



Exploring In-Service Teachers' Lived Experiences in a Professional Development Program: An AI-TPACK Framework Approach

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Abstract

This study explored the experiences of 65 in-service teachers in a Professional Development Program (PDP) based on the AI-TPACK framework, focusing on integrating ChatGPT into classrooms. Using a mixed-method approach, researchers employed a quasi-experimental design with pre-test and post-test assessments to measure instructional design competencies and acceptance of ChatGPT. A focus group of 12 participants further examined their experiences. Results indicated significant improvements in instructional design competencies, particularly among computer science and language teachers, and acceptance of ChatGPT technology. The study highlights the effectiveness of the AI-TPACK PDP in developing teachers' integration skills and supports AI in teacher preparation programs.

Keywords: Artificial Intelligence, ChatGPT, PDP, AI-TPACK framework, TAM model

1. Introduction

ChatGPT represents a novel interface designed to bridge the gap between humans and computers. As an open Generative Artificial Intelligence (GAI), it effortlessly generates responses to users' inquiries and commands, fostering a natural mode of interaction. Powered by advanced deep learning and machine learning algorithms, ChatGPT skillfully crafts new data within human-like dialogues, enhancing the user experience with its intelligence and flexibility (Javaid, Haleem, & Singh, 2023). Quickly, ChatGPT demonstrated its ability, with some limits, to produce human-like answers and develop the answers depending on users' interaction (Terwiesch, 2023). In education, first research projects and research papers advocates that ChatGPT could be used to enhance knowledge acquisition and improve writing skills and tasks (Terwiesch, 2023; Chatterjee & Dethlefs, 2023). Although Artificial Intelligence AI and GPT are being used in different industrial applications (Ahuja, 2019; Veloso, et al 2021), studies exploring chatbots integration into classroom practice and teachers' professional development are still beginning (Hwang & Chang, 2021).

In classroom, ChatGPT can be used for various instructional purposes such as gathering content, writing assessment questions, and creating rubrics (Abramson, 2023). Other AI tools can be used to create more interactive and engaging materials such as videos, animations, or simulations, which can make the learning experience more effective and memorable. According to Mollick and Mollick (2023), AI and ChatGPT offer a practical solution for incorporating five effective teaching strategies that are valuable and challenging to apply in real-classroom settings due to time and resource limitations. These strategies involve offering numerous examples and explanations, addressing and correcting student misconceptions, employing regular low-stakes testing, evaluating student comprehension, and promoting distributed practice. As with any emergent technology, generative ChatGPT comes with both benefits and limitations when integrated in the classroom. Some of these are still being discovered through teachers' experimentation (Mollick & Mollick, 2023).

The literature review argues that effective teachers possess a distinguished combination of in-depth subject matter expertise and proficient problem-solving skills (Dibapile, 2012; Sammons, & Bakkum, 2013; Laine & Tirri, 2023). Therefore, teachers' professional development programs PDPs that address problem-solving skills become a crucial aspect of their professional growth. According to Saks, Ilves, and Noppel (2021), teachers commonly leverage problem-solving skills to seamlessly integrate theoretical knowledge with procedural know-how knowledge, thereby refining their instructional practice. Therefore, the integration of well-defined instructional design (ID) skills into teachers' PDPs holds promise for effectively enhancing these initiatives.

Although several studies tackled teachers' professional development for instructional design of new technologies, little concern was given to how teachers achieve this development (Altun, Yabaş, & Bal Nayman, 2021). In this context, an iterative process model can serve as a cognitive organizational framework for teachers' development and guide them when designing and developing instructional activities (Alsaleh, 2020).

Teachers' professional development incorporating ChatGPT integration to enhance instructional design skills stands as a pioneering method within educational training. With the integration of ChatGPT, educators unlock access to a multidimensional tool capable of generating instructional content tailored to the context, providing individualized feedback, and fostering interactive learning experiences (Mai, Da, & Hanh, 2024). This innovative approach empowers teachers to craft customized instructional materials that cater to diverse learning needs and preferences. Leveraging ChatGPT, teachers can refine their lesson planning, plan

engaging learning activities, and design assessments that effectively gauge student comprehension (Javaid, et al, 2023).

In this study, our aim is to explore the lived experiences of in-service teachers participating in a Professional Development Program (PDP) based on the AI-TPACK framework. We also intend to measure the effectiveness of this PDP in developing the instructional design competencies of in-service teachers for integrating ChatGPT into classroom settings. Furthermore, we seek to investigate the impact of this PDP on their acceptance of ChatGPT technology.

2. Literature Review

2.1 ChatGPT in classroom setting

The literature review reveals that ChatGPT use in teaching and learning has been generally well-received by educators, with 41.4% expressing positive attitudes towards its integration into their teaching practice (Mai, Da, & Hanh, 2024). ChatGPT has been found to be useful in various aspects of teaching and learning, including personalized tutoring and feedback, lesson planning, language learning and practice, research and information retrieval, creative writing and storytelling, and test and project preparation (Pradana, Elisa, & Syarifuddin, 2023; Mai, Da, & Hanh, 2024). Empirical studies have shown that ChatGPT can enhance traditional teaching methods, provide personalized learning experiences, and support idea generation and quality explanations (Mai, Da, & Hanh, 2024). However, there are also limitations to its use, such as the potential for off-topic responses, inaccuracies, and the lack of a deep understanding of specific domain knowledge (O'Connor, & ChatGPT, 2023). The literature review also highlights the importance of establishing clear guidelines and expectations for ChatGPT use in the classroom, as well as evaluating the accuracy and reliability of the information generated by the tool (Pradana, Elisa, & Syarifuddin, 2023). Furthermore, this literature emphasizes the need for educators to undergo training and regulation with ChatGPT features, capabilities, and limitations before introducing it in the classroom setting (Pradana, Elisa, & Syarifuddin, 2023). In terms of educational subjects, the literature review indicates that ChatGPT has been mainly used in English language education, with 21.57% of the included studies focusing on this area (Mai, Da, & Hanh, 2024). Other popular knowledge domains include health education and computer science, with 9.8% each (Mai, Da, & Hanh, 2024).

ChatGPT is capable of performing various educational tasks, such as answering exams and writing educational essays, with a probable error percentage (O'Connor, & ChatGPT, 2023). This capability has a significant impact on the teaching process and the acquisition of essential educational competencies. Moreover, students' ability to access this tool at home, puts additional pressure on the educational system to understand AI tools' capabilities and address their exponential potentials. In this notion, Mai, Da, and Hanh (2024) conducted a SWOT analysis of ChatGPT to document its strengths, weaknesses, opportunities, and threats in the context of educational practice. The analysis highlights the potential of ChatGPT to facilitate personalized learning, generate plausible and real-time feedback, and decrease teaching workload (Mai, Da, & Hanh, 2024). However, it also acknowledges the limitations of ChatGPT, such as its lack of deep understanding and difficulty in evaluating the quality of responses (Mai, Da, & Hanh, 2024). In light of this situation, teachers should consider redesigning their instructional activities while taking into account the capabilities of AI tools.

To make informed decisions on integrating AI tools into the curriculum, teachers need instructional design skills to locate, evaluate, and integrate different AI tools. Classroom activities and tasks should be redesigned based on AI tools availability and their capabilities. For instance, teachers might choose to adjust the complexity of an assignment based on the

availability of a specific AI tool in their students' hands (Salvagno, Taccone, & Gerli, 2023). This approach can ensure that the tasks assigned to students align with the capabilities of AI tools while still challenging and engaging.

In conclusion, the literature review suggests that ChatGPT use in teaching and learning has the potential to enhance instructional design, provide personalized learning experiences, and support language acquisition. However, it is crucial to address ethical considerations, establish clear boundaries, and ensure responsible usage of the tool to maximize its benefits and minimize potential drawbacks. Therefore, developing teachers instructional design skills is crucial to help them leverage ChatGPT capabilities in the classroom setting.

2.2 ChatGPT in PDP

ChatGPT can be a valuable aid for teachers and educators, assisting them in locating and organizing educational resources and data for research papers and other academic events. It also has the ability to guide teachers through the process of action research, providing them with essential resources. ChatGPT can also enhance teachers' daily routines by automating tasks such as customizing instruction, creating quizzes, and communicating with parents. This automation frees up teachers' time to dedicate themselves more to engage with students (Heaven, 2023). As a result, if teachers gain knowledge about ChatGPT potential and risk, and become capable of integrating it in designing and developing instructional activities that cultivate higher-order thinking skills, this AI technology holds vast promise for advancing the educational environment.

Integrating artificial intelligence technology and ChatGPT in PDP provide new methods for developing the PD activities. It's expected that this new digital context interrupts the participants' learning and persona and affects their feelings and professional identity (Saunders, 2012). Teachers' professional identity is a complex phenomenon that refers to teachers' optimistic attitudes and commitment to their profession (Sun, et al, 2022). Therefore, examining teachers' feelings and attitudes is helpful to reveal change in the professional identity (O'Connor, 2008; Kelchtermans, 2005). Furthermore, teachers' feelings and attitudes play vital role in their performance. These feelings can affect the memory and influence their decisions (Hargreaves, 2005). Their feelings can also affect their ability to learn and benefit from professional development (Reber, & Greifeneder, 2016). However, professional development research and literature usually adopt new models in professional development and examine their effectiveness with little concern on the participants' feelings, attitudes, and acceptance of this new technology (Evans, 2014).

Although recent studies have explored the educational potential of ChatGPT such as its ability to support personalized learning, automate assessments, and generate instructional content (Mai, Da, & Hanh, 2024), much of the literature remains conceptual or exploratory in nature, with limited focus on structured implementation through teacher training. While several reviews emphasize the promise of AI tools in classrooms (Javaid, et al, 2023; Mai, Da, & Hanh, 2024), few studies provide empirical evidence on how teachers practically develop the competencies required to integrate these tools, particularly within the scope of instructional design. Moreover, most existing professional development research in the AI domain tends to examine general outcomes, with insufficient attention to the processes, models, and frameworks (such as AI-TPACK) that guide teacher learning. A significant gap also persists in understanding how AI integration plays out across different subject areas, as most studies concentrate on language and computer science education, leaving other disciplines underrepresented. In addition, the affective dimensions of AI integration such as teacher attitudes, professional identity, and acceptance are rarely explored in depth, despite their critical role in shaping technology adoption. Therefore, there is a pressing need for studies that

not only assess the effectiveness of AI-integrated professional development programs but also investigate the nuanced, lived experiences of teachers across various disciplines, using a comprehensive mixed methods approach. This study responds directly to these gaps by applying the AI-TPACK framework in a PDP context and examining both the measurable outcomes and subjective experiences of in-service teachers.

2.3 Instructional design of new technologies

Although several studies tackled teachers' professional development for instructional design of new technologies, little concern was given to how teachers achieve this development (Altun, Yabaş, & Bal Nayman, 2021). The instructional design literature emphasizes the following characteristics of a successful professional development program (PDP). First, it is necessary to apply "an informed design process" to help the participants master instructional design skills (OECD, 2019). Second, the participants should practice classroom activities to address pedagogical content knowledge and students learning (Gerard, et al, 2011). Third, the participants should be active during the PDP. This can be achieved through implementing various activities: observing experts, being observed by colleagues, receiving feedback, etc. These activities should support teachers in integrating instructional design process to classroom activities and collect evidence of students' progress (OECD, 2009). Fourth, the participants should work collaboratively to master instructional design skills. Collaboration activities help the participants articulate and reflect on their practice and understand their colleague experiences (OECD, 2009; McDonald, 2024). Fifth, the PDP should provide the participants with required resources and facilities to achieve program objectives (Beausaert, Segers, & Gijsselaers, 2011). These organizational factors should be taken into account when designing, developing, and implementing the PDP. Finally, the PDP should integrate new technology to help the participants: interact with technology, figure out how this technology affects learning, and plan for technology use (Shambaugh, 2013; McCusker, n.d.).

Instructional design aims to utilize systematic design process to develop effective and efficient solutions for educational challenges. It can direct the process of planning, designing, developing and implementing the PDP. Despite the existence of various instructional design models and approaches, all of them incorporate the essential elements of the ADDIE model. This model consists of the following steps: analyze, design, develop, implement, and evaluate (Alsaleh, 2020).

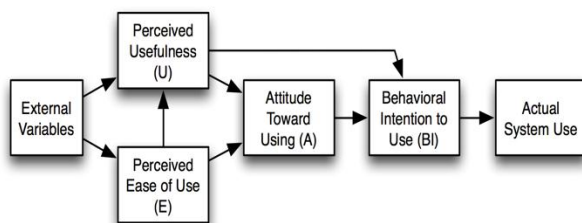
3. Theoretical Framework

There are few studies that specifically focus on how teachers' PDP, and particularly their knowledge of AI, influence their instructional behavior and attitudes towards integrating AI technology tools into their practice (Gersten et al, 2010; Nazaretsky, et al, 2022; Mavidou, & Kakana, 2019). To understand ChatGPT integration process, two frameworks will be implemented in this study, the TAM model, and AI-TPACK framework.

The Technology Acceptance Model (TAM) highlights two essential factors that impact teachers' intention to use a new technology like ChatGPT in the classroom. These factors are perceived ease of use and perceived usefulness (Davis, 1989). Previous studies have verified that if teachers believe that a new technology is useful and easy to use, then its integration in the classroom is more likely to happen (Granić, & Marangunić, 2019). By understanding and improving the perceived ease of use and the perceived usefulness of AI tools/ChatGPT, educators and researchers can better comprehend the factors influencing teachers' decisions and behaviors when it comes to integrating this technology in their teaching practices. Further research in this area is crucial to guide educational institutions in effectively implementing AI

technologies and to ensure teachers receive adequate support and training to fully leverage the potential benefits of these advancements in the classroom.

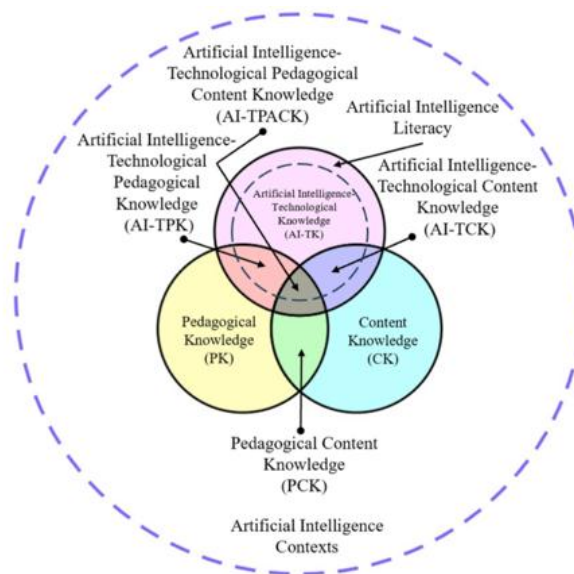
Figure 1: The Technology Acceptance Model (TAM) (Davis, 1989)



Ning et al (2024) developed and validated a framework for AI integration, called AI-TPACK, which integrates the Technological Pedagogical Content Knowledge TPACK related to Artificial Intelligence (AI) technology. This framework aimed to clarify how AI technology, teaching methods, and subject-specific content interact in education. This framework consisted of seven components: 1) Content Knowledge (CK), content knowledge refers to a deep understanding and familiarity with the subject matter or topics within a particular field or discipline. It encompasses the essential concepts, principles, facts, and skills relevant to that subject area. 2) Pedagogical Knowledge (PK), pedagogical knowledge refers to the understanding and know-how teachers possess about teaching and learning activities. It encompasses knowledge of instructional strategies, classroom management techniques, assessment methods, and theories of learning and development. Pedagogical knowledge enables teachers to effectively plan, implement, and evaluate instructional activities to support student learning. 3) AI-Technological Knowledge (AI-TK), this knowledge emphasizes the importance of teachers having a deep understanding and practical proficiency in utilizing artificial intelligence (AI) technologies in educational settings. This understanding encompasses being familiar with various visible and tangible AI tools, platforms, products, and educational resources. Moreover, it stresses the significance of educators adopting a pedagogical approach, meaning they should have a methodological strategy for integrating AI effectively into their teaching practices. 4) Pedagogical Content Knowledge, this knowledge refers to the specialized knowledge that teachers possess, which combines both their understanding of subject matter (content knowledge) and their knowledge of how to teach that content effectively (pedagogical knowledge). It encompasses various aspects such as understanding students' prior knowledge, selecting appropriate teaching strategies, designing engaging learning activities, and assessing student understanding. PCK is essential for effective teaching as it enables educators to tailor their instruction to meet the specific needs of their students and facilitate deeper learning. 5) AI-Technological Content Knowledge (AI-TCK), this knowledge refers to how teachers harness AI to deliver engaging and interactive learning experiences tailored to each student's unique knowledge, cognitive abilities, and preferred learning styles. By leveraging AI tools and techniques, educators can create dynamic and personalized learning environments that adapt to individual needs, ultimately enhancing the effectiveness of teaching and learning processes. 6) AI-Technological Pedagogical Knowledge (AI-TPK), this knowledge refers to teachers understanding of the reciprocal relationship, support, and limitations between AI technologies and pedagogy. It also involves the ability to develop teaching strategies and activities that capitalize on AI's potential effectively. In essence, educators need to grasp how AI influences education and adapt their instructional

approaches accordingly to maximize its benefits while addressing any challenges or limitations. This knowledge involves having a fluid comprehension of how integrating AI impacts teaching and learning methods. 7) AI-Technological Pedagogical Content Knowledge (AI-TPACK), the concept of AI-TPACK encompasses specialized knowledge related to incorporating AI technologies into subject-specific instruction. This knowledge includes the ability to express subject concepts effectively using AI tools, creatively apply pedagogical skills when teaching with these tools, utilize AI to overcome challenges students face in understanding concepts, and leverage AI applications to either create new ways of understanding knowledge or strengthen existing ones built on established principles. In essence, AI-TPACK involves a deep understanding of how to integrate AI effectively into subject-based teaching practices to enhance learning outcomes.

Figure 2: The Technology acceptance model (TAM)



Source: (Ning et al, 2024).

Based on the AI-TPACK Framework, this study implemented a PDP that provides in-service teachers with guidance on utilizing the ADDIE model phases and skills to tackle the educational challenges of effective integration of ChatGPT in classroom activities. The ultimate goal is to identify successful solutions for ChatGPT integration process. ChatGPT itself was utilized to design the PDP activities as seen in the following table 1.

Table 1: The professional development program activities

ChatGPT Suggested TPD	ChatGPT PDP Activities
Introduction to Chatbots and ChatGPT	• Explain what chatbots are and how they work. • Introduce ChatGPT and its capabilities, including text generation, language understanding, and context handling. • Discuss the potential benefits of integrating ChatGPT in the classroom.
Hands-On experience	• Provide teachers with access to ChatGPT in a controlled environment. • Let them experiment with the tool, ask questions, and observe how the chatbot responds. • Encourage them to identify potential use cases for their respective subjects and grade levels.
Identify use cases in teaching	• Brainstorm with teachers to identify specific use cases where ChatGPT can enhance learning experiences. • Examples might include language practice, generating creative stories, answering factual questions, and fostering critical thinking.
Design lessons with ChatGPT	• Collaboratively design sample lessons or activities that incorporate ChatGPT. • Emphasize the importance of clear instructions and context to obtain accurate responses from the chatbot. • Discuss how ChatGPT can be integrated into existing lesson plans to enhance learning outcomes
Promote student engagement	• Explore strategies to engage students actively in interactions with ChatGPT. • Discuss how ChatGPT can be used as a tool to spark discussions, encourage creativity, and problem-solving
Address ChatGPT challenges and limitations	• Discuss the limitations of ChatGPT, such as generating incorrect or biased responses. • Teach teachers how to verify information provided by ChatGPT and supplement it with reliable sources. • Encourage critical thinking and evaluation when using AI-generated content.
Understand responsible usage:	• Address the ethical considerations of using AI and chatbots in the educational setting. • Discuss the importance of responsible AI usage, data privacy, and avoiding biases in the training data. • Provide guidelines on using ChatGPT appropriately and avoiding harmful or inappropriate content.

4. The Present Study

4.1 Research problem

ChatGPT is potentially a powerful tool that could provide users with complex and immersive environment for learning. Educators have started thinking about incorporating

ChatGPT for use in educational settings. If integrated properly, ChatGPT could bring about benefits such as enhance knowledge acquisition, improve writing skills, and practice in problem solving (Chatterjee, & Dethlefs, 2023; Terwiesch, 2023). Zhai (2022) raises concern regarding the potential adverse effects of employing ChatGPT on students' learning experiences. Although the AI-driven bot can produce conversational responses based on user input, it lacks the capability to instruct students in critical thinking or the cultivation of their original ideas. The ability of some AI tools like ChatGPT to produce human-like answers, coupled with concerns that students might misuse them to solve exams and write essays without exerting the necessary mental and cognitive effort, has led several school districts to block access to these tools. However, a recent national survey conducted in the United States between June 23 and July 6, 2023, involving 1000 K-12 teachers and 916 parents, revealed interesting findings. According to the survey results, 63% of the participating teachers reported using the chatbot in their jobs, with 84% of the users stating that it had a positive impact on their classes teaching. From the parents' perspective, the same survey found that 64% of the participating parents believe that teachers and schools should allow ChatGPT use in educational settings. Among them, 28% of parents even expressed the vision that schools should actively encourage ChatGPT use (Toppo, 2023). Overall, these findings demonstrate a significant shift in attitudes towards ChatGPT, with a growing number of teachers and parents recognizing its potential benefits in the educational contexts.

Given the educational benefits and obstacles of ChatGPT integration and the major changes it brings to the classroom, improving teachers' instructional design skills is vital for improving the integration process. It is essential to employ instructional design professional development to train teachers efficiently to integrate this new technology in classroom setting. Evaluating teachers' abilities to apply instructional design skills is crucial for successfully incorporating this new technology into classroom activities. This assessment helps teachers enhance their practical skills in integrating this new technology.

A common approach in teachers' professional development is to conduct tasks that are similar to classroom activities. Applying this approach helps teachers design classroom activities, practice teaching with new technology like AI, and receive constructive feedback to reflect on this professional development journey (Loucks-Horsley, et al, 2010). Therefore, integrating AI/ChatGPT in teachers PDP provide educators with new methods to design, develop, and implement learning activities for the participants to interact with. While there is high potential for the effective integration of AI applications in the classroom, there are several external barriers that could hinder this integration. These barriers include insufficient equipment and internet connectivity, inadequate training related to AI technology, and a lack of technical and administrative/peer support. These external factors can pose significant challenges when implementing AI tools in the educational setting (UNESCO, 2019). Moreover, there are internal barriers to consider as well. These include teachers' attitudes and acceptance of AI technology and their confidence in their own AI knowledge and skills (Kathleen, et al, 2012). Thus, the present study seeks to explore the effectiveness of a Professional Development Program (PDP) rooted in the AI-TPACK framework. Its objective is twofold: first, to enhance the instructional design competencies of in-service teachers for integrating ChatGPT into classroom settings; and second, to investigate the impact of this PDP on their acceptance of ChatGPT technology. Additionally, the study aims to document the lived experiences of these in-service teachers throughout their participation in the PDP.

4.2 Research questions

This study sought to answer the following research questions: 1). To what extent do in-service teachers acquire instructional design competencies to integrate ChatGPT in classroom

setting when participating in a PDP that uses the AI-TPACK framework. 2). What is the impact of a PDP that uses the AI-TPACK framework on in-service teachers perceived ease of use of ChatGPT integration on classroom setting? 3). What is the impact of a PDP that uses the AI-TPACK framework on in-service teachers' intentions to use ChatGPT on classroom setting? 4). What is the impact of a PDP that uses the AI-TPACK framework on in-service teachers perceived usefulness of ChatGPT integration on classroom setting? 5). What are the main characteristics of in-service teachers lived experience when participating in a PDP that uses the AI-TPACK framework to integrate ChatGPT in classroom setting?

5. Methodology

This study utilized a mixed method approach to address the research objective. A quasi-experimental design was used to explore instructional design competencies related to integrating ChatGPT in classroom setting. This study adopts an *explanatory sequential design*, where quantitative data from pre- and post-test surveys measured changes in instructional design competencies and AI acceptance using the TAM model, followed by qualitative data from a focus group to contextualize and deepen these findings. The quantitative results demonstrated significant improvements across all TAM factors, with notable differences based on subject specialization. To complement these findings, qualitative insights from teachers revealed how subject relevance, technological familiarity, and resource availability influenced their experiences and outcomes. By triangulating statistical trends with participants' lived experiences, the study presents a comprehensive understanding of how the AI-TPACK-based PDP facilitated meaningful professional growth and technology integration.

5.1 Study context

The Professional Development Program (PDP) was structured to provide teachers with a comprehensive understanding of integrating ChatGPT into their teaching practices. The program spans a total of 24 training hours, divided into three sessions, each lasting approximately 8 hours. This time allocation ensures that each module receives sufficient attention while allowing for interactive activities, discussions, and practical applications. The time distribution for each module was as follows: Introduction to AI and ChatGPT (2 hours), Hands-On Experience (3 hours), Identifying Teaching Use Cases (3 hours), Designing Lessons with ChatGPT (4 hours), Promoting Student Engagement (2 hours), Addressing ChatGPT Challenges (2 hours), Understanding Responsible AI Usage (2 hours). This structured approach enables educators to grasp the concepts thoroughly and prepares them for successful implementation in their classrooms.

A three hours focus group was conducted with 12 participants at the end of this Professional Development Program (PDP) to explore and document their lived experiences. The focus group data analysis involves creating transcripts of the discussions, identifying themes, and summarizing the key insights derived from the participants' responses.

5.2 The Participants

The target population of this study consisted of in-service teachers. Table 2 presents demographic data of the participants.

Table 2: Demographic data, frequencies, and percentages of the participants

Gender	Specialty Area	Teaching Experience
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Male	32	Computer Science	10	1-5 Y	14
Female	33	Math	10	6-10 Y	16
		Languages	11	11-15 Y	17
		Geography & History	12	16-20 Y	11
		Science	10	<20 Y	7
		Religions	12		

5.3 The Instruments

The classical Technology Acceptance Model (TAM) is a widely used framework to understand and predict user acceptance of new technologies. This model was adapted and adopted to develop the research questionnaire. The key components of the TAM model in the context of artificial intelligence (AI) include (Ahmed Alnagrat, 2023; Alismaiel, Cifuentes-Faura, & Al-Rahmi, 2022; Kelly, Kaye, & Oviedo-Trespalcacios, 2023): 1) AI Perceived Usefulness (AI PU), this measures the degree to which teachers believe that using the AI technology will enhance their classroom performance or be useful to them (4 items). 2) AI Perceived Ease of Use (AI PEOU), this measures the degree to which teachers believe that using the AI technology will be free of effort (4 items). 3) Intention to Use AI, this refers to teachers' intention or willingness to use the AI technology in classroom setting (4 items). 4) AI Use, this is the actual usage or adoption of the AI technology by teachers (4 items). The questionnaire consisted of three sections: the first contained an introduction to present the study aim and subject, while the second covered the demographic data of the participants such (gender, specialty area, and teaching experience). The third section contained the 4 factors (derived from the TAM model) and 16 items. A five-point Likert scale was used to rate the participants' response level. This questionnaire was administrated with the participants before starting the PDP, and repeated three days after finishing the last session of the PDP.

A five-point rubric was developed and utilized by the researcher to evaluate the instructional design competencies of the participants in integrating ChatGPT in classroom setting. This rubric incorporated the following criteria: Content Knowledge, Learning Activities Design, Student Assessment Design, Ethical Use, Adaptability and Innovation, and Differentiation. The validity of the rubric was confirmed by distributing it to a panel of referees consisting of six experts with graduate-level degrees and extensive experience in instructional design. The reliability of the instrument was established by applying it to a pilot sample of 10 participants. The Cronbach's alpha coefficient was calculated to assess internal consistency for the five-point scale; it yielded a score of (.87), which is deemed acceptable for the purposes of this study (Taber, 2017).

5.4 Validity and reliability of the instruments

To assess the validity of the instruments, the questionnaire (TAM model scale in the context of AI) was presented to 6 experts with graduate degree level and vast experience in instructional design. The experts evaluated the scale accuracy, clarity, and appropriateness. A final version of the scale (consisted of 16 items) was developed based on the experts' feedback. Cronbach's Alpha was used to determine the internal consistency reliability of the scale. It scored .92, an accepted value for this study purposes (Taber, 2017).

To test for bias since the researcher was participating in conducting the workshop, an external evaluator from Hebron University with a doctoral degree in curriculum and instruction

was asked to use the rubric and evaluate a sample of 10 designed activities from different levels. The Pearson Correlation between the scores assigned by the external evaluator and the researcher was found to be .91; thus, the inter-rater reliability including the second rater was high.

6. Results

6.1 Data analysis results

The Shapiro-Wilk test was used to test for normality and produced a W statistic of 0.973 and a p-value of 0.187. which indicates that the data was normally distributed

The t-test was conducted to compare in-service teachers scores on the TAM model scale before and after participating in the PDP. The results revealed that there is significant difference at the 0.05 level on the participants scores.

Table 3: T-test results of participants scores on the TAM model scale before and after participating in the PDP

TAM Model Factors	Treat.	N	Mean	Std. Dev.	t	Sig.
AI Perceived Usefulness	Before	65	2.9826	.78185	-7.765	.000
	After	65	4.1163	.55460		
AI Perceived Ease of Use	Before	65	2.9186	.80312	-8.904	.000
	After	65	4.2442	.55498		
Intention to Use AI	Before	65	3.0233	.85184	-7.577	.000
	After	65	4.1919	.54510		
AI Use	Before	65	3.0581	.70887	-7.176	.000
	After	65	4.0465	.55970		

The arithmetic mean score of AI perceived usefulness among the participants before joining the PDP was 2.982. This means the participants had medium level of AI perceived usefulness. This score increased to a high medium level of 4.116 score after participating in the PDP. The arithmetic mean score of AI perceived ease of use among the participants before joining the PDP was 2.918. This means the participants had medium level of AI perceived ease of use. This score increased to 4.244, which means the participants had high level score of AI perceived ease of use after participating in the PDP. The arithmetic mean score of intention to use AI among the participants before joining the PDP was 3.023. This means the participants had medium level of intention to use AI. This score increased to 4.191, which means the participants had a high medium level score of intention to use AI after participating in the PDP. The arithmetic mean score of AI use among the participants before joining the PDP was 3.058. This means the participants had medium level of AI use. This score increased to 4.046, which means the participants had a high medium level score of AI use after participating in the PDP.

One Way Analysis of Variance was also conducted to assess whether a significant difference in in-service teachers' competencies of integrating ChatGPT in a classroom setting exist based on specialty area after participating in the AI literacy PDP.

One-Way ANOVA test results by specialty variable after participating in the PDP.

Table 4: One-Way ANOVA test results by specialty variable after participating in the PDP

	Sum of Squares	Df	Mean Square	F	Sig
Between Groups	3.491	5	.698	10.082	.000
Within Groups	2.562	59	.069		
Total	6.053	64			

Table 5: Arithmetic mean of teachers' competencies of integrating ChatGPT in a classroom setting by specialty area after participating in the PDP.

Specialty Area	N	Mean	Std. Deviation
Computer Science	10	4.4048	.21207
Math	10	4.0000	.26352
Languages	11	4.2917	.21362
Geography & History	12	3.5278	.37143
Science	10	3.8889	.29187
Religions	12	3.8095	.22420
Total	65	4.0078	.37963

Table 4 shows that a significant difference exists in the teachers' competencies of integrating ChatGPT in a classroom setting among the participants based on specialty area, LSD test was applied to figure out the direction of these differences.

Table 6: LSD test results

	Computer Science	Math	Languages	Geography & History	Science	Religion
Math	*	-				
Languages	-	*	-			
Geography & History	*	*	*	-		
Science	*	-	*	*	-	
Religions	*	-	*	-	-	-
Computer Science	-	*	-	*	*	*

Table 6 shows that the participants with computer science and languages specialty area had the highest teachers' competencies of integrating ChatGPT in a classroom setting with a high score of 4.404 and 4.291 respectively. Otherwise, the participant teachers in Geography & History specialty had the lowest competencies of integrating ChatGPT in a classroom setting with a score of 3.527.

An independent sample t-test was also conducted to assess whether a significant difference in competencies of integrating ChatGPT in a classroom setting exist based on gender after participating in the PDP.

Table 7: Independent Sample t-test results by gender variable after participating in the PDP

Group	N	Mean	Std. Deviation	t-test
Male	32	4.016	.4520	.142
Female	33	4.000	.3138	

$P > .05$.

Table 7 shows that no significant difference exists between male and female in-service teachers on their competencies of integrating ChatGPT in a classroom setting after participating in the AI literacy PDP. Both female and male teachers had high levels of competencies.

5.2 The Focus group results.

The focus group was conducted with twelve participants from different specialty areas to provide further insights into the main findings of this study. Below is a summary of the responses and the questions posed.

Question 1: Do you think it was easy for you to develop the learning activities that integrate ChatGPT in your educational subject? Why or why not?

The majority (70%) of the participants in the focus group believed that teachers can easily develop learning activities integrating ChatGPT into the classroom setting. However, teachers in computer science and languages found it easier to design these activities compared to those in other specialty areas. A language teacher explained, "I can create activities to engage my students in conversations, pose questions, and receive feedback on their English language skills, allowing them to immerse themselves in a linguistic environment beyond the classroom." A computer science teacher added, "My students can articulate coding problems or errors they encounter, and ChatGPT can assist them in debugging their code by offering suggestions, tips, and solutions. This interactive problem-solving approach can enhance my students' critical thinking and debugging skills."

On the other hand, science and math teachers highlighted ChatGPT's limitations in visually representing math and science concepts. For them, many math and science concepts are best conveyed through visual representations, such as diagrams, graphs, and charts. While ChatGPT can describe these visual elements in text, it may not be as effective as interactive visual aids or multimedia resources.

Questions 2: What are the benefits that you gained from this learning experience? Explain.

The majority of participants in the focus group (80%) expressed having had an exciting experience. Most of them successfully designed the required learning activities. A history teacher shared, "In this professional development program, I discovered how to utilize ChatGPT to assist my students in conducting historical research, analyzing primary sources, and exploring various perspectives on historical events." Similarly, a geography teacher remarked, "I can employ ChatGPT to facilitate discussions among my students on geography concepts, map interpretation, and global issues. This tool is invaluable in providing my students with a deeper understanding of social and cultural contexts."

Question 3: Do you think it is easy for your students to use for learning ChatGPT? Why or why not?

The majority (80%) of teachers believed that ChatGPT could be a helpful tool for their students to learn from. Some of them explained that the ease of use for students largely depends on their familiarity with technology and their ability to navigate and interact with ChatGPT effectively. For students who are comfortable with using digital tools and platforms, learning to utilize ChatGPT may come more naturally. It has a user-friendly interface and intuitive design. However, other teachers raised concern that some students may initially find it challenging to engage with ChatGPT for learning purposes. This could be due to factors such as lack of experience with similar AI-driven tools, unfamiliarity with the interface, or difficulty in formulating queries that yield meaningful responses. Additionally, from teachers' perspectives the effectiveness of ChatGPT for learning depends on the quality of the learning activities. If students receive clear instructions and guidance on how to use ChatGPT for specific learning tasks, it can enhance their understanding and ease of use. Overall, while ChatGPT has the potential to be a valuable learning tool for students, its ease of use may vary depending on individual students' technological proficiency and the support provided by teachers.

Question 4: What are the obstacles that you faced in applying the model phases?

A majority of the participants (60%) require additional time to design and develop the necessary activities. They believe that school computer labs are not adequately equipped for the integration of AI tools, as the machines are not sufficiently fast. One teacher noted, "I find it easy to use ChatGPT for designing lesson plans and developing exam items for my students. However, integrating ChatGPT activities into the classroom setting was challenging and time-

consuming." This suggests that while teachers recognize the potential benefits of using ChatGPT, they also encounter obstacles in effectively adapting it within their teaching practices.

7. Discussion

This study investigated the effect of a PDP in improving in-service teachers' ability to integrate ChatGPT in classroom setting. The empirical findings showed that the mean score of AI perceived usefulness changed from 2.982 to 4.116 ($t = -7.765$, $p < 0.05$), AI perceived ease of use changed from 2.918 to 4.244 ($t = -8.904$, $p < 0.05$), intention to use AI changed from 3.0233 to 4.191 ($t = -7.577$, $p < 0.05$), and AI use changed from 3.058 to 4.046 ($t = -7.176$, $p < 0.05$) after participating in the PDP program. Therefore, the PDP was effective strategy in developing AI technology acceptance based on the TAM framework factors. This result converges with previous research findings that calls for improving AI training among teachers (Fernández, Reyes, & Montenegro, 2019; Holstein, McLaren, & Alevén, 2018).

The findings also revealed that in-service teachers exhibit favorable attitudes towards the use of AI technology and express a willingness to utilize it, prior to engaging in the PDP with mean scores of 3.0233 for intention to use AI technology and 3.058 for actual AI usage. Prior studies have demonstrated that teachers generally hold positive views towards educational technologies, including those incorporating AI (Yeter, 2023; Pokrivcakova, 2023). Nevertheless, teachers' perceptions of AI are subject to various influences, underscoring the importance of ongoing dialogue and research to address their apprehensions and ensure the successful integration of AI in educational settings. However, teachers' attitudes toward AI are influenced by various factors, and ongoing discussions and research are important to address their concerns and ensure the effective integration of AI in education.

The empirical finding of this research showed that the factor "AI perceived ease of use" received the highest mean score among the participants after joining the PDP the mean score changed from ($m = 2.9186$) to ($m = 4.2442$) after finishing the PDP. The ease of use of AI tools is a significant factor in determining whether teachers will accept and integrate AI in the classroom (Zhang et al, 2023, Moura, & Carvalho, 2024). The literature emphasizes that positive experiences with AI in the classroom, coupled with adequate training and support, are fundamental for teachers to effectively integrate AI into their teaching practices and enhance the quality of education (Zhang et al, 2023; Moura, & Carvalho, 2024; Lin et al, 2022). As teachers gain more experience and understanding of AI technology, their perceptions and attitudes towards it may evolve (Zhang, et al, 2023; Moura, & Carvalho, 2024). However, teachers may express concerns about the transparency of AI decision-making, potential changes to their roles (Moura, & Carvalho, 2024; Lin, et al, 2022).

This study found a significant difference among the participants in their instructional design competencies to integrate ChatGPT in classroom setting based on specialty area in favor of computer science and languages.

Literature review highlighted that computer science teachers suggested various ChatGPT-based tasks that can deepen students' understanding of computer science concepts, enhance their computer science thinking skills, and increase the level of abstraction in discussions (Hazzan, 2023). This result was also supported by the focus group results as a computer science teacher mentioned that computer science students "can articulate coding problems or errors they encounter, and ChatGPT can assist them in debugging their code by offering suggestions, tips, and solutions. This interactive problem-solving approach can enhance my students'

critical thinking and debugging skills.” The literature also emphasized ChatGPT opportunities for Language Education. ChatGPT can improve accessibility to education for languages learners by providing language support and translation services, helping them understand and engage with classroom content more effectively. The multilingual capabilities of ChatGPT can be leveraged to support students learning various languages, providing personalized learning experiences and language assistance (Javaid, et al, 2023). This result was also supported by the focus group as a language teacher explained he can utilize ChatGPT to “create activities to engage students in conversations, pose questions, and receive feedback on their English language skills, allowing them to immerse themselves in a linguistic environment beyond the classroom.” The participants in the other specialty areas.

This study also found that teachers in religions and geography and history specialty area had lower instructional design competencies to integrate ChatGPT in classroom setting, it seems that these groups of teachers may require additional training to effectively incorporate ChatGPT into their teaching practices. Specialized training based on specialty area on the use of ChatGPT and other AI tools can enhance their successful integration. However, a teacher in the focus group highlighted opportunities to integrate ChatGPT in history and geography lessons through conducting historical research, analyzing primary sources, and exploring various perspectives on historical events. Teachers can utilize ChatGPT to facilitate discussions among students on geography concepts, map interpretation, and global issues.

This study found that no significant difference exists between male and female in-service teachers on their instructional design competencies to integrate Chat GPT in a classroom setting after participating in the PDP. Literature on AI integration has thus far provided conflicting results about the impact of gender. For example, female teachers may be more apprehensive about utilizing AI-based applications in their teaching and learning processes than male teachers (Zhang, et al, 2023).

After finishing the PDP, the participants got high mean scores on their instructional design competencies of integrating ChatGPT in classroom setting. Their mean scores $m = 4.0078$ with significant differences based on specialty area of the participants. Most of the educational literature supports the idea that technology training is an important component to help teachers gain positive attitudes towards technology and achieve effective instructional design skills to integrate new technologies (Maddux, 2005). The training should move beyond exposure to basic computational thinking skills into deeper, meaningful, and exemplar activities that show teachers how to integrate the AI technologies into the curriculum and the classroom as given in this PDP. This approach is supported by literature that emphasizes the importance of providing educators with practical and comprehensive training on AI integration in education. For instance, a study by Zhang et al. (2023) highlights the need for educators to be equipped with the skills to effectively integrate AI tools like ChatGPT into their teaching practices, moving beyond basic exposure to more meaningful and practical applications. Furthermore, the literature emphasizes the significance of providing educators with opportunities to engage in hands-on activities that demonstrate the integration of AI technologies into the curriculum and classroom. This approach is seen as crucial for enhancing teacher confidence and competence in using AI tools, as well as for fostering a deeper understanding of how AI can be effectively integrated into educational settings (Chandy, 2023).

In addition, a comprehensive framework for ChatGPT integration in teaching and learning, as proposed by researcher, emphasizes the importance of providing educators with a structured approach to integrating AI technologies into their practices. This framework aims to enhance

student engagement, foster critical thinking skills, and promote personalized learning experiences mediated by AI (Reyna, 2023).

7.1 Implications and recommendations

The findings of this study offer several important implications for educators, school leaders, and policymakers seeking to integrate AI tools such as ChatGPT into real classroom practice. First, the significant improvements in teachers' instructional design competencies suggest that structured, hands-on professional development using the AI-TPACK framework is an effective strategy for equipping educators with the skills to meaningfully adopt AI in diverse educational contexts. This means that school systems can implement similar PDPs to not only build AI literacy but also ensure teachers are confident in using AI tools to create, evaluate, and adapt classroom materials across subjects.

Second, the real-world classroom applications emerging from both the quantitative data and focus group findings demonstrate that ChatGPT can be integrated in subject-specific, authentic learning scenarios. For instance, language teachers can use ChatGPT to facilitate conversation practice and generate writing prompts, while computer science educators can deploy it to assist students in debugging code or understanding logic structures, both of which were identified by participants as high-value use cases. Teachers in humanities subjects also highlighted the value of ChatGPT in supporting historical research and fostering critical discussion on global issues—applications that extend beyond mere content delivery into higher-order thinking and inquiry-based learning.

Third, the study revealed that while many teachers found ChatGPT easy to use, infrastructure limitations such as outdated computer labs and inconsistent internet access remain significant barriers. Therefore, policymakers must address these foundational needs to ensure equitable implementation. Additionally, teacher support systems including peer collaboration, mentoring, and administrative encouragement are crucial to sustaining AI integration, especially for teachers in disciplines where AI applications are less intuitive (e.g., history, religion).

Lastly, this study underscores the need for professional development programs to go beyond technical training. They must incorporate ethical discussions, practical modeling, and iterative design practices, preparing teachers not only to use AI but to critically evaluate its role in teaching and learning. These findings offer a roadmap for schools aiming to move from AI experimentation to scalable, sustainable classroom integration ensuring AI becomes a pedagogical asset rather than a technological novelty.

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Informed consent of participation

Informed consent of participation was obtained from each participant.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used [ChatGPT] in order to [Develop AI literacy literature review]. After using this tool/service, the author(s) reviewed and edited the

content as needed and take(s) full responsibility for the content of the publication.

Declaration of interest

The author has no conflicts of interest to declare. I certify that the submission is original work and is not under review at any other publication.

Data Availability

All data generated or analyzed during this study available upon request.

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