

Leveraging Artificial Intelligence for Enhancing Postgraduate Teaching: A Framework to Engaging Professional Learners

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Abstract: *In the contemporary landscape of postgraduate education, the strategic integration of Artificial Intelligence (AI) has gained prominence as a transformative approach for optimizing pedagogical experiences, particularly among professional learners. This paper presents a framework aimed at harnessing the potential of AI to elevate postgraduate teaching, focusing on fostering active engagement and meaningful learning interactions within the context of professional education. Following the PRISMA guidelines, this research conducts a systematic review of pertinent literature sourced from Scopus and other reputable databases. Studies encompassing empirical investigations, conceptual frameworks, and pedagogical models that explore the integration of AI in postgraduate*

education for professional learners are selected. A stringent search strategy and clear eligibility criteria ensure the inclusion of studies that contribute to the development of the proposed framework. Drawing from the findings of the systematic review, this paper proposes a multidimensional framework that strategically incorporates AI into postgraduate teaching for professional learners. This paper contributes a novel framework for integrating AI into postgraduate education, specifically tailored to the needs of professional learners. The synthesized framework serves as a pragmatic guide for educators, curriculum designers, and policymakers aiming to leverage AI's potential to enrich professional education. By strategically combining AI technologies with pedagogical strategies, educators can empower professional learners to thrive in their careers, offering them a robust learning experience that resonates within their professional pursuits.

Keywords: *Artificial Intelligence, Learning Theories, Postgraduate Teaching, Professional Learners, Learners Engagement*

1. INTRODUCTION

Postgraduate education plays a pivotal role in shaping professionals for various industries and equipping them with the knowledge and skills necessary to excel in their careers. However, the landscape of education is evolving rapidly with the advent of Artificial Intelligence (AI). The utilization of artificial intelligence in the realm of education has led to the complete integration of teaching and learning, presenting an opportunity for the transformation of these processes (Huang et al., 2021). Nevertheless, educators have a responsibility to assess the current capabilities of AI and identify potential avenues for enhancing learning (Zhai et al., 2021).

However, it is worth noting that this technology is already making inroads into higher education, although many instructors are unaware of its full potential and, more importantly, its underlying principles (Hinojo-Lucena et al., 2019). A study conducted by Hinojo-Lucena et al. (2019) also uncovered that artificial intelligence has the potential to reshape education through the automation of administrative teaching tasks, the utilization of software programs that promote personalized learning, the identification

of areas requiring additional classroom reinforcement, the provision of guidance and support to students beyond traditional classroom settings, and the intelligent use of data for teaching and student support.

Nonetheless, there remains an absence of consensus when it comes to identifying the key factors necessary for implementing a dynamic learning approach, one that can provide each learner with a unique and successful educational experience, despite the existence of technology designed to personalize learning (Shemshack et al., 2021). Relatively, little attention was given to recognizing the importance of human agency in the integration of AI within educational contexts (Nazaretsky et al., 2022). One potential strategy to mitigate the impacts of educator job-related stress is to equip them with additional support and skills through professional development (Sandilos et al., 2018). Numerous studies have underscored the advantages of employing AI in education (Ouyang et al., 2022).

Though evidence from various fields confirms that the adoption of AI-based technology by practitioners is not a straightforward process, the willingness of users to incorporate such tools into their practices is likely influenced by their level of trust in these tools (Nazaretsky et al., 2022). Accordingly, AI should present itself as an invaluable resource for educators and trainers by integrating AI technologies into teaching, learning, and administrative processes to foster positive attitudes among them (Aldosari, 2020).

2. ARTIFICIAL INTELLIGENCE

Advancements in AI technology are bringing about a profound transformation in education, enhancing the skills necessary for success in both classrooms and workplaces (Hashim et al., 2022). In Malaysia, AI plays a central role in the ongoing convergence of emerging technologies within the context of the fourth industrial revolution. This convergence encompasses a range of innovations, including the Internet of Things (IoT), Big Data Analytics, Augmented Reality, Cybersecurity, Simulation, Cloud Computing, Additive Manufacturing, System Integration, and Advanced Materials (Ministry of International Trade and Industry, 2018).

Artificial intelligence operates on algorithms, which consist of a set of rules and instructions that computers follow when performing problem-solving tasks to achieve specific objectives. These algorithms serve as the guiding principles for AI and machine learning systems (Tapalova & Zhiyenbayeva, 2022). Machine learning algorithms, in turn, analyze data to identify patterns and construct models, which are then used to predict future values (Akgun & Greenhow, 2022). The data analytics capabilities of AI have empowered the field of education to develop more advanced technology-enhanced learning systems (Ingkavara et al., 2022). According to Su & Yang (2023), the integration of AI into education has garnered significant attention in recent years, with an increasing number of educational institutions and organizations exploring the potential benefits of AI-driven technologies, such as ChatGPT, a cutting-edge natural language processing (NLP) model.

ChatGPT, as described by Thorp (2023), belongs to the category of extensive language models. These large language models utilize deep learning techniques to analyze and generate text, a fact highlighted by Su and Yang (2023). Among these large language models, the Generative Pre trained Transformer (GPT-3), as outlined by Floridi and Chiriatti (2020), stands out. These models undergo training on vast volumes of text data, equipping them with the ability to produce text that closely resembles human language. They excel in tasks like answering questions and performing various language-related functions with remarkable precision, as documented by Kasneci et al. (2023). Nevertheless, Su and Yang (2023) have recently observed the expanding application of ChatGPT in diverse domains, including library services, healthcare, and education.

In the realm of education, ChatGPT holds the potential to serve as a practical AI tool for enhancing AI literacy among both teachers and students. AI literacy encompasses the capacity to comprehend, utilize, and critically evaluate AI technologies, along with their societal repercussions (Su & Yang, 2023). Furthermore, according to Kasneci et al. (2023), large language models can offer valuable assistance to educators. They provide teachers with access to resources, summaries, and explanations concerning new teaching methodologies, technologies, and educational materials. This support aids teachers in staying current with advancements in their field and enhances the overall effectiveness of their teaching practices.

2.1 POSTGRADUATE TEACHING

Educational philosophy and learning theory serve as the foundational principles that underlie all educational methodologies. They provide the conceptual frameworks that elucidate how individuals acquire knowledge, skills, and attitudes, ultimately leading to changes in behavior, performance, or potential, as elucidated by Mukhalalati and Taylor (2019). This influence extends across the entire spectrum of education, spanning from early childhood education, such as infant education, to the most advanced postgraduate levels. One of the primary ways in which AI is poised to impact the field of education is through the implementation of personalized learning applications, as highlighted by Ocaña-Fernández et al. (2019). Barakina et al. (2021) observe that significant shifts in educational interactions are underway, particularly for the Z generation and the subsequent generation Alpha in schools. These shifts involve a transition from traditional structured and auditory learning approaches to the adoption of more engaging and effective visual, multimodal, and hands-on teaching methods tailored to the learning preferences of these new generations.

Furthermore, L. Sie et al. (2018) express concerns regarding the maintenance of educational quality in the online teaching and learning experience. This challenge is multifaceted and requires the development of a range of strategies to support the professional development of teaching staff. These strategies encompass the delivery of online pedagogical principles, the creation of well-designed online learning environments, and a deep understanding of the relationships between these elements and student outcomes. Additionally, McInerney and Green-Thompson (2020) have documented challenges faced by students in postgraduate programs, particularly in the context of graduate education for rural health professionals in Australia. These challenges encompass factors such as financial costs, geographical distances, and the time commitment required, all of which pose significant hurdles to effective participation in these programs.

2.2 PROFESSIONAL LEARNERS

In our rapidly evolving world, the ability for professionals to acquire and adapt new skills quickly has become more critical than ever. Traditional methods of professional development and training often fall short in meeting

the diverse learning needs and preferences of today's workforce. As Maity (2019) points out, the paradigm for employee training and development has shifted from the old "mass upskilling" approach, where groups of employees received training in batches during the early twentieth century, to a personalized and individualized training model. Many contemporary training methods still rely on a single training format, typically lecture-based, or extend over extended periods, like two-day workshops. However, it is important to note that the attention span of the average adult learner remains limited (Dolasinski & Reynolds, 2020). In today's digital era, learners are expected to process and understand various types of information; not only text, but also various forms of visual content, including static and dynamic visualizations (Mason, 2018).

Therefore, large language models like ChatGPT can play a valuable role in developing job specific skills through professional training. Kasneci et al. (2023) mentioned that ChatGPT offers a unique opportunity to deliver personalized and highly effective learning experiences. . These models can enhance the clarity of teaching materials and assist professionals in locating information or resources they may need during their on-the-job learning process. This level of support becomes crucial as professionals face a multitude of new challenges, necessitating access to high-quality training in their initial year and continuous professional development opportunities throughout their careers, as emphasized by McGill et al. (2020).

2.3 TEACHING WITH AI

Continuous engagement in professional development is essential for all individuals involved in the field of education. Zulfikar et al. (2022) characterized teaching as a multifaceted profession that demands educators, instructors, and teaching personnel to continually pursue learning to enhance their professional competence. Utami et al. (2019) mentioned that teacher professional development encompasses the acquisition of skills, knowledge, and ongoing learning opportunities necessary to enhance their effectiveness in carrying out their professional responsibilities, as elucidated by . Simultaneously, educators should possess a solid grasp of tools for the digitalization of academic subjects, necessitating their participation in relevant professional development courses in the realm of information technology, as noted by Elfeky (2019). Conversely, the integration of AI

technologies has been shown to enhance teaching skills, as demonstrated by Jaiswal and Arun (2021), and promote teaching competence by fostering inspiration and encouraging self-reflection (Aldeman et al., 2021).

AI also offers educators opportunities for professional development by providing teaching evaluation models and offering suggestions to enhance their instructional practices, as discussed by Adiguzel et al. (2023). Numerous studies have emphasized the advantages of incorporating AI in education, particularly in online higher education settings. AI plays a role in predicting student performance, satisfaction, and learning progress, suggesting relevant resources, automatically evaluating student work, and ultimately improving the overall learning experience, as indicated by Ouyang et al. (2022). In the context of a comprehensive language model like ChatGPT, the potential for enhancing both learning and teaching experiences is significant, spanning across all levels of education, including primary, secondary, tertiary, and professional development (Kasneji et al., 2023).

2.4 LEARNERS ENGAGEMENT

The consideration of students' engagement is a crucial factor in the development of a learning system geared towards supporting reasoning skills. As revealed by Zhai et al. (2021) study, engaged learners exhibit a greater capacity to comprehend the various levels of organization within complex systems. This insight draws upon sociocultural learning theories, which play a pivotal role in the design of AI systems aimed at enhancing students' reasoning abilities. Furthermore, AI technology possesses the potential to identify areas within course topics that require improvement, a fact that educators may not always be cognizant of, potentially causing confusion among students, as noted by Fahimirad and Kotamjani (2018). Moreover, these advanced technologies hold promise in offering valuable insights for enhancing individual engagement levels and refining the overall tutoring process, as indicated by Jaiswal and Arun (2021).

AI has the potential to elevate learning outcomes, productivity, and student engagement by creating new opportunities for personalized education, feedback, and assistance, an idea underscored by Adiguzel et al. (2023). However, it is imperative that the utilization of technology is closely

aligned with educational and learning theories to inform instructional design and technological advancement, as emphasized by Bower (2019). When learning theories are meticulously considered, and design decisions are rooted in specific theoretical foundations, it becomes possible to make more informed design choices. This, in turn, enables designers to have greater confidence that their efforts will yield the desired outcomes, as supported by prior evidence, as highlighted by Walkington and Bernacki (2020). Therefore, the integration of learning theories with AI should foster enhanced engagement in learning tasks and subsequently lead to improved task performance.

3. METHODOLOGY

The PRISMA systematic review methodology was meticulously employed to conduct a rigorous analysis and synthesis of the existing literature concerning the application of AI for postgraduate teaching within the contexts of engaging professional learners. A systematic and comprehensive search was conducted across well-regarded academic databases to identify articles that met the stringent criteria set to align with the research objectives. Following PRISMA guidelines, this review specifically selected the following reputable databases: Scopus, Science Direct, IEEE Xplore, JSTOR, and Web of Science, as they encompass a broad spectrum of journals pertinent to the field (Shemshack & Spector, 2020).

In order to maintain the quality and reliability of the study, preference was given to peer reviewed articles from online journals. Online academic journals were chosen for their established credibility and authority (Shemshack et al., 2021). Editorials, letters, opinion pieces, commentaries, essays, and preliminary notes were deliberately excluded from this review. The scope of this study was deliberately confined to journals, a decision made to ensure the review remains manageable and to produce thoroughly reviewed data that can serve as a valuable resource for future research endeavors. Relevant papers were initially identified through systematic searches of online databases and academic journals, and these papers were subsequently scrutinized to determine their relevance and applicability to the study.

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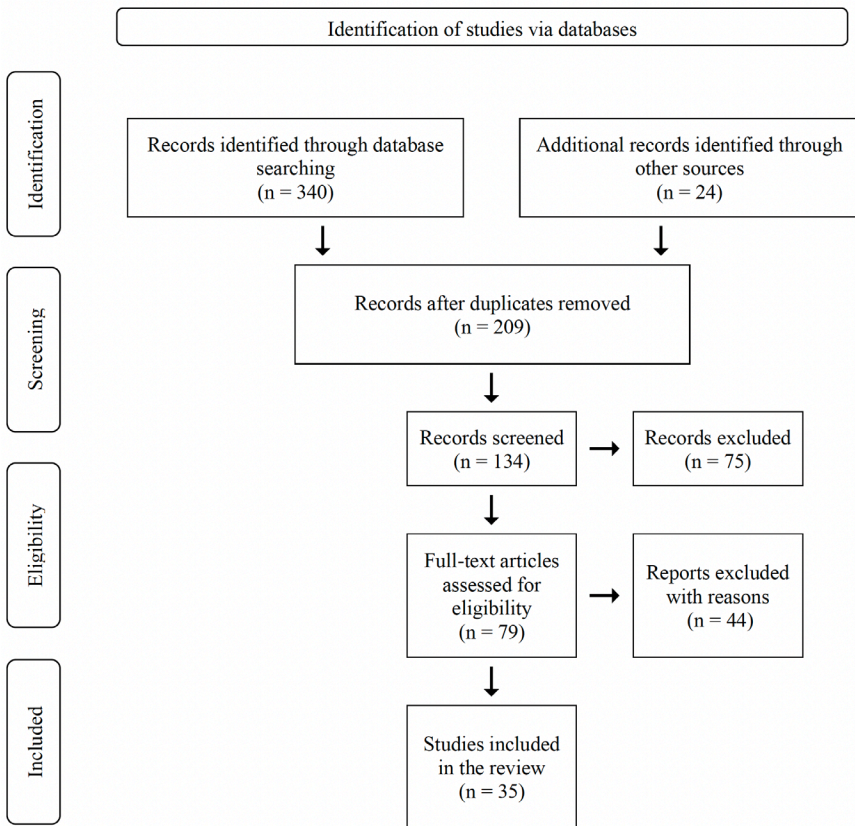


Figure 1. PRISMA model describing systematic review methodology

A literature search was initially conducted in 2018 and subsequently updated in 2023. This search involved various combinations of the following keywords: “professional learners,” “artificial intelligence,” “postgraduate teaching,” and “engaging learners.” The selection of articles for review was based on both their content and quality, with a meticulous examination of these components to provide an in-depth analysis of artificial intelligence elements that offer distinctive educational experiences for all (Shemshack et al., 2021).

In the initial screening phase, 44 articles were excluded. Subsequently, during the subsequent phase, 35 articles were chosen for a comprehensive review. Among the 44 articles that were excluded, 22 did not pertain to postgraduate teaching, 15 were unrelated to professional learners, and 7 were not related to artificial intelligence. In the selection phase, a thorough examination of full-text articles was conducted, following specific eligibility or entry criteria. Out of a total of 79 sources, 35 articles addressing postgraduate teaching and professional learners were thoughtfully selected. These articles served as valuable sources for identifying key strategies and solutions aimed at bridging the gap in postgraduate teaching, particularly concerning the integration of artificial intelligence.

4. FINDINGS

In the ever-evolving landscape of education, postgraduate programs hold a critical role in shaping professionals across various industries, endowing them with the knowledge and competencies essential for success in their respective careers. However, this dynamic realm is undergoing profound transformations with the emergence of Artificial Intelligence. The integration of AI into education has seamlessly intertwined the processes of teaching and learning, offering a window of opportunity for reform (Huang et al., 2021). Yet, this transformative technology remains somewhat enigmatic to many educators, who are still grappling with its scope and capabilities (Hinojo-Lucena et al., 2019). While AI promises to revolutionize education through automating administrative tasks, personalized learning tools, and intelligent data utilization (Hinojo-Lucena et al., 2019), the path towards dynamic personalized learning experiences is not yet clearly defined (Shemshack et al., 2021). Moreover, the human element in AI adoption within educational settings has been somewhat overlooked (Nazaretsky et al., 2022).

To ensure the effective integration of AI in education, educators must not only receive adequate support and professional development (Sandilos et al., 2018) but also trust in the capabilities of AI (Nazaretsky et al., 2022). AI should be viewed as an indispensable ally in teaching, learning, and administration, fostering a positive attitude among educators (Aldosari,

2020). As technology advances, AI stands poised to revolutionize education, equipping learners with the skills necessary to excel in today's classrooms and workplaces (Hashim et al., 2022). In Malaysia, AI, together with other emerging technologies, is at the forefront of the fourth industrial revolution (Ministry of International Trade and Industry, 2018).

The foundation of AI lies in algorithms, which provide instructions for AI and machine learning systems (Tapalova & Zhiyenbayeva, 2022). Machine learning algorithms, in particular, have empowered educational technology by analyzing data to identify patterns, create models, and predict future outcomes (Akgun & Greenhow, 2022). AI's data analytics capabilities have given rise to more effective technology-enhanced learning systems (Ingvavara et al., 2022). The widespread adoption of AI in education has attracted significant attention in recent years (Su & Yang, 2023), with applications like ChatGPT making inroads in various fields, including education (Kasneci et al., 2023).

Large language models like ChatGPT have the potential to revolutionize professional training by offering personalized and effective learning experiences (Kasneci et al., 2023). In an era where learners process diverse textual and visual sources (Mason, 2018), ChatGPT can assist in skill development specific to various professions, providing resources, summaries, and explanations to aid professionals in staying up-to-date and enhancing their effectiveness (Kasneci et al., 2023). In a world that demands rapid adaptation, access to quality training and ongoing professional development is paramount (McGill et al., 2020).

For educators, professional development is a continuous journey (Zulfikar et al., 2022), essential for improving teaching competence (Jaiswal & Arun, 2021) and keeping up with digitalization in their respective fields (Elfeky, 2019). AI can play a pivotal role in this journey, offering teaching evaluation models and actionable suggestions for enhancing teaching practices (Adiguzel et al., 2023). While AI holds great promise in education, aligning it with educational and learning theories is crucial for effective instructional design and technological development (Bower, 2019). In this way, AI, guided by educational theory, can foster superior engagement and performance in learning tasks (Walkington & Bernacki, 2020).

In summary, as AI continues to reshape the educational landscape, its potential to offer personalized learning experiences, support educators, and enhance student engagement cannot be overstated. The synergy between AI and educational theory holds the promise of not just transforming education but also preparing professionals for a future that demands adaptability and lifelong learning.

5. DISCUSSION

For the discussion, it is essential to highlight the significance of student engagement in developing a learning system that supports reasoning skills. As established in the study by Zhai et al. (2021), engaged learners demonstrate an enhanced capacity to grasp the intricate levels of organization within complex systems. This observation draws on sociocultural learning theories, which serve as a critical foundation for the design of AI systems aimed at enhancing students' reasoning abilities. Additionally, AI technology has the potential to identify areas within course topics that require improvement, often escaping the notice of educators and potentially leading to student confusion, as observed by Fahimirad and Kotamjani (2018).

Furthermore, these advanced technologies hold great promise in providing valuable insights for enhancing individual engagement levels and refining the overall tutoring process, as indicated by Jaiswal and Arun (2021). AI has the potential to elevate learning outcomes, productivity, and student engagement by opening up new avenues for personalized education, feedback, and assistance, as underscored by Adiguzel et al. (2023).

However, it is crucial to emphasize that the integration of technology should be closely aligned with established educational and learning theories to guide instructional design and technological advancements, as stressed by Bower (2019). When these theories are meticulously considered, and design decisions are firmly rooted in specific theoretical frameworks, it becomes possible to make well-informed design choices. This, in turn, provides designers with greater

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Learner Characteristic	Behaviorism	Constructivism	Social Learning Theory
Role of Prior Knowledge	Limited emphasis on prior knowledge; learning is seen as a response to stimuli and reinforcement.	Prior knowledge is considered essential; learners build new knowledge on their existing understanding.	Prior knowledge influences social learning; learners observe and model behaviors based on what they already know.
Motivation Source	External rewards and punishments drive motivation; extrinsic motivation is prominent.	Intrinsic motivation is encouraged; learners are motivated by personal curiosity and interest in the subject matter.	Both intrinsic and extrinsic motivation play a role; learners can be motivated by both internal interest and external rewards or recognition.
Active Engagement	Learners are often passive receivers of information and are expected to respond to stimuli or conditioning.	Active engagement is emphasized; learners are encouraged to explore, question, and construct knowledge actively.	Active participation in social interactions is central; learning occurs through observation, imitation, and active engagement with others.

Table 1. Learners’ characteristic of learning theory

confidence that their efforts will yield the desired outcomes, a principle supported by prior evidence, as highlighted by Walkington and Bernacki (2020).

Therefore, the fusion of learning theories with AI should result in heightened engagement in learning tasks and, subsequently, improved task performance. Thus, postgraduate teaching should offer a flexible and tailored approach to education. Its effectiveness relies on a deep understanding of learning theory and the careful alignment of instructional design with theoretical principles. Table 1 summarises three major learning theories from the literature review to be used in the framework which is consistent with Behaviourism, Constructivism and Social Learning Theory.

This paper introduces a comprehensive framework that leverages AI to elevate professional development and training. It addresses the limitations of conventional methods, empowering educators and learners alike by integrating AI to identify suitable learning theories and strategies for postgraduate teaching. Through using AI such as ChatGPT to construct the type of learning theory, the framework leverages learner characteristics to provide instruction to ChatGPT according to the prompt as follows:

I'm looking to design a teaching approach based on my students' learning preferences and needs. Could you please analyse the following learning criteria:

[List of criteria, such as 'visual learners,' 'active learning,' 'real-world application,' 'collaborative learning,' etc.]?

Based on these criteria, can you recommend a learning theory or a combination of theories that would best align with these preferences? Please explain how the chosen theory/theories address each of these criteria effectively.

In this perspective, ChatGPT is being used to generate a suitable learning theory according to the learner's characteristics by providing the prompt into the chat box and proceeding to assist with the personalised learning design. With the intention of contextualising and positioning the learner characteristic of learning theory in the ChatGPT OpenAI platform, this study constructs a design space with three axes consisting of the Role of Prior Knowledge, Motivation Source, and Active Engagement (Figure 2). The learner characteristic is the measurements that are varying degrees of ability measuring each of the learning theories. For example, a learner characteristic of greater prior knowledge can be more related to the theories that require an essential consideration of their existing understanding, and lower prior knowledge can be considered for theories with limited emphasis on prior knowledge.

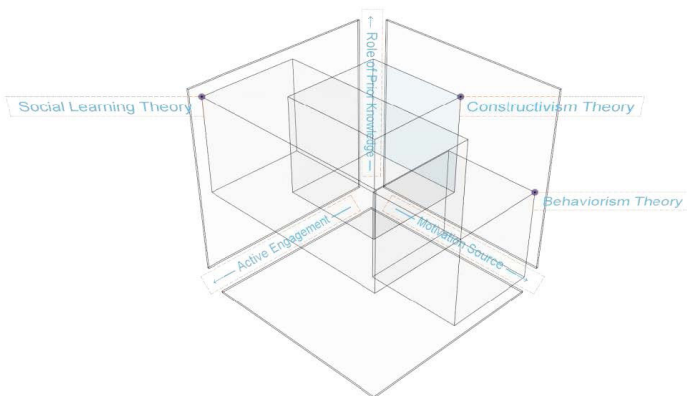


Figure 2. Three Axes Learning Theory Design Space

Similarly, the learner characteristic of motivation source can be the higher requirement for a learning theory that drives motivation whereby, lower measurement contributes to a learning theory with learners that have curiosity and interest in the subject matter. Active engagement of the learner characteristic will vary from passive to active engagement learning theory. These learner characteristic differences highlight how learners are viewed and engaged in behaviourism, constructivism, and social learning theory. Each theory has its own perspective on how learners' prior knowledge, motivation, and active engagement influence the learning process. The AI-generated learning theory is like the educational psychology theory but the purpose of integrating ChatGPT is to empower educators to identify suitable learning theories.

6. CONCLUSION

The integration of Artificial Intelligence (AI) into postgraduate teaching is reshaping education, offering the potential for highly personalized learning experiences. However, it is crucial to recognize that the journey towards fully realizing this dynamic and artificial intelligence approach is complex and multifaceted. In Malaysia and globally, the adoption of AI in education holds the promise of addressing various challenges. It has the potential to bridge the digital divide in online education access and alleviate the burden on educators by enhancing professional development opportunities. Trust in AI tools is essential for their successful adoption. The symbiotic relationship between human agency and AI technologies is central to their effective implementation in educational settings. Embracing AI's transformative potential in professional development and training can enrich learning experiences and optimize educational outcomes for learners worldwide. Learning theories play a vital role in guiding instructional design and creating effective learning environments. When educators consider these theories in detail and align their design choices with theoretical principles, they can create more effective instructional strategies. Furthermore, the integration of technology into postgraduate teaching should be closely aligned with educational and learning theories. This alignment informs instructional design and technological development, ensuring that the learning environment remains responsive and promotes engagement and performance in line with these theories.

Hence, this study proposes a three axes design space with the intention of contextualize and position the learner characteristic of learning theory in the ChatGPT OpenAI platform. The purpose of integration ChatGPT on defining the learning theory is to empowering educators and learners alike by integrating AI to identify suitable learning theories and strategies. In conclusion, the integration of AI and postgraduate teaching into education has the potential to revolutionize the field. Still, it requires a deep understanding of learning theories, careful alignment of instructional design, and a recognition of the symbiotic relationship between human educators and AI technologies. As we navigate the evolving educational landscape, stakeholders must recognize AI as a valuable asset and incorporate it into various aspects of education to enhance teaching and learning practices.

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