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Comparing Pre-service English Language Teachers' AITPACK Perceptions in Online and Face-to-face Learning Contexts: Insights from the Technology Acceptance with Peer Support Theory

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Abstract

Recent trends in pre-service English teacher education increasingly emphasize the integration of AI technology. Few studies have examined pre-service teachers' real-world experiences with AI in language instruction, despite exploring their perceptions and attitudes. Studies on AI-TPACK perceptions primarily utilize technology acceptance frameworks like TAM, TPB and UTAUT. The existing literature regarding pre-service teachers' perceptions of AI-TPACK and the Model of Technology Acceptance with Peer Support (MAPS) is relatively sparse. Furthermore, the existing body of research comparing online and face-to-face instruction in AI-TPACK education for pre-service teachers is limited. To address these gaps, this study examines the impact of the MAPS on pre-service English language teachers' AI-TPACK perceptions in both online and face-to-face learning environments, focusing on their use of AI within K-12 practicum settings. This study involved 35 online and 50 face-to-face participants using a mixed-methods design. Quantitative data were collected via a questionnaire adapted from An, et al. (2023), and qualitative data were gathered through open-ended survey responses, focus group interviews, and classroom observations. An independent samples t-test found no significant differences between groups in Behavioral Intention, Network Density, and Valued Network Centrality. Significant disparities were found in System Use, Facilitating Conditions, Network Density and Centrality. Qualitative findings emphasize that peer support and practical experiences in practicum schools significantly influence pre-service teachers' attitudes toward integrating AI in instruction. Both groups stressed the need for compulsory AI-TPACK education with peer support in teacher programs. The implications for teacher education are examined, and recommendations for future research are presented.

Keywords: pre-service teacher education; English language teaching; AITPACK; Model of Technology Acceptance with Peer Support; behavioral intention; AI

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1. Introduction

AI, as an emerging technology, has commenced its integration into language learning processes (Zhang & Umeanowai, 2024). The significance of AI in the transformation of English as a Second Language (ESL) and English as a Foreign Language (EFL) education is becoming progressively evident and impactful (Choukaier, 2024). In the context of English language teaching instruction, the integration of AI presents novel opportunities for teachers to enhance both the efficiency and quality of their teaching practices (Zhang et al, 2023). AI systems utilized in language learning predominantly encompass natural language processing, adaptive learning frameworks, speech recognition technologies, intelligent agents such as chatbots, machine translation applications, and writing assistance tools (Crompton et al, 2024; Edmett et al, 2024; Liu et al, 2023). Research indicates that AI-tools are effective in facilitating language acquisition and enhancing students' motivation and confidence levels (Sharadgah & Sa'di, 2022; Klimova et al., 2023).

The growing significance of AI within K–12 education necessitates that teachers develop the competencies essential for effectively instructing young learners about AI (Lane, 2023; UNESCO, 2023; Wang, 2023). Teachers are mandated to engage in ongoing enhancement of their AI literacy, as well as to perpetually acquire knowledge and adapt to the advantages afforded to teaching and learning in the era of advanced intelligence (Wang & Nie, 2023). Nevertheless, comprehensive analyses of educational platforms employed within the K-12 context (Wang & Lester, 2023) indicate that the utilization of AI-tools in classroom settings is infrequent and lacks consistency (Chounta, 2022; Edmett et al, 2024). A study conducted by Diliberti (2024) involving 1,020 K–12 public school teachers across the United States indicates that the utilization of AI-tools remains relatively rare among teachers. The classification of teachers is categorized into three distinct groups: those who utilize artificial intelligence, those who experiment with artificial intelligence, and those who do not engage with artificial intelligence. Only 18 percent of teachers are reported to be utilizing AIi n their teaching practices. This 18 percent encompasses 11 percent of teachers who utilized AI-tools and products in their professional practice, having received these resources through provision or recommendation from other parties, presumably including school system leaders or fellow teachers. The remaining teachers indicated that they were proactively engaging in the exploration and acquisition of new AI-tools and products independently. We classified an additional 15 percent of teachers as individuals who have engaged with AI technologies. These teachers have engaged with AI-tools or products in their professional practice at least once; however, they do not plan to incorporate them into their teaching on a regular basis. In the meantime, a significant majority of teachers, accounting for 66 percent, do not utilize artificial intelligence. The 66 percent figure encompasses 9 percent of individuals who have no prior exposure to AI-tools and products, 44 percent who are aware of such tools and products but have not utilized them, and 13 percent who exclusively employ AI tools and products in contexts unrelated to their teaching responsibilities. Furthermore, the utilization of AI among teachers demonstrated variability contingent upon both the grade level and the specific subject areas they instructed. For instance, 27 percent of teachers primarily assigned to English language arts (ELA) or social studies reported the utilization of AI tools or products in their professional practice. This percentage is notably higher in comparison to their

counterparts in other primary teaching assignments, such as general elementary education, which stood at 11 percent, and in the fields of science, technology, engineering, and mathematics (STEM), where the proportion was 19 percent. Research has demonstrated that teachers may insufficiently possess the requisite knowledge and skills necessary to effectively impart AI knowledge (Diliberti et al., 2024; Yue et al., 2024). A deficiency in teachers possessing training in AIhas been identified. Collaborating with pre-service teachers (Karina & Kastuhandani, 2024) and in-service teachers within school settings (Chiu et al, 2021; Sabaruddin et al, 2024) has been suggested as a viable and effective intervention to address this issue (Casal-Otero et al, 2023). There exists a deficiency of qualified teachers capable of developing and executing curricula related to AI (Wang & Lester, 2023; Kim & Kwon, 2023). This phenomenon can be attributed to the nascent status of AI within K–12 education (Yue et al, 2022), coupled with the observation that the majority of teachers did not receive formal training in AI during their undergraduate studies (Su et al., 2023). Teachers frequently face challenges in the integration of AI curricula within educational settings, primarily due to the lack of formal training in AI education (Chiu & Chai, 2020; Diliberti et al., 2024; Kim & Kwon, 2023). As a result, numerous teachers experience difficulties in comprehending complex and abstract concepts associated with AI (Crompton & Burke, 2022; Ottenbreit-Leftwich, 2023).

The emergence of AI as a contemporary subject matter presents a unique challenge not only for K-12 students but also for teachers. This necessitates the development of new skill sets that facilitate critical engagement with AI technologies. AI literacy aims to bridge the divide between academic research and the practical application of AI-related competencies (Velander et al., 2023). The integration of AI-enhanced environments presents substantial challenges for numerous teachers (Choukaier, 2024). While certain teachers swiftly adopt new technologies, perceiving them as instruments to enhance their pedagogical practices, others encounter difficulties in navigating the technical complexities associated with AI-tools (Pokrivcakova, 2023). The effectiveness of AI-tools may be constrained in the absence of sufficient teacher training and pedagogical integration, highlighting the necessity for a balanced approach to the integration of technology in educational settings (Crompton et al., 2024). Consequently, the incorporation of AI in educational settings necessitates a significant emphasis on the role of the educator to ensure its successful implementation (Zulkarnain & Yunus, 2023). Teachers play a pivotal role in the integration of AI literacy within K-12 education, as evidenced by a multitude of studies that have explored this subject (Casal-Otero et al et al., 2023; Lane, 2023; Liu et al., 2023; Wang & Lester, 2023; Wang & Nie, 2023).

Teachers' attitudes toward the instruction of AI represent critical determinants in their acceptance of pedagogical practices associated with emerging subjects. The interest and attitudes of teachers toward a specific subject significantly impact the effectiveness of their instructional practices related to that subject (Yue et al., 2024). The efficacy and integration of technology within educational settings are significantly shaped by the attitudes and beliefs of teachers (Johnson et al., 2016). Therefore, it is imperative to examine the effects of integrating AI technology within the teaching and learning processes from the perspectives of teachers. As key stakeholders in the implementation of curricula in educational institutions, teachers play a fundamental role in this context (Zulkarnain & Yunus, 2023). Teachers' perceptions of AI significantly influence their pedagogical

approaches, subsequently impacting students' learning outcomes. Yau et al. (2023) highlighted the significant influence of teachers' beliefs on the formulation of their instructional decisions and the implementation of classroom practices. When teachers perceive a subject, such as artificial intelligence, as possessing significant value, they are inclined to develop more comprehensive and engaging learning experiences. These experiences are conducive to fostering higher-order thinking and problem-solving skills, which are critical components of AI literacy. Research has demonstrated that a teacher's passion for a subject can significantly enhance their effectiveness in delivering instruction on that subject (Kunter et al., 2008). Interest serves as a vital motivator for teachers to stay abreast of the most recent developments in AI education, thereby ensuring the currency and applicability of their knowledge (Yue et al., 2024). Such passion frequently results in more dynamic and engaging interactions within the classroom, thereby enhancing student interest and facilitating more effective learning processes (Kunter et al., 2008). In addition to cultivating positive attitudes, it is imperative for teachers to possess pertinent content knowledge and technological competencies to effectively teach technology-related subjects (Mishra & Koehler, 2006). Research indicates that teachers exhibit a negative disposition toward technology-enhanced teaching when they possess insufficient disciplinary knowledge and lack effective pedagogical strategies (Yau et al., 2023). Consequently, it is posited that TPACK and teachers' attitudes may mutually reinforce one another (Yue et al., 2024). Hence, an exploration of teachers' attitudes, beliefs, and preconceptions appears to be a critical factor in facilitating engagement with AI-related TPACK (Velander et al., 2023). Training programs aimed at enhancing teachers' technological knowledge have been recognized as essential for their professional development (Wei, 2021), particularly through the application of the TPACK framework (Casal-Otero et al et al., 2023).

Research has underscored the significance of teachers' attitudes regarding the integration of technology in the cultivation of TPACK (Ayanwale et al., 2023; Koehler et al, 2013). Teachers who demonstrate a favorable disposition towards technology are more inclined to assign higher evaluations to their perceptions of the dimensions of TPACK (Mishra & Koehler, 2006; Yue et al., 2024). Nevertheless, there has been a paucity of research conducted regarding attitudes toward the instruction of technology-related subjects. While a significant correlation exists between TPACK and attitudes toward teaching technology subjects, there is a dearth of empirical research that has systematically investigated this relationship. Furthermore, there is a notable scarcity of studies examining the relationship between TPACK and attitudes towards AI in the context of teaching, wherein AI functions as both the technological tool and the subject matter. Ongoing research in this domain has the potential to yield significant insights that could improve teacher education programs, inform individual professional development, and ultimately enhance the overall quality of education (Sabaruddin et al., 2024). The TPACK framework serves as a theoretical construct for the integration of technology within educational environments. Mishra and Koehler (2006) formulated the TPACK framework to offer a comprehensive understanding of the multifaceted dimensions of teachers' knowledge and the interconnections among these dimensions (Yue et al., 2023). The TPACK framework is a widely recognized model for elucidating the interactions among teachers' Technological, Pedagogical, and Content Knowledge. It examines how

these distinct, yet interconnected domains collectively enhance teachers' capacity to integrate technology effectively into their instructional practices (Koehler et al., 2013). The TPACK framework is extensively utilized to characterize teachers' competencies in the integration of technology into pedagogical practices (Kohler et al., 2013). Additionally, it serves as a framework for assessing teachers' proficiency in the effective use of digital technologies for educational purposes (Chai et al, 2023). Based on the analysis conducted, the framework serves as a foundation for the design of professional development activities aimed at enhancing teachers' TPACK (Kim et al., 2021). Teachers who instruct on AI may benefit from the application of the TPACK framework. This framework serves as a valuable resource for teachers aiming to enhance their understanding of the effective integration of AI education within classroom instruction (Su et al., 2023; Karina & Kastuhandani, 2024). The AITPACK framework was integrated with various theoretical models, including the Theory of Planned Behaviour (Ayanwale et al., 2022; Chai, 2022; Sanusi et al., 2024), the Technology Acceptance Model (Choi et al., 2022; Hsu, 2017; Yang, 2021; Zhang, 2023), and the Unified Theory of Acceptance and Use of Technology (UTAUT) (An et al., 2023; Chatterjee & Bhattacharjee, 2020; Lim & Harwati, 2021). This integration aims to conceptualize teachers' perceptions, knowledge, and behavioral intentions regarding the utilization of AI to enhance teaching and learning processes. However, to date, there appears to be a lack of empirical studies in the existing literature that combine AITPACK with the Model of Technology Acceptance with Peer Support (MAPS) theory, as identified by the researcher (Sykes et al., 2009).

Learning constitutes a modification in behavior, with such changes being influenced by various determinants, including teachers, the learning environment, peer interactions, and the characteristics of the course content (Ebadi & Amini, 2022). The MAPS framework highlights the importance of social networks in relation to individual performance, proposing that colleagues function as vital resources for overcoming knowledge barriers that hinder the effective utilization of complex systems (Sykes et al., 2009). This model proposes the existence of two distinct categories of social ties. The primary interaction among employees involves the procurement of assistance from colleagues, which subsequently facilitates an augmentation of knowledge related to the effective utilization of the system. Another form of interconnection among employees involves the provision of assistance and support to colleagues, which enhances the overall understanding of the system's configuration and deployment processes. These connections are classified as "get-help" ties and "give-help" ties. In the context of the concepts of 'seeking assistance' and 'providing assistance,' the authors propose two innovative constructs: 'network density' and 'network centrality,' which correspond to each respective concept. These constructs are further elucidated as ‘valued network density’ and 'valued network centrality' through the integration of the extent of resources, information, and knowledge available within the system (Sykes et al., 2009). It is crucial to underscore that a prominent attribute common to these models is their emphasis on technology adoption from an individual standpoint. The incorporation of AI into educational paradigms requires that prospective teachers develop new competencies in collaboration and management in order to keep pace with technological advancements (Edmett et al., 2024). To develop the essential competencies in pre-service teacher education programs, it is essential to establish learning communities, implement peer-coaching initiatives (Kohnke et al., 2023), promote

collaboration among teachers, and utilize innovative pedagogical strategies (Kaul, 2024). The attainment of proficiency in a novel system requires the dissemination of knowledge among users with disparate levels of expertise. Informal interpersonal networks play a crucial role in the knowledge transfer process within organizations, as demonstrated by the research conducted by Reagans and McEvily (2003). An essential approach by which individuals assimilate new concepts involves the integration of these concepts with their pre-existing knowledge frameworks. Individuals frequently face considerable difficulties in assimilating new concepts that lie beyond their particular domain of expertise. Knowledge transfer is more effectively facilitated among individuals who possess similar levels of training, backgrounds, and professional characteristics. This suggests that employees within an organizational unit are more inclined to engage in knowledge sharing effectively, which consequently impacts their adoption and utilization of new systems (Sharma & Mishra, 2014). Research suggests that early career teachers who engage in constructive school-based induction practices—characterized by supportive colleagues, collaborative team teaching, and comprehensive orientation programs—exhibit improved competencies in managing and adapting to the challenges associated with online teaching (König, 2020; Moorhouse, 2024). Considering the necessity for AI teacher education to foster collaborative practices, it is crucial to investigate the potential contributions of "The Model of Technology Adoption with Peer Support" as proposed by Sykes et al. (2009). This model, which integrates analogous components while assigning varying degrees of significance to individual roles within social network frameworks, merits examination concerning its impact on the acquisition of pertinent skills.

AI education is increasingly being acknowledged as a fundamental component of the K–12 curriculum (Yue et al., 2022). Teachers within the K-12 educational framework are anticipated to incorporate technological advancements into their pedagogical practices in order to effectively instruct in an era characterized by artificial intelligence. Additionally, AI is experiencing rapid advancements and presents significant opportunities for the support of teachers (Su & Yang, 2022). The incorporation of AI within ESL and EFL educational contexts entails a multifaceted interaction among technological innovations, pedagogical approaches, and learner participation. The successful implementation of AI in language education necessitates a comprehensive understanding of both the potentialities of AI technologies and the pedagogical frameworks that underpin language acquisition (Choukaier, 2024). One of the significant challenges confronting AI education is the necessity for teachers to possess adequate content knowledge and competencies to instruct AI with confidence and effectiveness. This issue constitutes a pressing challenge, particularly in light of the current deficiencies in institutional opportunities for AI learning among teachers (Lane, 2023). The current landscape of teacher education in AI is notably insufficient (Sanusi et al., 2024; Yue et al., 2024), highlighting the necessity for the development of professional development programs aimed at equipping teachers with the skills to effectively facilitate discussions on this topic in classroom settings (Ayanwale et al., 2022). In order to gain a comprehensive understanding of teachers' preparedness for integrating AI into educational practices, it is essential to ascertain their readiness with respect to the AITPACK framework, as well as to evaluate their attitudes toward teaching. This assessment is crucial for the effective development of relevant teacher training programs (Chai et al., 2023; An et al., 2023). Despite the extensive body of research on AI

technology (Chiu & Chai, 2020), inquiries into teachers' perceptions regarding the application of AI are still in their nascent stages and remain relatively sparse (Yue et al, 2024). In prior research, there has been a notable absence of a comprehensive analysis regarding the manner in which teachers have implemented these pedagogical frameworks within their instructional practices (Yue et al, 2023). There is a paucity of research that elucidates the lived experiences of pre-service English teachers (Karina & Kastuhandani, 2024). To the best of the author's knowledge, there is currently no study that investigates the perceptions of pre-service English language teachers regarding AITPACK through the framework of the Model of Acceptance with Peer Support (MAPS). In response to the emerging trend of integrating AI into K-12 education, the present study examines the behavioral intentions of pre-service English language teachers to implement AI-Technology, Pedagogy, and Content Knowledge (TPACK) in language learning environments. Furthermore, it explores the influence of peer interactions on the AITPACK learning process, utilizing the Model of Acceptance with Peer Support (MAPS) as outlined by Sykes et al. (2009) as a theoretical framework. This exploratory mixed-methods research investigates pre-service English language teachers' perceptions of AITPACK in relation to the teaching and learning of English using AI tools. It considers both online and face-to-face peer interactions, as well as the teachers' practical experiences during their practicum placements at schools. The following research questions guided the study:

- Is there a difference in pre-service teachers' perceptions of AITPACK between online and face-to-face AI-tool based English language teacher education programs using Model of Technology Acceptance with Peer Support (MAPS) theory?
- Based on their lived experiences in practicum schools, what are pre-service teachers' AITPACK perceptions?

The utilization of AI as a pedagogical tool in the preparation of pre-service teachers can significantly enhance their comprehension of the ways in which contemporary technologies can inform and support their TPACK framework. Furthermore, the findings of this study hold the potential to inform the development of future AI-assisted pedagogical models within teacher education. Additionally, the proposed AI training initiative may be integrated into professional development programs for both pre-service teachers and practicing teachers. This may encourage researchers to pursue additional investigations into the application of MAPS theory within educational contexts, as its utilization in the realm of technology adoption remains infrequent. This framework possesses the capacity to produce significant insights that can guide necessary modifications within the educational landscape. By disseminating information pertaining to the challenges and deficiencies encountered in the implementation of this model, it is possible to effectively equip teachers, teachers, researchers, and other key decision-makers and stakeholders with the essential knowledge required to address these issues and investigate viable solutions.

2. Method

This mixed-method study employed the Model of Acceptance with Peer Support (MAPS) to investigate whether there exists a disparity in pre-service teachers' perceptions of the AITPACK framework when comparing online versus face-to-face AI tool-based English

language teacher education programs and drawing upon their lived experiences in practicum schools, what perceptions do pre-service teachers hold regarding the AITPACK framework. This inquiry is grounded in the MAPS theory. The MAPS framework encompasses seven fundamental components: behavioral intention, system usage, facilitating conditions, network density, network centrality, valued network centrality, and valued network density, as delineated by Sykes et al. (2009). The MAPS framework underscores the significance of social networks in enhancing individual performance, positing that colleagues serve as essential resources in mitigating knowledge barriers associated with the utilization of complex systems. Furthermore, interactions within these networks can significantly impact an employee's capacity to influence the configuration and functionalities of the system. This model posits the existence of two distinct categories of social ties. The primary interaction among employees entails soliciting assistance from colleagues, a practice that can significantly augment their understanding of the system. An additional form of inter-employee connectivity pertains to the provision of assistance and support to colleagues, thereby fostering a deeper comprehension of the system's configuration and deployment processes. These connections are classified into two categories: "get-help" ties and "give-help" ties. The authors present two novel constructs pertaining to the concepts of 'seeking assistance' and 'providing assistance': 'network density' and 'network centrality. ' These constructs are firmly rooted in established social network literature and are posited as significant predictors of system usage (Sharma & Mishra, 2014). These constructs are conceptualized as 'valued network density' and 'valued network centrality,' emphasizing the comprehensive range of resources, information, and knowledge accessible within the system (Sykes et al. 2009) These constructs may function as supplementary predictors (Sharma & Mishra, 2014). Additional constructs identified in the study encompass 'Behavioral Intention,' 'System Use,' and 'Facilitating Conditions' (Sykes et al., 2009).

2.1. Participants

This study was conducted utilizing a purposive sampling methodology during two separate 14-week periods in the spring semesters of the 2022-2023 and 2023-2024 academic years at a state university located in the western region of Turkey. In response to the earthquake disaster that occurred in Türkiye on February 6, 2023, universities transitioned to a distance education format for the spring semester of the 2022-2023 academic year. As a result, the sample for this study comprised 35 preservice English language teachers who engaged in the research through an online platform. In the spring semester of the 2023-2024 academic year, a cohort of fifty pre-service English language teachers engaged in an in-person study, thereby constituting the face-to-face group for this research. All participants were senior students pursuing a Bachelor's degree in English Language Teaching (ELT). The pre-service teachers fulfilled the prerequisites by successfully completing the requisite courses in Computer I and II. Moreover, the participants received instruction in four English Language Teaching (ELT) courses, all of which were delivered by the same instructor-researcher. Furthermore, participants in both groups participated in Practicum school sessions for a duration of six hours per week for

the entirety of the study. Participants were recruited through direct engagement strategies.

2.2. Ethical considerations

Ethical principles were consistently upheld throughout the duration of the study. Prior to participation in the study, detailed information about the research was systematically provided to all potential participants, and informed consent was appropriately obtained from each individual. Additionally, participants were explicitly made aware of their right to withdraw from the study at any point in time. Furthermore, pseudonyms were utilized in the data files to safeguard the confidentiality and privacy of the participants.

2.3. Data collection

An exploratory mixed-method research design, as delineated by Creswell and Clark (2017), was utilized the integration of quantitative and qualitative data. Quantiative data included a questionnaire divided into two sections. The initial section focused on general perspectives concerning AI and included inquiries pertaining to the participants' interests, experiences, and viewpoints related to AI. This survey, adapted from the research conducted by Yoon (2019) and Du and Gao (2022), consisted of five binary (yes-no) questions designed to elucidate the participants' interests and experiences. Furthermore, the survey comprised seven questions utilizing a 5-point Likert scale and ten questions employing a 9-point Likert scale to obtain insights into participants' perceptions of artificial intelligence. The reliability coefficients suggest that the survey exhibits a significant level of reliability and internal consistency, as indicated by a Cronbach's alpha coefficient of 0.846. The survey was administered at the onset of each spring semester for both online and face-to-face groups to ensure the comparability of the two groups. The second section included a 5-point Likert scale AITPACK survey, which was developed by An et al. (2023). The survey encompassed eight constructs: Behavioral Intention, Performance Expectancy, Effort Expectancy, AI Technological Knowledge, Facilitating Conditions, AITPACK, Technological Pedagogical Knowledge, and Social Influence (An et al., 2023). These constructs correspond to Behavioral Intention, Network Density, System Use, Facilitating Conditions, Valued Network Density, Network Centrality, and Valued Network Centrality within the context of the MAPS framework, respectively. In the reliability analysis of the scale, the internal consistency coefficients, specifically Cronbach's α values, were computed. It was determined that for both the overall scale and all individual constructs, these values should exceed the threshold of 0.7, as established by Fornell and Larcker (1981). The internal consistency, measured by Cronbach's Alpha, for each factor exhibited a range of 0.82 to 0.91.

Qualitative data were collected through the inclusion of open-ended questions at the end of the survey as interviews, focus group interviews, and in-class observations. Interviews were employed as a supplementary methodological approach to deepen the understanding of participants' engagement in the processes of seeking and providing assistance within the context of AITPACK learning in class and teaching in practicum schools. Open-ended questions asked participants to provide their perspectives on AITPACK in their roles as both students and teachers within practicum schools, and their perspectives on

collaborative work and their integration of AI into English language lessons in practicum schools to determine whether their attitudes toward AI changed throughout the duration of the research study. Two focus group interviews were conducted to further explore the responses to the open-ended survey questions. One group consisted of 16 participants, while the other included 20 participants. Each interview had a duration of 40 minutes and was conducted either through in-person sessions or through Zoom videoconferencing. Over the course of 14 weeks, the researcher/instructor conducted class observations within both groups. During these observations, field notes were taken regarding the questions posed and discussions initiated by the pre-service teachers during the presentations. Data triangulation was achieved through the integration of fieldnotes and interviews.

2.3.1. Data collection process

In the initial meeting, participants received an overview of the study. Informed consent forms were distributed and collected with participants' contact information. In the second week before treatment began, the General Perspective AI survey was given to both groups to ensure equivalence. The questionnaire was distributed via Google Forms and made available to participants through a WhatsApp group. Participants completed the online form within a week. The independent samples t-test results on survey responses showed no significant differences in mean scores between the online and face-to-face groups regarding participants' interests, experiences, and perspectives on artificial intelligence. The results of the independent samples t-test indicated that there were no statistically significant differences in the mean scores between the online and face-to-face groups concerning the participants' interests, experiences, and perspectives, as well as their perceptions of artificial intelligence with respect to perceived usefulness, enjoyment, technical complexity, and effort. The findings indicate that the two groups were statistically similar at the onset of the study. After the questionnaire, an earthquake forced the group participants to complete the study online. In the next meeting, six curated topics were presented to explore the impact of MAPS on pre-service English language teaching teachers' perceptions of AI in the ELT process. Topics were assigned to small groups based on participants' preferences for collaboration. Each small group investigated two topics integrating AI in reading, writing, listening, speaking, and assessment. The groups were to identify and present the most effective applications and programs on these topics to their peers. The presentations featured various multimedia formats, including short videos, online resources, audio recordings, and relevant reading materials. Participants were expected to collaborate during presentations based on MAPS theory principles. The presenting groups were required to upload relevant links to the class Pbwork pages. This stipulation would allow other participants to explore at their convenience, before or after the presentations. Participants were encouraged to engage actively by sharing insights and asking relevant questions during the presentations. Although a limited cohort introduced the subject, the whole class had the chance to engage in the discussion. After the presentations, presenters had the chance to revise their Pbwork pages. The revision process included adding links to newly recommended applications from peers and removing links to applications that received audience critique. The presentation sessions lasted ten weeks, each lasting 80 minutes. In the online cohort (n=35), presentations were held via Zoom during the spring semester of 2022-2023. In-person presentations for the face-to-face group (n=50) took place during the spring semester of the 2023-2024 academic

year. The recorded Zoom meetings were uploaded to the system for later access by online group participants. The researcher conducted instructional sessions for both groups. This study involved the researcher, as a teacher educator, in a collaborative learning process with the participants, adopting a peer-like role. At the end of the study, the AITPACK Questionnaire was administered via Google Forms. To achieve data triangulation, open-ended interviews and focus group interviews were conducted with both participant groups. The online focus group interview was conducted via Zoom and recorded for analysis. The face-to-face group session was held in person and recorded as an audio file. The interview data were transcribed and analyzed for triangulation with other datasets.

2.4. Data Analysis

This study utilized both descriptive analysis and thematic analysis methodologies. The descriptive analysis and independent sample *t*-tests were conducted using SPSS version 24 to analyze quantitative data obtained from questionnaires. Prior to the commencement of data analyses, a normality test was conducted. All measured variables exhibited acceptable skewness values and kurtosis values (Noar, 2003). Levene's test verified the equality of variances indicated the assumption of homogeneity of variances ($p>0.5$). In the present analysis Independent samples t-tests were computed. Simultaneously, the audio recordings of the focus group interviews were transcribed verbatim to accurately capture the participants' expressions and perspectives. Member checking was employed to verify the accuracy and credibility of the research findings. The data were subsequently processed and organized for analysis. The audio recordings of the focus group interviews were transcribed verbatim to accurately capture the participants' expressions and perspectives. Member checking was employed to verify the accuracy and credibility of the research findings. The data were subsequently processed and organized for analysis. Thematic analysis, based on Strauss and Corbin's (1990) methodology, was utilized to develop a coherent thematic structure using selective coding, exploring pre-service teachers' perceptions of AITPACK framed within the Model of Acceptance with Peer Support in both online and face-to-face contexts.

3. Results

An independent samples t-test was conducted to to examine whether there exists a difference in pre-service teachers' perceptions of AITPACK within online versus face-to-face AI-tool-based English language teacher education programs, informed by the Model of Technology Acceptance with Peer Support (MAPS) theory. The findings are presented in accordance with the components outlined in the MAPS (Sykes et al., 2009). The aforementioned components encompass Behavioral Intention, System Use, Facilitating Conditions, Network Density, Valued Network Density, Network Centrality, and Valued Network Centrality.

3.1. Behavioral Intention

Behavioral intention is defined as the subjective probability that an individual will engage in a specific behavior (Fishbein & Ajzen, 1975). The statements measured include willingness to learn about AI education from others and the internet, share AI teaching

resources, and intend to use AI in teaching in the future. The analysis reveals no statistically significant difference in Behavioral Intention between the online group (M = 4. 5357, SD = 0. 82593) and the face-to-face group (M = 4. 5561, SD = 0. 73164), as evidenced by the independent samples t-test results (t(334) = -0. 239, p = 0. 811).

The qualitative data indicates that, across both groups, several pre-service teachers exhibited a transition from negative to positive perspectives and from student to teacher role by the conclusion of the study. Initially, negative and pessimistic perceptions of AI have gradually transformed into more favorable viewpoints as individuals have acquired the skills necessary to effectively utilize, critically evaluate, and investigate AI technologies. The subsequent excerpts demonstrate a transition from a negative to a positive state.

> Recently, I see that teachers, especially, have negative and pessimistic opinions about AI programs. If it hadn't been for this course, maybe I would have been one of those teachers, but now I know how to use it, question it, and research it. Thanks. (online group)

Participants exhibited a transition from experiencing fear to cultivating more positive perspectives. Initially, there was considerable apprehension regarding the utilization of AI by students. Another quotation illustrates the participants' progression from fear to a state characterized by positivity and confidence.

> At the beginning of the course, I had no idea about these programs. As a teacher candidate, I was worried at first. Because it worried me that every student had access to everything so easily and remained dependent on the machine for creativity. However, it is a blessing that we can make great progress with the correct use, the countless opportunities it provides to teachers and the right student interaction. (B1)

Pre-service teachers exhibited a progression from initial uncertainty to the adoption of positive perspectives regarding the integration of AI into their coursework. Initially, these teachers expressed apprehension about the incorporation of AI technologies. However, through a thorough exploration of AI applications across diverse educational domains, their perceptions evolved towards a more favorable outlook.

> I didn't have any prejudices against AI, but I didn't know how to integrate it into my course schedule. Dividing it into reading, writing, speaking, listening and assessment and examining it in more detail helped me better understand the opportunities available in all these areas. Therefore, I can say that this course took me from a neutral emotional state to a positive emotional state. (Face-to-face-group)

Some individuals transitioned from a positive perspective to an even more favorable view regarding AI after encountering additional useful AI applications.

> I was introduced to much more useful and effective programs that I can use in my classes. This situation made me look at AI programs more positively. There was a change from positive to ultra positive. (online group)

Some participants reported experiencing a transition from a student role to that of an educator, primarily interpreting their experiences through the lens of a student's

perspective. Recognizing the potential of AI from the perspective of teachers for enhanced effectiveness.

> Although I generally tried to look at it from the student's perspective, at one point I looked at it from the teacher's perspective and realized that I could teach very good lessons with AI and achieve things I could never imagine. (Face-to-face-group)

Both the quantitative and qualitative findings indicate that the participants' attitudes toward AI in education showed a marked improvement throughout the duration of the study. Quantitative analysis revealed that there was no statistically significant difference in Behavioral Intention between the online and face-to-face groups. Qualitative data indicates that participants experienced significant shifts in their perspectives, transitioning from negative, fearful, or neutral states to more positive attitudes. They also acknowledged the utility of AI-tools in the pedagogical process, successfully surmounting initial biases and misconceptions. This finding suggests that exposure to and education regarding AI can substantially improve teachers' propensity and preparedness to incorporate AI into their pedagogical approaches. The qualitative data indicate a favorable change in behavioral intentions regarding the adoption of AI education applications. Throughout the course, participants exhibited a transformation from negative, fearful, or neutral states to more positive, heightened, or ultra-positive perspectives, with some also reporting transition from a student to a teacher role. This shift was significantly influenced by the support provided by peers and insights gained from practical applications.

3.2. System use

System Use encompasses the frequency, duration, and intensity of interactions with a specific system, as articulated by Venkatesh (2003). Regarding system use, both groups' mean scores were 4 or higher. A statistically significant difference was observed in Effort Expectancy between the online group (M = 3. 9643, SD = 0. 95519) and the face-to-face group (M = 4. 1735, SD = 0. 82928). This difference was confirmed through an independent samples t-test, which yielded (t(334) = -2.139, p = 0.033). The face-to-face cohort indicates a greater ease of utilization when employing AI teaching systems.

A statistically significant difference was observed between the online (M = 4. 3333, SD = 0. 90582) and face-to-face (M = 4. 5782, SD = 0. 60732) groups regarding the AI LTK scores, with an independent samples t-test yielding (t(169.090) = -2.410, p = 0.017). The group participating in face-to-face interactions demonstrates a more comprehensive understanding of AI learning technologies.

Table 1. Independent samples t-test results of system use

	Group	N	Mean	Std. Deviation	t	df	p
Effort Expectancy	online	140	3.9643	.95519	-2.139	334	.033
	face-to-face	196	**4.1735**	.82928			
AI LTK	online	105	4.3333	.90582	-2.410	169.090	.017
	face-to-face	147	**4.5782**	.60732			

The results indicate that the face-to-face group exhibits higher mean scores for both Effort Expectancy and AI LTK, suggesting that participants in this group perceive AI

teaching systems as more user-friendly and demonstrate a greater understanding of AI Technologies.

3.3. Facilitating conditions

Facilitating Conditions are defined as "the degree to which an individual perceives that an organizational and technical infrastructure is available to support the utilization of the system" (Venkatesh, 2003, p.453). A statistically significant difference was identified between the online group (M = 3. 5214, SD = 1. 17815) and the face-to-face group (M = 3. 8316, SD = 1. 05598) regarding Facilitating Conditions, as indicated by a t-test result (t(278. 846) = -2483, p = 0. 014). The face-to-face group exhibits a more favorable perception of the facilitating conditions. The face-to-face group exhibits higher mean scores for Facilitating Conditions, suggesting that they perceive a greater level of organizational and technical support for the implementation of AI in educational contexts. The notable disparity in facilitating conditions indicates that participants engaged in face-to-face group interactions may have a greater advantage in accessing and utilizing AI resources, when compared to those in online group settings.

Table 2. Independent samples t-test results of facilitating conditions

Facilitating conditions	Group	N	Mean	Std. Deviation	t	df	p
When I need to use AI in teaching, my school will provide help for me.	online	140	3.5214	1.17815			
There are convenient conditions for me to use AI in teaching.							
When I have difficulties in using AI in teaching, specific people will help me.	face-to-face	196	**3.8316**	1.05598	-2.483	278.846	.014
When using AI in teaching, I know where to get technical support.							

Both groups emphasized various challenges that affect the effective implementation of AI in educational contexts. Upon conducting a thorough analysis of the qualitative data, four predominant themes have emerged: challenges related to accessibility in various educational institutions, the influence of human factors, concerns pertaining to curriculum design, and the implementation of AI programs.

Accessibility challenges within various educational institutions consist of insufficient internet connectivity and inadequate technological equipment. Furthermore, these institutions face financial constraints that hinder their ability to keep up with rapid technological advancements, including the costs associated with AI programs, in addition to issues pertaining to overcrowded classrooms.

The disparities in teacher expertise, emerging classroom management strategies, and variations in student readiness levels significantly influence human factors in educational contexts. These factors include differences in English language proficiency, the abstract nature of artificial intelligence, a lack of experience with AI among teachers, and

challenges associated with maintaining student engagement. Additionally, there is a need to address age-specific requirements, particularly concerning younger learners.

Curriculum-related concerns underscored the significance of insufficient pedagogical alignment and the absence of professional development opportunities for the effective integration of AI in educational settings.

With regard to AI programs, participants reported issues related to developmental dysfunction and technical malfunctions. They noted the incompatibility of AI tools with interactive classroom boards, the elevated costs associated with these technologies, and the rapid advancements in AI tools that necessitate continuous adaptation on the part of teachers.

3.4. Network density

In the context of the concept of "get help," Sykes et al. (2009) introduces the term "network density. " Network density encompasses soliciting assistance from employees, which can enhance knowledge regarding system usage. It is characterized by the degree of interconnectedness within a network and is quantitatively defined as the ratio of the actual number of ties present in the network to the maximum potential number of ties that could exist (Sharma & Mishra, 2014). The analysis revealed no statistically significant difference in Performance Expectancy between the online group (M = 4. 6214, SD = 0. 78170) and the face-to-face group (M = 4. 6939, SD = 0. 49424), as indicated by the t-test results (t(217. 096) = -0967, p = 0. 335). Regarding Network Density, both groups' mean scores were 4.6 or higher. Both groups recognize AI as a beneficial tool for enhancing the quality and efficiency of educational practices. The absence of a statistically significant difference indicates that both online and face-to-face instructional formats are comparably effective in improving participants' perceptions regarding the usefulness and helpfulness of AI in educational contexts.

Qualitative data indicate that participants received assistance from two primary sources. The initial source of assistance, 'getting help', identified was the utilization of AI-tools. "AI helps me" (Face-to-face-group)

> At the beginning of the course, I did not think that AI programs had so much potential to be useful in language teaching. Thanks to this course, I learned many programs that I found as a result of my own research and offered by my friends, that will help me in both my education and work life. (online group)

Additional resources for obtaining assistance beyond AI were categorized into several groups, including peer group members, presenter groups, the broader class community, and other subject matter experts. Pre-service teachers identified their peers as valuable resources for assistance, drawing support from their group members, representatives from the presenter group, collaborative class discussions, and the class wiki page.

Participants described their group members and peer interactions for 'getting help' from each other while preparing for the topic they were about to present, as illustrated by these quotations:

"Everyone reveals their strongest sides"

"Working with friends who have different levels of knowledge allows us to complement each other's shortcomings."

"We can see the information our team member missed and we can motivate each other."

"Being able to support each other and help each other learn new things and different perspectives."
"I can ask my questions without hesitation"
"We learn in a more fun way and to provide a new perspective and it is easier to be understood by a group of friends than to be understood by a teacher"
"Students can exchange ideas and teach each other things that the other didn't know of without the presence of an authority figure. Therefore, it is less stressful and boring"

For group members, participants described 'getting help' as emphasizing mutual dependence and learning together, asking each other questions without hesitation, and the comforting feeling of having someone to rely on.

Participants receive assistance from the presenter groups, as evidenced by the following quotations:

> instead of reading all these AI programs from a list and watching and going through promotional videos, it was quite positive to have a presenter who also evaluated and explained the negative sides of using and trying the application, as I did (Face-to-face-group)

As the statement above shows, pre-service teachers were actively involved in the learning and teaching process during the other groups' presentations.

Participants also reported that they received assistance through the class community, which included whole-class discussions and a shared class wiki. The wiki served as a repository for the materials presented by all groups, facilitating access to resources for the entire class. They indicated that:

> This class was very supportive and it pushed me to create and question in a positive sense. I will be good enough to criticize it negatively but for now I am impressed by the whole process and progress. (online group)

"I know a lot of different tools thanks to our wiki page. This way I can use various types of new tools." (online group)

> This course provided very useful resources for both my student life and my teaching life, and helped me become a more productive student and teacher thanks to my access to unlimited information. (Face-to-face-group)

In addition to seeking assistance from AI tools, their peers, and class wiki page, participants reported that, in preparation for their presentation topics and to familiarize themselves with the AI tools they intended to present, they also received support from 'other experts' who share instructional videos regarding AI tools on social media platforms. For example, one participant indicated, "Firstly there are a lot of videos about Ai applications on YouTube. Before I use a program I look for useful videos." (Face-to-face-group)

The qualitative data analysis reveals that a strong support network density improves perceptions of the effectiveness of AI in educational contexts. Peer interactions, information presented by presentation groups, whole-class discussions, collaborative resources, and contributions from external experts collectively foster a supportive environment that enhances technology acceptance and facilitates effective utilization. The qualitative data indicates that network density, which is defined by the support and assistance acquired from peers and various other sources, is instrumental in augmenting

performance expectancy. The findings emphasize the significance of a supportive network and access to diverse resources in augmenting the perception of the utility of AI in educational contexts.

3.5. Valued network density

The interconnectedness of a focal employee with other individuals is influenced by the perceived strength of these relationships, alongside their access to various forms of system-related information, as delineated by Sykes et al. (2019). This encompasses critical information pertaining to system features, upcoming releases, and demonstration dates, as well as pertinent knowledge, including practical tips, shortcuts, and sequences of processes. According to Sharma and Mishra (2014), it also includes access to tangible resources such as training materials, manuals, and tutorials, all of which are essential for the effective utilization of the system. Regarding Valued Network Density, the questions assess teachers' ability to use AI-driven strategies and tools to enhance students' English language learning across vocabulary, grammar, cultural understanding, thematic teaching, personalized guidance, immersive experiences, tailored materials, and practice opportunities with instant feedback. Both groups' mean scores were 4 or higher. A statistically significant difference was observed between the online group (M = 4. 1371, SD = 0. 88512) and the face-to-face group (M = 4. 4082, SD = 0. 59714) regarding AI-TPACK, as indicated by the t-test results (t(569. 828) = -4976, p < 0. 001).

Table 3. Independent samples t-test results of valued network density

	Group	N	Mean	Std. Deviation	t	df	p
AI-integrated Technological Pedagogical Content Knowledge	online	350	4.1371	.88512	-4.976	569.828	.000
	face-to-face	490	**4.4082**	.59714			

The group engaged in face-to-face interactions exhibits a greater proficiency in the integration of AI into their pedagogical strategies.

Pre-service teachers from both groups reported utilizing AI programs for various applications, including the preparation of lesson plans and the development of instructional materials, which encompassed videos, music, and presentations. Additionally, these programs were employed for assessment, online instruction, language skill enhancement, and self-directed learning. In the context of practicum schools, pre-service teachers employed AI tools in disparate manners. Specifically, an online group predominantly utilized a teacher-centered approach; conversely, a face-to-face group implemented AI tools in a student-centered manner. This latter approach facilitated the involvement of students in collaborative activities, such as collectively composing songs through the use of AI technology. An exemplary quotation provided by the face-to-face group illustrates the utilization of AI within practicum schools, emphasizing a student-centered approach.

> "I use students' ideas and generate songs and poems"
>
> "I usually apply interactive activities with groups and individually by using AI"
>
> "I utilize interactive and visual learning tools, such as AI simulation platforms and data visualization software, to help students grasp complex concepts more easily"
>
> I usually use games in which students have to actively use the language, which means I use AI applications more for speaking. I do not like using classical exercises

such as fill-in-the-blanks or matching activities, as I consider them predominantly inefficient and dull. I want the students to understand why they are learning a language and to use it in an authentic environment and atmosphere.

The face-to-face group employed the resources in a manner that prioritized student engagement, whereas the online group predominantly utilized them in a teacher-centered approach.

"While teaching 'planets' I use presentation and video maker AI programs (Presentations, movie makers)"

"AI-Powered language games, storytelling, listening and comprehension activities"

Participants from both groups indicated that they utilized AI programs for a range of purposes, including the preparation of lesson plans, the development of instructional materials such as videos, music, and presentations, as well as for assessment, online instruction, enhancement of language skills, and self-directed learning. However, in practicum schools pre-service teachers used AI tools in different ways: while online group used commonly teacher-centered way, face-to-face group used AI-tools in a student-centered way, integrating students into the process such as creating songs as a whole class via AI-tools.

3.6. Network centrality

Network centrality, 'give help', refers to the degree to which an individual participates in assistance exchanges with colleagues (Mossholder et al., 2005; Sparrowe, 2001). An individual's centrality within a social or organizational network has been empirically associated with various outcomes, including their capacity to exert influence (Burkhardt & Brass, 1990), their engagement in innovation processes (Ibarra, 1993), and their attitudes towards the adoption of new technologies (Rice & Aydin, 1991).

In the survey, Network Centrality included questions that assess participants' knowledge of how to effectively use AI tools for planning, pacing, and personalizing instruction, as well as for identifying student needs and motivating learning. Regarding Network Centrality, both groups' mean scores were 4 or higher. A statistically significant difference was observed between the online group (M = 4. 2367, SD = 0. 84511) and the face-to-face group (M = 4. 4606, SD = 0. 60991) regarding their AI TPK scores, as indicated by the t-test results (t(586) = -3. 732, p < 0. 001). The face-to-face group exhibits greater proficiency in using AI-tools to enhance pedagogical practices and "give help" to students.

Table 4. Independent samples t-test results of network centrality

	Group	N	Mean	Std. Deviation	t	df	p
AI TPK	online	245	4.2367	.84511	-3.732	586	.000
	face-to-face	343	**4.4606**	.60991			

Despite certain challenges, pre-service teachers indicated that they provide support to students in practicum schools by incorporating AI tools into their lessons during their practicum experiences.

AI offers students the opportunity to learn at their own pace, especially when it comes to assignments. For example, Quill.org is an incredible tool for teachers. Because it

> is very difficult to provide individual feedback to each student. Moreover, it is also quite a savior when it comes to students' complaints, "Sir, did you read the exams and what did you do?" Of course, it is possible to read the test exams quickly, but it is very difficult to read the exams that measure the writing ability and no matter how noble we try to be, it is very difficult to make a comprehensive and detailed evaluation due to fatigue, rush and emotional factors. Therefore, applications such as Noredink, Quill.org and HMT Writable mentioned in the presentations perform detailed analysis. And even better, it can identify what students need. In addition, since such applications pass various tests, they actually offer students the opportunity to test themselves, learn and practice in a reliable environment, and can even turn informal learning into a formal element.

These quotations indicate that pre-service teachers, despite facing challenges, recognize the value of AI tools in supporting student learning 'give help' during their practicum experiences. AI tools like Quill.org, Noredink, and HMT Writable allow teachers to provide personalized, efficient feedback, especially in areas like writing, where individual attention is difficult due to time constraints and emotional factors. These tools not only help with assessment but also foster self-directed, reliable learning for students, turning informal learning into a more structured and formalized process.

3.7. Valued network centrality

Valued Network Centrality refers to the perceptions of peers regarding the extent of system-related resources managed by a designated employee (Sharma & Mishra, 2014). This section included questions assessing the influence of colleagues' opinions and respect on a teacher's use of AI in teaching, highlighting the social value placed on AI proficiency in the professional environment. Regarding Valued Network Centrality, both groups' mean scores were 4 or higher. The analysis indicates that there is no statistically significant difference in Social Influence between the online group (M = 4. 2190, SD = 0. 98039) and the face-to-face group (M = 4. 1905, SD = 0. 95324), as determined by an independent samples t-test (t(250) = 0. 232, p = 0. 817).

Qualitative data suggests that participants correlate the concept of a 'successful' or 'good teacher' with proficiency in the use of artificial intelligence.

> "This course creates an important awareness about following the age. Thanks to the course, I learned a lot of AI applications that I can use in my professional life."
>
> "If we cannot follow technology in the age of technology, we cannot be a successful teacher. This lesson teaches us why we should not be outdated."
>
> "Teachers should be open-minded and willing to learn new technologies." (online group)
>
> First of all, teachers need to be very active in technology. In this way, they also become guides for students. Since students are not used to using AI, teachers need to have a positive and supportive attitude (online group)
>
> The teacher should understand the concept of the AI, how it works, and what to do when it doesn't work. Also, he/she should understand the mechanism behind the AI. They need to be digital citizens as well and they should know what is ethical in terms of copyrights and everything. (online group)

The excepts suggest that participants assess the level of respect and admiration that teachers garner for their utilization of AI in educational settings, as well as the perspectives of colleagues regarding the significance of integrating AI into teaching practices. Consistent with the principles of valued network centrality, the participants identified themselves as peers within the educational system, occupying roles that encompass both the reception of teacher training and the provision of instruction within practicum schools.

The qualitative research presents the participants' perceptions of the 'focal employee' responsible for managing various resources within the system, specifically in the context of teaching English using artificial intelligence. Upon examination of the qualitative data, it was identified that the participants predominantly recognized three key stakeholders: these included teacher education programs, the Ministry of National Education, and AI-developers.

Participants expressed the view that teacher education programs should be enhanced by the inclusion of additional courses aimed at providing teacher candidates with access to pertinent resources, specifically AITPACK information. It was suggested that AITPACK should be integrated across various courses within the curriculum and offered through both online and face-to-face formats. In their assessment of the Ministry of National Education, the participants expressed the viewpoint that the ministry should implement training programs focused on AITPACK for teachers, develop comprehensive guidelines for the effective integration of AITPACK in classroom settings, restructure the existing curriculum to incorporate AITPACK principles, and supply the requisite equipment to educational institutions. Participants identified AI programmers as the final group of "focal employee". Participants reported that certain AI programming tools were malfunctioning, highlighting the necessity for ongoing product development. Furthermore, they emphasized the importance of enhancing user-friendliness in these tools and recommended the provision of support resources, such as user manuals, to facilitate effective utilization.

4. Discussion

The discussion section is structured into two distinct subsections: Perspectives on AITPACK among Pre-service Teachers and the Facilitating Conditions for AITPACK. The conclusion is articulated in the concluding section of the document.

4.1. Perspectives of Pre-Service Teachers on AITPACK

Behavioral intention is defined as the individual's subjective probability of engaging in a specific behavior (Fishbein & Ajzen, 1975, p. 288). Learning can be defined as a modification of behavior, influenced by various factors including teachers, environmental contexts, peer interactions, and the characteristics of the course material being studied (Ebadi & Amini, 2022). The emotional component underscores the notion that a supportive teacher-learner relationship fosters greater student engagement and motivation. Consequently, this enhanced involvement is likely to result in improved academic outcomes (Freedman, 1993). This productive relationship facilitates the establishment of a communicative channel between learners and instructional content (Pishghadam et al.,

2015). Grounded in the MAPS theory, this study involved participants engaging with one another in both classroom settings and extracurricular meetings as they prepared their presentation topics. To effectively observe changes in pedagogical practices, it is imperative for teachers to first achieve a conceptual understanding of adaptive learning technologies. As highlighted in the literature, this entails comprehending the underlying principles and significance of adaptive learning, as well as cultivating a positive disposition towards "adaptive adjustment, interactive facilitation, and beneficial teaching. " Such a mindset is essential for enhancing the effectiveness of instruction and learning processes that are integrated with intelligent technologies (Wang & Nie, 2023). The current study reveals no significant differences between the online and face-to-face pre-service teacher groups regarding their behavioral intentions toward AI and the integration of AI in English language teaching. In both groups, the pre-service teachers evaluated their TPACK competencies as being above average, with scores exceeding 4 across all categories. The mean scores were found to range from 4. 284 to 3.4604.

Consistent with the findings of Shankar et al. (2024), it was observed that nearly fifty percent of teachers who self-report possessing digital literacy, familiarity with AI tools, and an understanding of the TPACK framework have yet to integrate AI tools into their instructional practices. In their 2017 study examining the readiness of EFL teachers for the integration of AI, Yau et al., (2023) discovered that although the teachers expressed a willingness to adopt new technologies, their understanding of AI was limited. Furthermore, there was skepticism regarding the potential of AI to effect substantial transformations within EFL classrooms. In a separate study, it was discovered that a limited number of teachers expressed comfort with artificial intelligence, while the majority demonstrated minimal or no understanding of the subject (Zulkarnain & Yunus, 2023). In alignment with the findings of previous research, initial responses from participants in the present study indicated a lack of awareness regarding the extensive applications of AI in the field of education. Upon conclusion of the study, participants reported an enhanced understanding of various AI tools available for their use as teachers, distinct from those they had utilized in their roles as students. Furthermore, several participants expressed surprise at discovering the broader scope of AI applications than they had initially perceived. It is noteworthy that a majority of participants initially expressed uncertainty about AI, accompanied by feelings of apprehension and diminished self-confidence. The deficiency in understanding these systems may contribute to diminished self-esteem, as noted by Wang and Lester (2023) and Yue et al. (2024). However, participants in the present study experienced an evolution in their perceptions; through increased engagement with and practice of AI and its integration, their initial apprehensions were supplanted by a sense of reassurance and confidence, as reported at the conclusion of the study.

Consistent with prior surveys and interviews conducted with ESL/EFL teachers and learners (Choukaier, 2024), this study elucidated a diversity of attitudes regarding AI technologies. Furthermore, Velander et al. (2023) have identified that teachers' understanding of AI-related content is predominantly acquired through incidental learning, which frequently leads to the development of preconceptions and misconceptions regarding artificial intelligence. This study corroborates the aforementioned findings by highlighting the initial misconceptions held by participants regarding AI. It documents a significant transition in participants' attitudes, which evolved from negative perceptions—

characterized by skepticism, fear, and uncertainty—to more positive outlooks. Notably, those who reported positive feelings at the conclusion of the study indicated an increase in their positive sentiments throughout the duration of the research. Karina and Kastuhandani (2024) also observed the emergence of pedagogical beliefs and the evolution of attitudes within their preservice English Language Teaching program, which aligns with the findings of the current study. Prior research has indicated that it is inappropriate to assume that participants' perceptions of their knowledge related to AI are grounded in objective evidence. The authors contended that such misperceptions could pose significant challenges to the effective integration of AI systems in educational settings. Specifically, it was found that teachers who exhibit a high level of confidence in their understanding of AI often encounter difficulties stemming from inaccurate self-assessments, while those who lack confidence in their AI knowledge may refrain from utilizing AI systems despite possessing the requisite competencies (Chounta et al., 2022). Nonetheless, this study is grounded in an examination of the experiences of preservice teachers during their practicum in educational settings, focusing specifically on the application of AI-tools in English Language Teaching (ELT). This approach distinguishes it from prior research in the field. Based on the evidence presented by the participants, this study demonstrated a transition and transformation in teachers' attitudes and beliefs.

The inadequacy of qualified and certified teachers in the field of AI has emerged as a significant barrier to the effective implementation of AI education (Su et al, 2023; Yue et al 2024). A significant number of teachers responsible for instructing on AI lacked formal education in the subject during their academic training (Diliberti et al, 2024; Edmett et al., 2024). The existence of knowledge gaps among teachers concerning AI may lead to the development of misconceptions, thereby adversely impacting their instructional practices and curricular design. The precise identification and characterization of teachers' knowledge deficiencies can inform and enhance the efficacy of professional development initiatives. Lindner and Berges (2020) observed that teachers' preconceptions regarding AI were characterized by the presence of foundational concepts and ideas, yet lacked comprehensive and detailed descriptions. The studies conducted by Xia and Zheng (2020) and Williams et al. (2021) indicated that the teachers involved in the research acquired both knowledge and experience as a result of their participation. However, Yau et al. (2023) suggest that the short-term programs may lack comprehensive coverage of the diverse aspects of AI knowledge. The current study demonstrated that participants in both online and face-to-face programs exhibited improvements in AITPACK, as analyzed through the lens of the MAPS. Notably, the face-to-face group displayed superior outcomes compared to the online group, despite both groups being engaged in a 14-week program.

The findings of this study indicate that educational strategies ought to prioritize the mitigation of initial apprehensions and misconceptions regarding AI. It is imperative to furnish comprehensive and practical knowledge concerning the applications of AI. Furthermore, it is essential to support teachers in their transition from learners to adept users and advocates of AI in the field of education. Both online and face-to-face formats demonstrate efficacy in promoting positive attitudes; however, the provision of consistent support and practical demonstrations appears essential for the maintenance of these favorable changes. Professional development programs have the potential to mitigate anxiety and enhance confidence in the instruction of AI concepts (Kim & Kwon, 2023). Specifically, professional development programs designed to enhance content knowledge

(CK) pertinent to technological knowledge (TK) and pedagogical knowledge (PK) may equip teachers with the requisite expertise and abilities to integrate AI education effectively into their classrooms (Kim & Kwon, 2023). Scholarly research has highlighted that teachers' beliefs regarding the integration of technology play a significant role in shaping their learning experiences and perceptions within pre-service teacher education programs (Moorhouse & Kohnke, 2024); Yau et al, 2023). The beliefs and perceptions of pre-service teachers during their educational training significantly influence their future pedagogical performance in the classroom (Zhang & Umeanowa, 2024). Furthermore, pre-service teachers occupy a pivotal phase in the cultivation of skills and knowledge, as well as in comprehending the effective integration of learning technologies within educational environments (Choukaier, 2024). Focusing on the perceptions of teachers regarding technology during their pre-service training phase can facilitate the ability of pre-service teachers to navigate challenges and difficulties encountered in instructional practices (Pokrivcakova, 2023). Moreover, this attention can ensure that pre-service teachers develop a sufficient literacy for the integration of information and technology into their teaching and learning methodologies (Edmett et al., Sanusi et al, 2024; 2024; Yue et al., 2024). In the current context characterized by the swift proliferation of diverse learning technologies, it has become increasingly crucial to prioritize the education of pre-service teachers and their experiences with technology-assisted learning. Although a consensus on the evolution of teachers' beliefs remains elusive, a significant body of research indicates that the beliefs of pre-service teachers serve as direct predictors of their subsequent attitudes toward technology integration in teaching following graduation (Moorhouse, 2024). Understanding the beliefs of pre-service teachers regarding the use of learning technology is crucial for teachers aiming to effectively integrate technology into educational practices. Such comprehension will provide insights into meeting future educational expectations for technology-assisted teaching and learning.

Consequently, further research is essential to gain a comprehensive understanding of teachers' beliefs concerning the implementation of emerging instructional technologies (Liu, 2023). Examining the beliefs of pre-service teachers may contribute to resolving this issue, as their familiarity with and perceptions of instructional technology are predominantly shaped by their experiences during pre-service training (Yang & Chen, 2023). Moreover, the conceptions held by pre-service teachers regarding the application of educational technology significantly influence their perceptions of learning as well as their intentions to utilize such technologies in educational settings (Moorhouse, 2024). An investigation into teachers' perceptions and intended utilization of AI-tools within the context of their pre-service training could reveal new avenues for the advancement of educational chatbot development (Yong & Chen, 2023). Enhancing the comprehension of methodologies for designing the most effective professional development programs in AI for K-12 teachers. This undertaking will involve the establishment of a research program focused on design principles aimed at developing professional development initiatives that encompass both content knowledge related to AI and pedagogical knowledge pertaining to its instructional application. Research on K-12 AI professional development should explore strategies that effectively address the diverse array of competencies in AI possessed by teachers and administrators at the outset. While the investigation of K-12 AI professional development methods for pre-service teachers is of paramount importance, it is equally essential to extend such inquiries to in-service teachers.

4.2. Discrepancies in Educator Proficiency

The provision of comprehensive and targeted professional development tailored to the identified competencies in AI may effectively mitigate the scarcity of professional development opportunities within K–12 education pertaining to AI (Kim & Kwon, 2023). The formulation of professional development programs grounded in the delineated AI competencies can equip teachers with the requisite knowledge and skills to proficiently incorporate AI education into their instructional practices (Liu, 2023). In the current study, both the online and face-to-face groups utilized predominantly virtual learning platforms, adaptive learning systems, and chatbots, corroborating findings from previous research (Choukaier, 2024; Diliberti et al., 2024). Participants predominantly employed AI to generate lesson ideas, as well as to customize, supplement, and enhance their instructional materials.

AI systems are capable of proposing tailored lesson plans that take into account the progress and performance of individual students or groups. These systems can adjust the content and pacing in alignment with specific learning objectives (Yue et al., 2024). Teachers utilizing AI predominantly employed AI tools and products for the purposes of adapting instructional strategies and generating educational materials. The researchers employed AI to modify instructional content, ensuring it is suitable for the respective grade levels of their students. Teachers who employed AI technologies utilized these tools for various purposes, including language translation, offering academic assistance to students facing challenges, and delivering personalized feedback. Notably, it was observed that the online teacher cohort predominantly adopted an AI-centered approach, whereas the face-to-face group of pre-service teachers implemented AI in a more student-centered manner.

The TPACK framework serves as a valuable tool for comprehending teachers' competencies in effectively incorporating technology into their pedagogical practices. This study proposes two pertinent avenues for future research concerning methodologies aimed at eliciting teachers' TPACK. First, it is important to note that conventional instruments designed to assess Intelligent TPACK are influenced by respondents' individual conceptualizations and interpretations of specific terminology, such as AI. These conceptualizations can vary significantly among respondents, as highlighted by Velander et al. (2023). Furthermore, the diverse and multifaceted conceptualizations of AI imply that teachers' Intelligent TPACK is intricately linked to their individual conceptual understandings and preconceptions (Moorhouse, 2024). To fulfill the requirements of adaptive learning, a transformation and innovation of existing knowledge is imperative, facilitated by intelligent technology. As a result, teachers gradually transition from being mere producers and transmitters of knowledge to becoming organizers and facilitators, thereby transforming teaching into a dynamic, learner-centered process of knowledge construction (Wang & Nie, 2023). In the context of this study, the online group utilized AI in a teacher-centered manner to prepare and present educational materials, whereas the face-to-face group adopted a student-centered approach, employing AI in the classroom to collaboratively produce learning materials that incorporated students' suggestions.

Additionally, it is noteworthy that the factors influencing teachers' intentions to utilize technology can vary significantly across different contexts (An et al., 2023). The investigation conducted on pre-service teachers' utilization of AI revealed that only Performance Expectancy demonstrated a substantial explanatory power (0. 91) in

predicting Behavioral Intention. In contrast, the variables of Effort Expectancy, Technological Knowledge (TK), Technological Pedagogical Knowledge (TPK), Pedagogical Knowledge (PK), and other related factors were not found to be significant predictors of Behavioral Intention (Bardakci & Alkan, 2019). Nonetheless, research focusing on pre-service teachers' engagement with general technology indicates that, when integrating the two models, only the TPACK framework demonstrates a significant predictive relationship with Behavioral Intention. In contrast, the constructs of Performance Expectancy, Effort Expectancy, and Facilitating Conditions do not significantly predict Behavioral Intention (Lim & Harwati, 2021). The interrelationship between teachers' acceptance of emerging technologies and their design efforts represents a crucial dimension that must be addressed to foster the development of pedagogical expertise in utilizing these technologies.

Usability and usefulness can be viewed as outcomes of technological design; however, these factors are also influenced by users' perceptions regarding the affordances provided by the existing design of the technology. For example, a significant number of teachers regard PowerPoint as an effective tool for the delivery of information and utilize it predominantly within a teacher-centered pedagogical framework. For teachers who exhibit a strong inclination towards student-centered pedagogies, PowerPoint may serve as an effective multimedia tool for knowledge construction, enabling students to develop a comprehensive understanding of a subject through the integration of diverse informational resources (Teo et al., 2008). Both forms of utilization reflect teachers' acceptance of technology; however, teachers who possess a robust understanding of both traditional and student-centered pedagogies—often characterized by a higher level of TPACK—are likely to demonstrate a greater degree of acceptance. This enhanced acceptance can be attributed to their increased capacity to identify and implement pedagogical applications for the technology. Hence, teachers' technological and pedagogical knowledge may significantly influence their evaluation of the utility and usability of a given technology, which, in turn, could affect their intention to adopt said technology in their instructional practice. Consequently, MAPS and the AITPACK framework exhibit interrelatedness (An et al., 2023). Teachers' conceptions of teaching are understood as instructional and pedagogical frameworks that encompass their beliefs regarding the nature of content knowledge, methodologies for instructing students, and the processes through which students acquire learning (Yue et al., 2024). These conceptions are linked to teachers' preferred pedagogical approaches, encompassing the roles of both teachers and students, as well as the methods of content delivery (Yau et al., 2023). These elements signify teachers' comprehension of content knowledge, pedagogical objectives, and student learning outcomes (Yau et al., 2023). Consequently, these factors influence both the quality of instruction and the learning outcomes of students.

The conceptions of teaching can be categorized into two primary frameworks: teacher-centered and student-centered approaches (Yau et al, 2023). In the context of knowledge acquisition, it is imperative to facilitate the transformation and innovation of existing knowledge through the application of intelligent technologies in order to satisfy the demands of adaptive learning. Teachers are progressively transitioning from roles as knowledge producers and transmitters to those of organizers and facilitators, thereby transforming the teaching process into a dynamic, learner-centered approach to knowledge construction (Wang & Nie, 2023). The implementation of AI tools catalyzes the

enhancement and reformation of educational concepts and methodologies, necessitating adherence to principles that prioritize human-centeredness, student-centeredness, and holistic development (Kong & Yang, 2024). Specifically, although usability and usefulness represent the outcomes of technological design, they are also contingent upon users' perceptions concerning the affordances inherent in the existing technological framework. For example, a considerable number of teachers regard PowerPoint as an effective instrument for the dissemination of information, employing it within a teacher-centered pedagogical framework. Teachers who exhibit a strong preference for student-centered pedagogical approaches may utilize PowerPoint as a multimedia tool to facilitate knowledge construction. This platform enables students to synthesize and articulate their understanding of a topic by drawing from a variety of informational resources (Teo et al., 2008). Although both modalities reflect teachers' acceptance of technology, it is posited that teachers possessing a robust understanding of both traditional and student-centered pedagogies—often characterized by a higher level of TPACK—are likely to demonstrate a greater degree of acceptance (Choukaier, 2023). This enhanced acceptance can be attributed to their increased capacity to identify and implement pedagogical applications for the technology in question. In essence, teachers' technological and pedagogical knowledge has the potential to influence their evaluation of a technology's utility and usability. This evaluation can subsequently affect their intention to implement the technology in their instructional practices (An et al. ,2023). The successful integration of AI into educational settings is contingent upon teachers' capacity to align AI applications with specific pedagogical objectives. This alignment requires a comprehensive understanding of both technological frameworks and educational theories.

4.3. New classroom management skills for AI integrated lessons for teachers

Moreover, it is essential for teachers to expand their responsibilities to encompass the roles of guide and facilitator, in addition to their traditional pedagogical functions. This necessitates a critical re-evaluation of their roles in order to more effectively foster and enhance the individualized potential of students (Wang & Nie, 2023). This process necessitates that teachers consistently enhance their proficiency in AI to effectively meet the evolving demands of contemporary societal development (Lane, 2023). This finding aligns with prior research that underscores the significance of professional development in mitigating barriers to access to AI education for teachers (Ayanwale et al., 2022; Kim & Kwon, 2023). Numerous challenges undermine teachers' attitudes toward and preparedness for integrating AI into their teaching practices. These challenges include the lack of comprehensive teacher training in AI, the necessity for evolving curricula tailored for AI instruction, as well as external factors such as insufficient funding, underdeveloped teaching resources, and inadequate technical infrastructure (Yue et al., 2024). As an enhancement of teachers' pedagogical vision and capabilities, AI literacy is paramount for the effective integration of intelligent technology in instructional practices. Furthermore, it constitutes a fundamental component of educational intelligence (Wang & Nie, 2023). Consequently, it is imperative for teachers to enhance their proficiency in AI in order to effectively engage with the integration of adaptive learning technologies within instructional practices.

Addressing the variations in student readiness levels concerning English language proficiency and experience with AI, several challenges emerge, particularly in maintaining student engagement. There is a notable deficiency in courses designed for both students and teachers that would facilitate familiarity with the evolving educational landscape shaped by AI. Unlike previous research findings, pre-service teachers have advocated for the development of courses that would enable students to familiarize themselves with AI tools and to engage in lessons delivered through AI, thereby fostering a comprehensive understanding of AI in education. Without such initiatives, students tend to perceive AI-integrated English courses primarily as sources of entertainment and gamification, rather than recognizing their potential for educational enrichment. Consistent with the findings of Lindner and Berges (2020) and Velander et al. (2023), this study corroborates the significance of students' backgrounds, knowledge, and attitudes.

Moreover, teachers face considerable pedagogical challenges in developing and facilitating methods for students to engage, collaborate, and acquire knowledge related to or utilizing AI (Kim et al., 2022). For example, teachers frequently encounter difficulties in integrating both content and pedagogical considerations. To address this issue, the participants emphasized the necessity for pre-service teachers to acquire new classroom management skills tailored to AI-integrated English lessons. This transition necessitates the development of distinct competencies and roles for teachers to effectively maintain student engagement and foster a conducive educational environment. These insights are critical to take into account when formulating teacher education programs and professional development initiatives aimed at enhancing AI literacy. Ayanwale et al. (2022) posited that educational institutions might engage in partnerships with the private sector to enhance and facilitate student learning of AI fundamentals beyond the traditional classroom setting. They suggested the implementation of programming activities as a means to achieve this objective. The Ministry of National Education may establish partnerships with the private sector to develop AI-tools and resources aimed at enhancing educational experiences for both teachers and students.

4.4. Curriculum-related concerns:

The identified challenges pertaining to the curriculum revolved around the misalignment between the curriculum and pedagogical practices. An additional finding pertains to the perspectives articulated by both pre-service teachers regarding the numerous challenges they encounter in acquiring AITPACK. These challenges are critical for effectively teaching AI literacy, which is integral to fostering adequate AI competence within the context of the new curriculum. These challenges pertain to ambiguous and inadequately defined constructs within the curriculum, as well as the expectations placed on teachers to interpret unclear policy documentation. Additionally, there are difficulties associated with maintaining current knowledge and skills that remain unspecified. This observation is consistent with the findings of Velander et al. (2023), The challenges associated with identifying the prerequisite skills necessary for effectively teaching AI literacy can be attributed to the ambiguities present in the curriculum definitions (Casal-Otero et al., 2023).

Considering the disparities that exist between policy and curriculum content, as well as teacher education and professional development, there is an imperative to develop

methodologies for fostering AI literacy among teachers. Such methodologies should be applicable within the context of teacher education (Edmett et al., 2024). A significant challenge arises from the incongruity between alterations in educational policy and curriculum and the corresponding developments in teacher education and professional development (Lane, 2023; Su et al., 2023).

An additional challenge pertains to the temporal lag in the implementation of policy and curricular modifications. This issue is illustrated by the observation that teachers continue to grapple with the integration of programming into their instructional practices, despite the introduction of this content into the curriculum (Velander et al. (2024). There exists a deficiency in a comprehensive framework for the provision of education in AI (Kim & Kwon, 2023). The efficacy of AI-tools is significantly contingent upon their incorporation within established educational frameworks. The favorable outcomes observed in AI-integrated learning environments within this study highlight the significance of adopting a deliberate and systematic methodology for the integration of technology into educational contexts.

The integration of AI technologies into existing frameworks for English language teaching extends beyond the mere implementation of novel tools; it necessitates a comprehensive reassessment of pedagogical methodologies and curriculum structures (Ottenbreit-Leftwich et al., 2023). Teachers must critically assess the potential of AI to complement and enhance traditional pedagogical approaches, rather than viewing it merely as a replacement for these established methods (Choukaier, 2024). AI not only provides tools to augment conventional pedagogical approaches but also facilitates the exploration of novel educational methods and learning opportunities that were previously unattainable. It promotes a learner-centered approach that can be customized to meet the diverse needs of student populations across various geographical and cultural contexts (Bellas et al., 2023; Velander, 2023). Nevertheless, for AI to achieve its full potential and enact meaningful transformation, it is imperative that its integration be executed with careful consideration and strategic planning. This encompasses the imperative of ensuring that AI enhances, rather than substitutes, the human dimensions of pedagogy. Furthermore, it is essential to provide comprehensive training for teachers to facilitate effective integration of AI technologies. As AI continues to advance, its capacity to augment English language education is expected to increase significantly (Zhang & Umeanowa, 2024). Furthermore, to achieve effective integration of AI in educational settings, it is imperative to prioritize teacher training and professional development. Such initiatives must ensure that teachers are adequately prepared not only to utilize these tools but also to seamlessly incorporate them into their pedagogical practices (Choukaier, 2024). The successful integration of AI within English language teaching curricula necessitates ongoing dialogue among developers, teachers, and learners.

Additionally, the implementation of comprehensive training programs and the provision of equitable access to technology are essential components of this integrative process (Edmett et al., 2024; Yau et al., 2023). Nonetheless, such expansive initiatives and national strategies raise important considerations regarding the practicality of hastening the implementation of AI in classroom settings. This is particularly pertinent prior to achieving a comprehensive understanding of the feasibility and adaptability of these technologies within established frameworks of knowledge and pedagogical practices (Ottenbreit-Leftwich et al., 2023). As with any novel and unfamiliar educational initiative, it is imperative that teachers are provided with substantial resources and support.

According to Ottenbreit-Leftwich et al. (2023), successful integration necessitated that teachers surmount significant learning challenges associated with new content areas, which in turn demanded considerable assistance from instructional coaches and curriculum specialists. To establish a developmentally appropriate AI curriculum that teachers can effectively implement, it is imperative to gain insights into the current perceptions of both teachers and students regarding AI (Karina & Kastuhandani, 2024). In order to address these challenges, it is imperative to establish guidelines for the ethical and responsible utilization of AI.

The analysis identified several potential challenges that teachers may encounter in the pursuit of mastering essential constructs of AITPACK. Notably, among these challenges are the presence of vague and ambiguous guidelines within both policy frameworks and curricular documents (Velander et al. 2023). The observed phenomenon pertains to the insufficient confidence levels exhibited by secondary school teachers in the instruction of artificial intelligence. To effectively address this issue, it is essential for teachers to be provided with comprehensive guidelines, well-structured curricula, and relevant resources aimed at enhancing their confidence and competency in teaching artificial intelligence. The guidelines should delineate the objective of instruction in AI, emphasizing the promotion of AI literacy as opposed to the attainment of expertise in programming (Yue et al., 2024). The resources should be designed to elucidate AI and offer actionable strategies for the incorporation of AI concepts within educational settings. An understanding of suitable objectives and foundational knowledge in AI education can empower teachers to mitigate their apprehensions regarding the instruction of AI concepts, thereby enabling them to interact with their students with greater confidence in the classroom setting. Moreover, teacher professional development programs ought to promote the acquisition of knowledge regarding AI among all teachers, irrespective of their specific subject areas, and encourage the integration of AI into their pedagogical practices.

4.5. Facilitating Conditions for AITPACK.

In terms of facilitating conditions, a noteworthy distinction exists that favors face-to-face group interactions. In the context of system utilization and facilitating conditions, the face-to-face group encountered fewer challenges in comparison to the online group. The face-to-face group demonstrates significantly higher mean scores for Facilitating Conditions, suggesting that they perceive a greater level of organizational and technical support for the integration of AI in educational practices. The online cohort encountered greater challenges in accessing essential infrastructure, including internet connectivity and technological equipment. The rapid development of AI within a short time frame may account for the observed differences in the sophistication and variety of AI programs utilized by face-to-face groups compared to online groups. Specifically, the face-to-face groups may have access to more advanced AI resources, as they have been exposed to more recent developments in the field, while the online groups received their education a year earlier and, consequently, may encounter less advanced AI tools.

Previous research has indicated that the integration of technology into teaching and learning processes constitutes a multifaceted challenge characterized by various forms of obstacles (An et al. 2023). Despite its considerable potential to enhance English language learning, the incorporation of new technologies into classroom instruction typically

necessitates that teachers navigate a series of complex, multilayered barriers (Kim et al., 2021). EFL teachers may encounter a variety of challenges when integrating AI into their pedagogical practices and maximizing its potential to enhance instructional effectiveness. In the context of the practicum school experiences assessed within this study, both online and face-to-face groups of pre-service teachers identified several common issues, most of which were related to infrastructure.

4.6. Challenges Associated with AI-tools:

Finally, the challenges associated with AI tools can be categorized into several developmental issues, which include technical malfunctions, incompatibility with interactive boards, elevated costs, and the swift pace of advancement in AI technologies. Furthermore, adaptive educational products remain in the developmental phase, and the underlying technology has yet to reach a mature level of advancement. Consequently, this situation has given rise to a market characterized by a notable disparity in product quality (Wang & Nie, 2023). To achieve this objective, the implementation of AI education systems and associated pedagogical frameworks is essential. Many AI education programs are currently in beta testing phases, which may lead to various conflicts and operational inefficiencies. A significant concern associated with the widespread implementation of customized AI-tools in educational contexts is the financial burden associated with these technologies. Specifically, certain developing countries or regions may lack the necessary economic and material resources requisite for the development of such tools (Su et al., 2023; Pokrivcakova, 2023).

In order to facilitate the effective integration of AI within educational settings, it is imperative to confront various challenges associated with this endeavor. This necessitates the establishment of strong technical and organizational support systems, enhancements in accessibility, the provision of sufficient financial resources, and the alignment of curricular and training initiatives with the specific requirements of both teachers and learners. By addressing these factors, the conditions that facilitate the adoption of AI in educational contexts can be substantially improved. According to Freeman et al. (year),An alternative explanation may be that the current AI-enhanced technologies available do not adequately meet the needs of K-12 teachers (Chounta et al., 2022). Foster collaboration among technologists, teachers, linguists, and psychologists to develop AI-tools that are pedagogically effective and culturally responsive.

Such interdisciplinary initiatives have the potential to augment both the efficacy and applicability of AI applications within the realm of language learning (Choukaier, 2024). For example, Ayanwale et al. (2022) provides an example of the utilization of AI-tools in the African context. A considerable amount of research has indicated that a significant proportion of AI applications utilized in Africa are developed in other continents. Consequently, these applications often exhibit a lack of contextual relevance, as they do not adequately account for critical factors such as cultural dynamics and infrastructure limitations (Ayanwale et al., 2022). AIhas the potential to exert a significant influence in Africa similar to that observed in other regions of the globe. However, the degree of this impact will be contingent upon the unique characteristics and operational dynamics inherent to the African context. However, cultural sensitivity must be taken into account

in the development and implementation of AI tools not only in Turkey but also in other countries.

5. Conclusions

In summary, the findings presented in this study elucidate the key implications and contributions to the existing body of knowledge. It is evident that the results underscore the significance of the examined phenomena, highlighting both theoretical and practical applications. The incorporation of AI in English language teaching and learning presents a range of promising opportunities, while simultaneously posing distinct challenges. Furthermore, it elicits varied responses from teachers and students alike. Comprehending these perspectives is essential for the development of AI-tools that effectively address educational requirements and facilitate their adoption within pedagogical settings. Participants in both online and in-person groups emphasized the significance of idea exchange, the alleviation of anxiety, the reinforcement of personal accountability, and the enhancement of self-confidence that arises from interactions with fellow group members. This finding is consistent with the theoretical framework, which underscores the significance of peer support in the acceptance of technology. Furthermore, the presence of presenters who delivered evaluations and elucidations enhanced the participants' comprehension of the practical applications of the technology, thereby reinforcing the critical role of informed support within the network. Furthermore, the implementation of class discussions and a dedicated wiki page served as instrumental resources and platforms for collaborative learning, significantly augmenting students' perceptions of the utility of artificial intelligence. Additionally, the utilization of videos and tutorials provided by external experts significantly enhanced the participants' ability to effectively engage with artificial intelligence, thereby underscoring the influence of an extended network on performance expectancy. These insights underscore the imperative for educational institutions to cultivate a cohesive and supportive learning environment, utilizing a variety of resources to promote the effective integration of AI in educational contexts. The MAPS suggests that a strong support network plays a crucial role in amplifying perceptions of the effectiveness of AI in educational settings. Peer interactions, presenter feedback, collaborative resources, and contributions from external experts collectively foster a supportive environment that facilitates the acceptance and effective utilization of AI technologies. These insights underscore the imperative for educational institutions to cultivate an interconnected and supportive learning environment that efficiently utilizes a variety of resources to enable the successful integration of AI within educational frameworks. Educational strategies should prioritize the promotion of collaboration, ensure access to diverse resources, and facilitate knowledge sharing among all stakeholders involved. Both online and face-to-face instructional modalities can effectively establish a supportive environment that fosters the productive integration of AI within educational settings. Furthermore, it facilitates the mitigation of affective filters, such as

anxiety and tension, for both teachers and learners, thereby promoting the enhancement of essential interpersonal skills and intrinsic motivation.

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