From AI-Generated Lesson Plans to the Real-Life Classes: Explored by Pre-Service Teachers

Dilara Yılmaz Can[1] [ID] **, Ceyda Durmuş[2]** [ID]

[1]Kocaeli University, Turkey, [2]Republic of Türkiye Ministry of National Education, Turkey

Abstract

ChatGPT is a powerful Artificial Intelligence (AI) technology that has the potential to revolutionize the way we study in education. It can be used in a variety of ways and we, on the other hand, focused on senior pre-service teachers' designing a mathematics lesson plan to implement in primary schools. Four voluntary participants attended, as half of which designed a mathematical task by asking AI while the rest used traditional methods in planning the task. In the next breath, participants implemented their lesson plans in a public school and collected the data relating to tasks they used. At the end, we compare the outcomes concerning the lesson plan and implementation in schools, and determine the strengths and weaknesses of each approach. This research offers valuable insights into using ChatGPT in teacher education to be used in practice and considering the teachers' task designing role in classrooms with and without ChatGPT.

Keywords: Artificial intelligence; ChatGPT, teacher education, pre-service teachers, mathematics lesson plan

1. Introduction

Once, it was education leading the way in paradigm shifts. Now, propelled by research and development activities— in other words, by riding the wave of artificial intelligence's [AI] meteoric rise—it has become inevitable to compel the four horses of education to pursue novelty. AI-generated tools elegantly dance onto the stage. Generative AI is stirring up quite the excitement, thanks to using the magical blend of natural language processing and extensive language models. Because AI has this superpower to grasp and spit out human language which is known to be the pinnacle of sophistication in system development, to spot patterns; the trained-up versions of this AI can shuffle through language constructs (Bozkurt, 2023). While it took humans approximately six million years to evolve, we now possess a polyglot and talkative genius at our fingertips, capable, if trained proficiently, of swiftly solving previously unsolved problems in mathematics.

Generating quite the mojo with its content-creating prowess, generative AI has sparked a flurry of scholarly debates, prompting researchers to dive into its potential perks and pitfalls (Johinke et al., 2023). Authorities in the realms of education and innovation proclaim that given the burgeoning presence of generative AI tools in the lives of young individuals, a strategic endeavor is imperative to blend them seamlessly into educational frameworks. Knowing that AI is used in numerous fields (Kasneci et al., 2023), we attempt to answer this question in the educational scope. This research seeks to explore the effects of incorporating AI-generated lesson plans into the teacher education program, center upon the viewpoints and encounters of future educators.

One of the AI tools that can be employed for educational purposes is ChatGPT AI language model developed by OpenAI. It's designed to understand and generate human-like text based on the input it receives. Using a vast amount of data and machine learning techniques, ChatGPT can engage in conversations, answer questions, generate text in various styles, and assist with a wide range of tasks, from providing information to creative writing. What makes ChatGPT unique is its ability to produce high-quality text for broad input, constant learning capabilities, and partly free usage. ChatGPT showcases its capacity to bolster student writing through multiple avenues: offering outlines, scaffolding knowledge, generating summaries, paraphrasing content, providing feedback on diverse submissions, and even facilitating practice quizzes on specified subjects (Halaweh, 2023).

ChatGPT offers a spectrum of support in educational settings, from automated feedback, discussion starters, and grammar/spelling corrections to crafting syllabi, lesson plans, and developing curricula (Cope et al., 2021; Lin, 2022). Numerous recent studies have proposed that the utilization of ChatGPT within educational contexts presents opportunities for enhanced teaching methodologies and improved learning experiences (Adiguzel et al., 2023; Cooper, 2023; Kasneci et al., 2023). When it comes to core subjects, the integration of lesson plan preparation within teacher education programs, with a particular focus on mathematics may affect the classroom setting at the schools. Hays et al., (2023) found that the majority of teachers do not use any AI tools and ChatGPT either in their lessons. And the minority use it for the lesson plans/substitute plans, letters of recommendation and asking how to teach with it. The AI platform, by identifying a student's areas of struggle in mathematics, can dynamically adapt the lesson (Graham, 2023). Spot on the present research, Hong (2023) and Phillips (2023) have discussed aspects of lesson planning. However, no research articles that focus on GPT-generated lesson plans in mathematics and also carry out the plans in primary schools to see if it works in real practice. This study aims to investigate the impact of integrating AI-generated lesson plans into the teacher education curriculum, focusing on the experiences and perspectives of pre-service teachers. Based on this, we specify the research question:

1) What similarities and differences exist between Chat-GPT and the traditional mathematics lesson plans created by pre-service teachers?

2) What implications arise from varying learning plan applications for pre-service teachers and primary students?

2. Methodology

This research is comparative case study which is a research approach to formulate or assess generalizations that extend across multiple cases. Yin (1984) states that case studies in qualitative research assist in researching complex phenomena (cases) or those that we do not know much about. The cases in this research are designing a mathematical task by the aid of ChatGPT and without the ChatGPT support. Research trajectory is explained below.

AI-generated lesson planning workshop and creating the lesson plan: We conducted a two hour-workshop where pre-service teachers are introduced to ChatGPT and guided in using the AI model to generate lesson plans. Three pre-service teachers participated in this training while the other three participants who will conduct the lesson with traditional methods were out in that part of the research. Pre-service teachers created the lesson plan in accordance with their topic in accordance with the 5E model from constructivist approach and right after the workshop and sent it to the researchers. We specify to study "fractions" as a mathematical theme so that all participants are coherent with the implication of the theme. We employed three fraction concepts for every two of the pre-service teachers (one uses AI, one uses a traditional method) to design a lesson: i) Instruction of unit fractions' magnitude, ii) Instruction of proper fractions' magnitude, iii) fraction comparison.

Implementation in school visits and observations: Whole process takes place in the same public school where the classrooms include 24, 4th grade students on average. Each attainment was implemented in the same classroom subject to two different lesson plans. In other words, one attainment was assigned to a class and the attainments were implemented as two practices in 3 different classes. Researchers gather observations and feedback from both pre-service teachers. As a sum, the observation form is filled by researchers and by pre-service teachers regardless of implementer or observer.

Comparative analysis: Texts generated by ChatGPT and tradition-based lesson plans were utilized for document analysis. The researchers ensured that, through credibility, the data were collected from the official ChatGPT site. Participants' reflections, their notes, and researchers' observation notes were assessed, and all data were cross-checked for better implications. All data were analyzed collectively by the researchers, and decisions were reached by consensus.

3. Findings

3.1. Assessment of lesson plans

The lesson plans with a traditional lens and with the support of ChatGPT were analyzed according to the six criteria on Table 1.

Table 1: Assessment Results of Participants' Lesson Plans

Method & Techniques		Originality	
AI-generated	*Traditional*	*AI-generated*	*Traditional*
-Question & answer -Narrative -Discussion -Group working	-Question & answer -Demonstration	-Highly original	-Mostly conventional tasks and activities -Depends on the planner
Functionality		**Suitability**	
AI-generated	*Traditional*	*AI-generated*	*Traditional*
-Supporting various strategies -Promoting peer teaching and sharing -Giving otantic example -Offering accessible materials -Rule-based approach	-Emphasis on visual representation and modeling -Detailed explanations	Inappropriatenes s to student level and grade level -Redirection to arithmetic processing	-More flexible to arrange the plan according to the suitability

According to Table 1, ChatGPT offers group working and discussion regarding methods and techniques. Question and answer methods are standard for both tools. Oppositely, ChatGPT generates more original ideas. Besides, traditional lesson plans offer more convenient content and require less inference. As for functionality, supporting various strategies, promoting peer teaching and sharing, and giving real-life examples are considered positive features of AI-generated tools. Emphasis on visual representation and modeling and detailed explanations are positive sides of traditional lesson plans. It can be accepted that quite similar lesson plans were created by offering easily accessible materials such as papers, cardboard, and visual models.

3.2. Assessment of Pre-Service Teachers' Implications

The lessons with a traditional lens and with the support of ChatGPT were analyzed according to the strengths and weaknesses based on the observations of researchers and participants themselves.

According to Table 2, while the ChatGPT lesson plan stands out for providing creative and varied ideas and saving time, the weaknesses observed by both the researchers and the participants were the lack of depth/superficiality in the subject matter, the predominance of the narrative technique, and the plans that were not suitable for the grade level and the level of the students. The timing of the plan stages is a deficiency because it gives very short time for essential tasks, for example, while it gives much longer time for the reminder stage. As a weakness, it was also noteworthy that it did not provide any technological support and did not

Table 2: Assessment of Participants' Implications with AI-generated Lesson Plan

Implications with AI-generated Lesson Plan			
Strengths		**Weaknesses**	
To implementers	*To observers*	*To implementers*	*To observers*
-The predominance of the question & answer technique -Saving time -Offer different perspectives and diversity	-Proposing number line activities -Providing examples of effective reminders -Suggestions on material	-Superficiality -Dominance of narrative techniq -Inappropriate for grade level -Inappropriate for student level -Lack of joy -Timing	-Superficiality -Dominance of narrative technique -Inappropriate for grade level -Not offering technology support -Proposing number line activities -Inadequate contextual problem -Professional knowledge deficiency -Direction to arithmetic process
Implications with Traditional Lesson Plan			
Strengths		**Weaknesses**	
To implementers	*To observers*	*To implementers*	*To observers*
-Leaving free space for the teacher -Supporting authentic learning	-Leaving free space for teacher -Classroom management effectiveness	-Offering single point of view	-Adherence to the textbook

suggest any contextual problems. Providing compelling reminder examples was interpreted as a strength because the comprehensibility of the topic needs to provide reminders about fraction concepts, as the last topic was seen about a year ago. Finally, the observers noticed a deficiency in participants' professional knowledge and redirection to arithmetic processing.

While the prominent strengths of traditional lesson plans are leaving free space for the practitioner, flexibility, and supporting authentic learning, the weaknesses are offering a single point of view depending on the decision of the implementer and adherence to the course materials. As a final step, participants were asked: *What are the differences between the lesson plan and implementation with the other method?*

PT1: "In the traditional plan, the pre-service teacher prepared a more flexible plan. When I stayed connected to the chatGPT, I felt as if I was making a presentation rather than teaching, so there was a one-sided communication."

PT4: "Tools such as ChatGPT may harm the teacher's productivity and creativity in the long run. But it saves a lot of time when preparing lesson plans. I think traditional and AI generated can be used together."

PT3: "A plan designed for 1 hour requires at least 3 hours. Timing is a big problem"

PT2: "Despite all the weaknesses, if I didn't know beforehand, I wouldn't have realized that it was prepared with AI."

4. Discussion and Conclusion

In this research, while asking about the differences between traditional and ChatGPT-supported lesson plans, we wanted to answer the question, "Which one provides more effective teaching?" It is not easy to give a simple answer to this. Traditional does not always mean unuseful and old, but it does not mean that we should always stick to it. This proposal not only explores the practical implications of AI in lesson planning but also delves into the perceptions and experiences of those directly involved in the educational process—student teachers. It adds a valuable dimension to the ongoing discourse on AI in education and teacher training.

The suggestion of visuals and modeling as a common strength of ChatGPT and the traditional lesson plan is essential because visual representations in mathematics teaching make the subject concrete and comprehensible (Goldin, 2008). Contrary to traditional lesson plans, ChatGPT presents various viewpoints and diversity, offering imaginative and diverse suggestions. Delving deeper into the concept of creativity is valuable, as aspiring educators highlighted its role in generating innovative lesson plans and fostering their professional expertise. Compatible with this result, van den Berg & du Plessis (2023) assesed that ChatGPT can serve as a potent resource in honing educators' abilities for critical thinking. This tool empowers them to assess, modify, and enhance their teaching methodologies, thereby catering more effectively to their students' requirements. Considering the activities generated by ChatGPT can certainly expand teachers' viewpoints and nurture creativity by introducing various approaches to teaching fractions. This exposure inspires educators to explore inventive methods which can captivate learners in dynamic learning endeavors. Nonetheless, educators may face challenges, as specific curricula necessitate adherence to strict guidelines and designated textbooks. Therefore, while embracing creative strategies, teachers must tread carefully within these constraints.

Along with the positive sides of AI-generated lesson plans, considerable weaknesses exist. The prominent situation is that plans are only partially suitable for the grade level and the level of the students. It offers different and effective content, but the implementers should reconsider its offer before using it. The participants stated that chatGPT had one-way communication and were in a situation where the way of presentation was active in the implementation process, contrary to the interactive environment required by constructivism. The situations that emerged in practice due to the limited flexibility and the predominance of narrative support these pre-service teachers' views. According to some participants, ChatGPT may harm the teacher's

productivity and creativity in the long run. While ChatGPT excels in offering precise and pertinent information, it lacks the capacity for emotional support and the essential human interaction necessary in teaching (Javaid, et al.,2023). We did not observe such a result in this study, probably because it required a longer data collection process. As a result, AI-driven technologies should be used in teacher education to make teaching and learning practices more effective and efficient. However, teachers should reassess the plans or instructions in ChatGPT to make it more useful and suitable. The results show that candidates do not want to turn their backs on Chat but want to use it in a way that allows them to intervene. ChatGPT should be seen as tools to enhance and supplement teachers' work but not replace the teachers.

As a remarkable result, the AI's suggestion of number line activities is both a weakness and a strength. It is a strength because the number line is an essential and vital tool for understanding many subjects in mathematics (Kieran, 1988; Siegler et al., 2011). It is a weakness because using the number line is a problematic tool for preservice teachers and students (Tunç-Pekkan, 2015). This study interpreted it as students' lack of professional knowledge. As another example of a negative situation, the contextual problem statement of ChatGPT was only proposed in the lesson on finding the fractional equivalent of a quantity. The lack of problems with unit fractions and fraction comparison tasks can make it difficult for students to understand fraction magnitude and force them into rote learning.

Time and duration are also prominent and can be interpreted differently. ChatGPT is a very effective and powerful feature at the point of plan preparation and saves much time in the lesson plan preparation phase. However, it appears to be a limitation and weakness in the implementation phase. It requires intervention because it gives too many things at the same time in the same lesson plan. As an echo of this result, according to Duha (2023), the lesson plan in ChatGPT is at a rudimentary level and requires significant editing. Saving time for the practitioner can be very useful for a teacher at the beginning of his/her career. However, in almost all of the lesson plan examples requested from Chat, it was observed that it used the same way to determine the duration of the lesson sections. Designing lesson plans tailored to specific subjects and concepts is essential. Consequently, it is anticipated that standardized examples of the same plan could pose challenges in implementation.

This study has the potential to illuminate the effectiveness and implications of integrating such tools for prospective teachers. Maximizing the educational benefits of these models requires a careful approach, including a critical examination of their limitations and potential biases. Recognizing that these tools support teaching and learning is crucial, emphasizing the importance of a balanced evaluation to leverage their advantages (Duha, 2023) effectively. According to Kim & Adlof (2023), we should view ChatGPT as a tool to enhance the learning process in education rather than as an end in itself for generating artifacts. Despite the various concerns surrounding using and integrating ChatGPT in classroom settings, we believe that educators will continue to play central role in haping and guiding students' learning experiences.

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