of English proficiency and exposure, shaped by urban-rural disparities and multicultural backgrounds. Differentiated learning strategies, which emphasize tailored educational approaches, have been widely recognized as effective in bridging these gaps. This paper explores how AI

technologies can enhance differentiated learning strategies for Malaysian ESL learners, highlighting its potential to address diverse needs and overcome challenges [9,10].

2.1 AI Contributions Towards Personalised Learning Experiences

One of AI's most significant contributions to education is its capacity to offer personalized learning experiences. Using data-driven insights, AI systems can analyse each learner's strengths and weaknesses to customize instruction. Adaptive learning platforms like intelligent tutoring systems (ITS) adjust the complexity of tasks and feedback based on the learner's progress, ensuring that students receive targeted support. For Malaysian ESL learners, this is particularly advantageous as it allows educators to address their varying linguistic abilities. Moreover, AI-powered solutions can help bridge the gap between rural and urban students, enabling equitable access to tailored education despite disparities in exposure to English [11].

AI has also revolutionized language acquisition through advanced technologies such as speech recognition and natural language processing. These tools facilitate real-time feedback, empowering students to improve their grammar, pronunciation, and vocabulary with minimal external intervention. For example, conversational AI applications provide a safe, pressure-free environment for learners to practice speaking skills, thereby boosting confidence. Such technologies are invaluable in Malaysian classrooms, where learners may struggle with English proficiency due to limited resources or fear of making mistakes in front of peers [12,13].

Furthermore, AI can play a pivotal role in integrating culturally relevant content into the learning process. In Malaysia's multicultural society, educational materials that reflect students' unique cultural identities are essential for engagement and inclusivity. AI algorithms can curate culturally sensitive and relatable examples that resonate with students, enhancing their motivation to learn. By incorporating localized narratives into lessons, AI not only enriches linguistic development but also fosters a sense of belonging among learners [14].

However, while the potential of AI in education is undeniable, challenges remain in its implementation. Digital inequality, insufficient infrastructure in rural areas, and the need for teacher training pose significant barriers. For Malaysia to maximize the benefits of AI, collaborative efforts between policymakers, educators, and technologists are crucial. Professional development programs aimed at equipping teachers with AI literacy are essential, alongside investments in infrastructure to ensure all students have equal access to technology [15,16].

In conclusion, AI offers transformative potential in enhancing differentiated learning strategies for Malaysian ESL learners. Through personalized instruction, real-time language support, and culturally relevant content, AI addresses the diverse linguistic and cultural needs of these students. While challenges such as digital access inequality and teacher readiness must be tackled, a concerted effort can ensure that AI-driven education benefits learners across Malaysia, ultimately contributing to the nation's aspirations for inclusive and quality education [17].

3. Roles of AI in Personalized Learning

The integration of artificial intelligence (AI) into education has brought transformative possibilities, particularly in personalized learning, which tailors' education to individual learners' needs. In Malaysia, English as a Second Language (ESL) learners represent a linguistically and culturally diverse population, necessitating differentiated learning strategies to address variations in proficiency levels, backgrounds, and learning preferences. The personalized approach powered by AI

can significantly enhance differentiated learning strategies, offering adaptive, equitable, and impactful interventions for Malaysian ESL learners [18,19].

AI-driven tools provide unparalleled opportunities to create personalized learning environments by analysing learners' data and customizing content to suit their individual needs. Machine learning algorithms enable adaptive learning platforms to adjust the complexity of tasks and provide real-time feedback that aligns with each student's progress and learning gaps. For Malaysian ESL learners, especially those from rural areas with limited access to resources, AI systems can bridge educational disparities by providing equitable access to personalized learning opportunities. These tools cater to students from diverse proficiency levels, ensuring no one is left behind [9,19].

Furthermore, AI technologies such as speech recognition and natural language processing offer critical support in real-time language acquisition. These tools allow learners to practice speaking, improve pronunciation, and expand vocabulary in a self-paced, low-pressure environment. Malaysian ESL students often face a lack of exposure to English, especially in rural settings where practical conversational opportunities are limited. Through AI-driven language applications, learners can simulate real-life interactions, build confidence, and address common challenges such as the fear of making mistakes. This is particularly impactful for developing oral fluency and conversational skills [20,21].

Another critical aspect of AI in personalized learning lies in its capability in creating culturally responsive educational content. Malaysia’s multicultural context requires instructional materials that resonate with students’ cultural identities and experiences. AI systems can curate localized narratives, examples, and contexts, warranting the learning process to be both meaningful and engaging. For instance, incorporating relatable cultural elements into ESL lessons not only enhances comprehension but also encourages learners to connect their cultural heritage with language learning. This fosters inclusivity and improves motivation among Malaysian ESL learners [22,23].

Despite its benefits, the implementation of AI in personalized learning for Malaysian ESL learners faces significant challenges. Infrastructure limitations, especially in rural schools, digital inequalities, and a lack of teacher readiness for AI integration remain key obstacles. Teachers require professional development and training to ensure effective incorporation of AI tools into their classrooms. Moreover, issues of data privacy and ethical use of AI must be carefully addressed ensuring sustainable, safe, and equitable applications of AI in education. Policymakers and educators must work hand in hand in overcoming these challenges, thus making AI-powered education accessible to all learners [24,25].

In conclusion, AI has the potential to transform personalized learning in enhancing differentiated strategies for Malaysian ESL learners. By adapting instruction to individual needs, providing real-time language support, and integrating culturally relevant content, AI addresses the diverse linguistic and cultural challenges faced by Malaysian students. However, the success of such initiatives relies on overcoming infrastructure, training, and ethical barriers. With dedicated efforts from all stakeholders, AI can be the bridge that connects the gaps in ESL education, paving the way for a more inclusive and effective learning environment [26,19].

4. Practical Applications and Tools

Differentiated learning is a teaching method that adjusts lessons to meet the different needs, abilities, and learning styles of students. AI can change this approach by providing personalized learning experiences, instant feedback, and flexible content. In Malaysia's ESL setting, where students have varying levels of English skills from beginner to advanced, AI can be a valuable tool for

creating tailored learning paths, boosting student engagement and improving their overall language skills [27].

AI systems can use data to examine how students learn and progress. This helps in designing learning experiences that fit each student's needs, ensuring they don't feel overwhelmed or under-challenged. According to Lam, K., Hassan, A., Sulaiman, T., & Kamarudin, N. [28], AI technologies can provide learners with adaptive content so that their learning paths are adjusted to their individual strengths and weaknesses. Furthermore, AI can take over time-consuming tasks like grading, allowing teachers to concentrate more on personalized instruction.

The role of AI in personalized ESL education Artificial Intelligence (AI) has revolutionized numerous fields, and the field of education is no exception. In teaching English as a Second Language (ESL), AI technologies pose great benefits, especially in personalized content delivery aligned with the student's unique learning needs. Being able to align with a learner's level of proficiency, AI-based tools complement learning processes as well as enhanced results. This essay explains how AI enhances ESL learning, focusing on personalized content delivery, chatbots for speaking and listening practice, writing support tools, and multi-modal content support.

4.1 AI as A Provider of Personalised Learning Experiences

One of the primary advantages of AI in ESL learning is that it can provide personalized learning experiences. AI-powered Intelligent Tutoring Systems (ITS) are designed to adapt to the level and needs of individual learners. These systems assess students' performance and progress, identifying areas where they may be struggling, such as vocabulary acquisition, grammar, or pronunciation. According to the evaluation, the system tailors' activities to meet targeted needs [29]. Artificial intelligence-driven systems such as Duolingo and Rosetta Stone, for instance, employ complex algorithms to generate adaptive lessons that vary their level of complexity in accordance with the learners' progress. This provides the students with a balance between too great a challenge that may frustrate them and mundane tasks that may bore them [30]. These adaptive learning systems enable more efficient and tailored education, leading to improved student outcomes and higher retention rates.

The other significant advantage of AI in ESL learning is its ability to enhance speaking and listening skills by using AI-driven chatbots. EnglishBot is one example that can simulate real conversations, providing learners with a platform to practice speaking without fear of judgment from peers or instructors. Chatbots provide a low-risk space for users to practice the English language in a conversational format, which is especially helpful for students who feel nervous or self-conscious about speaking in front of their classmates [31]. The artificial intelligence-powered sites allow students to converse at their own pace, slowly developing their confidence and oral fluency.

Moreover, artificial intelligence tools such as Grammarly are also indispensable in writing skill development. English as a Second Language (ESL) students, particularly those whose first language is quite different from English, tend to struggle with grammar, punctuation, and sentence structure. Grammarly offers real-time feedback and improvement suggestions, which enable students to improve their writing while fostering a better understanding of English syntax [32]. By providing instant feedback, these programs assist students in locating and fixing errors, thereby accelerating the learning process and enabling the formation of good writing habits.

4.2 AI Supports Varied Learning Styles

In addition to personalized content, AI technology also supports varied learning styles because it delivers the content in additional formats, including interactive lessons, videos, and quizzes. The technology is appropriate for visual, auditory, and kinaesthetic learners and therefore renders ESL learning more inclusive. Visual learners, for instance, can be assisted with video-based lessons that allow them to see the language being used, and auditory learners can be assisted with speech-based feedback or listening exercises. Empirical studies indicate that catering to various learning preferences enhances student engagement and knowledge retention [33]. Artificial intelligence offers various learning modalities to facilitate access to resources that are most beneficial for students' preferred learning methods [34].

Furthermore, AI technologies have the potential to democratize ESL learning by enhancing the accessibility of education. Tools like Duolingo and Grammarly are either free or low-cost, which makes it more convenient for students from different socio-economic backgrounds to access quality learning materials. This is particularly important in countries where access to traditional language learning resources may be restricted.

Real-time assessment and feedback are key to personalized learning. For Malaysian ESL learners, who have different levels of language proficiency, immediate feedback is essential for improving learning outcomes. AI tools, especially those that utilize Natural Language Processing (NLP), can analyse student responses in real-time and provide quick feedback on errors, helping learners fix mistakes as they happen [35]. For example, Siri and Google Assistant use speech recognition and NLP to assess spoken English and suggest improvements in pronunciation, fluency, and vocabulary usage.

Additionally, AI writing tools like ProWritingAid and Ginger offer instant feedback on writing tasks, pointing out areas for improvement in sentence structure, grammar, and vocabulary. These tools are very helpful for ESL learners who are aiming to enhance their writing skills in English. By getting immediate corrective feedback, students can keep practicing independently, strengthening their language skills beyond the traditional classroom setting [30].

4.3 AI as a Resource for Individualised Learning Needs

Another major application of AI in differentiated learning is that it can dynamically allocate resources based on student needs. AI-driven platforms such as Knewton and DreamBox adapt the curriculum in real time, giving students personalized resources based on their performance [28]. In the students' ESL scenario, these systems can recognize whether a student has trouble with certain language points such as tenses or vocabulary, and provide additional resources in terms of exercises, videos, or interactive lessons directly related to his/her needs. This adaptive fit guarantees that every student is tackling the appropriate level and receiving help where he or she needs it most.

Moreover, AI can support differentiated instruction by providing recommendations for more practice materials to students. For example, a student who cannot perform well in reading comprehension may be asked to practice vocabulary exercises, while a student who excels in reading but not speaking may be asked to practice extra listening and speaking exercises. This ability to be tailored in accordance with unique needs makes AI a highly practical tool for constructing an entirely tailored learning space [29]

While AI can support individualized learning, social interaction must be retained in the learning of language, especially in ESL. Cooperative learning, where students work together to solve an issue or practice language, is a sound way of inculcating the usage of language in real contexts. Cooperative

learning can be improved through AI by connecting students with native speakers through the use of language exchange websites. Other programs like Tandem or HelloTalk use AI to match students with language exchange partners based on their learning needs and levels of proficiency, enhancing cross-cultural conversation and language usage [34].

AI can also be utilized to facilitate group learning through the provision of platforms upon which students can work on assignments and share resources. For example, AI-supported platforms like Google Classroom or Edmodo allow students to work together on assignments, share feedback, and engage in peer review, enhancing both their social and language skills. These group learning platforms encourage the practice of English in social contexts, an important area of language learning [30].

Despite the potential benefits of AI in ESL instruction, there are several issues that must be overcome. One is the digital divide because many Malaysian learners, particularly those from low-income or rural areas, may lack the necessary technology or access to the internet to fully utilize AI tools [31]. To address this, steps must be taken to ensure that AI-based instructional materials are made available equally around the country.

The other concern is the danger of overreliance on AI in education. While AI technologies have a lot to contribute to personalized learning, they cannot replace the role of human teachers in building emotional support, social abilities, and thinking capabilities [28]. Teachers continue to play active roles in guiding students, facilitating discussion, and dealing with non-cognitive aspects of learning

5. Addressing Challenges in Integrating AI as a Differentiated Learning Tool for Personalised Learning

The incorporation of Artificial Intelligence (AI) into English as a Second Language (ESL) education in Malaysia has created new opportunities for personalized learning, enabling instruction to be customized to meet the unique needs of each student. AI-driven resources, such as adaptive learning systems, intelligent tutoring applications, and automated feedback tools, have shown potential in catering to the varied linguistic competencies of Malaysian ESL students. Nevertheless, several challenges continue to exist, including limitations in infrastructure, the preparedness of educators, ethical dilemmas, and the potential for excessive dependence on AI technologies. This paper examines the obstacles and prospective pathways for utilizing AI in differentiated learning for Malaysian ESL students.

5.1 Digital Infrastructure Disparities

A significant challenge in the deployment of AI-enhanced differentiated learning within Malaysian ESL classrooms is the inconsistency in digital infrastructure. Urban educational institutions may benefit from high-speed internet and advanced digital resources, while their rural counterparts frequently face issues with inadequate connectivity and limited technological access. This digital disparity intensifies educational inequities, hindering certain students from reaping the advantages of AI-enhanced learning tools, according to [36]

5.2 Teacher Preparedness and Training

Moreover, the capacity of teachers to effectively incorporate AI into differentiated instruction poses a considerable challenge. According to Ruslim and Khalid [2], numerous educators report feeling uncertain about the application of AI tools, primarily due to insufficient training and

professional development opportunities. While younger instructors generally exhibit a greater openness to AI integration, their more seasoned colleagues often resist its adoption, concerned that it may undermine traditional pedagogical approaches. Comprehensive training is essential for educators to adeptly employ AI-driven personalized learning resources.

5.3 Ethical Concerns and Data Privacy

The use of AI in education is heavily reliant on data collection to facilitate tailored learning experiences. However, issues surrounding student data privacy, security, and the ethical use of AI remain critical concerns. The processes involved in collecting and analysing student data raise significant questions regarding the storage and management of such information. The handling and application of personal data are critical considerations. Furthermore, the presence of algorithmic bias within AI systems may result in unequal educational experiences for students from diverse linguistic and cultural backgrounds, according to Jia *et al.,* [37].

5.4 Limitations of AI in Emotional and Cultural Sensitivity

AI-enhanced educational platforms pose a threat to the interpersonal aspects of language acquisition. Although AI can offer tailored instruction and prompt feedback, it lacks the emotional sensitivity and cultural insight that human educators contribute to the learning environment. According to [38], an excessive dependence on AI could result in fewer in-person interactions, which are essential for fostering speaking and listening competencies among ESL learners.

5.5 Need for Localized Research in Malaysian Context

In spite of the increasing enthusiasm for AI technologies in ESL education, there is a notable deficiency in research focused on Malaysia. According to [36], the majority of current studies concentrate on AI within the broader context of general education, neglecting the specific linguistic and cultural hurdles encountered by Malaysian ESL students. There is a pressing need for more localized research to evaluate the effectiveness of AI in Malaysian ESL educational settings.

To address these challenges, collaboration among government entities, educational organizations, and private technology companies is essential for the advancement and execution of AI-driven educational solutions. According to [39], public-private partnerships can play a crucial role in mitigating costs, offering technical expertise, and ensuring that AI applications are in alignment with national educational objectives. By promoting such collaborative efforts, Malaysia can enhance the adoption of AI in English as a Second Language (ESL) education, while also ensuring that access to cutting-edge learning technologies is both sustainable and equitable.

5.7 Future Directions

To address the digital divide, it is imperative for policymakers to enhance digital infrastructure throughout Malaysia, with a particular focus on rural and underserved areas. Initiatives such as expanding internet connectivity, supplying AI-compatible devices to educational institutions, and incorporating AI technologies into the national education system can facilitate equitable access to AI-enhanced learning opportunities.

The effectiveness of AI in personalized learning is contingent upon educators' proficiency in its integration within their teaching practices. It is essential to establish comprehensive training

programs that equip teachers with the requisite skills to effectively utilize AI tools. Professional development initiatives, including workshops, online training sessions, and partnerships with AI specialists, can bolster educators' confidence in employing AI for tailored learning experiences [2]. AI-based educational platforms should be designed to resonate with Malaysia's rich linguistic and cultural diversity. By integrating local dialects, cultural nuances, and contextually appropriate learning resources, AI-driven education can become more engaging and effective for Malaysian ESL learners [36]. Although AI significantly contributes to personalized learning, the role of human interaction in language acquisition remains crucial. Blended learning models that combine AI with traditional teacher-led instruction can offer a balanced approach. AI can manage administrative responsibilities, deliver immediate feedback, and support self-directed learning, while educators concentrate on developing communication skills and cultural understanding.

It is vital to establish comprehensive policies regarding AI ethics and data protection to ensure the responsible implementation of AI in educational settings. Guidelines must be formulated to oversee data collection practices, mitigate algorithmic bias, and protect student privacy. Implementing transparent AI systems that clarify their recommendations can foster trust among educators, students, and parents [37]. Further empirical investigation is essential to evaluate the long-term effects of artificial intelligence on Malaysian English as a Second Language (ESL) learners. Subsequent research should examine the efficacy of AI across various educational contexts, its role in fostering inclusivity, and the influence of AI-driven personalized learning on student performance. Collaborative research initiatives involving universities, governmental bodies, and technology developers can facilitate the formulation of evidence-based policies regarding the integration of AI in educational frameworks [36].

The financial burden associated with the implementation of AI-driven educational solutions poses a significant obstacle for numerous schools, especially those operating under constrained budgets. The deployment of AI technologies necessitates considerable investments in software, hardware, and ongoing maintenance, which can hinder the ability of underfunded institutions to both adopt and maintain these innovations. Furthermore, the continuous expenses related to software updates and teacher professional development exacerbate the strain on educational finances, thereby restricting the broader integration of AI within differentiated learning settings [2].

Artificial intelligence holds significant promise for transforming differentiated learning experiences for Malaysian ESL learners by offering tailored instruction, immediate feedback, and customized learning trajectories. Nonetheless, several challenges must be confronted, including limitations in infrastructure, teacher preparedness, ethical dilemmas, and the potential reduction of human interaction. To optimize the benefits of AI in ESL education, it is imperative to improve digital accessibility, provide comprehensive teacher training, create culturally appropriate AI resources, and ensure a harmonious balance between AI and traditional teaching methods. Through ongoing research and the ethical application of AI, Malaysia can leverage these technologies to foster an inclusive and effective ESL educational environment.

6. AI Roles in Achieving Equity and Accessibility in Classroom

AI in language learning has offered a wide range of learning opportunities in a classroom. Technology has become a digital weapon in escalating the process of spreading information, but a detailed and careful analysis is imperative to justify if it can create a fair and open learning atmosphere or if it inflicts a more critical technological war while receiving the knowledge. AI, combined with differentiated learning, could have a significant effect on students' learning experience and thus could reflect their academic performance in the classroom. [40] found that

students with cultural and lingual disparity are more interested in learning when differentiated learning is applied in the classroom. The foundation of learning is a process of making the relevance of the lesson by interpreting and demonstrating their mastery through a certain assessment and test. The goal is to see if students are able to communicate with the objective of the lesson despite their learning challenges. Therefore, there are four main components that serve as a yardstick in measuring the success of differentiated learning in a classroom with mixed-ability students. Those four elements are content, process, product, and environment, which could produce a snowball effect on students' progress if necessary action is taken while steering the teaching and learning process in the classroom.

Nowadays, differentiated instruction in a classroom is a necessity to increase the effectiveness of English language learning. Büyüksoy, Taşcıoğlu, and Ergin [41] in their research on the connection between students' success rate and the learning techniques with the integration of AI, revealed that differentiated learning instruction has had tremendously affected the students in the low-level academic achievement class. This would protect students from being isolated and safeguard them against exclusive learning. In a classroom with mixed-ability students, it is perceived as one of the solutions to cater to the student needs. However, it could be a mixed blessing whereby there are several challenges that teachers need to overcome to ensure the best possible outcome. According to [42], among the obstacles that teachers faced are the time constraint in preparing the lesson, the excessive workload as well the size of class. Thus, reliable assistance is crucial in helping the teachers to ensure the consistency in their lesson development in terms of content, process, product, and learning environment.

Artificial Intelligence (AI) has demonstrated its capability in maintaining the diversity, equality, and inclusivity in a classroom. AI is renowned for its stability in aiding teachers in a mixed-ability classroom. There are situations where a classroom consists of different levels of proficiency and learning needs. Teachers are trained to handle the situation; however, they need extra hands to ensure the lessons are efficiently delivered to achieve the objective. The toughest challenge for the teachers is to deal with the time. However, with the incorporation of AI into their lesson planning as a whole, aspects such as time management can be drastically improved; thus, AI can take over the long, laborious work of teachers. Another factor as important as time productivity, is adaptive learning experience. It positively affects the students learning performance due to its competence in students learning inclusivity regardless of their proficiency level.

The enhancement in capturing students' diversity in learning using AI features evidently can be seen in several AI tools in language learning, for example Talk-Pal, Duo-lingo, Rosetta Stone, and Mondly [43]. All the mentioned tools are designed in such a way that in line with the TPACK framework which emphasizes on the pedagogical endeavour, which focuses on the interaction between content knowledge and the technology usage. This is where AI plays a significant role in providing equity and accessibility of learning in the classroom. It is convincing that the elements of AI in language learning would be an appropriate portion to the efficient learning adaptation in the 21st century learning atmosphere. However, it is crucial to ensure the credibility of the language lesson to be executed in an organised and strategic way. The concerns underpin the fact that the teacher needs to be fully aware and comprehend the AI skills and also the management of differentiated learning in the classroom, thus to sustain the diversity, equity and inclusiveness of the lesson delivered.

There are still the urgent for human intervention in steering the direction of AI whereby human skills such as analysis, scoping, and rock-solid research are mandatory to fully utilize the AI [44]. In fact, human creativity and intelligence are as well important to foster the effectiveness of AI in language learning in a mixed-abilities classroom. Although AI is so helpful in offering brilliant ideas in

content knowledge, the success of the lesson delivery depends much on the ability of teachers to manoeuvre the features in the AI itself, and continually to explore any evolution of the technology. The epoch of post-pandemic communication offers a great deal of both exciting and challenging aspects of teaching and learning. This could be more obvious in language learning where technology integration is crucial to achieve maximum delivery output. There are several concerns that are now being discussed in AI topics, which emphasize on the 4E's of Edtech Integration that includes Equitable, Efficient, Effective, and Engaging [45]. The combination of these elements is the rubric for the AI effectiveness in learning and teaching. It reflects the idea that the teachers would have a proper and valid guideline when operating AI in the classroom, thus fostering the stability of the elements while delivering the lesson with the presence of AI in their classroom, in accordance to the readability of teachers to conduct the class with the technology on hands, it is vital to look at several strategies to ensure the consistency of the lesson delivery in the classroom. This is not only to maintain its effectiveness, but also to include the equity and the accessibility in the classroom that comprises mixed-ability students. Teachers not only trained to identify a variety of learning differences, but also must be well aware of the relevance of lesson materials distributed to students with different learning acceptance. Digital era nowadays presents an array of latest pedagogical approaches that would open the new paradigms of teaching and learning in the 21st century learning environment.

There is no doubt that the exploration of AI should be initiated and constantly encouraged when the teachers are in the preservice level, thus they are more knowledgeable and expert by the time they are in service. Teachers are the main role in producing quality teaching and learning in a classroom. Even with the advancement of technology, the teaching and learning process in a classroom stays stagnant and unproductive in the absence of teachers in the classroom. It shows the urgent needs of human instructors to support language learning with AI elements. Omer [46] stated that it is essential to utilize meaningful human interactions with the experience of learning language with AI. The autonomous AI features aligns with the teacher's expertise in the content would be a good fit in modelling the effective language learning experience. Emotional preference is also important in language teaching, hence teachers' role in providing that particular support is also required to retain the equity and accessibility in learning language. This suggests that human intervention is necessarily significant for AI success in the classroom. However, there are aspects that need to be considered in promoting the inclusivity of AI. The concern is on algorithmic fairness which can instigate bias of the AI in the classroom. This is mainly due to its incorporation with the training data that works best with the completed set of data and promotes incompetency when needed data occurs otherwise. In addition, bias could happen in ways that the system applies opaque decision-making processes where it does not comply with the transparency to acknowledge and identify the biases [47]. Therefore, the design must be ethically constructed to avoid feedback loops due to the discrimination in its patterns.

7. Future Study and recommendation

To comprehend the impact of AI on Malaysian ESL differentiated learning strategies, the future of research has to prioritize empirical work assessing the effectiveness of AI instruments in the field among classrooms. Research can examine how AI can serve to counter the different requirements of diverse ESL learner groups, such as novice and experienced learners or students with disabilities [48]. Research on the long-term effects of AI interventions on language acquisition, motivation, and academic achievement would provide useful information on sustainability and scalability in Malaysian ESL.

Additionally, studies could explore the challenges faced by students and teachers to integrate AI in their learning environment. This includes looking at infrastructure, teacher development, and students' attitudes toward AI in learning barriers. Studies could also target the development of culturally responsive AI tools that are sensitive to Malaysia's unique socio-cultural dynamics and multilingual settings [49]. Finally, future studies can explore the ethics of AI in education, for instance, privacy concerns, data security, and bias risk in AI algorithms [50].

7.1 Recommendations

From the insights obtained through this conceptual paper, several recommendations are made to effectively scale up differentiated learning approaches in Malaysian ESL classrooms with the help of Artificial Intelligence (AI). The recommendations address key areas that range from teacher professional development, access to technology, cultural responsiveness of AI tools, stakeholder involvement, to continuous monitoring and evaluation. By focusing on these areas, the integration of AI in ESL education in Malaysia can be better supported so that teachers and students alike are in a position to reap the benefits of AI-driven personalized learning.

Invest in teacher professional development whereby successful implementation of AI in ESL classrooms relies on equipping teachers with skills in utilizing AI tools. Professional development opportunities for teachers should be designed to not only provide a knowledge base of AI technologies but also emphasize their daily usage in differentiated instruction. Teachers need to be instructed on how AI can be applied to address the diverse learning needs of students, from students with varying levels of proficiency to students with varying learning styles. Along with this, these kinds of programs must prioritize pedagogical change in the necessity to integrate AI into classroom practice towards changing the mindset from traditional, one-size-fits-all kind of teaching to more adaptive and personalized forms of teaching. As indicated by [51], teacher preparation and competence in the use of AI-based tools are critical to the success of AI-enhanced education.

Moreover, the establishment of trust in AI-based learning technology is crucial to their effective utilization. Nazaretsky *et al.*, [52] emphasize the need for professional development activities that address educators' concerns and establish their confidence in utilizing AI tools. By giving teachers a chance to interact with AI tools in supportive settings, these activities can reduce the risks and foster a positive attitude towards AI adoption. Hence, investment in continuous professional development is required so that educators feel equipped and prepared to utilize AI in manners that assist all students.

Another core strategy involves creating professional development opportunities that centre on integrating artificial intelligence into teaching practice. Koh *et al.,* [53] comment on the significance of these programs by observing that educators who build Technological Pedagogical Content Knowledge (TPACK) are more successful at translating technology into teaching practices. The programs should be designed with experiential learning opportunities through AI tools that can allow educators to effectively plan and execute lesson plans that are augmented by artificial intelligence.

Another recommendation is the increase Access to Technology remains one of the biggest hindrances to the widespread application of AI-powered learning tools, particularly in rural or under-equipped schools in Malaysia. It is necessary to ensure that both urban and rural schools are equally equipped with the technological infrastructure necessary for AI-based learning to thrive. The Malaysian government and schools must invest in digital infrastructure, such as high-speed internet connectivity, new computer hardware, and software platforms compatible with AI tools. Zainuddin and Cheng [54] emphasize that equitable access to technology is essential in closing the digital divide and ensuring AI-powered educational tools are available to all students regardless of geographical

location or socioeconomic status. By closing such technological gaps, Malaysia can realize a more inclusive and equitable education system where AI can be used to its utmost in enhancing differentiated learning.

Another development of Culturally Relevant AI Tools is to be effective in Malaysian ESL classrooms, whereby AI tools must be culturally and linguistically appropriate. Malaysia is a multilingual society with several ethnic groups possessing different languages and cultural practices. AI applications must take these factors into consideration to provide meaningful and relevant learning. Developers of AI-based educational software should work in close liaison with Malaysian educators, linguists, and cultural experts to ensure that the content, examples, and language features of the software are aligned with the needs of Malaysian students. As Mahmood [55] observes, cultural appropriateness is essential if students are to be engaged in learning and if learning materials are to be accessible and meaningful. For instance, AI-powered language learning platforms should incorporate local dialects, idioms, and culturally appropriate subjects, which will help learners become more connected to the content and make the learning process more enjoyable and effective.

Next, encouraging collaboration between stakeholders' collaboration between stakeholders—policymakers, schools, AI developers, and teachers—is the secret to effective implementation of AI in ESL classrooms. There must be a deliberate attempt to align AI technologies with national educational goals so that these technologies complement, rather than hinder, the broader objectives of the education system. Policymakers will have to consult with educators to understand their needs and challenges, and AI developers will have to ensure that their offerings are designed to meet the specific needs of the Malaysian education system. Samsudin *et al.,* [56] argue that such collaboration ensures AI-backed differentiated learning strategies are not only available, but also effective and inclusive. Through collaborations, Malaysia can create a holistic framework for AI adoption in education that addresses the needs of all stakeholders, from students and educators to policymakers.

Moreover, monitoring and evaluating AI impact ongoing evaluation of the effects of AI on ESL students is paramount to determining whether the tools in use are efficient and address the needs of learners. Monitoring systems should be adopted in schools to check the progress of learners and collect feedback from teachers and students. Periodic assessments should address various aspects of learning, such as linguistic ability, student interest, motivation, and general academic achievement. As Wong *et al.,* [57] suggest, ongoing assessment allows for AI tools to be calibrated and instructional strategies to be adjusted to best support learners. Tracking how AI tools are improving equity is also important to verify that all learners are benefiting equally from AI-powered personalized learning. By adopting a data-driven monitoring and evaluation system, Malaysian schools can determine that AI is used in ways that optimize learning outcomes and the long-term success of education.

The use of AI in Malaysian ESL education has tremendous potential to enhance differentiation mechanisms of learning towards a more personalized, inclusive, and effective learning experience. However, successful incorporation of AI requires diligent consideration of several key factors ranging from teacher preparation, access to technology, cultural appropriateness, stakeholder coordination, and continuous monitoring and evaluation. By overcoming these obstacles and enacting the recommendations outlined herein, Malaysia can pave the way for a future where AI will be at the forefront of pushing ESL education forward, allowing students from all backgrounds to realize their full potential. Systematic and considered implementation of AI will undoubtedly aid in creating an education system that is more aligned to the diverse requirements of ESL learners in Malaysia.

7.2 Conclusion

The use of Artificial Intelligence (AI) in learning has the potential to revolutionize how students engage with content, especially in the case of English as a Second Language (ESL) education in Malaysia. The current reality of ESL education in Malaysia is confronted with varying needs of learners, limited resources, and traditional teaching approaches that often are not able to respond to differences. This theoretical article explained how AI is able to complement differentiated learning methodologies for ESL students, arguing that AI has the capability to deliver tailored learning, react to different learners' needs, and accelerate learning performance.

Artificial intelligence-powered tools such as intelligent tutoring systems, natural language processing (NLP), and machine learning facilitate personalization of content, pace, and teaching methods to suit the learning requirements of each student [58]. With the use of these tools, Malaysian ESL learners are able to receive instant feedback, track their progress, and receive customized instructional support. Secondly, AI can complement traditional ESL teaching by offering scalability, where students and instructors alike can engage with high-quality learning content and activities outside the classroom.

This paper posits that AI can help teachers adopt differentiated learning strategies, which can lead to increased learner motivation, engagement, and ultimately, language proficiency [59]. Furthermore, AI can also accommodate multiple learning speeds and styles, which makes it a perfect tool for a multicultural and multilingual nation such as Malaysia, where students have diverse linguistic and cultural backgrounds [59]. However, while being promising in outcomes, there still exist some difficulties ahead, including technology access, teachers' adaptation to the adoption of AI-based practices, and pedagogical support that is appropriate for integrating AI in schools.

Acknowledgement
This research was not funded by any grant.

References

[1] Ab Kadir, Mohd Najib, Sarimah Ismail, and N. S. A. M. Shah. "COVID-19: The Transformation of Learning and Teaching for Skill-Based Subject." *International Journal of Academic Research in Progressive Education and Development* 11, no. 3 (2022). https://doi.org/10.6007/ijarped/v11-i3/13858

[2] Ruslim, Muhammad Izzat, and Fariza Khalid. "The use of artificial intelligence in differentiated instruction classrooms." *International Journal of Academic Research in Business & Social Sciences* 14, no. 8 (2024): 682-697. https://doi.org/10.6007/ijarbss/v14-i8/22435

[3] Jian, Maher Joe Khan Omar. "Personalized learning through AI." *Advances in Engineering Innovation* 5 (2023): 16-19. https://doi.org/10.54254/2977-3903/5/2023039

[4] Anis, Muneeba. "Leveraging artificial intelligence for inclusive English language teaching: Strategies and implications for learner diversity." *Journal of Multidisciplinary Educational Research* 12, no. 6 (2023): 54-70.

[5] Tilepbergenovna, Utepbergenova Aysuliu. "THE ROLE OF ARTIFICIAL INTELLIGENCE IN EDUCATION." *International Journal of Pedagogics* 4, no. 10 (2024): 184-187. https://doi.org/10.37547/ijp/Volume04Issue10-32

[6] Murgayah, Minoshini, Hemadarshini Nair Anadan Nair, and Melor Md Yunus. "AI-Driven Vocabulary Enhancement: Transforming Writing Skills for Secondary Students using ChatGPT." *Progress in Computers and Learning* 2, no. 1 (2025): 12-28. https://doi.org/10.37934/picl.2.1.1228

[7] Goh, Kok Ming, Mahaliza Mansor, Dayang Rafidah Syariff M. Fuad, and Juharyanto Juharyanto. "Designing Future-Ready Education: Criteria for AI Learning Tool Selection and AI Learning Design." *Semarak International Journal of Innovation in Learning and Education* 4, no. 1 (2024): 1-12. https://doi.org/10.37934/sijile.4.1.112a

[8] Eden, Chima Abimbola, Onyebuchi Nneamaka Chisom, and Idowu Sulaimon Adeniyi. "Integrating AI in education: Opportunities, challenges, and ethical considerations." *Magna Scientia Advanced Research and Reviews* 10, no. 2 (2024): 006-013. https://doi.org/10.30574/msarr.2024.10.2.0039

[9] Kara, S., Lu, X., and Gao, Y. "Adaptive learning technologies in second language education." *International Journal of Language Technology* 5, no. 4 (2019): 210–225.

[10] Hashim, A., and Yusof, R. "Personalized learning through AI in Malaysian schools." *Journal of Education Research* 9, no. 1 (2020): 30–45.
[11] Rahman, S., Ibrahim, N., and Hashim, A. " Bridging digital divide in ESL education." *Journal of Educational Development* 8, no. 4 (2021): 130–145.
[12] Lu, X., Gao, Y., and Li, J. "AI-assisted language learning: Opportunities and challenges." *Language Acquisition Technology Review* 14, no. 2 (2021): 76–94.
[13] Rahman, S., Ibrahim, H., and Hashim, A. "Transforming ESL learning through AI in Malaysia." *Journal of Digital Learning Research* 10, no. 3 (2022): 34–58.
[14] Cheah, P. K., and Pandian, A. "AI and culturally responsive pedagogy in Malaysian classrooms." *Asian Journal of Education and Technology* 14, no. 3 (2022): 56–78.
[15] UNESCO. "Artificial intelligence and education: Opportunities for developing nations." UNESCO Publishing (2021).
[16] Mohd Noor, A., Ibrahim, M., and Rahman, S. "Teacher training in AI integration: A Malaysian perspective." *Malaysian Journal of Educational Policy* 20, no. 1 (2023): 54–73.
[17] Amir, Z., and Rahman, F. "AI and ESL teaching in Malaysia: Future perspectives." *Journal of Educational Innovation* 6, no. 2 (2024): 101–119.
[18] Hashim, A., Rahim, S., and Sulaiman, N. "Bridging rural-urban gaps in ESL learning with AI." *Education Horizons* 15, no. 4 (2019): 89–105.
[19] Rahman, S., Ibrahim, H., and Hashim, A. "Transforming ESL learning through AI in Malaysia." *Journal of Digital Learning Research* 10, no. 3 (2022): 34–58.
[20] Lu, X., Gao, Y., and Mohamad, M. "Real-time language assistance: AI in ESL classrooms." *Language and Technology Studies* 18, no. 2 (2021): 134–149.
[21] Amir, Z., and Yusof, R. "Personalized language learning through AI technologies." *International Journal of ESL Studies* 5, no. 1 (2023): 23–40.
[22] Cheah, P. K., and Pandian, A. "Multiculturalism in ESL classrooms: Impacts of AI integration." *Asian Journal of Language Studies* 12, no. 3 (2022): 45–68.
[23] Mohd Noor, A., Ibrahim, M., and Rahim, N. "Professional development for AI integration in education." *Malaysian Journal of Teacher Education* 15, no. 4 (2023): 45–62.
[24] UNESCO. "Artificial intelligence in education: Promises and challenges for developing nations." UNESCO Publishing (2021).
[25] Rahim, F., Amir, Z., and Yusof, R. "Addressing ethical concerns in AI-driven education." *Journal of Education Policy* 19, no. 1 (2024): 67–85.
[26] Amir, Z., and Rahman, F. "AI and ESL teaching in Malaysia: Future perspectives." *Journal of Educational Innovation* 6, no. 2 (2024): 101–119.
[27] Li, Li, Yi-Lun Lin, Nan-Ning Zheng, Fei-Yue Wang, Yuehu Liu, Dongpu Cao, Kunfeng Wang, and Wu-Ling Huang. "Artificial intelligence test: A case study of intelligent vehicles." *Artificial Intelligence Review* 50 (2018): 441-465. https://doi.org/10.1007/s10462-018-9631-5
[28] Lam, Kim Wai, Aminuddin Hassan, Tajularipin Sulaiman, and Nurzatulshima Kamarudin. "Instructional technology competencies as perceived by university lecturers in malaysia." *International Journal of Academic Research in Business and Social Sciences* 8, no. 3 (2018): 401-417. https://doi.org/10.6007/IJARBSS/v8-i3/3938
[29] Mouza, C., et al. "Personalized learning in the classroom: The role of artificial intelligence." *Educational Technology Research & Development* 67, no. 1 (2019): 123-140. https://doi.org/10.1016/j.compedu.2022.104530
[30] Shin, M., et al. "Adaptive Learning in ESL: The Use of AI-based Applications." *Journal of Educational Computing Research* 58, no. 2 (2020): 263-279.
[31] Cai, X., et al. "AI in Language Learning: Exploring the Effectiveness of Chatbots for ESL Students." *Journal of Educational Technology* 38, no. 4 (2019): 55-67.
[32] Lee, J., and Chen, L. "Using artificial intelligence to enhance ESL writing instruction." *Language Learning & Technology* 20, no. 1 (2016): 34-51.
[33] Liu, M. "Analyzing the effectiveness of AI-based ESL tools in diverse learning environments." *Language Learning & Technology* 20, no. 2 (2016): 82-95. https://doi.org/10.5325/korelangamer.20.1.0095
[34] Zhang, Y., and Zheng, M. "Exploring the impact of AI in language education: Tailoring content to learner needs." *International Journal of Educational Technology* 15, no. 3 (2020): 210-225.
[35] Liu, Pei, Xuemin Wang, Chao Xiang, and Weiye Meng. "A survey of text data augmentation." In *2020 International Conference on Computer Communication and Network Security (CCNS)*, pp. 191-195. IEEE, 2020.
[36] Sharifuddin, Nor Syazliana, and Harwati Hashim. "Benefits and Challenges in Implementing Artificial Intelligence in Education (AIED) in ESL Classroom: A Systematic Review (2019-2022)." *International Journal of Academic Research in Business and Social Sciences* 14, no. 1 (2024): 146-164. https://doi.org/10.6007/IJARBSS/v14-i1/20422

[37] Jia, X., Chen, Y., and Wang, H. "AI in Education: Ethical Concerns and Challenges in Implementation." *International Journal of Digital Learning and AI* 10, no. 3 (2022): 112-125.
[38] Alharbi, Khalaf, and Lubna Khalil. "Artificial intelligence (AI) in ESL vocabulary learning: An exploratory study on students and teachers' perspectives." *Migration Letters* 20, no. S12 (2023): 1030-1045.
[39] Nguyen, Thuong TK, Hoang T. Thuan, and Minh T. Nguyen. "Artificial Intelligent (AI) in teaching and learning: A comprehensive review." *ISTES BOOKS* (2023): 140-161.
[40] Zaier, Amani, and Faith Maina. "Assessing Preservice Teachers' Perceptions and Practices to Differentiate Instruction for Culturally and Linguistically Diverse Students in Secondary Classrooms." *International Journal of Multicultural Education* 24, no. 2 (2022): 1-16. https://doi.org/10.18251/ijme.v24i2.2473
[41] Büyüksoy, Ceylin, Zeynep Taşcıoğlu, and İbrahim Ergin. "and Observing the Impacts of Differentiated Education Model." *European journal of teaching and education* 2, no. 2 (2020): 122-130.
[42] BINTI UMAR, NURUL HIDAYAH, and AZLINA ABDUL AZIZ. "Differentiated Instruction in ESL Classrooms: Insights from ESL Primary School Teachers." *Jurnal Pendidikan Malaysia* 49, no. 1 (2024).
[43] Pavithra, M., and Rajkumar, K. "Implementing Artificial Intelligence Tools as a Language Learning Method for Second Language Learners." *Language in India* 24, no. 10 (2024).
[44] Wade, Mwannesi. "The Fast Track: DEI and AI for Learning Design." In *International Forum of Teaching and Studies*, vol. 20, no. 2, pp. 45-70. American Scholars Press, Inc., 2024.
[45] Kilbane, Clare R., and Natalie B. Milman. *Using Technology in a Differentiated Classroom: Strategies and Tools for Designing Engaging, Effective, Efficient & Equitable Learning*. ASCD, 2024.
[46] Omer, N. I. M. *Maintaining Meaningful Human Interaction in AI-Enhanced Language Learning Environments: A Systematic Review. Arts for Linguistic & Literary Studies, 6 (3), 533–552*. 2024. https://doi.org/10.53286/arts.v6i3.2083
[47] Di Bello, Marcello, and Ruobin Gong. "Informational richness and its impact on algorithmic fairness." *Philosophical Studies* 182, no. 1 (2025): 25-53. https://doi.org/10.1007/s11098-023-02004-7
[48] Popenici, S. A. D., and Kerr, D. "The impact of artificial intelligence on learning, teaching, and education." *European Journal of Education Studies* 3, no. 3 (2017: 4-8.
[49] Abdul Aziz, N., and Hanafiah, M. H. "Culturally responsive pedagogy in Malaysian ESL classrooms: Challenges and strategies." *International Journal of Education and Literacy Studies* 8, no. 2 (2020): 123-130.
[50] Hao, Zhifeng, Fan Fang, and Jian-E. Peng. "The integration of AI technology and critical thinking in English major education in China: Opportunities, challenges, and future prospects." *Digital Applied Linguistics* 1 (2024): 2256-2256.
[51] Chung, G. K. W. K. "Teacher readiness for integrating artificial intelligence into language learning." *Technology, Pedagogy and Education* 30, no. 1 (2021): 101-115.
[52] Nazaretsky, Tanya, Moriah Ariely, Mutlu Cukurova, and Giora Alexandron. "Teachers' trust in AI-powered educational technology and a professional development program to improve it." *British journal of educational technology* 53, no. 4 (2022): 914-931. https://doi.org/10.1111/bjet.13232
[53] Koh, Joyce Hwee Ling, Ching Sing Chai, and Wei Ying Lim. "Teacher professional development for TPACK-21CL: Effects on teacher ICT integration and student outcomes." *Journal of educational computing research* 55, no. 2 (2017): 172-196. https://doi.org/10.1177/0735633116656848
[54] Zainuddin, Z., and Cheng, D. "The role of AI in enhancing learning experiences for ESL learners in Malaysia." *Journal of Computer Assisted Learning* 36, no. 1 (2020): 13-21.
[55] Mahmood, A. "AI-based language learning systems in multilingual classrooms." *Journal of Language Teaching and Research* 10, no. 4 (2019): 752-758.
[54] Hussain, I., Perea, C. M., and Gomez, D. "AI-based solutions for differentiated instruction in ESL classrooms." *Journal of Educational Technology Systems* 47, no. 4 (2018): 453-473.
[56] Samsudin, N., Sulaiman, N., and Aziz, N. "Integration of AI in education: A review of strategies and challenges in Malaysia." *International Journal of Educational Research* 99 (2020): 139-151.
[57] Wong, K. W., Lee, H. M., and Tan, K. K. "Artificial intelligence and the future of ESL education: A Malaysian perspective." *Educational Media International* 58, no. 1 (2021): 22-36.
[58] Kukulska-Hulme, A. "Artificial intelligence in language learning: A new frontier." *Language Learning & Technology* 23, no. 3 (2019): 1-7.
[59] Heffernan, N. T., & Heffernan, C. L. "AI in education: Adaptive tutoring and personalized learning." *Educational Technology Research and Development* 65, no. 5 (2017): 1033-1051.
[60] Hussain, I., Perea, C. M., & Gomez, D. "AI-based solutions for differentiated instruction in ESL classrooms." *Journal of Educational Technology Systems* 47, no. 4 (2018): 453-473.