

Lesson Plan Preparation Process with ChatGPT in Mathematics Teaching: An Example of Research and Practice¹

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Abstract: In order to keep up with the developing student profile in this century, the competencies of teachers and pre-service teachers in technology should be increased; both groups should follow the new developments on the agenda and be up to date. The aim of this study is to examine the use of ChatGPT, one of the generative artificial intelligence tools, by pre-service mathematics teachers and to present a study. Pre-service mathematics teachers in the 4th grade at a state university were asked to prepare a lesson plan in accordance with the 5E learning model. The data of the study were collected by recording this process. The study is a qualitative study by nature. Case study design was used in the study. When the findings of the study were examined, it was concluded that the pre-service teachers made changes in the lesson plans presented by ChatGPT in the sections of duration, number of activities, type of activities, expansion/change in the stages of the method used, methods and techniques used in the lesson plan, integrating technology. When the data obtained during the study are analyzed, it is seen that pre-service teachers' competencies in using ChatGPT are not strong.

Keywords: ChatGPT, Generative Artificial Intelligence, 5E Learning Model, Lesson Plan, Teacher Education.

1. INTRODUCTION

Since the 21st century, knowledge has become very important in areas such as research, production and business (Aktaş, 2007). As summarised by Engin and Korucuk (2021), adaptability, effective information management and critical thinking are among the basic qualities for individuals living in this century. In the 21st century, new generations are expected to acquire high-level skills such as digital literacy and problem solving while preserving their values (Uçak & Erdem, 2020). These “21st century skills” have a very important place for effective citizenship and career success (Ananiadou, & Claro, 2009). The students of this

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century are called “digital natives”. The role of teachers in developing the skills of digital natives is critical (Palfrey & Gasser, 2008; Anagün et al., 2016).

In the 21st century, the demand for teachers who can provide their students with the skills they need and who can focus on these skills is increasing day by day. For this reason, it is necessary to review and update the knowledge, skills and attitudes of teachers trained in the field of education; teachers need to have certain standards or competencies in order to become suitable for the needs of the age (Yavuz, Özkara, & Yıldız, 2015). Published in 2011 by The Australian Institute for Teaching and School Leadership Limited (AITSL), the teacher standards were developed to identify the skills and competencies of teachers in Australia. These skills are: knowledge and understanding, planning and preparation, teaching, creating environment, assessment and reporting, professional development, professional values and ethics (AITSL, 2011). The design of activities that teachers plan and organize to increase students' academic achievement is another important competency expected from 21st century teachers (Gürültü, Aslan, & Alcı, 2018). In order for teachers to have these competencies, it is necessary for teacher education systems and teacher training programs to focus on these skills. It is also important for teachers to be open to continuous learning and self-improvement because technology and knowledge are changing rapidly every day (Incik-Yalçın, 2020).

Artificial intelligence, which is frequently used in the new world, can help teachers to plan and execute the teaching environment (Lesgold, 1988). ChatGPT, which is one of the tools of Generative Artificial intelligence, has the potential to change how various professions are carried out with its ability to speak like a human (Kung et al., 2023; Lund, & Wang, 2023). This technology is considered to have the potential to change paradigms in information access, which can benefit many sectors such as education (Liebrenz et al, 2023; Shen et al, 2023; van Dis et al, 2023). The new world also has the potential to be an assistant for teachers.

The report published by the National Research Council (NRC) in 1999 on how people learn presents a synthesis of research on human learning processes. This synthesis emphasises key aspects such as students' interest, active participation, the ability to question existing knowledge, develop new understandings and apply what they have learned. In order to maintain this learning process effectively, there are different techniques, methods and models that adopt the constructivist approach. One of them is the 5E (Engage, Explore, Explain, Elaborate, Evaluate) learning model. The 5E learning model is a tool proposed to help teachers to teach students effectively by considering these findings (Tanner, 2010).

When the literature is examined, some of the studies related to the use of ChatGPT by teachers/pre-service teachers are as follows:

Tapan-Broutin (2023) investigated how pre-service mathematics teachers interacted with ChatGPT and concluded that pre-service teachers perceived ChatGPT as a tool for both emotional and social communication and access to scientific and instructional information. This perception suggests that ChatGPT can be seamlessly integrated into education. Trubić and Črnjarić (2024) evaluated the impact of ChatGPT on students' critical thinking and mathematical understanding, noting that trends such as attention deficit increase students' dependence on technology and require teachers to adapt to new educational conditions.

Meanwhile, Pelton and Francis Pelton (2023) explored the potential of ChatGPT in mathematics teacher education, emphasizing its value as a resource and recommending further experimentation with the technology.

When the research literature is analysed, it is concluded that in order to keep up with the digitally engaged student profile, the competencies of teachers and pre-service teachers in technology should be increased; both segments should follow the new developments on the agenda and be up to date. Artificial intelligence (AI), which has been an important area of development in recent years, is explained as a field of technology used for computer systems to acquire human-like abilities (Turing, 1950). As in other fields, developments in the field of AI in education have gained momentum and various applications and research using GAI tools in education have come to the agenda (Arslan, 2020). Generative artificial intelligence (GAI) generally refers to AI systems that can generate creative and original outputs in a human-like manner (Murphy, 2022). Unlike traditional AI models, these systems can engage in creative processes and produce new ideas, designs, music, images or texts (Bozkurt, 2023; Aydın, & Karaarslan, 2023). ChatGPT, one of the most popular language models of recent times, has the potential to pioneer many innovations in this field (Mhlanga, 2023; De Angelis et al., 2023; Aydın Yıldız, 2023).

The purpose of this research is to examine the experience of pre-service elementary mathematics teachers in creating a lesson plan in accordance with the 5E Learning Model using ChatGPT. In addition, it is aimed to create awareness of what pre-service teachers can do through ChatGPT regarding the research process. The research includes the steps that can be followed in preparing a sample lesson plan apart from the experiences of pre-service teachers. By sharing information on how to use ChatGPT effectively in the task of preparing lesson plans, it is aimed to introduce an application that can both save teachers' time and keep them up to date in the developing century in the task of preparing lesson plans.

2. METHODOLOGY

This section includes the characteristics of the participants in the study, the tools used to collect data in the study, and the data collection and analysis processes.

2.1. Research Design

This research is an application of qualitative research methodology. Qualitative research is an approach designed for in-depth understanding, interpretation and explanation of a phenomenon or problem. Using this approach, the researcher aims to uncover the insights and complexity of the topic under investigation. In this process, various data collection methods such as observation, in-depth interviews, focus group studies, content analysis and descriptive analysis are used. These methods help the researcher to develop a comprehensive and detailed understanding of the subject under investigation (Yıldırım, & Şimşek, 2013). This research adopts case study methodology, which is a qualitative approach to examine a specific phenomenon in depth (Yin, 1994; Merriam, 1988). Case studies provide a comprehensive and detailed analysis of a particular phenomenon, event, context or individuals. This analysis is

carried out with the aim of systematically describing and explaining one or more phenomena (Bromley, 1990).

2.2. Participants

The participants of the research consisted of 4th grade students studying at Eskisehir Osmangazi University, Faculty of Education, Elementary Mathematics Teaching Undergraduate Program in the fall semester of 2023-2024 academic year. Ten pre-service teachers, three males and seven females, who voluntarily took the compulsory Teaching Practice course, were selected for this group. Convenience sampling, one of the purposeful sampling methods, was used to form the working group. Convenience sampling is a type of sampling that allows the researcher to collect data in a fast and cost-effective manner and is usually easily physically available or accessible. This sampling method is frequently used when it is easy to access data related to the research topic (Yıldırım, & Şimşek, 2013). In order to learn the knowledge status of the pre-service teachers participating in the study on artificial intelligence, each pre-service teacher was interviewed before the study. As a result of this interview, it was concluded that most of the pre-service teachers had knowledge about ChatGPT and one pre-service teacher participated in trainings on GAI. Most of the pre-service teachers stated that they used ChatGPT in their lessons or in relation to the subjects they wanted to do research. The pre-service teachers who participated in the research were coded as PT1, PT2, PT3, PT4, ..., PT10.

2.3. Data Collection Tools

Data collection tools refer to the methods and tools by which data are collected, recorded and analyzed for a research or study. Different tools can be used depending on the type of research, objectives and requirements of the data collection process (Doğan, 2019). The data collection tools used in this research are the task form prepared for the 5E Learning Model and the purpose to be achieved related to the ChatGPT language model.

This research consists of two stages. The first one is the task part given to pre-service teachers within the scope of this study. The pre-service teachers were asked to prepare a lesson plan using ChatGPT in accordance with the 5E Learning Model. This task given to pre-service teachers consists of two parts. In the first part, there are contents including the formal features (name of the subject, purpose, grade level, learning and sub-learning area, unit name, outcomes or concepts, duration, material(s)) related to the subject they have chosen. In the second part, the stages of the learning and teaching process (stages of the 5E Learning Model) are given. In the last part of the form, there is a section where pre-service teachers can write the sources they used. In this task form, students were also asked to add visual materials. They were asked to screen record their correspondence and prompts they entered while using ChatGPT and send them to the researcher. In this study, in addition to presenting the experiences of pre-service teachers, the researcher will also share the process of preparing a sample lesson plan in accordance with the 5E Learning Model using ChatGPT.

2.4. Data Collection Process and Analysis

The implementation process lasted for two weeks. In the first week of the implementation, a presentation was prepared in order to raise awareness of the use of AI interfaces. In this presentation, AI, GAI, ChatGPT and other language models were mentioned. During the explanation of these topics, definitions, their importance, where they can be used, and their advantages in education were given. The purpose of such a broad presentation is to show prospective teachers that there are GAI that they can use in their lessons when they start their professional lives in the future. At the same time, it is to contribute to their becoming teachers with the skills of this century by not lagging behind the age. In the second week of the implementation, pre-service teachers were asked to prepare a lesson plan in accordance with the 5E Learning Model using ChatGPT. The task form prepared for the pre-service teachers was given to them online. The participants were asked to record the process of preparing the lesson plan in accordance with the 5E Learning Model using ChatGPT. Every Prompt they entered ChatGPT and every data they searched online while preparing lesson plans were recorded with the screen recording program selected by the participants. During the process, a Google Drive folder was created and the link address was shared with the participants so that they could send the data they recorded and created to the researcher. The participants were allowed to upload their screen recordings and the lesson plans they created to this folder. The data obtained at the end of the application and the interviews with the participants were transferred to the computer environment and the data were analyzed in detail using the content analysis method. This analysis method was used to understand the participants' discourses in depth and to answer the research questions (Creswell, 2013).

3. FINDINGS

In this section, the findings obtained from the process of preparing a sample lesson plan in accordance with the 5E Learning Model using ChatGPT and a sample lesson plan of ten pre-service teachers are presented.

3.1. Findings from Pre-service Teachers' Experiences of Preparing Lesson Plans via ChatGPT

When the first Prompts entered by the pre-service teachers to ChatGPT are analyzed, the data obtained are as follows:

- **PT1:** Can you prepare a lesson plan according to the learning outcome 'draws line segments of equal length to a line segment' in accordance with the steps of the 5E learning model?
- **PT2:** Can you prepare a lesson plan in accordance with the 5E model for the 8th grade mathematics learning outcome of solving equations with one unknown?
- **PT3:** Can you prepare a lesson plan in accordance with the 5E learning model about 6th grade mathematics multiples and multiples?
- **PT4:** Do you know the 5E model in education?
- **PT5:** Do you know the 6th grade algebraic expressions topic?
- **PT6:** Do you know the 5E learning model?

- **PT7:** Do you know the 5E learning model?
- **PT8:** Do you know the 5E model?
- **PT9:** Can you prepare a lesson plan for the 5th grade mathematics lesson on fractions in accordance with the 5E model?
- **PT10:** Do you know the 5E model?

When the first Prompts entered are analyzed, it is seen that four participants asked ChatGPT to prepare a lesson plan directly related to the subject they wanted, five participants tested ChatGPT on the model they would use first, and one participant tested ChatGPT on the subject they would use in the lesson plan they would prepare.

Subsequently, it was determined that the participants entered Prompts to make some changes related to the lesson plan that ChatGPT first presented to them. These Prompts are as follows:

- **PT1:** Can you create a more detailed plan?
- **PT2:** Can you organize the plan using an equal-armed scale?
 - Can you make changes to the plan to make students more active?
 - Can you reorganize the plan by adding a fun and informative game?
 - Can you organize this plan so that it can be completed in 2 class hours, i.e. 80 minutes?
- **PT3:** Can you make it more activity-oriented?
- **PT4:** Can you give more concrete examples?
 - What kind of an arrangement can I make if I want to do it in fewer class hours?
 - What can I do if I want to add technology support?
 - Do you have any online simulation suggestions for interactive applications?
 - Can you remove the video watching section in the extension section and replace it with a content that includes the teacher's own narration?
 - Can you organize the lesson plan by adding where I will use the technology support in the lesson plan?
- **PT5:** If I include an activity about algebraic expressions in this lesson plan, what kind of activity would you suggest?
 - Can you suggest an online application to enrich the lesson content?
 - Can you make the introduction part of this plan more detailed?
 - Can you suggest an activity for the deepening part of this lesson plan?
- **PT6:** Which methods and techniques can I use in the factorization 5e model we have just prepared?
 - How many minutes should the lesson duration be in the latest 5e model we prepared?
- **PT7:** Can you give an example of a simpler activity?
 - Which methods and techniques should I use while teaching this lesson?
 - How many lesson hours do I need for this lesson plan?

- **PT8:** Can you add activities and games suitable for this model?
Can you change the exploration part of the 5E model?
Can you make the evaluation part of the 5E model more comprehensive?
- **PT9:** Can you suggest a suitable activity for this plan?
Which teaching methods and techniques should I use for this activity?
- **PT10:** Can you make the introduction part of this plan more detailed?
Can you suggest activities related to the deepening part of this lesson plan?
Can this plan be applied in any classroom environment?

When the Prompts entered by the participants are examined, it is seen that they made changes in some common sections. Four participants made changes in the duration of the lesson plan, three participants made changes in the number of activities, four participants made changes in the type of activities, four participants made changes in the stages of the 5E learning model, three participants made changes in learning the method and technique used in the lesson plan, and two participants made changes because they wanted to integrate technology into the lesson plan.

3.2. Example of A Lesson Plan Prepared through ChatGPT

In this section, data on the process of preparing a sample lesson plan by entering some Prompts into ChatGPT are presented.

First, the Prompt 'Can you prepare a lesson plan in accordance with the steps of the 5E learning model for the topic "*M.7.1.5. Percentages*" in the middle school mathematics curriculum in *Türkiye*' was entered into ChatGPT. The content created for the introduction part of the lesson plan is given in Table 1.

Table 1 : Engage to ChatGPT's Lesson Plan

Engage (<i>Motivation-Attention-Mobilizing Prior Knowledge</i>):
- Students are given examples of how percentages are used in daily life. For example, calculating the discount rate in a shopping trip, percentiles of an athlete's score in a race, etc.
- Through a discussion, students are encouraged to talk about how familiar they are with percentages and how they encounter them in daily life.

Table 1 shows the engage part, which is the first step of the lesson plan prepared by ChatGPT in accordance with the 5E Learning Model. The Prompt "*What can I ask students to do as a preparation for the lesson?*" was entered to further elaborate the introduction. When ChatGPT's response was analyzed, it was seen that it suggested four activities. These are: Collecting examples from daily life, real life scenarios, preparing their own questions about percentages, watching videos

The second stage of the 5E Learning Model is the "Exploring" part. The content offered by ChatGPT for this section is given in Table 2.

Table 2. *Exploring Part of the Lesson Plan Prepared by ChatGPT*

Explore
-Students are given a short presentation about the definition and uses of percentages. -Students are given a series of examples and asked to explore how percentages are calculated. -Students are given a series of questions and examples to provide practical uses of percentages.

In the "Exploring" section in Table 2, ChatGPT was asked how this section could be integrated into out-of-class learning environments. For this, the Prompt "*In what kind of learning environment can I realize the exploration section outside the classroom?*" was entered. Out-of-class environments that ChatGPT offers as examples: Practicing at home, research tasks, presenting games and activities to the student, using a virtual environment, visiting out-of-school spaces (museums, shopping malls, gyms, etc.). Since the answer given did not meet what was required, a more detailed Prompt was entered as "*How can I create a learning environment outside the classroom without going outside the school?*". In response, ChatGPT suggested: virtual spaces and simulation, online discussion and group work, project-based learning, online quizzes and exams.

Table 3. *Explanation Part of the Lesson Plan Prepared by ChatGPT*

Explain
-Students are explained in detail how percentages are calculated. Basic concepts such as percentage, finding the percentage, converting the percentage to a number, calculating the percentage are emphasized. -Students are explained the relationship between percentages and fractions.

Since this section is usually verbal, we wanted to make it more interesting for students. Accordingly, the Prompt "*How can I present the relationship between percent and fraction more fun for students?*" was entered in response to this Prompt: games and activities, math games and applications, visual and interactive tools, real-life scenarios, storytelling. Among these options, the storytelling approach was considered to be more fun, so this section was continued. The Prompt "*Can you provide a storytelling example?*" was entered for ChatGPT to develop a story suitable for the topic. The story is included in Figure 1.

Once upon a time, in the Land of Mathematics, percentages and fractions lived harmoniously together. Percent often pondered where fractions were in their daily routines. One sunny day, while strolling through the picturesque Capital Park of Schuin, which was a perfect 100 percent, Percent encountered Fraction.

"Hello!" greeted Percent cheerfully. "Who are you, and how do you fit into everything?"

Fraction proudly introduced himself, "I am Fraction! You've seen me in math problems and in everyday life. It's a pleasure to meet you!"

Intrigued, Percent asked, "So, when do we encounter you, and why aren't you always with me?"

With a smile, Fraction explained, "I'm everywhere, including with you! For instance, when half of a cake is eaten, that's me too. That half is also expressed as a percentage. So, I am essentially 50 percent!"

Surprised, Percent inquired, "What about the other half?"

Fraction continued, "Ah, that's also me! The entire pie, which is 100 percent, represents the whole. Hence, the second half is also 50 percent!"

Listening intently to Fraction's explanation, Percent was fascinated. "I understand now!" exclaimed Percent joyfully. "So, you and I represent the same concept, just expressed differently!"

From that day forward, Percentage and Fraction became inseparable companions in the Land of Mathematics. They studied together, tackled math problems, and flourished in their shared understanding.

Figure 1. *Story about Percentage and Fraction Relationship*

According to the story in Figure 1, ChatGPT presents a story that explains the relationship between percent and fraction and includes math integration.

The content prepared by ChatGPT for the "Deepening" section, another stage of the lesson plan in accordance with the 5E Learning Model, is given in Table 4.

Table 4. *Deepening Part of the Lesson Plan Prepared by ChatGPT*

Elaborate

- Students are given a series of examples to solve problems with percentages.
 - Students work with examples from everyday life, such as shopping scenarios, sports statistics or examples from popular culture.
 - Students practice using different methods to calculate percentages.
-

Looking at the stages given in Table 4, it was seen that ChatGPT suggested three different contents for this section. In order to address the directive in the third item more comprehensively, the Prompt "*Where can I take the students in Eskisehir where they can calculate percentages?*" was entered in the 4th step, Elaborate. ChatGPT's response is shown in Figure 2.

1. **Eskişehir Metropolitan Municipality Agricultural Garden:** This venue allows students to observe various plant species in their natural environment and experience agricultural activities. Students can practice percentage calculations by engaging in real-life scenarios such as harvesting agricultural products, their sale, and calculating discounts.
2. **Eskişehir Science, Art, and Culture Park (Science Center):** With interactive exhibitions and experiment areas, this park provides students with a fun way to learn about mathematics and science. Here, students can practice percentage calculations and gain practical experience related to real-life situations.
3. **Eskişehir Children's Culture and Art Center (Children's Museum):** This center offers children interactive exhibitions and games for enjoyable learning experiences. Students can apply percentage calculations practically through interactive activities available at the museum.
4. **Eskişehir Shopping Centers:** Shopping centers in Eskişehir provide students with opportunities to practice percentage calculations based on daily life scenarios. Students can compare prices of discounted products and calculate discount rates, thereby gaining practical experience.
5. **Eskişehir Porsuk River:** Guided boat tours along the iconic Porsuk River introduce students to the city and provide information about discounts offered by various businesses. During these tours, students can practice percentage calculations by calculating discount rates.

Figure 2. *Out of School Learning Environments*

The places given in Figure 2 are places that can be visited for mathematics education in Eskişehir.

The content prepared for "Evaluation", which is the last stage of the lesson plan prepared by ChatGPT in accordance with the 5E Learning Model, is given in Table 5.

Table 5. *Evaluate Section of the Lesson Plan Prepared by ChatGPT*

Evaluate

- A series of questions and problems are given to measure students' level of understanding.
 - Class discussions are held to evaluate students' solution processes and results.
 - Feedback is given to students to reinforce their learning and provide extra support when needed to help them understand their gaps.
-

When Table 5 is examined, it is seen that it is suggested to use discussion method other than questions and problems for evaluation. For this part, ChatGPT was asked the question "*How can I create a discussion environment in the evaluation part?*". In response to this question, ChatGPT gave the steps to be followed to make a discussion. In order to achieve the desired result, a more explicit and detailed Prompt was given. This Prompt is: "Can you suggest a discussion topic related to the topic of percentages that I can use in the evaluation phase of the 5E learning model?". In response to this, the discussion topics offered by ChatGPT are shown in Figure 3.

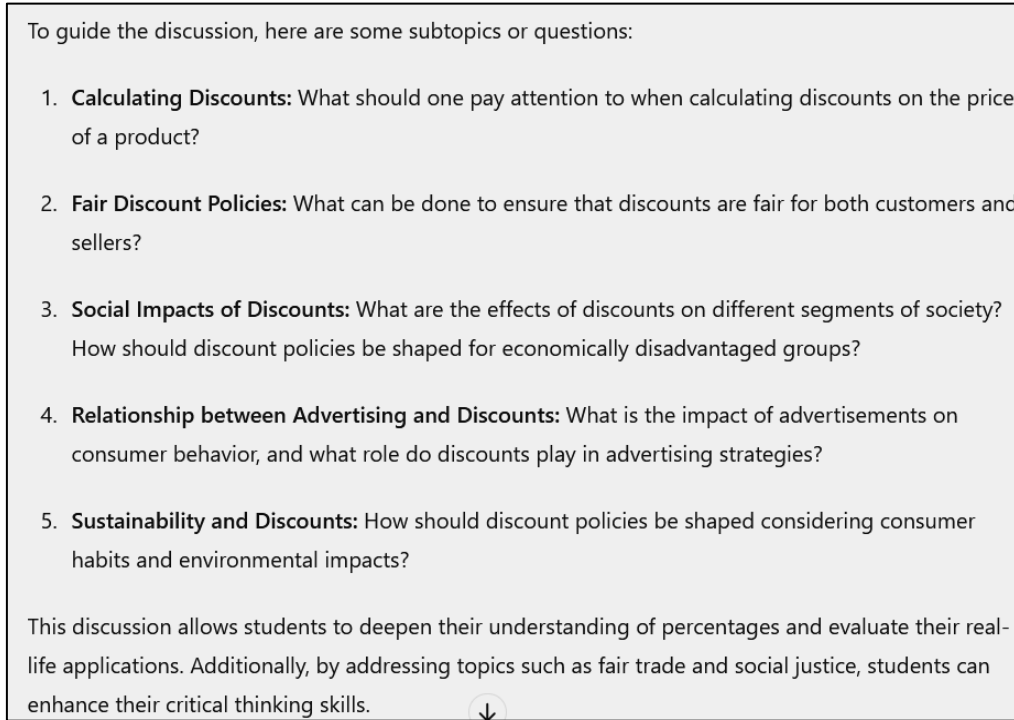


Figure 3. *Suggested Discussion Topics on Percentages*

Finally, ChatGPT was asked "Can you suggest a learning technology that I can use in accordance with the flow of this lesson plan?" in order to see which instructional technologies it would suggest during the lecture considering the whole plan. Suggested learning technologies: Online percentages calculation tools, E-learning platforms, simulations and interactive graphics, e-books and online resources, social media and forums. Among his suggestions, he focused on e-learning platforms and entered the Prompt "Can you give examples of e-learning platforms?" to ChatGPT. ChatGPT gave "Canvas, Moodle, Google Classroom, Edmodo, Schoolog" as examples of e-learning platforms.

4. RESULTS AND DISCUSSION

When we look at the first prompts that pre-service teachers entered ChatGPT, it is seen that the majority first tested ChatGPT. It was concluded that pre-service teachers started the conversation by asking questions about the model or subject they used. When Tapan-Broutin's (2023) study is examined, it is stated that pre-service teachers started their first interaction with ChatGPT with greetings, which is a social interaction.

When the Prompts that pre-service teachers entered into ChatGPT were analyzed in general, it was seen that they did not prefer to use the lesson plan that ChatGPT first offered. It was concluded that the pre-service teachers entered extra prompts into ChatGPT and customized the lesson plans prepared by ChatGPT in the way they wanted. It was concluded that the adjustments they made were generally in the form of "duration, number of activities, type of activities, expansion/change in the stages of the method used, methods and techniques used in the lesson plan, integrating technology". When all the Prompts entered were analyzed, it was concluded that most of the pre-service teachers wanted to make changes in the entire lesson plan presented by using holistic expressions instead of correcting the parts they found

inadequate in the lesson plan separately. In other words, instead of indicating the steps to be adjusted in the 5E Learning Model in the lesson plan presented, they asked them to redesign the entire lesson plan in accordance with the change they wanted. In the study conducted by Ergün (2023), it was stated that ChatGPT offered too many activities to pre-service teachers. It was concluded that pre-service teachers prepared lesson plans in accordance with the Prompts they entered in accordance with the desired subject and learning area. When the Prompts entered in this study are examined, it is seen that the pre-service teachers prepared plans in accordance with the desired content in line with their Prompts. However, it was also found that some pre-service teachers had difficulty in reaching the results because the Prompts they entered while preparing the lesson plan were not as detailed or meaningful as required. In the same direction, Tapan-Broutin (2023) concluded that the responses of ChatGPT depend on the Prompts and directions given, and that Prompts that are appropriate for the purpose and well-expressed produce the desired responses. Therefore, it is important for teachers to provide the correct Prompts and receive training on this issue. When the data obtained during the study are analyzed, it is seen that pre-service teachers' competencies in using ChatGPT are not strong. As a matter of fact, Bozkurt (2023) emphasizes the importance of AI literacy and engineering skills in his study and states that these skills are critical to better prepare for the future. He states that the development of AI-related skills will profoundly affect the teaching and learning methods of GAI technologies and will play an important role in meeting new thinking requirements. Aydın Yıldız and Çınar Yağcı (2023) also found similar results in their study. In this context, Bozkurt (2023) and Aydın Yıldız and Çınar Yağcı (2023) highlight the importance of being prepared for a future dominated by AI.

In the lesson plan example prepared with ChatGPT, in the section where the discussion topic was requested from ChatGPT, it presented the steps of the discussion instead of the discussion topic at the first stage. Then, it presented discussion topics as requested in the Prompt entered. When the discussion topics presented are analyzed, it is seen that there are interesting discussion topics. Sheikh (2020) stated that artificial intelligence can contribute to the teacher in preparing the course content with interesting, flexible and personalized content in the learning process. However, these interesting topics should be revised by the teacher and presented to the students instead of being used directly for 7th grade students. Indeed, Baidoo-anu and Owusu Ansah (2023) stated in their study that ChatGPT can be used for various purposes in education. These purposes include personalized and interactive teaching, creating assessment and evaluation questions of specific quality and quantity, and providing individual and subject-specific feedback. This shows that ChatGPT has a wide application potential in the field of education. The first answer of ChatGPT may not always be appropriate to the request. However, with the deep learning system, it is possible to reach the desired result with clear sentences and more detailed structures. When the results of Pelton and Francis Pelton's (2023) study are examined, it is emphasized that ChatGPT can produce grammatically correct and sometimes relevant texts when directed appropriately, that it can be a valuable resource for mathematics teachers, and that teachers should experiment and explore this technology more.

5. RECOMMENDATIONS

In line with the results obtained in this research, the following recommendations are presented for practitioners and researchers:

Recommendations for practitioners:

- Include courses on the effective use of GAI interfaces and Prompt engineering in the curricula of teacher education programs.
- It can be ensured that pre-service teachers can experience tasks such as lesson plan preparation and activity development that they will benefit from in the teaching profession through ChatGPT.

Recommendations for researchers:

- Within the scope of the teaching practice course, research can be planned in which pre-service teachers prepare lesson plans through ChatGPT and use them in their internship schools.
- Investigating the changes that occur in the classrooms of teachers who do not use GAI and the differences before and after using this technology in their lecturing and teaching methods.

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7. ABOUT THE AUTHORS

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8. References

Aktaş, C. (2007). Turkey in the context of information Society. *Journal of Selcuk University Faculty of Communication*, 4(4), 181-193.

Anagün, Ş. S., Atalay, N., Kılıç, Z., & Yaşar, S. (2016). Development of a scale for perception of 21st century skills competence among teacher candidates: A study of validity and reliability. *Pamukkale University Journal of Education*, 40(40), 160-175.

Ananiadou, K., & Claro, M. (2009). 21st century skills and competences for new millennium learners in OECD countries. *OECD Education Working Papers, No. 41*. OECD Publishing. <https://doi.org/NJ1>

Aydın Yıldız, T. (2023). The impact of ChatGPT on language learners' motivation. *Journal of Teacher Education and Lifelong Learning*, 5(2), 582-597.

- Aydin Yildiz, T., & Yağci, Ş. Ç. (2023). How can artificial intelligence help to a researcher? A sample of Chatgpt4 role. *International Journal of Language Academy*, 11(3), 277-296.
- Baidoo-Anu, D., & Owusu Ansah, L. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. Available at SSRN 4337484.
- Bozkurt, A. (2023). ChatGPT, generative artificial intelligence, and algorithmic paradigm shift. *Alanyazın*, 4(1), 63-72.
- Bromley, P. D. (1990). Academic contributions to psychological counselling: A philosophy of science for the study of individual cases. *Counselling Psychology Quarterly*, 3(3), 299-307.
- Broutin, M. S. T. (2023). Examination of questions posed by mathematics teacher candidates in initial experiences with ChatGPT. *Journal of Uludağ University Faculty of Education*, 36(2), 1-26.
- Creswell, J. W. (2013). *Qualitative research methods*. (M. Bütün & S.B. Demir, Trans. & Eds.). Istanbul: Siyasal Publishing.
- De Angelis, L., Baglivo, F., Arzilli, G., Privitera, G. P., Ferragina, P., Tozzi, A. E., & Rizzo, C. (2023). ChatGPT and the rise of large language models: the new AI-driven infodemic threat in public health. *Frontiers in public health*, 11, 1166120.
- Doğan, G. (2019). Research data method. February 12, 2024 retrieved from <https://acikveri.ulakbim.gov.tr/acik-veri-acik-bilim/bolum-2-arastirma-verisi-hazirlama-sureci/2-5-veri-toplama-araclari/>
- Engin, A. O., & Korucuk, M. (2021). Examination of students' 21st century skills from various perspectives. *Gazi University Journal of Gazi Faculty of Education*, 41(2), 1081-1119. <https://doi.org/10.17152/gefad.875581>
- Ergun, M., (2023). Fen bilimleri öğretiminde ders planı tasarlayan yapay zekâ: ChatGPT örneği [Artificial intelligence designing lesson plans in science teaching: The case of ChatGPT]. 3rd International Artificial Intelligence and Data Science Congress (pp.27). İzmir, Türkiye.
- Gasser, U., & Palfrey, J. (2008). *Born digital: Connecting with a global generation of digital natives*. New York: Perseus.
- Gürültü, E., Aslan M., & Alcı B. (2018). Examination of primary school teachers' competencies in the light of 21st century skills. *The Journal of Academic Social Sciences*, 6(71), 543-560.
- İncik-Yalçın, E. (2020). Examination of teachers' lifelong learning tendencies and 21st century teaching skills relationship. *Bolu Abant İzzet Baysal University Journal of Education Faculty*, 20(2), 1099-1112.
- Lesgold, A. (1988). Toward a theory of curriculum for use in designing intelligent instructional systems. In *Learning issues for intelligent tutoring systems* (pp. 114-137). New York, NY: Springer US.

Liebrez, M., Schleifer, R., Buadze, A., Bhugra, D., & Smith, A. (2023). Generating scholarly content with ChatGPT: ethical challenges for medical publishing. *The lancet digital health*, 5(3), e105-e106.

Lund, B. D., & Wang, T. (2023). Chatting about ChatGPT: how may AI and GPT impact academia and libraries?. *Library Hi Tech News*, 40(3), 26-29.

Merriam, S. B. (1988). *Case study research in education: A qualitative approach*. San Francisco, CA: Jossey-Bass.

Mhlanga, D. (2023). Open AI in education, the responsible and ethical use of ChatGPT towards lifelong learning. In *FinTech and artificial intelligence for sustainable development: The role of smart technologies in achieving development goals* (pp. 387-409). Cham: Springer Nature Switzerland.

Murphy, K. P. (2022). *Probabilistic machine learning: An introduction*. MIT Press.

National Research Council. (2000). *How people learn: Brain, mind, experience, and school: Expanded edition* (Vol. 1). National Academies Press.

Pelton, T., & Pelton, L. F. (2023, March). Adapting ChatGPT to support teacher education in mathematics. In *Society for Information Technology & Teacher Education International Conference* (pp. 1662-1670). Association for the Advancement of Computing in Education (AACE).

Sheikh, S. (2020). *Understanding the role of artificial intelligence and its future social impact*. IGI Global.

Shen, Y., Heacock, L., Elias, J., Hentel, K. D., Reig, B., Shih, G., & Moy, L. (2023). ChatGPT and other large language models are double-edged swords. *Radiology*, 307(2), e230163.

Tanner, K. D. (2010). Order matters: using the 5E model to align teaching with how people learn. *CBE—Life Sciences Education*, 9(3), 159-164.

The Australian Institute for Teaching and School Leadership Limited. (2011). Australian international standards for teachers. January 14, 2024 retrieved from <https://www.aitsl.edu.au/standards>.

Trubić, M. Š., & Črnjarić, N. (2024). New challenges in maths teaching - exploring the potential of ChatGPT. In *INTED2024 Proceedings* (pp. 4110-4118). IATED.

Turing, A. M. (1950). Computing machinery and intelligence. *Mind*, LIX(236), 433.

Uçak, S., & Erdem, H. H. (2020). In search of a new direction in education context: "21st century skills and educational philosophy". *Uşak University Journal of Education Research*, 6(1), 76-93. <https://doi.org/10.29065/usakead.690205>

Van Dis, E.A., Bollen, J., Zuidema, W., van Rooij, E., Bockting, C.L.(2023) ChatGPT: Five priorities for research, *Nature*, 614(7947), 224–226.

Yavuz, M., Özkara, T., & Yıldız, D. (2015). The teacher competencies and teacher education in international reports. *SDU International Journal of Educational Studies*, 2(2), 60-71.

Yıldırım, A., & Şimşek, H. (2013). *Qualitative research methods in social sciences*. Ankara: Seçkin Yayıncılık.

Yin, R. K. (1994). *Case study research: design and methods (2nd ed.)*. Thousand Oaks, CA: Sage Publications.