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# "Training primary school EFL teachers on AI teaching competencies via PBL to develop their AI awareness and English language productive skills" Dr/ Mohamed Ali Mohamed Kassem

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#### **ABSTRACT:**

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#### MOTS-CLÉS:

AI teaching competencies, PBL, AI awareness, productive skills, EFL primary school teachers

The current study aimed to investigate the effectiveness of using a training program based on artificial Intelligence (AI) teaching competencies in developing primary school EFL teachers' AI awareness and English language productive skills. The study adopted the quasi-experimental design of one group and pre-post administration of the instruments of the study. The study group included twenty-five (25) EFL primary school teachers. To meet the objective of the study, a training program based on AI teaching competencies was constructed, validated and taught via projectbased learning (PBL). In addition, an observation sheet of AI teaching competencies, Test of AI awareness, and a Test of English language productive skills were developed. Results of the study indicated the high effectiveness of the suggested training program in developing primary school teachers' AI teaching competencies, AI awareness, and English language productive skills. The study concluded that a well-structured training program that integrates AI teaching competencies with PBL can significantly enhance EFL teachers' AI awareness and their English language productive skills.

## **1. Introduction**

In today's rapidly evolving educational field, continuous development of EFL teachers' competencies is crucial for keeping pace with the changing demands of education. Teachers, as central figures in the learning process, need ongoing professional training to enhance both their pedagogical and linguistic skills. As educational institutions, Faculties of Education face the dual challenge of not only cultivating effective teaching practices in prospective teachers but also equipping them with the essential linguistic and technological skills necessary to meet the various needs of students. Waxman, Tellez, and Walberg (2005), along with Fillmore-Wong and Snow (2000), argue for the necessity of developing teachers' pedagogical and linguistic competencies to improve instructional quality and learning outcomes.

Recent educational reforms in Egypt, including the "Teachers First" initiative, have sought to address these challenges by training teachers to integrate emerging technologies into their teaching methodologies (Mogheith et al., 2019). This aligns with the broader strategic goals outlined in Egypt Vision 2030, which emphasizes the preparation of technically proficient and innovative teachers who can address students' future educational needs (Singer & El-Farahaty, 2020). Thus, there is an urgent need to provide teachers with training programs that do not only target traditional pedagogical practices but also incorporate new digital tools and methodologies.

One of these recent educational technologies is Artificial Intelligence (AI) that has a transformative potential in education, especially in the field of EFL, where it is reshaping how languages are taught and learned. AI technologies such as adaptive learning platforms, language learning applications, automated assessment tools, and speech recognition systems provide a unique feature that personalizes learning by providing real-time and data-driven feedback. In this regard, research has shown that this new technology gains teachers' wide recognition and support because of its positive effects on students' engagement, language development, and achievement of learning outcomes (Pokrivcakova, 2019; Gao, 2021; Wu, et al. 2024). Furthermore, AI has the potential to automate the traditional tasks such as analyzing learner progress, correcting pronunciation, and grading written assignments. This automation saves teachers' time, allowing them to engage more in interactive and creative classroom activities (Rashed, 2024).

Consequently, integrating these AI technologies into teacher training programs has become a necessity for equipping educators with the skills needed to effectively incorporate digital resources into their lessons. In this regard, several studies have argued that the incorporation of AI makes lessons more engaging, personalized, and accessible to students with diverse needs (Tsai & Chai, 2012; Tlili et al., 2021; Hwang et al., 2021). It has been emphasized that to fully integrate AI into EFL classrooms, teachers should be proficient in using these technologies, and be fully aware of their capabilities, limitations, and ethical considerations.

EFL teachers, in particular, need to familiarize themselves with various AI applications; automated grammar checkers, speech recognition tools, and machine translation systems, which can provide real-time feedback and support language learning processes (Jiang, 2022). In addition, they need to explore how AI tools can enhance teaching and learning while addressing ethical concerns, such as bias in AI algorithms and the effects of technology on human interaction in educational settings (Zawacki-Richter et al., 2019; Vinothkumar & Saratha, 2024).

Several studies have indicated the significance of developing teachers' AI competencies, noting that teachers who are skilled in using AI may outperform those who are not, as AI has the potentiality to enhance teachers' roles and to achieve more efficient management and decision-making (Vazhayil et al., 2019; Xu, 2020; Ng et al., 2022 & Markauskaite et al., 2022). Furthermore, recent research has suggested that more investigation is needed to fully explore AI's pedagogical potential, particularly in addressing the multifaceted challenges of EFL teaching, such as curriculum development and optimizing instructional methods. It has called for more exploration of the ethical implications and risks associated with AI use in instructional contexts (Zawacki-Richter et al. 2019 & Jiang, 2022).

In this context, Álvarez-Herrero (2024) conducted a study among Spanish teachers regarding their perceptions of AI and asserted that many teachers lacked basic understanding of AI and its practical implementation. The findings also revealed that teachers considered greater potential for AI in enhancing teaching competences than in improving teaching-learning processes directly. The study highlighted a need for carrying out a deep analysis of ethical constraints and pedagogical concerns of AI before its widespread adoption in educational settings.

Zhang et al. (2023) examined the factors influencing EFL teachers' acceptance of AI technology and identified perceived usefulness and ease of use as the most significant determinants. The study also pointed out a weak link between knowledge and use of AI in EFL classrooms, emphasizing the necessity of addressing these gaps in teachers' training programs. Similarly, Jiang (2022) noted that discussions of ethical constraints and accompanying risks of using AI in teaching have been insufficiently detailed, highlighting an area that requires urgent attention.

Beyond technological proficiency, language skills remain a crucial area of development for EFL teachers. Enhancing language proficiency is deeply linked to overall teaching effectiveness, as it underpins clear communication, effective instruction, accurate feedback provision, and student engagement. Van Canh and Renandya (2017) argued that strong language skills enable teachers to articulate concepts more clearly, provide accurate feedback, and foster interactive learning environments, particularly in language-focused subjects like EFL. Moreover, enhanced language skills support teachers in mastering other competencies, such as lesson planning, classroom management, and differentiated instruction, as they can adapt their language use to accommodate various students' needs and levels. Thus, a dual focus on language proficiency and pedagogical development ensures that teachers are well-equipped to deliver content effectively and support diverse learners in achieving their academic goals. Language skills are not an isolated component but a critical foundation that strengthens teaching skills and overall professional competence.

Richards (2010) noted that exemplary language teachers should possess a strong command of the language, using it fluently and confidently to provide clear explanations and model correct language use in the classroom. Teachers with high language proficiency can deliver lessons with greater clarity, explain complex language rules effectively, and engage students in meaningful communication, thereby enhancing learning outcomes. Gibbons (2002) emphasized that teachers who are proficient in the target language are in a better position to scaffold instruction, and to aid students in understanding language structures and concepts. This scaffolding ensures that students receive the appropriate level of support for their linguistic development. Similarly, Borg (2018) found that teachers with higher language proficiency levels reported greater confidence in classroom management and student engagement, which leads to a significant improvement in students' learning outcomes.

Research has underscored the need for EFL teachers to undergo continuous training in both language proficiency and pedagogical skills (Khandehroo et al. 2011; Lich, 2015; Nugroho, 2018, & Gezahegn & Eshete, 2023). In the Egyptian context, in-service EFL preparatory schoolteachers were in a need for additional training, particularly in writing skills (Shawky et al., 2022). Additionally, Hazaymeh et al. (2024) found that teachers demonstrated lower-than-expected writing performance, further highlighting the importance of enhancing EFL teachers' writing abilities.

In consistence with studies of Riordan (2018), Rao (2019), Chavoshan (2024) and Gordon (2024), who argued that the linguistic aspects of teacher training are often neglected, resulting in a decline in teachers' language skills, Abdel-Galil (2014) concluded that the existing in-service teacher training programs in Egypt are inadequate, as they do not meet teachers' needs, provide suitable training environments, or offer practical content. The programs are primarily theoretical in nature, which limits their impact on teachers' professional growth. The study recommended that teachers' professional training programs should be tailored to incorporate technology in both content and delivery methods. Similarly, Hassan (2017) reported that current training initiatives provided by the Egyptian Ministry of Education do not adequately address the needs of teachers or offer sufficient training time.

Based on the previous studies, incorporating modern teaching methodologies, such as PBL, could enhance both teachers' pedagogical competences and language proficiency. PBL has emerged as a modern teaching methodology that can enhance both pedagogical competencies and language proficiency. PBL is a student-centered instructional approach that encourages active involvement, discovery, and knowledge production through authentic and challenging projects (Kimsesiz, et al. 2017; Carrabba & Farmer, 2018; Liu et al., 2019). These studies have shown that PBL significantly improves language skills by promoting active learning, collaboration, and creativity. For example, Wahyudin (2017) found that PBL positively impacted speaking skills, enhancing vocabulary, grammar, fluency, pronunciation, and organization more effectively than traditional methods. Research by Diem (2018) demonstrated that PBL could also improve writing skills by increasing student engagement and fostering active learning.

The current study sought to train primary school teachers on AI teaching competencies using PBL. Thus, it addressed the research gap identified in previous research by providing a comprehensive training program that aimed at meeting the demands of contemporary education. By improving teachers' AI awareness and productive language skills, the study is expected to contribute to the development of a model for EFL teacher training programs that combine technology with innovative methodologies to prepare teachers for the demands of modern EFL classrooms. As AI continues to evolve, EFL teachers who are skilled in these technologies will be in a better position to meet diverse learners' needs, particularly in individualized instruction and language development. Thus, training in AI competencies is not only about mastering technical skills but also about understanding how AI can transform the educational landscape, ultimately enhancing language teaching and learning.

# **1.2.** Context of the problem

Despite the growing presence of AI technology in education, widespread use of technological advancements in language instruction, and the dramatic shift towards digital learning environments, the researchers observed that many in-service teachers lack the necessary competencies to effectively utilize AI tools in English language instruction. This gap in using AI and the absence of professional training programs tailored to these needs hinder the potential for AI to improve teaching and learning outcomes.

In the Egyptian context, the teachers' training programs presented by Ministry of Education seem to be inadequate and insufficient. Interviewing EFL primary school teachers (n=40) revealed that they are not adequately trained in using AI technology for language teaching. Also, teachers were unfamiliar with AI applications. Moreover, many teachers lacked the capacity to integrate these tools into their lesson plans effectively.

Additionally, many teachers depend on common teaching methods like rote memorization and grammar-focused practice rather than utilizing AI tools that can provide real-time feedback, personalized experiences, and automated assessments. Teachers learning demonstrated limited awareness of AI integrated utilization in EFL contexts. While some may use basic technology like videos or digital presentations, the deeper functionalities of AI such as adaptive content delivery, predictive analytics, and intelligent tutoring systems were not widely understood or applied. Many teachers lacked confidence in using AI tools for language teaching, citing insufficient training as a major barrier. Teachers reported a mismatch between their actual classroom needs and the content provided in the existing training programs.

From another perspective, the language proficiency of primary school EFL teachers is essential to ensure high-quality language instruction. It was observed that many primary school EFL teachers often struggle speaking in English, which limits their ability to provide effective learning experiences. The gap between the expected and actual proficiency levels is evident from classroom observations, indicating the need for focused linguistic development. Observations showed that teachers struggle with sentence structure, syntax, and grammatical accuracy, which negatively impacted their ability to model correct writing for students. It is revealed that some teachers are unfamiliar with specific academic or professional writing genres, limiting their ability to teach formal writing effectively. Many EFL teachers experience hesitation and pauses, struggling to speak fluently and respond spontaneously. Teachers often avoid speaking tasks in class. They rely on reading or grammar-focused activities. This, in turn, limits their speaking competence.

To address the limitations of current training programs of EFL teachers, the present study sought to improve teachers' AI awareness, AI teaching competencies, and their productive language skills through using a suggested training program based on AI teaching competencies.

# **1.3.** Objectives of the study

The present study sought to:

1. Develop primary school EFL teachers' AI teaching competencies.

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- 2. Develop primary school EFL teachers' AI awareness.
- **3.** Develop primary school EFL teachers' English language productive skills (Speaking & Writing).

# 1.4. Questions of the study

The present study attempted to answer the following questions:

- To what extent would a training program based on AI teaching competencies, instructed via PBL, be effective in developing primary school EFL teachers' AI teaching competencies?
- To what extent would a training program based on AI teaching competencies, instructed via PBL, be effective in developing primary school EFL teachers' AI awareness?
- To what extent would a training program based on AI teaching competencies, instructed via PBL, be effective in developing primary school EFL teachers' productive skills?

# 1.5. Hypotheses of the study

The present study sought to verify the following hypotheses:

- There would be a statistically significant difference between the mean scores of the study group in the pre and post application of AI teaching competencies observation sheet in favor of the post administration.
- There would be a statistically significant difference between the mean scores of the study group in the pre and post administration of AI awareness test in favor of the post administration.
- There would be a statistically significant difference between the mean scores of the study group in the pre and post administration of the English language productive skills test in favor of the post administration.

# **1.6. Significance of the study**

The present study was expected to be important for several reasons. First, it addressed the gap in AI teaching competencies among EFL teachers, which hindered them from using AI-driven technologies such as language learning applications, adaptive learning platforms, and automated assessment tools. By training teachers on how to use these tools, the study empowered them to integrate technology into their pedagogical practices, enhancing their instructional approaches and ultimately enriching the pupils' learning experiences.

Second, the present study sought to develop primary school EFL teachers' productive language skills. It highlighted the need to engage in-service teachers in tailor-made training programs that target the development of their language proficiency as well as their pedagogical competence. Third, the present study promoted the use of modern teaching method, PBL, which fosters active engagement, critical thinking, and collaborative learning. Developing the previous skills, the 21st century skills, is a prerequisite for academic and social success. The significance of this approach lies in its ability to shift traditional teaching paradigms towards more innovative and student-centered practices.

In addition, the present study highlighted the significance of teacher professional development in EFL contexts. Continuous professional development is crucial for helping teachers keep up with evolving educational technologies and methodologies. The study provided a model for training programs that did not only enhance teachers' technological skills but also improved their language proficiency and pedagogical knowledge. The suggested comprehensive training program seemed to have the potential to improve teacher quality, to increase classroom effectiveness, and to achieve better learning outcomes. Finally, the present study supported recent educational policies and initiatives that call for quality of education. It provided a suggested teacher training program that incorporated AI and innovative teaching methods. Results of the present study may encourage policy makers and curriculum developers to shape policies that support technology-enhanced education.

# **1.7. Delimitations of the study**

The present study was delimited to:

- Twenty-five (25) primary school EFL teachers were chosen randomly to participate voluntarily in this study from El Kharga administration, New Valley Governorate.
- The suggested program is based on the following AI teaching competences: AI Language Technological knowledge competence (AILTK), AI Language Technological Pedagogical

knowledge competence (AIL TPK), and AI Language Technological Pedagogical Content knowledge competence (AIL TPACK).

- Primary school EFL teachers' AI awareness in an Egyptian EFL context.
- Primary school EFL teachers' English language productive skills (speaking and writing).

# 2. Review of literature

# **2.1.** Artificial intelligence (AI)

AI is the most popular transformative technologies of the modern time. Fundamentally, it aims to reshape the individuals' interaction with machines and address complicated issues. The foundation of AI was laid by Alan Turing, in 1950, a pioneering scientist who is often regarded as the "ancestor" of AI. Turing suggested that machines could indeed possess abilities traditionally associated with human intelligence, such as decision-making and problem-solving (Arslan, 2020). Following Turing's groundbreaking contributions, AI continued to evolve rapidly, driving the field beyond merely creating intelligent systems to developing technologies capable of human-like thinking and problemsolving (Joshi, 2020).

AI is digital software that possesses human-like capabilities to learn, modify, analyze, self-correct, and manipulate data for complicated processing assignments. According to Fahimirad and Kotamjani (2018), AI is an application that makes assumptions, finds trends, and employs recent discovered formulas and patterns to new situations. From another perspective, Baker and Smith (2019, 10) believe that AI applications imitate human beings in carrying out some cognitive tasks such as learning and solving complicated problems. Thus, AI is considered as a specific set of skills of computers. From a broader view, AI is considered as a science, Stone et al. (2016) explain that "artificial intelligence is a science and a set of computational technologies that are inspired by the ways people use their nervous systems and bodies to sense, learn, reason, and act, but typically operate quite differently from. In educational context, AI is a tool to develop the quality of education via tailoring the content to suit all individuals. It makes learning process flexible, inclusive and interesting (UNESCO, 2017).

#### The significance of using AI in EFL instruction

AI transformed various aspects of teaching and learning, offering innovative solutions that can significantly enhance EFL instruction. AI technologies provide unique opportunities for language practice, assessment and progress. The growing body of research highlights how AI can significantly transform the educational context by improving teaching practices, student engagement, and students' achievement (Kozlova & Pikhart, 2021; Klimova et al., 2022).

Firstly, AI tools have the capability to personalize students' learning experiences by modifying instructional content to suit their personal needs. These technologies can evaluate students' performances, identify areas where they struggle, and provide targeted interventions. For instance, AI systems have the potential to analyze a student's progress in real time, offering insights that help teachers adjust their instruction to support slow learners and those who face challenges in specific subjects (Elsayed et al., 2015).

Secondly, AI tools facilitate self-directed and autonomous learning, enabling students to take control of their educational journey. With AI applications, learners can access unlimited resources, find study materials easily, and choose their own learning path and pace (Mijwil et al., 2022). This autonomy fosters a more learner-centered approach where students assume the responsibility of their learning. Consequently, teachers are invited to assume the role of facilitator who guides and supports the learning process.

Thirdly, AI tools are effective in enhancing specific language skills. For instance, AI tools can improve speaking skills through speech recognition software that provides feedback on pronunciation and fluency (El Shazly, 2020), while reading comprehension can be supported with tools that adapt reading materials to the learner's proficiency level (Bailey et al., 2021). In addition, AI contributes to the development of writing skills by offering grammar correction, suggestions for improvements, and resources for further study. Thus, promoting learner's autonomy in the writing process (Abdelatif & Siddiqui, 2021).

From another perspective, AI tools facilitate collaborative learning by enabling meaningful communication and group work. These tools can support the formation of appropriate learning groups, monitor interactions, and provide guidance at critical moments (Luckin et al., 2016). In addition, these tools provide immediate and individualized feedback, helping students improve their performance through consistent practice and self-revision (Bai & Hu, 2017; Gao, 2021).

Moreover, AI-based neural machine translation tools, such as Google Translate, can aid language learning by allowing students to compare original texts with translations to enhance their lexical and grammatical knowledge (Lee, 2019). Although MT tools are sometimes viewed as undermining academic honesty, studies suggest that when used appropriately, they can be beneficial learning aids for language practice (Cook, 2010; Garcia & Pena, 2011). Therefore, teachers should guide students on how to effectively use MT while understanding its limitations.

To sum up, AI can significantly benefit EFL teachers and students by offering personalized learning experiences, fostering learner autonomy, supporting specific language skills, facilitating collaborative learning, and automating routine tasks. With appropriate implementation, AI technologies can transform EFL education, making it more efficient, interactive, and impactful.

# Theories underpinning AI technology in education

AI technology integration in education can be understood through various learning theories, which highlight the possibility of using recent technology in fostering active learning, social interaction, and cognitive processes. They construct a basis for understanding how AI can enhance educational experiences and support diverse learning needs.

Constructivist learning theory emphasizes the significance of students' active involvement and self-construction of knowledge. AI

supports this by offering interactive learning scenarios, such as simulations and Intelligent Tutoring Systems (ITS). They present immediate feedback and adaptive assessments (Siemens & Long, 2011; Blikstein & Worsley, 2016). In this regard, AI promotes active learning by creating dynamic environments where students construct knowledge through hands-on experiences (Chan, 2015).

Constructivist principles also stress personalized learning, which accounts for the diversity of learners and their unique cognitive processes (Dede, 2010). AI adapts content and instructional strategies to individual needs using machine learning algorithms and fostering a student-centered approach. This personalization enhances motivation, engagement, and knowledge acquisition, aligning with the constructivist idea that learners actively shape their understanding (Russel & Norvig, 2010).

Another interesting theory is the Socio-Cultural Learning Theory. According to Vygotsky, social interactions play a crucial role in cognitive development (Vygotsky, 1978). AI can enhance these interactions through intelligent agents like chatbots and virtual tutors, which facilitate collaborative learning by guiding students through problem-solving (D'Mello & Graesser, 2014). According to Luckin et al. (2016), AI-driven social interactions positively impact students' cognitive development.

Socio-cultural theory emphasizes collaborative learning, which is enriched by AI tools that enable virtual collaboration and real-time feedback (Jackson, 2015). AI-supported platforms enable students to share ideas and perspectives, creating diverse and inclusive learning environments (Van Lehn, 2011).

Cognitive learning theory examines mental processes, including cognitive load. AI helps manage this cognitive load by adapting instructional strategies to learners' capacities (Mayer, 2008). AI tools can adjust task difficulty to balance challenge and skill, reducing extraneous cognitive load while enhancing learning outcomes (Chan, 2015). More widely, Cognitive learning theory supports the use of adaptive systems that account for individual variability in cognitive processes (Siemens, 2005). In addition, AI-powered adaptive systems analyze learning patterns to tailor content and pacing, optimizing cognitive engagement and academic achievement (Kabudi et al., 2021). In sum, major learning theories support the use of AI technology in educational context to maintain active and personalized learning (constructivism), enhance social interactions and collaboration (socio-cultural theory), and manage cognitive load through adaptive strategies (cognitive theory).

# AI teaching competencies in an EFL context

The integration of AI into teaching requires specific competencies that span technological, pedagogical, and content knowledge. These competencies enable language instructors to effectively use AI tools to enhance educational practices, making them better equipped to design AI-based instructional strategies that may improve learning outcomes. In order to handle AI competencies in teaching, the study adopted TPACK model of incorporating technology in education. The TPACK framework is commonly used to explain teachers' understanding of technology intergration into educational practices (Koh et al., 2013). Essentially, TPACK represents a form of context-sensitive knowledge that teachers develop, allowing them to adapt to specific subject-matters and student needs (Angeli & Valanides, 2009). This dynamic form of knowledge enables teachers to make informed decisions about incorporating new technologies and designing innovative lessons to enhance students' learning outcomes (Lin et al., 2022).

According to Mishra and Koehler (2006),TPACK is structured around three core knowledge areas: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). These areas interact to form more specialized competencies, including technological content knowledge (TCK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), and the integrative knowledge of TPACK (Koh et al., 2013; Hsu, 2017).

Research has shown that possessing strong TPACK significantly impacts teachers' readiness to adopt new technologies (Bardakci & Alkan, 2019; Lim & Harwati, 2021). Teachers are expected to use machine-oriented instructions, to assess students' performance, and to

make use of AI-based robotics to equipe students with adequate emotional and cognitive assistance (Edwards et al., 2018). In fact, language instructors should be trained on using AI applications to achieve learning outcomes and foster students' learning (Hazaymeh et. al., 2024). Training teachers in AI teaching competencies enables them to develop the necessary skills to use AI technologies effectively, while also considering how these tools can be integrated into their pedagogical practices to support students' learning and engagement (Markauskaite et al., 2022; Vinothkumar & Saratha, 2024).

Research has indicated some competencies that teachers should possess to guarantee a successful use of AI. Teachers should gain enough knowledge about the new technology and how to integrate it into the curriculum. They also should be able to use such technology to improve the quality of teaching practices. Recently, the <u>TPACK</u> framework has been widely utilized to sort and classify those competencies in three domains: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). Based on TPACK frame of competencies, the present study adopted the following three competencies that are needed to integrate AI in EFL instruction.

First, the Technological Knowledge (TK) that teachers should possess. It includes a foundational knowledge of AI concepts and various AI technologies, such as speech and text recognition, grammar-checking applications, and machine translation. Jiang (2022) indicates that teachers should understand the functions and limitations of these technologies, as well as how to utilize AI-powered tools for educational purposes. Kim et al. (2021) adds that teachers need proficiency with AIdriven learning management systems, automated grading tools, and platforms for creating interactive content. In addition, teachers should also be skilled in performing tasks such as data collection, sorting, and analysis using AI-based tools (Olari & Romeike, 2021).

Second, the Technological Pedagogical Knowledge (TPK) that denotes the instructors' recognition of using AI technologies to support various pedagogical strategies, such as collaborative learning, inquirybased learning, or flipped classroom models. For instance, AI can facilitate collaborative group work by forming optimal teams based on data analysis, or it can support flipped learning through automated content delivery (Luckin et al., 2016). Moreover, teachers should know how to use data to improve instructional design, to personalize learning experiences for students, and to make informed adjustments based on real-time feedback (Olari & Romeike, 2021). This includes selecting suitable AI tools, planning machine-oriented instructions, and using AI to create adaptive learning environments that address individual student needs (Edwards et al., 2018).

Pedagogical skills should also encompass monitoring learners' improvement and providing appropriate support using AI-based systems. Hsu (2017) mentions that teachers also should know how to use data generated by AI tools to inform instructional decisions and to adapt their teaching methods accordingly. This may involve using AI insights to tailor content delivery, adjust pacing, or modify learning tasks to better meet the students' needs.

Third, the Technological Pedagogical Content Knowledge (TPACK) that refers to teachers' mastery of how to combine technological, pedagogical, and content knowledge to design AI-driven learning experiences that are both pedagogically sound and content-appropriate. This includes creating lessons that utilize AI technologies for data-driven feedback, personalizing instruction based on AI analytics, and using AI to support collaborative, student-driven exploration, or challenge-based learning (Lin et al., 2022). Teachers also need to use AI to modify and present content based on the learners' progress. This may include using adaptive learning platforms that adjust the content difficulty according to each student's needs (Sun et al., 2022).

Thus, adopting the TPACK model to present AI teaching competencies highlights the teachers' need to integrate their knowledge of technology, pedagogy, and content in a dynamic and context-sensitive manner. By developing these competencies, teachers will be able to utilize AI efficiently to achieve the intended objectives, to support personalized instruction, and to foster a supportive learning environment.

# 2.2. EFL Teacher's AI awareness

AI awareness in education generally refers to teachers' understanding of AI's capabilities, applications, limitations, and ethical considerations in education. In essence, AI awareness helps teachers apply AI effectively in classrooms while addressing its ethical, practical, and pedagogical dimensions. This multi-faceted understanding is crucial for preparing educators to use AI responsibly and optimize its benefits in education (Olari & Romeike, 2021, Ng et al. 2022; Jiang , 2022; Vinothkumar & Saratha, 2024).

Reviewing pertinent literature indicated that teachers' AI awareness encompasses multiple dimensions: understanding AI technologies, using AI pedagogically, considering ethical issues, and using critical evaluation skills. Developing these components ensures that teachers can use AI responsibly, effectively, and in ways that maximize educational benefits (Jiang, 2022; Olari & Romeike, 2021; Lin et al., 2022). The key dimensions of teacher's AI awareness are discussed in the following section.

The first dimension deals with knowledge of AI technologies. It refers to teachers' understanding of AI concepts and technologies, such as machine learning, natural language processing (NLP), and adaptive learning systems. It also includes familiarity with AI applications like automated speech and text recognition, grammar checkers, and machine translation tools, which are relevant to language teaching (Jiang, 2022). Understanding how these technologies function, their potential uses, and limitations is crucial for making informed decisions about implementing AI tools in classes (Ng et al., 2022).

The second dimension tackles the pedagogical use of AI technology. It includes the ability to use AI in instructional practices in a manner that fosters the realization of learning outcomes. This involves using AI tools to support pedagogical strategies, such as providing personalized feedback, adaptive content, and automated assessments. Teachers need to design lessons that incorporate AI in a complementary manner, aligning AI tools with specific learning objectives and traditional teaching methods. The integration of AI should also address diverse student needs through differentiation and personalized learning paths (Sun et al., 2022).

The third dimension is concerned with teachers' awareness of ethical considerations and AI limitations in education. This includes understanding potential risks like data privacy issues, algorithmic bias, and the expected effect on equity and social justice in the classroom. Teachers should be prepared to address these concerns by ensuring transparency, data security, and fairness in the use of AI systems (Jiang, 2022). Ethical awareness also involves recognizing AI's limitations and avoiding over-reliance on technology at the expense of meaningful human interactions in education (Olari & Romeike, 2021).

The last dimension of AI awareness is related to critical evaluation of the effectiveness of using AI tools in education. Teachers should assess the quality, accuracy, and pedagogical value of AI applications to ensure they meet instructional goals and to improve students' engagement. In addition, this dimension includes teachers' evaluation of AI-generated feedback, recommended learning paths, and the alignment of AI tools with curriculum objectives (Vinothkumar & Saratha, 2024).

Some studies have been carried out to investigate the significance of AI awareness and perceptions either among students or among teachers. Kaur (2019) investigated the students' awareness level of artificial intelligence. The results showed that there was no statistically significant difference towards awareness level of AI in education system among the students. Yeh et al. (2021) investigated the perceptions of AI and its connections to sustainable development goals among educated peoples who had an access to the internet in Taiwan. Parthiban and Ganesh (2024) study aimed to examine the awareness of AI tools among the prospective teachers. The results showed that prospective teachers have moderate level of awareness of AI tools.

# 2.3. Teacher's English language productive skills

Generally speaking, English language encompasses two types of skills: productive and receptive. Speaking and writing skills are productive skills whereas listening and reading skills are receptive ones (Harmer, 2010). Speaking is defined by Shumine (1997,9) as a fundamental component of communication. It needs much care, time, practice, and appropriate feedback. According to Florez (1999, 2), speaking is "an interactive process of constructing meaning that involves producing, receiving, and processing information". It is also defined by Irawati (2014, 26) as an "activity to produce sayings in the form of words and sentences orally in order to communicate with others". Despite its significance, developing speaking is not an easy task. According to Pop et al. (2011, 120) "speaking is one of the most important yet most difficult skill to form due to many reasons, ranging from lack of interest

and self-confidence, lack of basic knowledge and fear of face-loss while communicating with more proficient users".

Based on the previous definitions, speaking skill is the ability to use the oral language efficiently and fluently to achieve successful communication. It includes several sub-skills such as correct pronunciation, rich vocabulary, grammar, intonation, fluency, and coherence. Possessing speaking skills enables everyone to reflect his beliefs, opinions, and emotions clearly and appropriately in different social and professional contexts. Speaking, in the present study, is the teachers' ability to speak clearly, to communicate successfully, and to express their thoughts and beliefs appropriately in social interactions.

Speaking is not just about articulating words but conveying messages effectively through oral communication (Bashir et al., 2011). In this regard, Sarjana (2022) adds that communication is essential in the global world, language serves as a key tool for interaction, and English is widely spoken worldwide, facilitating communication across different regions. Speaking skills consist of several components: grammar which is necessary for constructing correct sentences and helps learners communicate more effectively; vocabulary is another critical component that enables learners to carry out effective communication in both spoken and written forms; pronunciation is important prerequisite for producing clear speech which is crucial for enhancing communication; fluency, a common goal for language learners, refers to the ability to speak smoothly without hesitation; accuracy involves the degree to which language is used correctly, balancing grammatical correctness, vocabulary, and pronunciation and, eventually, comprehension that refers to the ability to understand and respond to spoken language, which is essential for meaningful communication. These components collectively contribute to the development of effective speaking skills, helping learners become confident and well-rounded communicators (Richards, 2006; Brown, 2010 & Harmer, 2010).

The second productive skill is writing that is defined as the ability to reason and communicate through the inscription or recording of signs and symbols. Ingels (2006, 83) considers writing as a process of communication and a conventional graphic system to convey a message to the reader. Pimsarn (2013, 99) adds that writing is the representation of language in a textual medium with a set of signs or symbols known as a writing system to convey an intended meaning. It involves encoding messages and translating thoughts into language and sharing ideas with others. It is the ability to communicate thoughts and ideas into structured patterns, in order to help readers understand what is meant by writing (Elhabiri, 2013, 22).

Writing is a complex productive language skill that entails the organization of ideas in written form to narrate, describe, expose, or persuade. Similarly, Myhill (2009) believes that writing is a complicated process that covers three perspectives: cognitive, linguistic, and sociocultural. The writer confronts a staggering hierarchy of problems represented in generating and organizing task relevant ideas, converting these ideas into grammatically correct sentences and using correct punctuation and spelling. Adding to converting ideas into a written form, the writer has to tailor the content, style, tone, and words to suit the target readers.

Generally speaking, writing is a process in which writers seek to create a good piece of writing that reflects their mastery of using grammatical rules and sentence structures correctly. In addition, it reflects their ability to infer the meaning of unfamiliar words and avoid mistakes in spelling and conventions (Abdelhameed, 2020, 60). Based on the previous definitions, the present study believes that writing is a constructive, generative and interactive process where students use the written form of language to communicate their ideas and emotions. Therefore, it includes planning, composing, editing, and evaluating skills.

Writing is a difficult and demanding task requiring attention to multiple skills. Brown (2010) clarified that writing skills include four skills. First, the macro-skills that include maintaining the communicative goals of written texts in terms of purpose and form, establishing relations and connections between events, writing with fluency in the first draft, using paraphrases and synonyms, and making use of peer and teacher's corrections to support editing and proofreading stages. Second, the micro-skills that include producing written texts at an efficient rate of speed to suit the purpose, producing an acceptable content, applying acceptable grammatical system, and, eventually, utilizing the rhetorical forms and mechanics of written texts. Third, the mechanical component of writing that includes handwriting, spelling, and punctuation. Fourth, cohesion and coherence of writing. Cohesion means establishing grammatical and lexical linking within the text or sentence that relates and holds the text together and gives its meaning. Coherence can be achieved when the writer sequences information in a logical manner. In other words, when the movement of one sentence to the next one is smoothly and logically delivered.

Arena (2013) divided writing skills into horizontal, vertical and outlining skills. The horizontal skills are grammatical, syntactic and mechanics of writing. The vertical skills include vocabulary choice skills, stylistics skills, and content skills. Outlining skills are judgment and organization skills. Andrade (2012) divided these skills into three stages: pre-writing, during writing, and post-writing. While pre-writing skills include planning to write, during writing skills include fluency, accuracy, content, organization, stylistics and mechanics skills. Postwriting skills include revision skills.

Mertens (2010) believes that writing is a highly complicated skill that includes five main components: content that refers to the substance of the written product; form that denotes the presentation of content in an organized manner; grammar that means the correct application of grammatical rules and syntactic patterns; style that refers to the choice of the structures and lexical items to produce a specific tone; and conventions which indicates punctuation marks, citations, and capitalization.

Developing English language productive skills of EFL teachers is a difficult goal. It is an essential component of EFL teacher preparation programs as possessing such skills enables teachers to communicate clearly, deliver content effectively, and engage students in meaningful language use. However, by reviewing literature, many teachers face difficulties and challenges in developing their speaking and writing skills. The first challenge is teachers' inadequate language proficiency. Many EFL teachers struggle with grammar, vocabulary, and pronunciation. These linguistic challenges can hinder their ability to speak or to write confidently and accurately in front of a class. According to Richards (2010), language proficiency is fundamental to teaching effectiveness, as teachers who lack adequate proficiency may struggle to model correct language use or respond accurately to students' questions. Inadequate vocabulary and grammar skills also pose a barrier to speaking proficiency. **Istiqamah** (2020) notes that limited vocabulary restricts a speaker's ability to express ideas clearly, while grammatical inaccuracies can undermine the clarity and credibility of communication. **Similarly, Luoma** (2009) emphasizes that teachers need to progress from using simple language structures to mastering more complex ones to improve their speaking skills. For non-native speakers, this progression can be difficult and time-consuming, especially if they lack sufficient interaction with real-world language use.

Moreover, Young (2010) points out that EFL teachers often experience a "fear of negative evaluation," which makes them hesitant to participate in speaking activities or practice their language skills. This fear is amplified in the context of teacher education, where trainees are aware that they will eventually be evaluated not only by their instructors but also by their future students. Overcoming this psychological barrier requires targeted interventions, such as building a supportive learning environment, providing constructive feedback, and incorporating anxiety-reducing strategies in the training process.

Teacher training programs may also face curriculum limitations that affect the development of speaking skills. In some programs, speaking practice is not given enough emphasis, or it is limited to structured activities such as rehearsed presentations and scripted dialogues. **Thornbury (2015)** argues that for speaking skills to be developed effectively, training programs must incorporate interactive and communicative activities that mimic real-world language use, such as role plays, group discussions, and debates.

Furthermore, the curriculum may lack a focus on specific elements of speaking such as pronunciation, intonation, and fluency. According to **Brown (2010)**, the development of speaking skills involves mastering various elements, including grammar, vocabulary, pronunciation, and discourse management. Teacher training programs that do not address these elements comprehensively may leave

prospective teachers inadequately prepared for the demands of the classroom.

Pronunciation poses a significant challenge for many teachers, particularly from non-English-speaking backgrounds. those Mispronunciation can hinder intelligibility and may lead to misunderstandings in the classroom. Gerald (2010) highlights that pronunciation issues can arise from differences in phonological rules between the prospective teacher's native language and English. For example, some languages may not have certain sounds found in English, making it difficult for learners to produce these sounds accurately. Thus, prospective teachers may still struggle with adopting these patterns in their speech. Without effective training in pronunciation, prospective teachers may lack the confidence to speak in front of a class or may inadvertently model incorrect pronunciation for their students.

Agustinasari, et al. (2022) argues that writing is a complex process that involves pre-writing, drafting, revising, and editing stages. Prospective teachers often need guidance to master these stages. Additionally, Selvi, et. al. (2023) added that non-native speakers may struggle with rhetorical conventions that differ from those in their native languages, making it difficult to produce well-organized and culturally appropriate texts. Swales and Feak (2004) highlight that understanding writing genres and mastering the conventions of writing are fundamental for EFL instructors, as they will need to develop these skills in their students.

To sum up, developing productive skills of EFL teachers is a complex process that involves overcoming various challenges, including language proficiency issues, psychological barriers, limited speaking practice, curriculum limitations, pronunciation difficulties, and the need to balance fluency and accuracy. Addressing these challenges requires a comprehensive approach to teacher training programs, incorporating interactive activities, providing targeted support, and offering real-life communication opportunities. With appropriate interventions, prospective teachers can overcome these difficulties and develop the speaking skills necessary for effective teaching.

# 2.4. Project-based learning (PBL)

PBL is a model that organizes learning around projects. A project is an activity that lasts for a relatively long period of time. Sometimes, it takes several weeks. In a project, a number of students work together to carry out cooperative tasks such as devising a research plan. The implementation process may take the form of empirical or document research. The participants are responsible for collecting, analyzing, and evaluating data. Finally, a report is presented orally or in writing. PBL enables students not only to explore their cognitive and emotional capacities but also to discover the surrounding world (Bas, 2008). Thus, students are given the chance to, independently, choose and create their projects based on their interests and priorities.

PBL is a significant strategy that is employed heavily in active learning as it considers seriously the students' needs. Wengerd (2009) reveals that PBL is a pedagogical philosophy that aims at engaging students in real-life situations to develop their critical thinking, goal setting, problem-solving, collaborative skills, negotiation skills, technological awareness and autonomy. In PBL, a supportive and authentic learning environment is created to improve the students' level of academic achievement and motivation.

In PBL, students are exposed to unique learning experiences to develop their ability to construct knowledge via establishing connections between knowledge, skills, values, and attitudes (Lam, et. al. 2010; Krauss & Boss, 2013). Hallermann, et al. (2011, 5) adds that PBL is a well-designed instructional strategy that seeks to provide students with important knowledge about the subject and develop recent 21<sup>st</sup> century skills through an extended student-influenced inquiry process that is based on complicated and original questions, precisely designed tasks and learning experience.

Moreover, Hung, et al. (2012) state that PBL is a teaching strategy where students are urged to negotiate, discuss, and share points of view with their group partners. It involves students in generating, evaluating and implementing the assigned projects. It is a student-focused constructivist teaching strategy where EFL students are responsible for producing information, individually or collaboratively, as a result of active group work. Also, students are autonomous in their learning (Carrabba & Farmer, 2018). According to Stoller, et al. (2020), there are six features of PBL:

- In the project work, the focus is on content learning rather than on specific language targets. The focus is on students and realworld subject matter can become central to projects.
- PBL is a student-centered approach, so teachers are expected to offer support and guidance.
- Cooperation is rather than competition in project work. Therefore, students exchange information and experiences throughout the project.
- PBL seeks to integrate skills and process information from various resources.
- PBL culminates in an end product that can be shared with others. The significance of students' work is not in the final product but in the procedures and models adopted to achieve the target.
- PBL potentially motivates, stimulates, empowers and challenges students. Having both a process and product orientation, PBL enables students to practice fluency and accuracy at different stages involved in the project.

PBL is underpinned by several educational theories that emphasize active and experiential learning. The key theories that support PBL include constructivism. PBL is strongly rooted in constructivist theory, which posits that learners actively construct knowledge through experience. Constructivism emphasizes that knowledge is built as learners engage in meaningful activities, interactions, and investigations (Liu et al., 2008). In this approach, students use their existing knowledge to make sense of new experiences, facilitating deeper understanding (Cholewinski, 2009).

From another view, the constructivist perspective views learning as a dynamic process where the learner is seen as an active participant rather than a passive recipient of information. PBL aligns with this view by providing students with adequate opportunities to participate in cooperative projects that require setting goals, proper scientific thinking, problem-solving, and group work (Hernandes Ramos & Paz, 2010). The ideology of "learning by doing" is another foundational theory behind PBL. It posits that knowledge is best acquired when learners actively engage in doing something, rather than merely reading or listening about it. This principle suggests that experiences and practical application are critical for deep learning (Kotti, 2008). Thus, PBL incorporates this principle by involving students in projects that emerge from real-life situations and authentic needs. This experiential learning encourages responsibility and application across interdisciplinary areas, thus connecting academic learning with broader social contexts.

PBL is based on the learner-centered and autonomy-oriented approach that promotes an active learning environment where learners are urged to engage in communicative activities and use language in meaningful ways. PBL prioritizes student-independence and autonomy. By focusing on individual contributions and self-directed learning, PBL supports diverse learning styles and mixed-ability classrooms, which enhances the development of language skills and other competencies (Sirisrimangkorn, 2018). In sum, PBL are based on constructivism, experiential learning theories like "learning by doing," and learnercentered approaches. These theoretical foundations support the emphasis on active participation, artifact creation, real-life experiences, and learners' autonomy.

According to PBL, the instructional procedures include three phases: planning, creating, and processing (Stoller et. al. 2020). In planning stage, students are requested to choose a project based on their interests, allocate resources that they need to collect data, and propose a plan for carrying out the chosen cooperative project. The implementation represents the second stage where students are involved in several activities such as employing cooperative techniques, coordinating members' contributions, documenting, and presenting the initial product to other groups. The third stage includes reflection, feedback and followup on the projects. Students are expected to share their products in a small group or with the entire class, and to receive feedback.

More elaboration is provided by Bell (2010) who claims that PBL implementation goes through four stages. The first is speculation where teachers provide a list of proposed projects that are related to the content and learning outcomes of the curriculum. Then, teachers run a discussion

regarding the projects and give the students the chance to choose and decide. In the second stage, participants seek to create project activities, distribute roles, set rules, organize work, and select reliable information sources. The third stage includes carrying out the project activities. In this stage, students collect and analyze information. They run discussions within the group, consult teachers, and display their end products that might be in form of presentation, performance, product or publication to wider community such as other classes. Finally, evaluation is the last stage where participants assess and reflect on the quality of activities, outcomes of discussions, achievement of initial objectives, implementation process, and the final products.

Based on the previous stages, the researchers designed procedures that were incorporated in the suggested teachers' training program and may help EFL teachers in integrating AI tools into language learning and assessment, with an emphasis on using AI-powered tools to develop and evaluate writing and speaking tasks. The training is based on PBL approach, where teachers actively engage in designing projects that incorporate AI for language assessment purposes. Through hands-on activities and collaborative learning, participants would develop a deeper understanding of AI technologies and enhance their awareness of AI's pedagogical potential.

PBL provides a dynamic and impactful educational environment that equips students with the necessary skills for academic and realworld success. It emphasizes active participation, interdisciplinary integration, and practical application, making learning more meaningful and engaging. PBL helps students acquire not only subject-specific knowledge but also essential life skills. By engaging in complex, and real-world tasks, learners are assumed to improve their critical thinking, decision-making, and reflective thinking abilities (Liu et al., 2008).

This approach encourages students to become independent learners who actively participate in their education. Sirisrimangkorn (2018) clarifies that PBL emphasizes a student-centered approach where learners take responsibility for their learning, making decisions, and solving problems collaboratively. It supports learner autonomy by allowing students to pursue their interests and questions, thus managing their own success. By involving students in meaningful and challenging projects that connect with real-world issues, PBL increases motivation, self-efficacy, and intrinsic interest. It fosters a sense of ownership over the learning process, which is crucial for sustained engagement (Fragoulis, 2009). Working on group projects enables students to improve their collaboration, communication, and conflict resolution skills. Engaging with peers and external community members helps learners to understand multiple perspectives and build teamwork capabilities (Grivaa et al., 2010; Lee & Kim, 2013).

In language education, PBL is particularly effective for developing language skills in meaningful contexts. It allows learners to use the target language in authentic tasks, thereby enhancing fluency, self-confidence, and language proficiency (Fragoulis, 2009). Many studies highlighted the effectiveness of PBL in improving students' language skills across different educational contexts. Rerg-anan (2011) reported that students showed increased writing skills and higher satisfaction levels when taught using PBL. Also, Ramirez (2014) noted that PBL not only improved students' writing abilities but also boosted their confidence and perceptions toward writing. This suggests that engaging in PBL activities helps students feel more capable and motivated to improve their writing skills. Thitivesa (2014) found that exposure to texts and PBL activities led to better mastery of basic writing features, such as sentence structure and phrasing. Furthermore, Al-Rawahi and Al-Mekhlafi (2015) reported that PBL positively impacted writing skills and language performance overall, leading to better academic results.

Several studies, including those by Astawa, et. al. (2017) revealed that PBL not only enhanced writing skills but also cultivated students' creativity, self-directed learning, and collaborative skills. This suggests that PBL supports the development of a broader range of competencies beyond writing. Studies by Newprasit and Seepho (2015), Natalia (2016), Ningsih (2016), and Sadeghi, et. al. (2016), indicated that PBL is adaptable and effective in various learning environments. Overall, the evidence from these studies underscores the effectiveness of PBL in fostering writing abilities, improving students' confidence and attitudes toward writing, and enhancing academic outcomes across diverse educational settings.

# 3. Method

## **3.1. Design of the study**

The present study adopted the quasi-experimental design of one experimental group and pre-post application of the instruments of the study. Twenty-five, male and female primary school EFL teachers, participated in the study. The study group was chosen voluntarily. Approximately, all participants had the same teaching experience.

## **3.2. Instruments and Materials of the study**

#### **3.2.1. AI teaching competencies observation sheet**

The AI teaching competencies observation sheet aimed at assessing the primary school EFL teachers' competencies of using AI in English language instruction. The construction of the observation sheet started with reviewing the pertinent literature and preparing an initial list of AI teaching competencies. The list included twenty-three (23) subcompetencies distributed on three main categories of TPACK competencies model: five (5) teaching competencies related to Technological knowledge competencies for using AI in an EFL classroom (AIL TK), Eight (8) teaching competencies related to Technological and pedagogical knowledge competencies for using AI (AIL TPK), and ten (10) teaching competencies related to Technological, pedagogical, and content knowledge competencies (TPACK).

The list was submitted to a panel of jury members who were specialized in teaching EFL and technology instruction (n= 13). They were requested to judge its suitability to the sample of the study. In the light of the jury's recommendations, the researchers carried out the necessary changes and prepared the final version of the list which included: seven (7) teaching competencies related to Technological knowledge competencies for using AI, eight (8) teaching competencies related to Technological and pedagogical knowledge competencies for using AI, and ten (10) teaching competencies related to Technological, pedagogical and content knowledge competencies.

Based on the final list of the teaching competencies of using AI in language instruction, the observation sheet was prepared. It included twenty-five (25) items with a scoring scale of three points ranging from 1 to 3. (1= available poorly, 2= available adequately, 3= available greatly). The total score of the observation sheet was (75) marks. The reliability of the observation sheet was measured by an inter-rater reliability method. The teachers' performance was recorded and assessed twice by the researchers. Then inter-rater reliability was calculated (0.85) which indicated a high level of reliability.

# 3.2.2. AI awareness Test

The AI awareness test aimed to assess primary school EFL teachers' awareness of AI applications. Constructing the test started with reviewing literature and previous studies that investigated the varied dimensions of AI awareness. It was concluded that AI awareness covers four dimensions: knowing and understanding the foundations of AI applications in English language instruction, using AI applications, designing and evaluating the use of AI applications, and considering the ethical issues related to AI. Then, stating a number of items for each dimension and determining the type of assessment suitable for each dimension.

The test, in its final version, included fifty (50) items that covered the previously mentioned dimensions. The first part included twenty MCQ items that aimed at assessing the participants' knowledge and understanding of AI applications. Each correct answer was given one mark. The second part included ten statements designed to assess the participants' use and application of AI. Each statement/behavior has three responses, which ranged from (0) to (2 marks). The third part is designed to assess the participants' evaluation and creation of AI applications. It included ten statements and three responses for each statement, which ranged from (0) to (2 marks). The last section of the test was designed to assess the participants' awareness and use of AI ethics. It included ten statements and three responses for each statement, which ranged from (0) to (2 marks). The last section of the test was designed to assess the participants' awareness and use of AI ethics. It included ten statements and three responses for each statement, which ranged from (0) to (2 marks). Thus, the total score of the test was (80).

To establish test reliability, it was piloted on a sample of fifteen teachers. Alpha Cronbach was used, and the test reliability was (0.810). Content validity of the test is displayed in the following table. The test was reliable to assess AI awareness of primary school EFL teachers.

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Table (1)							
Results of Cronbach-Alpha							
Level	R						
Knowing & understanding	0.89.5						
Using & applying	0.853						
Evaluating & creating	0.737						
AI ethics	0.721						
Total	0.844						

#### 3.2.3. English language productive skills test:

## **Objective of the test**

The English language productive skills test was prepared to assess primary school EFL teachers' speaking and writing skills and, therefore, to determine the improvement that might happen as a result of conducting the suggested training program.

#### **Construction of the test**

The test included two sections: the first one deals with speaking assessment tasks. It consists of two tasks in the form of an oral interview with the examiners and an oral presentation. The second section offers a writing task that has three prompts for writing paragraphs, where the test takers should choose one to write about.

#### **Test instructions**

The instructions of the test are written in English. They are brief, simple to understand and free from any possible ambiguities. They contain information about the objective of the test, time allowed to complete the test tasks, and how to record the answers.

#### Scoring the test

Two sheets for assessing students' oral and written performance were prepared to provide a reliable rating scale for speaking and writing performance. The sheets were decided to include three levels of performance: Good (3 marks), Fair (2 marks), and poor (1 mark). Participants were assessed according to their fluency, accuracy, and content (ideation).The total score of each sheet was (30).

## Validity of the test

The test was submitted to the jury members to report its validity. There was a consensus that the test was comprehensive and covered the most important speaking and writing skills.

# **Reliability of the test**

The reliability of the test was determined by Cronbach Alpha formula. The reliability coefficient of the test was (0,775) and it was found to be significant at (0,01) level which is acceptable.

# **3.2.4.** The suggested training program Aim

The overall aim of the suggested training program is to develop in-service EFL teachers' AI teaching competencies, awareness of using AI in language instruction, and their English language productive skills as well.

# Procedures of designing the training program based on PBL

Constructing the training program went through several procedures. The first step was considering the principles and theoretical foundations of the training program that included the significance of using AI teaching competencies, and the EFL teaching competencies with regard to TPACK model as well as the four dimensions of AI awareness; the benefits of using PBL in E-learning environment as an instructional method to train teachers on AI competencies; the demands of teaching English in primary stage and the need to integrate modern technologies and ICT in providing an interesting and exciting learning environment; the Egyptian vision 2030 which focused on the continuous professional development of teachers.

The second step was designing the modules of the training program in the light of AI teaching competencies in EFL classrooms, and the AI awareness dimensions. In this stage, several sources were selected to address the training content including research links, educational videos, presentations, and files. The next step was preparing the teaching procedures based on PBL and stating the training program objectives:

- Identifying the concepts of AI and its significance to language instruction.
- Exploring common AI applications used in teaching EFL.
- Planning for using AI in teaching and content creation.

- Designing instructional activities and tasks using AI applications to teach various language skills.
- Identifying AI assessment tools.
- Using AI in classroom organization and behavior monitoring.
- Promoting participants' engagement through AI-driven interactive content.
- Creating enhanced learning environment based on AI applications.

#### The content of the suggested training program

The training program was based on AI teaching competences. It is composed of six modules: building knowledge (AI concepts and importance), planning for using AI, various AI applications, instruction through AI, AI for assessment, and AI tools for classroom management. All modules were taught according to PBL. In each module, teachers experienced a group of activities to design a project. The projects varied according to the objectives and training content of each module. Examples of projects were preparing a lesson plan, designing teaching activities, and implementing an AI application to teach productive language skills. Different tools such as achievement tests, portfolio, and AI teaching competences observation sheet were used to evaluate the participants' progress.

## Piloting the suggested program

The program in its initial form was judged by a panel of jury members of technology and TEFL to ensure its validity to the purpose of the study and its appropriateness to the level of the study group. Additionally, two modules of the program were instructed to elicit the difficulties of the program and the problems that may appear during the experiment.

# The experimental Treatment Pre-testing:

According to the research design, the instruments of the study were applied prior to the implementation of the experiment; two weeks before. Both researchers participated in the assessment of the study group using the observation sheet of AI teaching competencies. Three tasks of teaching using AI were distributed to the participants. Then, participants' performance and progress were evaluated by the researchers using the observation sheet. The observation period lasted for one week. In addition, the AI awareness test and the written part of the English language productive skills test were distributed to the participants of the study in the training lab.

Moreover, the researchers participated in assessing EFL teachers' speaking skills. They recorded and reviewed the oral responses of the participants and assessed their performance according to the suggested rubric. The assessment lasted for two days, twenty minutes for every participant. The teachers' performance was recorded and evaluated twice.

# Implementing the suggested training program

The training program lasted for six weeks; one module a week. Each module needed four hours (two training sessions). Teaching procedures were as follows:

# Stage 1: Introduction to AI in Language Learning and Assessment

- Lecture and Demonstration: overview of AI and its role in language education, focusing on various AI applications in language learning.
- Hands-on Exploration: Participants explore AI tools like Grammarly for writing and ELSA Speak for speech analysis.
- Discussion: Address ethical considerations such as data privacy, algorithmic bias, and over-reliance on AI feedback.

# **Stage 2: Designing AI-Enhanced PBL Activities**

- Workshop: Design a project where AI tools are used for developing or evaluating students' written essays or spoken presentations. Outline project objectives, assessment criteria, and AI integration strategies.
- Group Work: Collaboratively create a project plan that includes AI-powered tasks. For example, groups could design a "Speech Contest" project where students record presentations and receive feedback from both peers and AI tools.
- Case Study Analysis: Review successful examples of AI integration in language projects. Discuss how AI- enhances language learning.

## **Stage 3: Implementation and Feedback on AI-Integrated Projects**

- Project Implementation: Participants implement their AIenhanced projects, either by piloting with actual students or simulating classroom scenarios with peers.
- Data Analysis Workshop: Learn to interpret AI feedback reports from tools like Grammarly (grammar, structure, vocabulary) and ELSA Speak (pronunciation, fluency). Participants identify strengths and areas for improvement in students' work.
- Peer Review and Feedback Session: Exchange project results and AI-generated feedback with peers. Provide constructive feedback on the implementation and AI tool effectiveness.

## **Stage 4: Reflection, Evaluation, and Next Steps**

- Reflection Journals: Participants reflect on their experiences with AI tools during the project and document their insights.
- Discussion Panel: Discuss the future of AI in education, potential challenges, and how to incorporate them.
- Capstone Project Presentation: Each participant presents his/her project, including an overview of the AI tools used, project outcomes, and recommendations for future implementation.
- Feedback Session: Collect feedback from participants on the module's effectiveness and areas for improvement.

# Stage 5: Assessment & Evaluation

- Formative Assessment: Ongoing observation of participants' engagement during workshops, group discussions, and project implementation.
- Summative Assessment: Submission of a project report detailing the design, implementation, and evaluation of the AI-integrated PBL project. Also, a reflective essay on the impact of AI on language assessment and ethical considerations.
- Peer and Self-Evaluation: Participants provide feedback on peers' projects and reflect on their own learning journey.

## **Stage 6: Resources and Tools**

- AI Tools: Grammarly, ELSA Speak, Pigai, Google Docs Voice Typing.
- Reading Materials: Articles on AI in education, ethical use of AI, PBL frameworks.
- Online Platforms: Learning management systems (e.g., Moodle, Google Classroom) for project collaboration.

**Post-testing:** The assessment instruments were re-administrated after implementing the training program on the study group. Data obtained were analyzed and compared to the pre-testing scores. Statistical means were used to get results and discuss findings.

# 4. Results

## **Findings and Discussions**

t-test was used to compare the pre- and post- performance of the study group to find out the degree of development in their competencies of using AI in EFL classroom, AI awareness, and English language productive skills. The results were as follows:

## Testing the 1<sup>st</sup> hypothesis

Hypothesis one predicted a statistically significant difference between the means of the study group scores on the pre-post observation sheet of AI teaching competencies favoring the post application. Table (2) shows the results of pre-post assessment of the participants' AI teaching competencies.

Results of the pre-post observation sheet of AI teaching competencies								
Variable	Exp.	Mean	Std	df	t.	Sig.	Blake	
AI Technology knowledge	Pre	7.84	1.518		18.51	0.05	1.06	
(TK)	post	16.44	1.757					
AI Technology &	Pre	11.44	1.386	24	30.02	0.05	1.35	
pedagogy knowledge (TPK)	Post	22.56	1.227					
AI Technology, pedagogy	Pre	10.72	1.458	24				
& content knowledge (TPACK)	Post	26.24	2.367		27.90	0.05	1.32	
Total	Pre	30.00	2.886		36.20	0.05	1.25	
	Post	65.24	3.918					

Table (2)

Table (2) showed the results of a t-test comparing pre- and postobservation sheet scores of AI teaching competencies: AI Technology Knowledge (TK), AI Technology, Pedagogy & Knowledge (TPK), and AI Technology, Pedagogy, and Content Knowledge (TPACK). The total scores for AI competencies showed a substantial increase from the pre-test to the post-test, with a large t-value (36.20) and effect size (1.25). This indicated a significant overall improvement in participants' AI teaching competencies as a result of attending the training program which aimed at developing the participants' AI teaching competencies and enhancing AI-related knowledge and skills.

#### Testing the 2<sup>nd</sup> Hypothesis

Hypothesis two predicted a statistically significant difference between the mean scores of the study group in the pre and post testing of AI awareness in favor of the post administration. Table (3) shows ttest results of pre-post testing of the participants' AI awareness.

Variables	Exp.	Mean	Std.	df	t.	Sig.	Blake
Using of AI	Pre	10.00	1.73205	24	18.28	0.05	1.24
	post	18.28	1.45831				
Evaluating AI	Pre	9.44	1.66032		17.02	0.05	1.15
	Post	17.36	1.62993				
Knowledge about AI	Pre	5.440	1.85023		15.86	0.05	1.03
	Post	14.08	1.99833				
AI Ethics	Pre	7.600	1.44338		17.74	0.05	1.22
	Post	16.96	2.20756				
Total	Pre	32.48	4.68259	25.1		0.05	1 15
	post	66.68	4.93052		23.14	0.05	1.15

 Table (3)

 Results of t-test of the pre-post testing of AL awareness

The above table shows the results of t-test comparing pre- and post-test scores of AI awareness dimensions: Using of AI, Evaluating AI, Knowledge about AI, and AI Ethics. The t-test results show significant improvements across all dimensions of AI awareness. The high t-values, large effect sizes, and consistent significance level (0.05) across the variables indicated that the intervention had a strong impact on enhancing participants' overall awareness of AI.

# Testing the 3<sup>rd</sup> Hypothesis

Hypothesis three predicted a statistically significant difference between the mean scores of the study group in the pre and post testing of the English language productive skills test in favor of the post administration. Table (4) shows t-test results of the study group in the pre-post testing of English language productive skills.

Kesuis of the i- Test of the pre-post English language productive skills testing							
Variable	Exp.	Mean	Std.	df	t.	Sig.	Blake
Writing	Pre	8.44	1.60935	24	28.22	0.05	1.40
	Post	25.96	2.65330				
Speaking	Pre	13.64	1.15036		29.92	0.05	1.16
	Post	25.88	1.69115				
Total	Pre	22.08	2.05994		37.73	0.05	1.28
	Post	51.84	3.36254				

 Table (4)

 Results of the t- Test of the pre-post English language productive skills testing

The above table shows the results of a t-test comparing pre- and post-test scores for productive language skills (writing and speaking) of the participants. The pre- post-test scores indicated a significant improvement in the participants' English language productive skills. The total score of productive skills showed significant improvement from the pre-test to the post-test. t-value (37.73) reflected a substantial overall improvement in the participants' productive language skills as a result of attending the training program.

## **5.** Discussions

The present study investigated the effectiveness of training primary school teachers on using AI teaching competencies in an EFL context. Findings of the study were encouraging as they showed that there was a statistically significant difference between the mean scores of the study group in the pre-post observation sheet of AI teaching competencies in favor of the post administration. This indicates that the study group's AI competencies included in the program have been developed. Moreover, teachers' awareness of AI was improved, as there were statistically significant differences between the mean scores of the study group in the pre-post test of the whole AI awareness and its dimensions in favor of the post administration.

The results obtained in the pre-testing indicated the participants' low performance in AI competencies, awareness, and English language productive skills. Analyzing the participants' responses in the pre-test revealed that they have limited knowledge of AI tools and concepts such as AI applications, algorithms, or machine learning. Their ability to explain how AI works or how it can be integrated into educational practices was inadequate. The participants appeared hesitant or unsure when using AI-based tools for tasks such as content creation, data analysis, or language learning activities. Some participants struggled to navigate AI-driven platforms or use AI-supported resources effectively. There was little evidence of participants incorporating AI into lesson plans, classroom activities, or assessments. Most teaching strategies were relying on traditional approaches rather than AI-enhanced methods. **The participants** demonstrated a poor understanding of ethical issues related to AI such as data privacy, algorithmic bias, or the implications of AI on job automation.

The participants' scores in pre-testing of **AI awareness showed a poor understanding of** basic AI concepts, terminology, or how AI works. Their understanding of AI might be mostly theoretical with limited practical insights. Few participants reported the use of AI tools in educational or personal contexts, with little awareness of AI's practical applications in teaching and learning context. Moreover, they show limited understanding of ethical considerations associated with AI such as data privacy, the potential for misuse, or the need for transparency in AI applications. **Their** ability to critically evaluate the effectiveness or limitations of AI tools were minimal. They struggled to assess whether a given AI tool is appropriate for a specific educational context or not. In relation to the pre-testing of language productive skills (writing and speaking), the participants showed frequent grammatical errors, limited variety in ideation, and lack of coherence. They were struggling to organize ideas and using appropriate academic language. In pretesting of speaking, participants revealed hesitation and lack of fluency. They faced real difficulty in expressing ideas clearly or responding spontaneously to prompts.

In contrast, the participants in post testing of AI teaching competencies demonstrated a better understanding of AI concepts, terminology, and applications. They showed familiarity with various AI tools used in education, such as chatbots, intelligent tutoring systems, and adaptive learning platforms. **They** exhibited greater confidence and competence in utilizing AI tools for teaching tasks, such as generating lesson content, assessing student performance, or facilitating interactive learning experiences. They were able to explain the functions of different AI tools and apply them effectively. They were able to integrate AI tools in lesson planning and delivery, use AI to enhance personalized learning, automate grading, and provide adaptive feedback. Their lesson plans reflected a thoughtful use of AI-driven resources. Additionally, they showed an increased awareness of ethical considerations, such as the importance of data privacy, understanding the risks of AI bias, and addressing ethical dilemmas when using AI in educational contexts.

The participants' post-testing of writing showed fewer grammatical errors, improved vocabulary, and better organization. There was a noticeable improvement in coherence and the use of appropriate academic language. Participants' responses to the assigned writing tasks demonstrated a more sophisticated expression of ideas. Furthermore, the post-testing of speaking skills revealed increased fluency, more accurate pronunciation, and greater confidence. Participants exhibited the ability to express ideas clearly, respond to questions promptly, and use a wider range of vocabulary. They also displayed improved interactive skills, such as engaging in discussions or debates more effectively.

The significant development of the participants' AI teaching competencies, AI awareness, and productive skills can be attributed to the following factors. The integration of PBL as a teaching method. It is an instructional strategy that emphasizes active, hands-on learning by engaging students in language related projects. PBL allowed the participants to explore and apply AI concepts through meaningful projects. This instructional strategy promoted active learning and encouraged participants to engage with AI tools and applications in practical tasks. The hands-on experience provided, helped them to practice real language teaching tasks and to evaluate their efforts. The program involved group work activities, which enhanced collaborative skills and provided opportunities to practice English in authentic communicative situations, thus improving the productive language skills.

The training program focused on training primary school EFL teachers on both AI teaching competencies (knowledge of AI technology, pedagogy, and ethics) and teaching productive skills (speaking and writing) provided a well-rounded educational experience. By integrating AI awareness with language skill development, the training addressed multiple aspects of teacher professional development, making the learning experience more comprehensive and effective. The dual focus ensured that participants developed not only technical AI skills but also language proficiency, which is crucial for their educational roles as EFL teachers.

#### 6. Conclusion

Based on the findings of the present study, it could be concluded that training teachers on AI teaching competencies was effective in equipping teachers with the skills to understand, navigate, and integrate AI tools into their EFL teaching practices. In other words, the participants showed a strong tendency to incorporate AI into lesson planning and classroom activities. It is concluded also that the program successfully broadened participants' knowledge and understanding of AI role in education. The integration of AI tools in language tasks led to real progress in teachers' productive skills, as this integration provided immediate feedback, facilitated practice, and supported skill development. It could be also concluded that the use of PBL as an instructional strategy allowed participants to engage deeply with AI tools in meaningful projects, fostering practical understanding and application. The PBL tasks encouraged collaboration, creativity, and the use of English in authentic communicative situations, thus enhancing both AI competencies and language productive skills.

The dual focus on AI teaching competencies and language productive skills provided a holistic training experience, addressing multiple aspects of teacher professional development. This approach ensured that participants not only acquired technical AI skills but also enhanced their language proficiency, which is essential for their future roles as EFL teachers. The program's comprehensive nature made it effective in preparing teachers to meet the demands of modern language education, where technological integration and language skills are both critical.

The results of the present study were in accordance with the results of studies of Liu et al., 2019; Kimsesiz, etal. 2017; Carrabba & Farmer, 2018; Astawa et al., 2017; Wahyudin, 2017) which revealed the positive effectiveness of PBL in developing language skills. Furthermore, the present study revealed the positive effect on enhancing teachers' AI competencies, this result agreed with the studies of Vazhayil et al., 2019; Xu, Zawacki-Richter et al. 2019; 2020; Ng et al., 2022; Markauskaite et al., 2022; Jiang,2022 and Álvarez-Herrero (2024) which focused on developing AI pedagogical awareness and use of EFL teachers.

In conclusion, the study demonstrated that a well-structured training program that integrates AI teaching competencies with PBL can significantly enhance teachers' AI awareness and English language productive skills. The combination of these instructional strategies contributed to the overall effectiveness of the program, making it a valuable approach for teacher professional development in the context of AI-enhanced EFL education.

#### Recommendations

Based on the findings of the study, teacher education programs should incorporate modules on AI teaching competencies, including AI tools, applications, ethical considerations, and pedagogical integration strategies. This would ensure that pre-service and in-service teachers will be well-prepared to use AI effectively in language instruction. In addition, PBL is recommended to be used as a central instructional approach in teaching EFL since it encourages hands-on and experiential learning. Projects that integrate AI can be designed to cover various language skills such as reading, writing, speaking, and listening. Thus, promoting a more comprehensive development of teachers' language skills.

Based on the results of the present study, policy makers are requested to offer continuous professional development opportunities to keep teachers updated on the latest advancements in AI technologies and their applications in education. Regular workshops, webinars, and refresher courses on using AI tools in teaching can help in maintaining and improving teachers' competencies.

In fact, there is a growing need to design more training programs that place greater emphasis on the ethical use of AI in education, including data privacy, algorithmic bias, and transparency. Meanwhile, teachers should be equipped with the skills to critically evaluate AI tools and to make informed decisions about their use in the classroom. Moreover, using AI-driven tools for providing real-time feedback on writing and speaking tasks should be expanded. These tools can help students monitor their progress, making timely improvements, and supporting continuous skill development.

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