

## PRE-SERVICE TEACHERS' EXPERIENCES IN DEVELOPING EDUCATIONAL MATERIALS WITH AI TOOLS

### EXPERIÊNCIAS DE FUTUROS PROFESSORES NO DESENVOLVIMENTO DE MATERIAIS DIDÁTICOS COM FERRAMENTAS DE IA

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**Mehmet Yalçın Yılmaz\***

\*Istanbul University (IU), Istanbul, Türkiye

Orcid: <https://orcid.org/0000-0002-4070-9116>

[myyilmaz@istanbul.edu.tr](mailto:myyilmaz@istanbul.edu.tr)

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#### Abstract

This qualitative study explored how prospective Turkish Language and Literature teachers conceptualized and experienced the design process of developing educational materials utilizing artificial intelligence (AI) technology and some of the difficulties they had encountered. Based on Kolb's Experiential Learning Theory, the qualitative study employed a single cycle practice oriented intervention design that was based upon action research. The study was conducted in a University located in the Marmara Region of Turkey with students who participated in a 4 week (12 hours) training program using Vyond, Gamma, ChatGPT/Gemini and Suno for listening, reading, speaking and writing. Semi-structured interviews, participant journal entries and researcher observation data collection methods were utilized to collect the data. Content analysis was applied to analyze the data. The results indicated an evolution from abstract potential focused views of AI (i.e. time savings, access to a wealth of information), to more concrete, understanding views of AI including personalization, increased efficiency, providing diversity of materials, increasing student motivation, and supporting teacher growth. AI was primarily used for creating texts, making presentations, conducting research, and testing new uses such as music, storytelling and animation. However, many of the participants identified risks including reduced critical thinking, and complacency of students' use of AI technology without teacher guidance. Therefore, it is concluded that structured participation in AI will increase digital and pedagogic literacy if supported by ethical considerations and reflective teaching practices.

**Keywords:** Artificial Intelligence (AI) in Education. Pre-Service Teachers. Instructional

#### Resumo

*Este estudo qualitativo explorou como futuros professores de Língua e Literatura Turca conceberam e vivenciaram o processo de design de materiais didáticos utilizando tecnologia de inteligência artificial (IA) e algumas das dificuldades encontradas. Baseado na Teoria da Aprendizagem Experiencial de Kolb, o estudo qualitativo empregou um modelo de intervenção prática de ciclo único, fundamentado na pesquisa-ação. O estudo foi conduzido em uma universidade localizada na região de Marmara, na Turquia, com alunos que participaram de um programa de treinamento de 4 semanas (12 horas) utilizando Vyond, Gamma, ChatGPT/Gemini e Suno para as habilidades de compreensão auditiva, leitura, fala e escrita. Entrevistas semiestruturadas, registros em diário dos participantes e observação do pesquisador foram utilizados para a coleta de dados. A análise de conteúdo foi aplicada para analisar os dados. Os resultados indicaram uma evolução de visões abstratas e focadas no potencial da IA (ou seja, economia de tempo, acesso a uma vasta gama de informações) para visões mais concretas e compreensivas da IA, incluindo personalização, aumento da eficiência, oferta de diversidade de materiais, aumento da motivação dos alunos e apoio ao desenvolvimento do professor. A IA foi usada principalmente para criar textos, fazer apresentações, conduzir pesquisas e testar novos usos, como música, narração de histórias e animação. No entanto, muitos participantes identificaram riscos, incluindo a redução do pensamento crítico e a complacência dos alunos no uso da tecnologia de IA sem a orientação do professor. Portanto, conclui-se que a participação estruturada em IA aumentará a alfabetização digital e pedagógica se apoiada por considerações éticas e práticas de ensino reflexivas.*



Material Design. Experiential Learning Theory.  
Digital Pedagogy.

*Palavras-chave: Inteligência Artificial (IA) na Educação. Professores em Formação. Design de Material Didático. Teoria da Aprendizagem Experiencial. Pedagogia Digital.*

## 1 INTRODUCTION

Artificial Intelligence (AI), in today's environment, has emerged as one of the primary components of digital transformation in education. With AI-assisted technologies, students can enjoy an enhanced learning experience through self- and personalized directed learning experiences, which lead to a greater efficiency of the learning process (Chattopadhyay, 2025). When using advanced technologies like robots as learning aids, for example, students learn better and faster than they do without them (Kumar et al., 2016). With digital teaching/learning tools students' understanding and overall learning experience are greatly enhanced by appealing to multiple senses (Taşkın, 2025). However, the intention behind the use of digital technologies is not to replace teachers but to assist in their role in education (Folgeri et al., 2024). Another important function of AI in education is the development of instant-feedback systems for students. Language instruction is one area where the AI tool allows students to find answers to their questions/problems right away, so they can learn faster (Turdaliyevna, 2024). Digital tools help teachers, too, with some tasks, which enables them to spend more time individually with more students (Alam et al., 2024). The use of Artificial Intelligence (AI) tools in developing and creating instructional materials provide many more advantages than the traditional ways of doing things. Unlike traditional instructional materials development, where instructional developers spend long hours of time planning, designing, and developing instructional materials that require the developer to be an expert in that area, the development of instructional materials using AI tools shortens the time required to plan and develop instructional materials due to the ease-of-use interface provided by the AI tools and the suggested instructional strategies that are used to increase the quality of the instructional materials (Dickey & Bejarano, 2023). Additionally, Generative AI tools significantly decrease the amount of time instructional designers need to spend developing educational materials because these tools produce a wide variety of educational materials of similar academic rigor (Gupta, Dharamshi, & Kakde, 2024).

Furthermore, AI tools support the creation of educational content that meets the specific needs and learning preferences of individual students, thereby increasing the efficiency and effectiveness of the educational process (Mon et al., 2023). Aspects of the use of AI in the development of instructional materials are particularly evident in the development of interactive and tailored learning resources. As an example of this, Google's Socratic Tool creates customized learning pathways for each student individually through interaction and customized educational experience and materials based upon the student's preferences (Jabbour et al., 2025), similar to many other tools available today, such as Microsoft's Immersive Reader, which allows students to learn through customized learning experiences, and customize their individualized learning pathway to meet their unique learning needs (Mishra, 2024). Utilizing AI algorithms to create individualized learning pathways, students can learn through educational experiences at their own pace (Chukhlomin, 2024).

AI-enabled tools have also been studied in the area of teaching Turkish in Turkey, and demonstrate that they greatly alter how teachers teach in terms of the development of audio-visual materials (Savaşkan, 2024). Studies show that pre-service teachers who were trained in AI-enabled tools demonstrated enhanced professional competencies, and digital literacy (Çelebi et al., 2023). Historically, the process of developing instructional materials has relied heavily on teachers' time, creativity, and expertise, and is typically restricted by resource constraints; therefore, the instructional materials created through this process rarely provide for individual differences among learners (Lawrence, Nesbitt, & Clay, 2024). In contrast to the past, AI tools enable teachers to develop instructional resources more quickly and efficiently than before. A major benefit to developing instructional resources with AI is that the AI can create individualized learning opportunities for users based upon the information provided to the AI. For instance, language learning applications like Duolingo assess users' proficiency in specific skills to develop tailored learning paths to enhance the learning experience for the user (Vega et al., 2024; Xu & Liu, 2025).

Research indicates that the utilization of AI-enabled tools in the educational environment leads to greater student motivation and engagement in the classroom, particularly if the AI generated educational resources appear to be innovative and engaging to students (Fountoulakis, 2024; Yuan & Liu, 2024). Due to the transformative effect of the digitalization of the educational system (i.e., using technology to transform

the delivery of educational processes), there have been numerous changes to the processes associated with delivering educational services (Kondur, Tsiuniak, & Verbeschuk, 2024). Consequently, it is essential for prospective teachers to establish a level of digital competency to enhance their professional and personal development (Yafie et al., 2024). The degree of digital skill that a prospective teacher obtains is highly correlated with the increasing importance of digital literacy in educational settings (Diachuk, 2024). Teacher preparation programs that include the incorporation of digital tools into the training of prospective teachers will enhance their pedagogical competencies and facilitate their ability to incorporate technology into their instruction (Temirkhanova, Abildinova, & Karaca, 2024). In addition, incorporating digital tools into teacher preparation programs in a deliberate and systemic manner, encourages prospective teachers to promote the responsible use of technology among their students (Chaerani et al., 2024).

Numerous studies within the field of education indicate that the application of artificial intelligence in educational environments produces a multitude of positive outcomes, including increased student motivation, more diverse instructional activities, and improved student achievement (Onesi-Ozigagun et al., 2024). The global body of research demonstrates the considerable potential of AI to contribute to the development of educational resources, through two principal types of AI applications: (1) Adaptive Learning Systems and (2) NLP-based Tools (Shrngare, 2022; Soelistono & Wahidin, 2023; Sajja et al., 2023). Further, the body of research demonstrates that the successful use of AI tools enables teachers to reduce the amount of time required to create pedagogical content (Jane et al., 2024). Studies also demonstrate that the successful use of AI tools enhance the digital competency of both teachers and students. Teachers who effectively use AI tools are able to enhance their professional competency, which can lead to enhanced academic achievement for their students (Sari et al., 2024). Similarly, teachers who exhibit positive attitudes towards digital tools and purposefully integrate these tools into their instructional practices, are able to optimize and streamline the learning process (Katona Gyonyoru & Katona, 2024).

As noted above, digital competence is considered to be one of the most important competences required of prospective teachers to successfully transition to the evolving education landscape of the 21st Century (Liu, 2025). Moreover, the inclusion of AI-based tools in teacher education programs presents prospective teachers with an opportunity to develop educational resources that reflect the characteristics of the digital age (Chisom et

al., 2024). Consequently, challenges related to the development of digital competence for prospective teachers must be addressed from both the individual and institutional perspective. Research demonstrating the development of digital competence for prospective teachers, has shown that the integration of digital tools into educational environments enhances the professional competences of educators (Dedebali, 2020). Prospective teachers exhibiting high levels of digital literacy are generally more productive in the classroom and better able to provide students with personalized learning opportunities (Kuru, 2022). Regarding Turkish language education, AI-supportive tools offer new and innovative methods to assist students in the development of their language skills, and create instructional materials in a more creative and student-focused manner (Yaşar & Arı, 2024). However, the successful application of these technologies is directly dependent upon the extent to which teachers and preservice teachers are digitally competent. Research has shown that AI-based tools used in the instruction of Turkish support the development of reading, writing, speaking, and listening skills and therefore increase the efficiency of the instructional process (Sengül & Demirel, 2022).

The design of the AI training program was informed by Kolb's Experiential Learning Theory (ELT) (Kolb, 1984), which explains learning as a cyclical process made up of four stages: (i) concrete experience, (ii) reflective observation, (iii) abstract conceptualization, and (iv) active experimentation. Thus, the program offered preservice teachers concrete experiences with the use of AI tools (e.g. Vyond, Gamma, ChatGPT/Gemini, Suno); the opportunity to reflect through written journal entries; conceptual understanding through guided discussions; and the ability to experiment actively through the creation of their own educational materials. The decision to use English Language Teaching (ELT) as the framework for the study provides a theoretical basis for explaining the transformation in the perceptions of the participants. In particular, the experiential aspect of the AI training program is anticipated to convert the abstract, and tool-neutral conceptions of preservice teachers about AI-supported material development into more practical and nuanced conceptions of AI-supported material development. Each of the four research questions was connected to the four stages of the ELT cycle to determine (i) participants' abstract conceptualizations before the training; (ii) participants' concrete experiences during training; (iii) participants' reflective observations based on journal entries; and (iv) the practical applications of the creation of educational materials with AI assistance. The objective of this study is to examine the

experiences of preservice teachers in developing educational materials using AI-based tools and to determine the difficulties they encounter in the process through a qualitative, in-depth analysis. In addition to the difficulties preservice teachers may experience in developing educational materials with AI-based tools, the study intends to offer suggestions for enhancing the digital competencies of future teachers. While there is a growing body of international research examining AI-supported material development, there is limited research examining the hands-on use of AI tools by preservice teachers in non-English contexts, or connecting these experiences to a robust theoretical model such as Kolb's Experiential Learning Theory. Therefore, this study represents an original contribution by examining the hands-on AI-supported material development of Turkish language preservice teachers within Turkish language teacher education, a context rarely examined in the global AI-in-education literature. Furthermore, the connection of Kolb's Experiential Learning Theory to a non-English, culturally specific context will provide additional perspectives that will enrich both national and international discussions on the integration of AI. In this regard, the research intends to contribute to both national and international literature by offering new perspectives on AI-supported material development within the specific context of Turkish language education.

## **2 RESEARCH PROBLEM**

There is an evident need to explore how AI-supported materials will affect the way preservice teachers create instructional materials, as well as their attitudes toward using such tools to assist them in creating materials, and any obstacles they may encounter when using such tools to create materials. There is also an evident need to identify methods to enhance the use of AI tools in educational practices. This research will help to address these needs by determining the attitudes of preservice teachers toward using AI to develop instructional materials and evaluating their performance in developing materials with the assistance of AI tools. To achieve the objective of this study, the study was guided by the following central question: "What are the effects of the AI supported material development process on preservice teachers' skill sets in developing materials, preservice teachers' perception of the tools used to support material development, and challenges they experience; and what can be done to improve the integration of AI tools

into educational practices." The study will also attempt to respond to the following research questions in relation to this central question.

- What are preservice teachers' perceptions prior to developing materials with AI support?
- How does the AI-supported material development process affect preservice teachers' material development skills?
- What challenges do preservice teachers encounter during the AI-supported material development process?
- How do preservice teachers' perceptions of AI tools change after their experience of preparing materials with these tools?

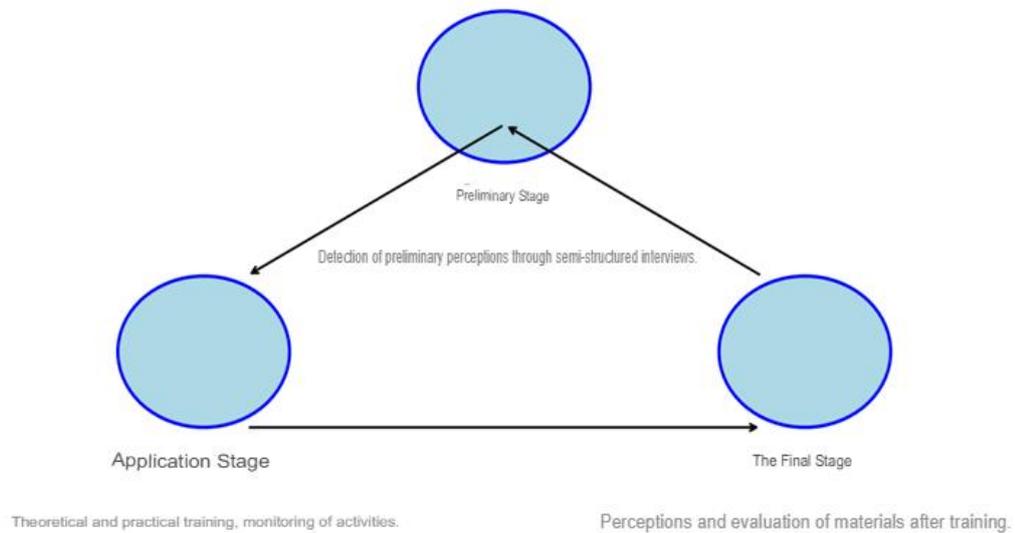
### **3 METHODOLOGY**

In this section of the study, information regarding the research design, study group, data collection process, and data analysis is presented.

#### **3.1 Research design**

There is a need to explore how AI-based materials will influence the ability of preservice teachers to create materials, their opinions on using these tools to create materials, and the barriers they encounter when creating materials using these tools. There also is an interest in finding ways to enhance preservice teachers' use of AI as part of their teaching practice. This research is designed to identify preservice teachers' views on using AI to produce educational materials, and to evaluate the success of preservice teachers in producing educational materials using AI tools. To achieve the above objective, the research was guided by the central question: "How does the preservice teacher's AI-supported material development process affect their skill at developing instructional materials, their perception of the tools used to support the process, and the problems they experience; and how might preservice teachers' use of AI tools be improved in their instruction?" In addition, the research will address the following research questions based on the central question.

**Figure 1**  
*Cyclical Structure.*



The study applied an exploratory qualitative study that is a practice-based intervention design that is inspired by action research methodology. The study has been implemented as three consecutive phases. At the beginning phase, the preservice teachers' preliminary views toward the use of AI for the design of educational materials were analyzed via semi-structured interviews and observation. In the middle phase, the preservice teachers attended both theoretical and practical courses to learn how to design educational materials by means of AI tools; throughout the course of the middle phase, the activities of preservice teachers, the problems they experienced and the results of their learning experiences have been monitored. Finally, at the last phase (after completing the training), the preservice teachers' final views regarding the design of educational materials using AI tools have been analyzed, and the educational materials they developed with AI tools have been examined relative to the defined standards. As well as being grounded within the reflective philosophy of action research, the study did not contain any iterative redesigns to be based upon participant feedback. Instead, the study has followed a one-time planned cycle of implementation. This methodological choice was made in order to create a structured, time-limited professional development experience which would allow participants to reflect upon and apply what they learned in a practical manner.

### 3.2 Action research process

In line with the objectives of the study, the following action plan was prepared and implemented:

**Table 1**

*Action Plan of the Study*

Date	Action
04.05.2025	Identification and Delimitation of the Problem
07.05.2525	Literature Review
10.05.2025	Selection of Artificial Intelligence Tools in Line with the Research Questions
15.05.2025	Development of Data Collection Instruments
20.05.2025	Finalization of the Action Plan Based on Expert Opinions
21.05.2025	Determination of the Research Setting
02.06.2025	Planning of Training on Material Design and Finalization of Activities
15.06.2025	Providing Preservice Teachers with a 4-Week, 12-Hour Training Program on Material Development with AI Tools
17.07.2025	Data Collection through the Instruments and Evaluation of Materials Using the Prepared Material Evaluation Form
25.07.2025	Data Processing
03.08.2025	Determination of the Validity and Reliability of the Study
10.08.2025	Interpretation of Findings

### 3.3 12-hour training process on material development with AI tools

**Table 2**

*Training Process*

Week	Session	Topic	Activity	Duration
Week 1	Sessions 1	Introduction to AI Tools and Their Integration into Turkish Language Education	<b>Topics:</b> Functions of AI tools and examples of their use in Turkish language classes. <b>Activity:</b> Examination of sample materials linked to listening, reading, speaking, and writing skills.	1 Hour
	Sessions 2	Planning Instructional Material Development for Turkish Language Courses	<b>Topics:</b> Setting objectives aligned with Turkish language course outcomes. <b>Activity:</b> Participants select one skill (listening, reading, speaking, or writing) and develop a material plan targeting that skill.	2 Hour
Week 2	Sessions 1	Developing Animation-Based Listening and Reading Materials with Vyond	<b>Topics:</b> Creating scenes and designing characters in Vyond. <b>Activity:</b> Participants select a listening or reading outcome and begin preparing a short animation that supports the chosen skill.	1.5 Hour
	Sessions 2	Designing Slides with Gamma for Speaking and Writing Skills	<b>Topics:</b> Creating visual content in Gamma. <b>Activity:</b> Participants design a slide that supports speaking or writing activities suitable for Turkish language classes.	1.5 Hour

Week 3	Sessions 1	Generating Writing and Reading Texts with ChatGPT (Gemini)	<b>Topics:</b> Using ChatGPT (Gemini) to produce sample reading and writing texts. <b>Activity:</b> Participants generate short reading or writing passages with AI support and adapt them to specific learning outcomes.	1.5 Hour
	Sessions 2	Voicing Listening and Speaking Content with Suno	<b>Topics:</b> Creating audio content with Suno. <b>Activity:</b> Texts generated with ChatGPT are voiced using Suno, and content is produced to be used for developing speaking skills.	1.5 Hour
Week 4	Sessions 1	Evaluation of the Developed Materials	<b>Topics:</b> Establishing evaluation criteria for instructional materials developed with AI tools. <b>Activity:</b> Participants' materials are assessed using a material evaluation form focusing on creativity, alignment with learning outcomes, and integration of AI-supported features.	Hour 1
	Sessions 2	Material Presentation and Group Evaluation	<b>Topics:</b> Presentation of the developed materials. <b>Activity:</b> Participants present the materials they have developed within the group and receive feedback.	2 Hour

### 3.4 Study group

This research utilized the criterion sampling technique, one of the methods of the purposeful sampling methods to select the study group. Criterion sampling is defined by Yıldırım and Simsek (2021, p. 122), "the study of all cases meeting a predetermined criterion." For this research the criteria for selecting the study group included; (1) The researcher could apply the research in the classes she/he currently taught in, (2) the class that the researchers conducted the application with would have to have at least two different discipline preservice teachers in it, (3) the preservice teachers in the study would need to be able to develop lesson plans utilizing materials created via AI technology, and (4) the preservice teachers would have to be willing to create materials utilizing AI technology. Based on these criteria, the research study group was composed of preservice Turkish Language and Literature teachers attending a University located in the Marmara region.

### 3.5 Data collection instruments

To increase the credibility (or internal validity) of the research through multiple methods of data collection, use as many different types of data collection tools as possible when conducting an action research project. A multitude of data collection tools are

utilized within this research. The table below presents the relationship between the data collection instruments used in this research and the research questions.

**Table 3**

*Relationship between Research Questions and Data Collection Instruments*

Research Question	Data Collection Instruments
1. Research Question	Initial Perception Interview Form for Preservice Teachers
2. Research Question	Participant Journals and Observation Forms
3. Research Question	Participant Journals and Semi-Structured Interview Form
4. Research Question	Final Perception Interview Form for Preservice Teachers

### 3.6 Details of data collection instruments

#### a) Initial and Final Perception Interview Form for Preservice Teachers

A 2-question "Pre-Perceptions" interview form and a 6-question "Post-Perceptions" interview form for determining preservice teachers' preliminary perspectives about material design were created by the researchers. Three experts from Turkish language education, and three experts from Instructional Technologies reviewed these two forms. The researchers made revisions to the forms based upon the feedback they received. A pilot study using at least three preservice teachers was then completed with the final version of the interview form. The questions that appear in the interview form are listed below:

**Table 4**

*Pre-Perception Interview Questions*

Pre-Perception Interview Questions	
1	What are your general thoughts on the use of artificial intelligence in education?
2	Have you ever used any AI tools before? If yes, which tools and for what purposes? If not, how do you think AI tools could be used in the field of education?
3	What are your expectations regarding the use of AI tools in your field?
4	What are your thoughts on the integration of instructional technologies with AI tools?
5	What are your predictions about the potential challenges that might be encountered in the use of AI tools?
6	What are your thoughts on the future role of AI-supported tools in education?
Post-Perception Interview Questions	
1	How have your thoughts on the use of artificial intelligence in education changed after your experiences in this process?
2	What are your reflections on your experiences of using AI tools?

3	How have your perspectives on the potential use of AI tools in your field evolved?
4	Have your expectations regarding the integration of instructional technologies with AI tools changed?
5	Have your views on the challenges you might face when using AI tools changed?
6	How have your thoughts on the future role of AI-supported tools in education been shaped by the end of this process?

### b) Participant Journals and Researcher Observation Form

The participant journals were created for the purpose of allowing the participants to reflect upon their experiences (challenges) and their learning processes during the training. Participant journals give the preservice teachers an opportunity to describe their individual perspectives and how much awareness they have gained in developing content using AI tools. The questions that will be included in the participant journal will be:

**Table 5**

#### *Participant Journal*

1	What did you learn today while working with AI tools?
2	What challenges did you face during the process? How did you overcome these challenges?
3	How do you think what you learned today will contribute to your future professional practices?
4	What are your views on the functionality of AI tools in the process of developing educational content?
5	Do you think there are aspects you need to improve regarding the use of AI tools in this process? If yes, what are they?

### 3.7 Researcher observation form

The researcher observation form was designed to systematically record participants' behaviors, their skills in using AI tools, and their interactions throughout the process. The planned observation questions are as follows:

**Table 6***Observation Form*

Sections	Questions
<b>Use of AI Tools</b>	Can the participant use the tool effectively?
	Can the participant generate accurate and meaningful prompts?
	How does the participant solve the technical problems they encounter?
<b>Material Development Process</b>	Can the participant relate the AI tool to the intended learning outcomes?
	How appropriate and functional is the material developed?
<b>Participant's Engagement and Effort</b>	Does the participant demonstrate active participation throughout the process?
	How are the participant's motivation and problem-solving efforts observed?

**3.8 Ethical considerations**

Ethics approval for this research project was given by the Social and Human Sciences Research Ethics Committee of Istanbul University, Turkey (Decision Number: 2025/137; Session Number: 03, dated March 24, 2025) . The study, "Pre-Service Teachers' Experiences in Developing Education Materials using AI tools" was found to be ethically acceptable through a unanimous vote, and therefore, approved by the ethics committee. The research was carried out in compliance with the Declaration of Helsinki and institutional ethics protocols. Participants were told that they were free to participate voluntarily without any influence on their course grade or status. Prior to their participation, written informed consent was received. Data were deidentified and stored safely. In order to limit any potential imbalance of power between the researcher/instructor and participant due to the instructor-researcher relationship, participants were told that their responses would not be available until after the final grade submission date.

**3.9 Data analysis**

The data generated in the study will be analyzed qualitatively using content analysis, based on the study's objectives. Qualitative research is an appropriate methodology for exploring participants' lived experiences and how they create meaning within specific contexts (Creswell, 2013), rather than creating statistical generalizations (Yıldırım & Şimşek, 2021). The use of content analysis allows for a systematic evaluation of preservice teachers' reflections and perceptions regarding their evolving understanding

of AI-assisted material design throughout the professional development. Frequency counts of codes (for example, theme occurrence) are reported as descriptive measures to represent the relative emphasis of ideas and should not be considered as a basis for statistical inference (Yıldırım & Şimşek, 2021).

Data were collected using participant reflective journals, observation forms and semi-structured interviews. The above data sources were used for inductive thematic content analysis (Yıldırım & Şimşek, 2021). According to Yıldırım and Şimşek (2021) inductively developing categories and themes from raw data in qualitative research content analysis is defined as analyzing the organized data in relation to pre-defined categories or themes to provide a coherent structure for the data. Therefore, the themes identified included challenges participants experienced, solutions participants devised, and skills that participants learned during the experience. Additionally, the researchers considered participants' individual variations and contextual influences in the analysis to further support the contextual validity of the results.

### **3.10 Validity and reliability of the research**

Although the ideas of validity and reliability are emphasized in quantitative research, there are other ways to think of this in qualitative research. For example, credibility, dependability, and the researcher's reflexivity are all forms of criteria to consider in qualitative research. According to Krefting (1991), a researcher should consider what he called "trustworthiness" when evaluating the quality of qualitative research. He said that evaluating trustworthiness would require multiple dimensions to be evaluated. Morrow (2005) stated that the researcher's reflexivity (acknowledging one's own position and biases) has a direct influence on the credibility of a study. The same is true for Williams and Morrow (2009); they highlighted data consistencies, participant interpretations, and transparency in reporting as some of the most effective ways to increase reliability in qualitative studies.

Peer debriefing and triangulation were both strategies implemented in order to assure the credibility of the study (internal validity). In qualitative research, one way to determine the credibility of a study is to have several experts evaluate the study by providing feedback from various perspectives. These experts could include those knowledgeable about the subject matter or methodology of the study (Lincoln & Guba,

1985; Krefling, 1991). Thus, in this study, prior to and during the data analysis process, feedback was sought from four experts: three of which were subject matter experts related to Turkish Language Education, but were not connected with the study group, and one of whom was a qualitative research expert. The opinions from those who are considered to be "experts" in the field, in relation to the data collection tools and the analysis plan, were taken into consideration when creating the tools. A second way that credibility was enhanced was through the use of triangulation. According to Patton (1999), and Morrow (2005) using multiple data sources, methods, or researchers creates reliability and consistency of data. Data for this study, were triangulated across three types of data, which included pre/post interviews, participant journals, and the researcher's observational data. In order to find patterns of convergence and divergence between the three forms of data, thematic matrices were used to systematically analyze all of the data. Participant journal entries were reviewed and summarized in terms of the most prevalent themes by each participant, and the participant was invited to comment on whether they believed that their experiences had been fairly and accurately represented in the interpretation of their data (Member Checking). The comments provided by participants, through member checking, were used to further refine the themes identified.

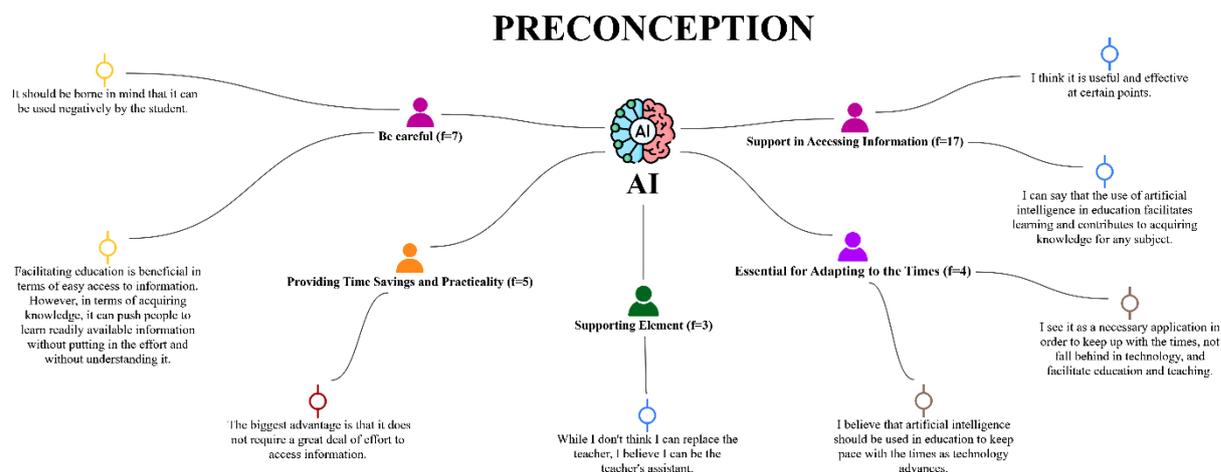
In addition to enhancing credibility, criterion sampling (a specific purposeful sampling strategy) was used to enhance the transferability (the external validity) of the study. Transferability refers to the ability to describe and disseminate results to a wider audience (Başkale, 2016). Dependability and confirmability were also considered to create reliability of the study. Several strategies were employed in the effort to develop dependability and confirmability. One strategy involved the extensive development of and review of the validity of tools such as the semi-structured interview guide and the observation protocol used during the data collection phase. Member checking was also used to verify the tool. Additionally, two independent coders conducted independent coding of the interview and journal data. An inductive codebook was developed and refined iteratively and collaboratively. Disagreements were resolved through discussion until a consensus was reached. Finally, an audit trail documenting the development of codes and refinement of themes was maintained.

## 4 FINDINGS

### A) Preconception

**Figure 2**

*Preconception.*



**Support in Accessing Information (f=17).** Participants expressed positive views on the contribution of AI to educational processes. One participant stated, *"In AI-supported education, the scope and boundaries of knowledge expand, and a more comprehensive flow of information is achieved. I find it logical to associate it with education today."* (P18) highlighting the dimension of access to comprehensive information. Similarly, another participant said, *"I have a positive opinion about the use of artificial intelligence in education. Since we are in the age of technology, children are already learning how to use smartphones before they learn to speak or write. Especially in middle school and continuing on to high school and university, they can take their creativity to higher levels by using artificial intelligence programs."* (P20) Another participant stated, *"I think positively. It makes it very easy to get information about a topic we are curious about in seconds. (ChatGpt) It benefits education and teaching in many ways."* (P21) This participant indicated that this technology directly contributes to education and teaching.

**Be careful (f=7).** Some participants emphasized that caution should be exercised when using AI in certain situations. In this regard, one participant stated, *"It is useful for facilitating education and easy access to information. However, when it comes to*

*acquiring knowledge, it can push people to learn ready-made information without effort and without understanding it.” (P14) pointing out that unconscious use can lead to superficiality. Similarly, “Just as I support the use of artificial intelligence in other areas, I also support its use in education. From the moment the concept of education emerged, it has used the materials required by the era. Today, we must also consciously adapt the technology required by our era to education. We must work to ensure conscious use in training knowledgeable monsters with artificial intelligence.” (P24) This statement reveals that AI can only produce meaningful results in education through conscious use.*

**Providing Time Savings and Practicality (f=5).** Some participants stated that AI has made accessing information and educational tasks more practical. One participant emphasized this contribution, saying, *“The use of artificial intelligence for educational purposes provides great convenience in an academic context. Its biggest advantage is that it does not require a great deal of effort to access information.” (P2) Another participant drew attention to the supportive role of AI in students' learning experience, stating, “I think the learning process has become easier for students. When learning styles, skills, and desires are combined with artificial intelligence, I think students will have a much more supportive role in education.” (P25)*

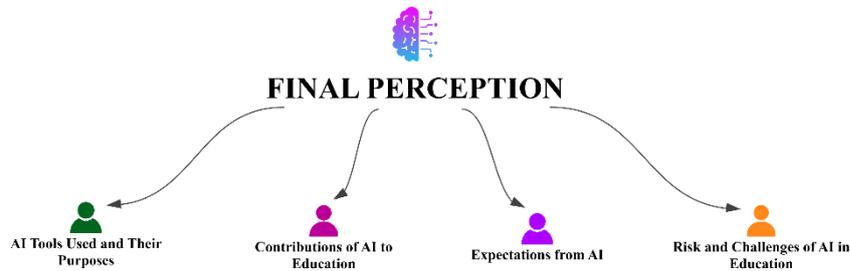
**Essential for Adapting to the Times (f=4).** Some participants pointed out that being able to use AI is an important skill for adapting to the modern age. Indeed, one participant stated, *“I believe that artificial intelligence should be used in education to keep pace with the times amid advancing technology” (P5), while another participant said, “In a changing, evolving world where technology has gained such momentum and importance, providing us with such convenience almost everywhere, not using it in education would be a great loss. I believe that the use of artificial intelligence in education is a great gain and convenience for education.” (P11)*

**Supporting Element (f=3).** Some participants stated that AI should be a supporting element alongside teachers and other resources rather than an educational tool in its own right. One participant explained this situation as follows: *“I can say that it would be insufficient to say that knowledge can be acquired solely through artificial intelligence. However, we can learn from books and teachers and also benefit from artificial intelligence.” (P4) Another participant shared a similar view, stating, “While I don't think it can replace the teacher, I think it can be the teacher's assistant.” (P8)*

## B) Final Perception

**Figure 3**

*Code-subcode model for final perceptions.*



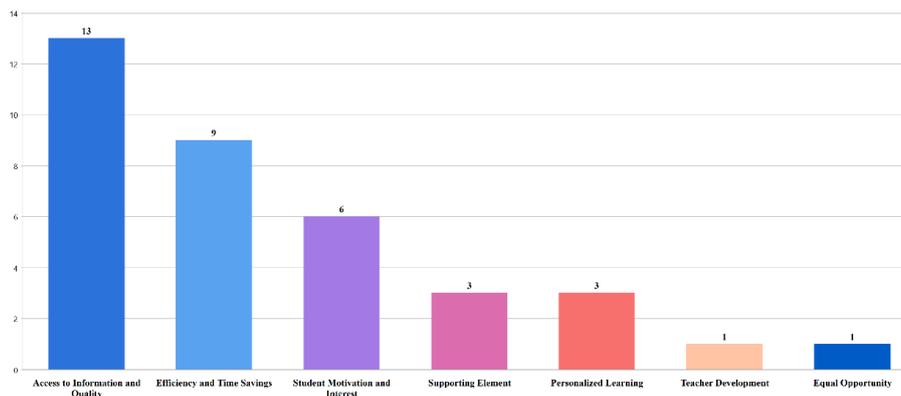
The map illustrates how participant perceptions in the final perceptions area were categorized with the thematic analysis into four broad categories and maps the subcodes into these categories.

This format provides a clear visual representation of the positive contributions of participants' perceptions (access to information, time, etc.), risks that need to be addressed (teacher support, complacency, etc.), areas where participants would like to see practical application (text/presentations/research, etc.) and their hopes for the future (development, interaction, creativity) of the tool. The detailed frequencies and sample quotes from the sample participants are supported by the tables and graphs found in the relevant subheadings.

### 1) Contributions of AI to Education

**Figure 4**

*Latest perceptions on the contributions of AI to education.*



Participants' current perceptions about how AI can contribute to education have a number of sub-themes. As demonstrated by the frequency distribution for the codes illustrated in Figure 4, the sub-theme "Access to Information and Quality" (f = 13) had the most frequent occurrence. Participants identified that AI has provided them with quicker, more precise, and greater quality of access to the information needed to support learning. Indeed, one participant stated, *"Artificial intelligence should definitely be used in education. For example, I can prepare questions for myself while studying for the ÖABT. I even created a KPSS page on Instagram where I prepare questions and share them with my followers. I have AI prepare all the questions."* (P4) expressed this contribution with a concrete example. Second was **"Efficiency and Time Savings"** (f=9), with participants stating that AI saves time in lesson planning, content preparation, and learning processes by lightening teachers' workloads. One participant expressed this situation with the words, *"Artificial intelligence is also beneficial for teacher candidates' own development. For example, it speeds up question solving, resource scanning, or academic writing..."* (P25), while another stated their opinion with the words, *"Artificial intelligence saves teachers a lot of time. I think it is particularly effective in content preparation and generating examples appropriate to students' levels."* (P15). In addition, under the subcode **"Student Motivation and Interest"** (f=6), it was stated that AI makes educational processes more interesting and interactive. One participant expressed their opinion with the words, *"AI-supported gamified activities can be very useful for increasing student motivation. This makes lessons more enjoyable."* (P22), while another participant expressed a similar perspective with the statement, *"I think artificial intelligence should be used in education because we are in the age of technology and the new generations are born into this technology, and I believe it contributes to capturing students' attention and lightening the teacher's workload."* (P5). Although at a lower frequency, the code **"Supporting Element"** (f=3) highlights that AI can be more functional under the guidance of teachers. One participant described this situation as follows: *"Careful use of artificial intelligence in education is essential. If teachers provide the right guidance, it can be productive for students; otherwise, it can lead to misinformation."* (P20). Similarly, under the code **"Personalized Learning"** (f=3), it was stated that AI has the potential to provide materials tailored to individual differences. One participant explained this situation, stating, *"I find the use of artificial intelligence in education beneficial. It provides the opportunity to offer materials tailored to students'*

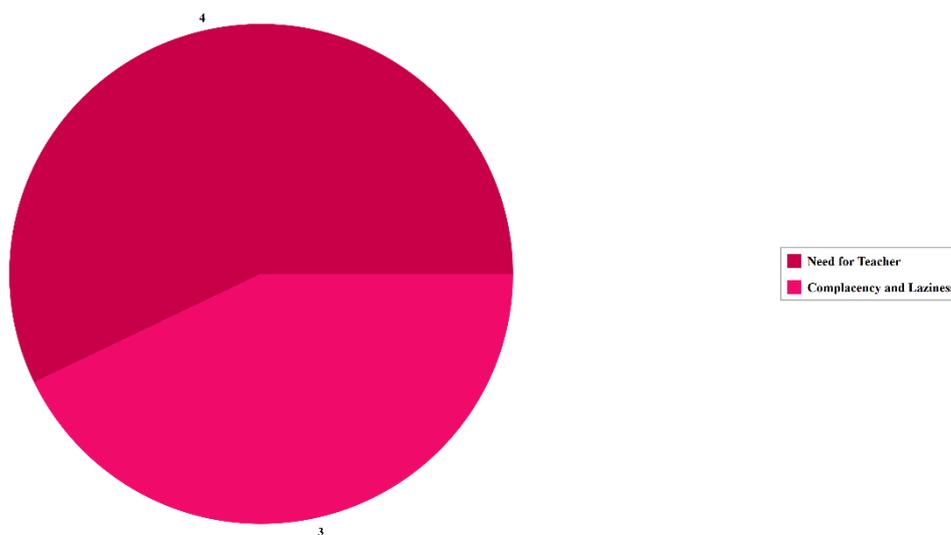
*different learning styles. This allows for a more personalized learning environment.*” (P13) On the other hand, **“Teacher Development”** (f=1) and **“Equal Opportunity”** (f=1) were sub-themes mentioned at a lower frequency. One participant stated that AI can enrich teachers' teaching processes and contribute to overcoming professional inadequacies, saying, *“I think it is necessary to be able to teach more comprehensively, to receive support where the teacher may be inadequate, to provide different education to students, and to teach student-centered lessons.”* (P8) Another participant emphasized that artificial intelligence could play a balancing role for students with limited opportunities, stating, *“Artificial intelligence can provide equal opportunities in education. It can serve as an additional resource, especially for students with limited opportunities.”* (P23)

Overall, it is seen that participants' final perceptions of AI's contributions to education largely focused on access to information, efficiency, and student motivation; in addition, its supportive, personalized, and equalizing aspects were also taken into account.

## 2) Risks and Challenges of AI in Education

**Figure 5**

*Latest Insights on the Risks and Challenges of AI in Education*



Participants have identified a number of potential risks and challenges as well as those associated with the use of artificial intelligence within education. The results from Figure 5 indicate that this was a common theme in the subcodes need for teacher (f=4), complacency and laziness (f=3).

**Need for teacher (f=4).** Participants acknowledged that AI-supported applications are useful in increasing students' interest, but emphasized that this process must be carried out under the guidance of the teacher. One participant drew attention to this point, stating, *“I have observed that AI-supported applications are useful in keeping students engaged, but I believe that progress should be made under the teacher's guidance without relying entirely on technology.”* (P16) Similarly, the statement, *“I have a positive view of AI in education, but it should be used in a balanced way so that students do not become accustomed to ready-made information. It can be a great asset if controlled by the teacher.”* (P26) Another participant expressed a similar view, stating, *“AI must be used carefully in education. It can be productive for students if teachers provide the right guidance; otherwise, it can lead to misinformation.”* (P20) Furthermore, the statement, *“Without proper guidance, students may become overly accustomed to ready-made information. This can negatively affect their critical thinking skills”* (P14) clearly highlights concerns about the importance of teacher guidance.

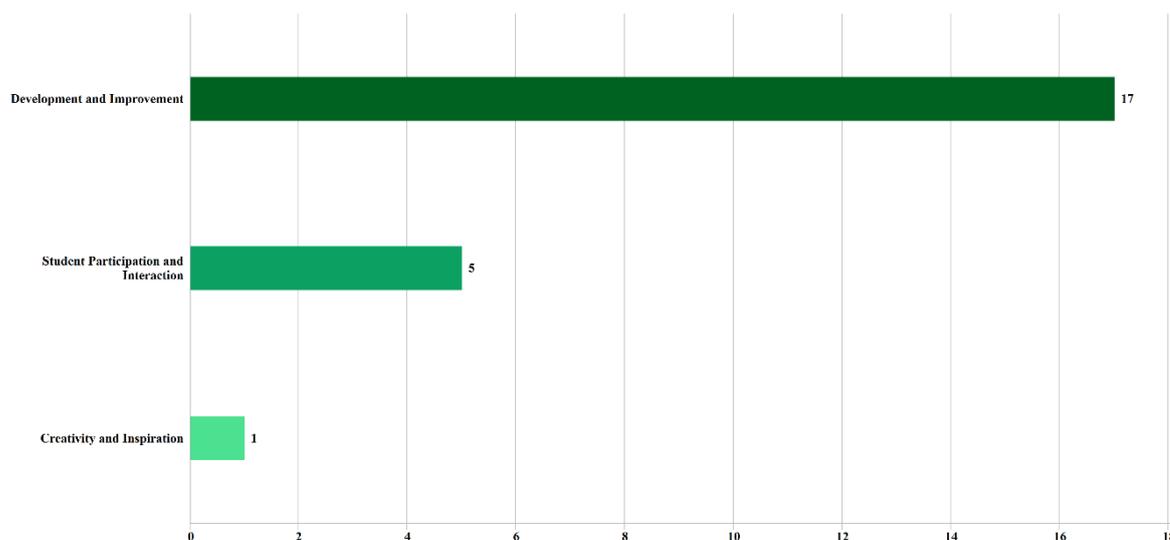
**Complacency and Laziness (f=3).** Some participants expressed concern that the misuse or overuse of AI could lead to complacency and laziness among students. In this context, one participant expressed their concern, stating, *“If we become complacent due to the influence of artificial intelligence and take advantage of it in every way with a lazy attitude, we will raise ignorant individuals.”* (P3) Similarly, the statement, *“I find its use in education particularly positive for teachers. Because today's students are in a position to use artificial intelligence unnecessarily and excessively. I am not particularly enthusiastic about artificial intelligence, especially in literature”* (P12), emphasizes the possibility of students overusing this technology unnecessarily. Furthermore, the statement, *“I am not completely negative about artificial intelligence, but the ethical dimension is very important. Students may move away from doing their homework on their own and leave everything to artificial intelligence. This hinders real learning”* (P18) reveals that the ethical dimension should not be overlooked alongside complacency.

Overall, participants acknowledged the beneficial aspects of AI in education but also expressed that using this technology without teacher guidance could be risky and might foster complacency and laziness among students.

### 3) Expectations from AI

**Figure 6**

*Expectations from AI.*



Students' top three theme-based expectations for how AI will function in the future are; Development and improvement (f=17), Student participation and interaction (f=5), and Creativity and inspiration (f=1). (Figure 6)

Development and Improvement (f=17): Many students expect AI to develop into an even better tool that, beyond what it currently does, provides more accurate, academic, and complete resources. One student expressed their idea of this future as follows

: *“I expect artificial intelligence to work with more reliable sources. It should provide academic accuracy instead of presenting incorrect or superficial information.”*

(P26) Similarly, another participant drew attention to the potential of AI to transform learning environments, stating, *“In the future, I want artificial intelligence to make virtual classroom environments more realistic. Students could take classes as if they were in a literature museum.”* (P22) In addition, some participants mentioned that in their current usage experience, AI can sometimes provide superficial or incorrect information, and that this aspect needs to be improved. For example, one participant stated, *“It can provide*

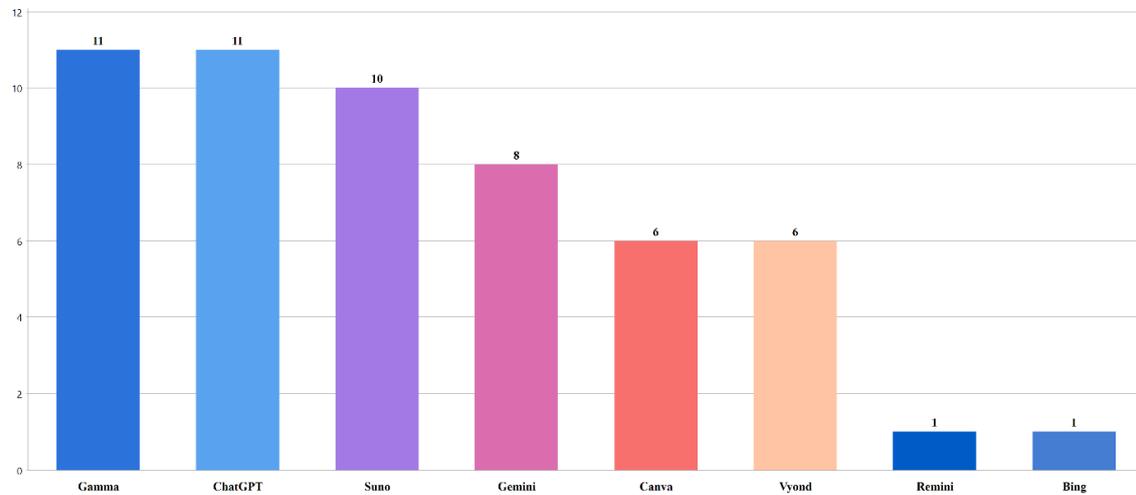
*superficial and, in rare cases, incorrect information on some topics. It would be great if this could be improved a little, but perhaps it is because I am asking the wrong questions or not asking comprehensive questions.” (P4)*

Incorporating Student Participation & Interaction (f = 5): Participants emphasized that AI tools should incorporate features not only to provide students with information but to actively encourage student participation. Participant P25 reflected this expectation as they stated, *“I want artificial intelligence tools to give us more interaction during classes. I want my students to be active participants not just passive listeners.”* Participant P11 reflected on their expectation in terms of accessibility and equality of access and opportunity as follows: *“I want all students to be able to use these applications, and to be supported both financially and through the information that is given. Or while the rest of the world is using this application, we will be spectators. So, I hope that it will be utilized and implemented correctly.”* Participant P5 also expressed the same sub-theme when they said, *“I have expectations in terms of creating and assigning activities for students and ensuring that the students are active participants.”*

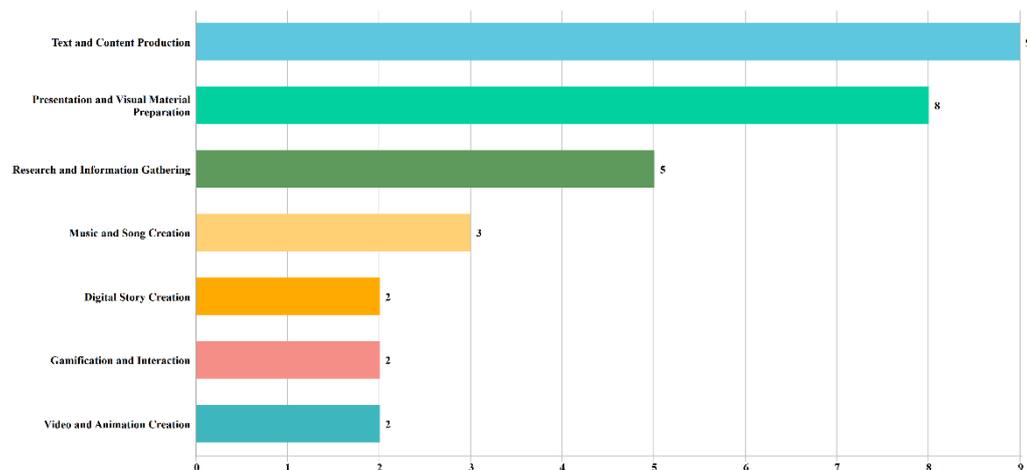
Encouraging Creativity and Inspiration (f = 1): While only one participant expressed this sub-theme, one participant stated that AI could be used to encourage creativity in writing process. The participant explained their expectation as follows: *“I want artificial intelligence to inspire students in the creative writing process. It could help them by giving them an idea for a first line for a poem or short story.”*

Overall, the participant's expectations fall into three general categories: AI providing more reliable and advanced content, AI increasing student participation in class, and AI as a tool that provides support for creative thinking.

#### **4) AI Tools Used and Their Purposes**

**Figure 7***The most commonly used AI tools*

The participants had a variety of experiences with the AI tools they interacted with as part of their training process, but experienced them on different platforms (Figure 7). Of all the tools utilized by the participants, who answered the survey; chat GPT was one of the top 2 tools, which was utilized by  $f=11$  participants and gamma was another tool, which was also utilized by  $f=11$  participants. The majority of participants (all) reported utilizing the two tools consistently during their training experience to produce text; summarize text; develop lesson plans and design presentation slides. Other tools, including Suno ( $f = 10$ ), and Gemini ( $f = 8$ ) were also widely used. Participants used Suno primarily in the area of music and song development, while participants used Gemini primarily to gather research and information. Although Canva ( $f = 6$ ), and Vyond ( $f = 6$ ) were less often used than the previously mentioned tools, the frequency of use of these tools was high in developing visual materials and producing videos and animations, respectively. Finally, the frequency of use of the tools, Remini ( $f = 1$ ), and Bing ( $f = 1$ ), was low; however, the scope of use for these tools was also low. In addition, the variety of AI tools selected by participants illustrates how AI can be used in a classroom setting for the production of content that is both text-based and non-text based (visual, auditory, and interactive).

**Figure 8***Purposes for using AI tools.*

Participants' views show AI resources are used to support different objectives when creating educational content. Figure 8 displays a frequency distribution of the ways participants use AI tools, such as for text or content production ( $n = 9$ ), to prepare presentations or visual materials ( $n = 8$ ), for research or finding information ( $n = 5$ ) and less often for music/song development, creating digital stories, creating interactive games, for creating videos/animation.

**Text and Content Production ( $f=9$ ):** Participants indicated that AI tools are particularly useful in written content creation and text editing processes. One participant expressed this contribution, stating, *“ChatGPT helped me summarize articles and write projects. It was especially useful in shortening long texts and making them understandable.”* (P15) Another participant pointed to potential areas of use, stating, *“I haven't had much experience with artificial intelligence tools, but I think they could be effective in my field, particularly in text analysis, question preparation, and exam applications.”* (P26)

**Presentation and Visual Material Preparation ( $f=8$ ):** Participants actively used AI tools for presentations, slides, logos, and visual material production. In this regard, one participant stated, *“I used Vyond for a class assignment, ChatGPT for extracting article summaries, writing a thesis, and preparing text, Gemini for a text preparation assignment, Suno for an assignment, Canva for creating logos while working at the tutoring center, and Gamma for preparing lecture activities and presentations, as well as for a reverse assignment and preparing lecture slides.”* Another participant who shared

a similar usage experience stated, *“Yes, I used them. Gamma was used for making presentations. Vyond was used for making videos. Suno was used for making songs. Apart from that, Gemini AI was used. Some questions were asked to prepare texts.”* (P12)

**Research and Information Gathering (f=5):** AI has been frequently preferred by participants in their homework, academic writing, and information gathering processes. One participant shared their experience, stating, *“Yes, I used ChatGPT and Gemini. I benefited from them mostly when preparing homework and drafting academic texts. The biggest advantage for me was the speed it provided.”* (P13) Another participant emphasized the variety of different tools, stating, *“Yes, I used Suno, ChatGPT, Gemini, and Gamma to create content and acquire knowledge in the field of education. It allowed me to create drafts on any content I wanted and enabled effective use.”* (P6)

Overall, participants use AI tools most frequently for text generation, presentation preparation, and research purposes. In addition, there are examples of use in more creative fields (music, storytelling, gamification, animation).

### **C) Comparison of Preconception and Final Perceptions**

Participants demonstrated a substantial transformation in their perceptions of AI as it relates to education when comparing their pre- and post-perceptions of AI. Initial perceptions were based on how AI facilitated access to information, saved time, and was a necessity for adaptation to the modern world. As participants initially viewed AI, they primarily identified AI as a useful element in regards to quick access to information, aiding students in their learning processes, and meeting the demands of education during the current era. However, some participants noted that AI could potentially limit students' research abilities and encourage people to rely upon ready-made information if utilized improperly. Thus, preconceptions created a more abstract, general, and potential focused lens of a balance between the advantages and disadvantages of AI.

However, recent perceptions demonstrate that the abstract, general, and potential-focused nature of the preconceptions developed into a more concrete, experienced, and diverse lens of perception. Participants now expressed the contributions of AI to education by way of additional details including access to, quality of, and efficiency and time-saving qualities of information, student motivation, individualized learning, teacher growth, and equal opportunities. Recent perceptions demonstrate that as participants utilize AI firsthand, they will better understand the multifaceted contributions of AI to education.

Similarly, while "be careful" was a primary concern of the initial perceptions, the cautionary statements made by participants in the final perceptions were much more organized and categorized into two distinct risk categories: teacher guidance and complacency/laziness. In other words, participants acknowledged the benefits of AI, but also stated that utilizing AI without the support of a teacher would result in decreased critical thinking among students and ultimately complacency among students.

Additionally, in contrast to previous perceptions, a theme of future expectations has emerged significantly in the recent perceptions. A large majority of the participants did not believe that the current applications of AI provided sufficient functionality; therefore, they anticipate AI to develop into an application that is more dependable, provides accurate academic resources, allows for the development of virtual classrooms, and encourages increased student engagement. Furthermore, while development and enhancement represented the category of expectations with the largest number of mentions, the subcategories of student involvement/interaction and creativity/inspiration were significant and notable as well. These results demonstrate that participants are evaluating the current benefits of AI, as well as the potential of AI to improve and expand in the future.

Lastly, an area that was not previously mentioned in the initial perceptions has been illustrated in the final perceptions of participants, who indicated which AI tools (i.e., ChatGPT, Gamma, Suno, Gemini, Canva, and Vyond) they currently utilize and for what purposes. The majority of the participants reported using these tools for academic purposes, such as creating content/text, preparing presentations, and conducting research, as well as creatively (i.e., music, storytelling, gamification, animation). These findings demonstrate that perceptions of AI have transitioned from being a theoretical or hypothetical subject of discussion to being an experiential domain that is increasingly integrated into participants' daily academic and professional practices.

Overall, it may be concluded that the evaluations of participants transformed from an abstract, cautious, and potential focused viewpoint to an experience-based, multi-dimensional, and concretely diverse viewpoint, inclusive of future-oriented expectations. The evolution of the assessments of participants indicates that AI is no longer simply viewed as an innovative technological advancement within the educational context, but is now becoming a central aspect of participants' educational experiences, resulting in both opportunities and risks that are more clearly defined in this process.

## 5 DISCUSSION

As shown in the results of this study, preservice teachers believe AI based tools to be most effective regarding: 1) customized learning; 2) Time saving; and 3) Diverse materials. As shown in the prior literature, AI, increases the quality of learning outcomes by presenting students with content that fits their individual learning pace (Chattopadhyay, 2025; Xu & Liu, 2025). Similar to the prior literature, Al Nabhani et al. (2025) have stated that AI developed systems generating content for students' individualized learning needs positively impact students' academic performance. A significant component of the literature demonstrates that AI systems are decreasing the work load of Instructional Designers by allowing them to create content faster (Dickey & Bejarano, 2023; Gupta, Dharamshi, & Kakde, 2024). Like the prior literature, our study found that preservice teachers were capable of creating a variety of different materials, in a short period of time.

Additionally, our study found that, like the prior literature, AI not only aids in the creation of content, but also helps to aid in increasing students' motivation and engagement in the learning process. Yuan and Liu (2024); Fountoulakis (2024); and Vieriu and Petrea (2025) all agree that AI assisted tools allow for greater student participation in foreign language education, by maintaining students' interests and making the learning process more interactive. Furthermore, the prior literature agrees that students who participate in individually designed learning experiences have less anxiety, and feel better emotionally during learning experiences (Vieriu & Petrea, 2025). Preservice teachers in our study emphasized the ability of AI supported materials to assist in increasing student interest, similar to the prior literature.

However, our study also found that the unintentional use of AI, may cause students to become complacent and superficial in their learning. The literature also agrees that the use of AI, without pedagogical oversight, may hinder students' ability to think critically (Alam et al., 2024; Folgieri, Gil, Bait, & Lucchiari, 2024). Gouseti (2024), in a systematic review completed in the K – 12 setting, reported that AI programs used without teacher direction may foster automatic thought patterns and lessen students' critical thinking abilities. Gouseti (2024) also found that AI has many ethical implications and a great deal of potential to provide misinformation (Gouseti, 2024; Mishra, 2024; Shrungare, 2022; Sajja, Sermet, Cikmaz, Cwiertny, & Demir, 2023). García-López et al.

(2025), also found that AI may contribute to several new risks in education including; risk of data privacy breaches, algorithmic biases, and inequities (García-López et al., 2025). These concerns echo the issues of complacency and ethical concerns expressed in our findings at a global scale.

The findings of our study reflect that preservice teachers improved their digital literacy through the utilization of AI tools, as does the majority of contemporary literature regarding the subject area of education. Prior research has indicated that AI tools have a positive effect on the digital and professional competence of preservice teachers (Çelebi, Yılmaz, Demir, & Karakuş, 2023). AI assisted digital modules improved the pedagogical competence of preservice teachers as well as the ability to utilize technology in the classroom (Temirkhanova, Abildinova, & Karaca, 2024; Yafie et al., 2024; Diachuk, 2024). A large number of studies including those conducted by Kelley and Wenzel (2025) and Daher (2025) indicate that AI literacy must include not only technical knowledge, but also an understanding of ethics, critical thinking and pedagogical integration. Chaerani, Harianto, Baehaqi, Frantius, and Mulvia (2024) discuss the importance of teachers and students consciously using technology. Additionally, Microsoft's (2025) educational report discusses how preservice teachers need to transition from being passive users to active creators and implementers of technology. Overall, collectively, our findings along with the current international literature demonstrate that AI tools are improving digital and pedagogical literacy. For this contribution to be long term, sustainable, ethical, critical, and pedagogical aspects must be continuously integrated.

Another significant finding of our study was that preservice teachers expect AI to provide them with more accurate and academically correct information than other sources. Our findings support the previous literature demonstrating that AI is viewed by educators as both a transformative and potentially risky force in terms of accuracy, quality and ethics in education (García-López et al., 2025; Anagnostopoulou, Grammatikos, Apostolou, & Mentzas, 2024). Furthermore, our study supports the growing body of literature that suggests that AI is not just a technological advancement, but it is also creating a paradigm shift in pedagogical restructuring (Siddiqui, Mansoori, Siddiqui, & Yadav, 2025). Specifically, Kestin et al. (2025) demonstrated that when properly designed to include pedagogical direction, AI supported individualized instruction may result in greater achievement than traditionally taught classroom instruction. As such, there is empirical evidence supporting the preservice teachers' expectations of accuracy

and quality. At the same time, concerns regarding ethics, privacy, algorithmic bias, and educational equity are still areas of great controversy (Zhu, Sun, & Yang, 2025; García-López et al., 2025). Simply having the technological capacity to implement AI in education will not provide a basis for responsible implementation; rather, educators need to develop pedagogical frameworks, establish ethical standards, and create ongoing assessment and improvement processes. In this regard, the expectations that preservice teachers have regarding the use of technology in their classrooms — which center on development, interaction, and creativity — provide positive views for how technology can be used in the classroom and for future directions, both technologically and pedagogically.

## 6 CONCLUSION

The results show that the preservice teachers' views about the artificial intelligence (AI), began to develop in a more complex, experience-based manner during the study. Their views on AI in the beginning were largely concerned with the generalized benefits of using AI - such as easy access to information, saving time and meeting today's needs; while their later views were much more specific and detailed, and therefore more pedagogically relevant due to their own experiences with AI. An example of this would be in relation to the several ways in which AI contributed to instruction. Their views on AI in instruction included: increased access to quality information, increased efficiency, increased motivation of students, and the opportunity for individualized instruction; in addition to promoting equal access for teachers and students.

Although the participants recognized the opportunities that AI presents in education, they also recognized potential pedagogical and ethical issues. In particular, the participants identified the potential for students to become too passive and/or lose the ability to think critically if the teacher does not provide active and critical guidance on the part of the student in regard to AI, and if the instruction related to AI is not designed by the teacher. As a result, there is a need to develop the appropriate pedagogical oversight, explicit ethics training, and intentional direction to successfully utilize AI in education.

In addition to identifying both the current and future possibilities of AI, the participants had high expectations for the future of AI. Participants believed that an AI

would produce a more reliable and academically accurate product than the students or other human tools that were available for creating academic work. The participants also believed that an AI could be used to provide interactive choices to enhance student engagement and participation with lesson activities and to support creativity and innovative instructional design. Thus, participants' perceptions of what an AI can accomplish represent an understanding that participants do not see AI as just a method to perform a specific task at a particular time. Rather, participants perceived an AI as a mechanism to foster long-range pedagogical reform and curriculum development.

Finally, the data demonstrated that the participants utilized a number of different AI tools (e.g. ChatGPT, Gamma, Suno, Gemini, Canva, Vyond) for a variety of educational purposes. This demonstrates that AI has evolved from being viewed as a theoretical construct to being viewed as a fundamental element of academic and professional practices in teacher education. Although most of the participants utilized AI primarily for the purpose of producing texts, creating presentations, and researching topics, they also utilized various creative and multimedia applications (music, stories, animations) of AI.

Overall, the study demonstrates that the participants' views regarding AI transitioned from being abstract and future-oriented views of what AI can do to a more practical and experientially-based views of what AI can do. Consequently, participants are aware of the benefits and limitations of AI, and they have articulated clearly-defined and future-focused views of AI's role in the classroom. As a result, it appears that teacher education programs should include a framework for utilizing AI in a practical manner, with a theoretical basis for that utilization, include modules for developing critical-thinking skills and ethics-related to AI, and support reflective-practice so that educators can utilize AI appropriately and ethically. Further research should attempt to explore how the initial enthusiasm for AI relates to long-lasting transformations in the participants' pedagogy through longitudinal comparisons or contrasts between the same group of participants at different points in time.

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### **Authors' Contribution**

All authors contributed equally to the development of this article.

### **Data availability**

All datasets relevant to this study's findings are fully available within the article.

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