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Are Lesson Plans Created by ChatGPT More Effective? An Experimental Study

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Abstract

In this research, we aimed to determine whether students' math achievements improved using ChatGPT, one of the chatbot tools, to prepare lesson plans in primary school math courses. The research was conducted with a pretest-posttest control group experimental design. The study comprises 39 third-grade students (experimental group = 24, control group = 15). The implementation process lasted five weeks and 25 lesson hours. In the experimental group, lessons were taught according to plans prepared using ChatGPT, while in the control group, existing lesson plans were used. Students' academic achievement was measured with a multiple-choice achievement test of 25 questions with two separate questions for each learning objective. According to the results, students' academic achievement increased significantly ($d = 1.268$) in math lessons taught according to lesson plans prepared using the ChatGPT. Although there was a difference between the post-test scores of the experimental group and the control group in favor of the experimental group, it was determined that this difference was not significant. These results show that teaching primary school math according to lesson plans prepared using ChatGPT is effective in academic achievement. Teachers should consider ChatGPT and their plans, combining them and benefiting from both in the implementation process.

Introduction

Artificial intelligence (AI) applications (e.g., facial recognition systems, digital assistants, chatbots, recommender systems), proposed in line with the gradual development of technology and the changing needs accordingly, are used in many sectors such as finance, health, economy, law, medicine, tourism, occupational health and safety, and education. The ease of use of these applications, which have different features and capabilities, and the advantages they offer to facilitate daily and professional life increase the demand for them. The working principles of these AI applications, which are used in many fields, vary depending on their intended use, and companies develop such applications accordingly.

One of the most common software designed to be used in various fields is a chatbot that works with a language processing model. These systems, which process data and interact with their users through the deep learning method, have human-like features. The further development of these features daily will further narrow the curtain

between human intelligence and artificial intelligence. To use chatbots as more valuable tools for the future of education, training them according to their culture and environment (eliminating the risk of bias) and enabling educators to explore chatbot design activities may be beneficial in terms of blending artificial intelligence with education (Kuhail et al., 2023). In this context, it is essential to observe the effects of chatbots, which have the potential to be used in educational institutions that have the mission of shaping society and guiding the future of all stakeholders of education.

Use of Chatbots for Teaching Purposes

Chatbots are computer software that communicates with users differently (Rukhiran et al., 2022). They can offer users solutions to daily life problems, be a helpful tool in setting and achieving goals, and are also machines frequently used in education. Chatbots can contribute to solving many problems due to the innovations, conveniences, and solutions they offer for possible problems in different education systems. The development of chatbots that provide consultancy services to successful young people who could not enroll in university due to limited opportunities and insufficient opportunities, especially during the transition to university after high school, can offer adequate solutions to the problems that arise in this field (Nguyen et al., 2023).

Chatbots can contribute to students receiving more subjective, personalized consultancy services and carry out activities in this field more quickly and effectively using learning mechanics (Kuhail et al., 2022). Chatbots' compatibility with course content, flexible structure, appropriate design, innovative and supportive features, and attractiveness make chatbots more efficient in the learning process (Haristiani et al., 2022). Considering the benefits that chatbots can provide within the scope of education-training activities, it is essential to integrate these software into education-training activities.

Considering that they can be used as educational tools for disabled individuals to improve and develop communication skills, acquire social skills, increase autonomy, and adapt to social life, the use of Chatbots for this purpose can contribute to the efforts to facilitate the lives of disabled individuals and integrate them into society (Sanchez et al., 2022). On the other hand, considering that older people can adapt to technological developments and some conditions required by their age, it may be possible to use chatbots as an educational tool and provide digital literacy skills to older people (Sriwisathiyakun & Dhamanitayakul, 2022). Considering the benefits that chatbots can provide within the scope of education-training activities, it is essential to integrate these software into education-training activities.

Using chatbots in learning-teaching activities prevents possible misconceptions. Using chatbots in lessons and implementation processes (e.g., chatbots making corrections using concept maps) provides instant feedback to students, preventing misconceptions and enabling more meaningful learning. In addition, integrating chatbots into the course process can increase students' motivation for the course (Kuo & Chen, 2022). In addition, Han et al. (2022) consider using chatbots as educational tools in distance education conditions as one factor that increases students' motivation towards the course. It is suggested that both teacher support and student skills are essential for intrinsic motivation and competence to learn with a chatbot (Chiu et al., 2023).

Ensuring the effective integration of chatbots into education and training activities can positively affect the academic success of students (Essel et al., 2022). Haristiani et al. (2022) state that using chatbots as educational tools in foreign language learning contributes to developing students' language skills. In addition, in studies that prevent logical errors in foreign language learning, chatbots can positively correct errors and improve students' argumentative writing skills (Zhang et al., 2023). Thanks to chatbots, students can make logical inferences and produce more qualified outputs in writing. Chatbots are also predicted to significantly contribute to gaining digital literacy skills.

In this context, chatbots are tools with facilitating qualities when considering education and training activities. However, in addition to all these positive developments, these tools are a matter of debate because they have the potential to cause some negativities such as abuse, transparency, fabricated and limited information, plagiarism, copyright, manipulation, confidentiality of personal data, prejudice, and violation of ethical values. When evaluated within the scope of education and training activities, the controlled use of chatbots will benefit all education stakeholders. In light of these predictions, conducting comprehensive studies on the use of chatbots, incredibly advanced language models, in educational activities will be beneficial in contributing to the literature and guiding practitioners. This study focuses on the effect of using the ChatGPT (Chat Generative Pre-Trained Transformer) application, which is one of the chatbots and has emerged recently in terms of planning the teaching process.

What is ChatGPT?

ChatGPT, a language model launched in November 2022 that can engage in natural dialogue, is an artificial intelligence application that can answer follow-up questions, recognize and accept mistakes, challenge false assumptions, and reject inappropriate requests (OpenAI, 2023). ChatGPT artificial intelligence language processing model, which OpenAI company offers for free (ChatGPT-4.0 is paid), is a chatbot with empathy, creative writing skills, and superior dialogue features, as well as the ability to provide its users with the ability to gain knowledge in different fields, improve their language skills, and provide instant feedback. It offers the opportunity to write creative texts and scenarios, look at events from different perspectives, and make evaluations and comparisons (Rahman et al., 2023). In addition, ChatGPT's ability to design the dialogue with its users interestingly distinguishes it from other chatbot applications and makes it one of the most popular applications in recent years (Rahman et al., 2023). Considering the capabilities and potential power of ChatGPT, this software contains clues of the technological revolution that can occur not only in certain areas but in all areas of life (Tlili et al., 2023). Considering this context, highly interactive artificial intelligence applications such as ChatGPT may benefit education and training activities but also have problems that may arise (Susnjak, 2022). The following section briefly mentions the advantages and disadvantages of ChatGPT for educational activities and the future of ChatGPT in terms of education.

Advantages of ChatGPT

ChatGPT provides opportunities such as understanding complex problems, offering solutions, clarifying a specific

issue, discussion, question-answer, and brainstorming. It can help students on subjects, and students can follow problem solutions step by step, ask questions, and have the opportunity to obtain accurate information about course content with instant feedback (Rahman et al., 2023). Using ChatGPT, it is possible to provide personalized learning environments appropriate to students' levels, and thus, students can follow and organize the course flow appropriate to their level and increase their academic success thanks to personalized learning experiences (Su et al., 2023). Considering that the constructivist learning approach involves the student in the learning process more effectively, a ChatGPT-supported learning environment is more suitable for the constructivist learning approach, and students can gain knowledge, ask questions, generate ideas, review their knowledge, and develop their understanding of learning in technology-supported learning environments. They can carry out activities more easily (Rasul et al., 2023). Group activities designed within the scope of cooperative learning can include students in the online discussion environment. They can contribute to online learning in flipped classrooms during distance education (Rahman et al., 2023). Using ChatGPT in the course process allows primary school students to become acquainted with artificial intelligence systems and make sense of them. Teachers can first explain what ChatGPT is and how it works, taking into account the age factor and using simple examples or gamification appropriate to the level of the students (Su et al., 2023). Kim and Adlof (2023) emphasize that teachers should use ChatGPT as a tool rather than a goal to provide a constructivist learning environment.

ChatGPT, which offers personalized learning experiences, can also be used as a teacher to help students manage their learning, determine their goals and strategies, evaluate their learning, and offer suggestions (Firat, 2023). Large language models like ChatGPT can take technological systems like augmented reality (AR) or virtual reality (VR) to the next level in language processing and communication. Thus, thanks to this software used as a solid bridge between users and the system, students can experience their knowledge and skills within the scope of AR/VR, especially in early childhood periods such as primary school, and enable students to learn the subject entertainingly and permanently (Kasneci et al., 2023). In addition, ChatGPT offers many opportunities in terms of being beneficial in foreign language learning and teaching, especially for students who do not have many opportunities to practice the target language, to close this gap and enable students to experience a different lesson environment rather than the familiar lesson environment (Hong, 2023). In addition, ChatGPT can help students with many issues, such as improving both speaking and writing skills, vocabulary, correct use of words, meaning, and grammar in sentences (Hong, 2023). Ali et al. (2023) find it essential to integrate ChatGPT into various language programs, with teacher control, to make the learning process more accessible and encourage students. It is seen that ChatGPT, which has the potential to make significant contributions to many disciplines and educational levels in terms of individual learning, can also provide essential opportunities for instructors. Therefore, integrating ChatGPT into learning is important (Grájeda et al., 2024).

Using ChatGPT, teachers can organize exercises, activities, and various events for students to understand the subject, create quizzes and activities appropriate to the grade level, and obtain information about learning activities by considering students' learning styles (Rahman et al., 2023). Liang et al. (2023) also found that ChatGPT could explain solutions to physics calculation problems and produce new exercises at the primary school level. ChatGPT and big language models can provide teachers with the opportunity to save time in evaluation studies, generate questions in different styles (e.g., multiple choice, open-ended, fill-in-the-blank), and provide convenience by

giving instant feedback to student answers (Kasneci et al., 2023). In addition to ChatGPT's potential in the context of individual learning in many disciplines listed above, it may also have similar capabilities for lesson planning, one of the critical stages of instructional design. ChatGPT can add a different dimension to instructional design by providing instant feedback to teachers and practitioners within the scope of the design and planning of educational activities (course curricula, course schedules, lesson plans, measurement and evaluation studies), as well as within the framework of original plans (Farrokhnia et al., 2023; Lo, 2023; Zhai, 2022). Mondal et al. (2023) also support this view in their study and state that ChatGPT encourages active learning by enabling teacher and student interaction thanks to its ability to create innovative materials and organize multimedia presentations. Finally, focusing on using ChatGPT in higher education to alleviate time-intensive tasks during the event planning process, Keiper (2023) found many benefits for faculty and students, especially in text-based tasks. Farrokhnia et al. (2023) also suggest that ChatGPT will enable teachers to save time while creating relevant lesson plans.

Criticisms on ChatGPT

ChatGPT, as one of the most important examples of AI technology, excites but also worries technologists and educators, and the potential of large language models developed in recent years, such as ChatGPT, to radically change the ways of learning and teaching shows that these concerns are not unfounded (Rudolph et al., 2023). Susnjak (2022) argues that students' performance and evaluation studies using ChatGPT on projects, assignments, and exams raise concerns regarding fairness and honesty. In addition, ChatGPT's ability to write comprehensive and persuasive texts with little data input, use high-level skills, and answer questions means that reliability problems may arise in exams. For example, Choi et al. (2023) state in their study that ChatGPT received passing grades in the law exams. Another study revealed that ChatGPT had as much information as an average-grade medical student (Gilson et al., 2023).

Additionally, Newton and Xiromeriti (2023) predict that ChatGPT may be beneficial in increasing the scores of students who have difficulty in academic exams and state that this situation may negatively affect healthcare services in the long term. Drawing attention to this issue, Sallam (2023) emphasizes that all necessary precautions should be taken to eliminate concerns, and researchers should evaluate by considering the pros and cons. In another study by Kohnke et al. (2023), it is mentioned that ChatGPT risks causing ethical violations, giving misleading answers to its users, and being open to cultural prejudices. Truong et al. (2023) support this claim and state that in systems with cultural and linguistic diversity in education, ChatGPT may have difficulties understanding the language and answering questions, and trust problems may occur.

Susnjak (2022) states that since ChatGPT only has data before September 2021, misleading answers may occur and give wrong information to students. ChatGPT's information is based on pre-2021 data so that it may reflect only some of the current cultural norms (Barrot, 2023). Mhlanga (2023) also talks about prejudices and states that ChatGPT is biased towards the language in which they are educated, thus exposing students to sociocultural and socioeconomic discrimination and creating concerns about data privacy. In addition, since ChatGPT is trained with a large dataset, the references requested for the information it provides are inconclusive, which may cause both the authors' attribution rights to be violated and the recipients of the information to receive incomplete and

incorrect information. ChatGPT's responses can sometimes be formulaic or robotic, lacking the originality and naturalness of human responses, and tend to follow a rigid template in organizing ideas (Barrot, 2023). For this reason, it seems that the success of ChatGPT and other AI systems in educational activities depends on solving many problems that need to be overcome and eliminating uncertainties (García-Peñalvo, 2023). In short, ChatGPT does not offer a plug-and-play solution, and personal touches are still needed (Keiper, 2023).

The Importance and Aim of the Study

When it comes to ChatGPT's potential contribution to educational activities and its predictions of artificial intelligence, it is observed that these systems will survive despite all kinds of prohibitions (e.g., the New York City Department of Education banning ChatGPT on school devices and all networks) and will become an indispensable part of education (Baidoo-Anu & Ansah, 2023). In addition, since it is predicted that all these prohibitions and restrictions will work for a while and that these artificial intelligence systems, which are developing day by day, will become whole for educational activities, educational institutions should adapt to these developing systems and start integration studies most effectively and rapidly (Baidoo-Anu, and Ansah, 2023). Bozkurt (2023) emphasizes that productive artificial intelligence technologies have the potential to affect learning processes; therefore, educators must be prepared for this.

The integration of ChatGPT and similar models into the education and training process shows that new education policies are needed. SWOT analyses (Farrokhnia et al., 2023) confirm this (Hirsh-Pasek & Blinkoff, 2023). New and updated policies should be implemented to integrate these models into the education process. Determining these policies (considering all the pros and cons of education) and taking appropriate steps are essential in positively contributing to the relevant subject (Wardat et al., 2023). In this context, seminars and training activities to be held to increase the competencies of teachers and students about chatbots and their skills in using chatbots are essential to make the education and training process more effective (Wardat et al., 2023). Rasul et al. (2023) stated that higher education institutions should first train students on the ethical and responsible use of ChatGPT and similar applications. According to Zhai (2022), students' ChatGPT experiences should be aimed at increasing critical and creative thinking skills rather than increasing general skills.

OpenAI will continue to develop ChatGPT in line with demands shortly, enabling the introduction of versions that are less likely to make errors (e.g., ChatGPT Academia as an alternative to Google Scholar) (Halaweh, 2023). Regarding the future of education, ChatGPT has the potential to bring many advantages and disadvantages (Nurtayeva et al., 2023). Although ChatGPT has positive and negative aspects, it should not be forgotten that when considered holistically, ChatGPT cannot replace a human, and the outputs must always be checked by an expert (Koçyiğit, 2023). Considering all these pros and cons of ChatGPT and its active use, it is clear that scientific research is needed to understand ChatGPT and use it more effectively. In this context, this study aims to experimentally demonstrate the effect of using ChatGPT in preparing lesson plans within the scope of math courses at primary school. For this purpose, an answer was sought to the following research question:

1. "What is the effect of math lesson plans created using ChatGPT on students' academic achievement in primary school?"

Method

The research was conducted with a pre-test, post-test control group quasi-experimental design. Quasi-experimental designs are carried out with ready-made groups only by group matching and without random assignment (Büyüköztürk et al., 2008). The teacher applied lesson plans prepared with ChatGPT to the experimental group in this study. Existing lesson plans were used in the control group. An academic achievement test was applied as a pre-test before and post-test after the implementation; it tested whether lesson plans prepared using ChatGPT created a difference in students' academic achievements.

Study Group

The study group consists of third-grade students in a primary school in Şanlıurfa, located in southeastern Turkey. All third graders at the school have similar socioeconomic, sociodemographic, cultural, and academic (see Table 5) characteristics. The class in which the first author was also the class teacher (28 students) was determined as the experimental group, and another randomly selected class (26 students) was determined as the control group.

The teachers of both groups had the same professional experience, and the students' pre-test mathematics achievement were equivalent (see Table 5). Both groups' facilities in the classroom environment (smartboard, motivational posters, equipment and materials, textbooks, worksheets, and other learning content) were the same. Therefore, the conditions were identical for both groups in the school environment during the five-week experiment period (except for the lesson plan).

The school is located in a socioeconomically poor neighborhood. Four students in the experimental group and 11 in the control group could not be included in the study because they were absent and could not participate in the pre-test and post-test. Thirty-nine students participated in this study: the experimental group of 24 students and the control group of 15 students. The experimental process was completed in five weeks in the spring semester of the 2022-2023 academic year. The distribution of the study groups by gender is presented in Table 1.

Table 1. Gender Distribution of the Study Group

Groups	Female	Male	Total
Experiment	14	10	24
Control	8	7	15
Total	22	17	39

Data Collection Tools

Academic achievement tests were used as pre-tests and post-tests to measure the academic achievement of the experimental and control groups in the math course. The academic achievement test consists of 25 questions, 21 multiple-choice, three draws, and one True/False question. Sample questions are given in Figure 1:

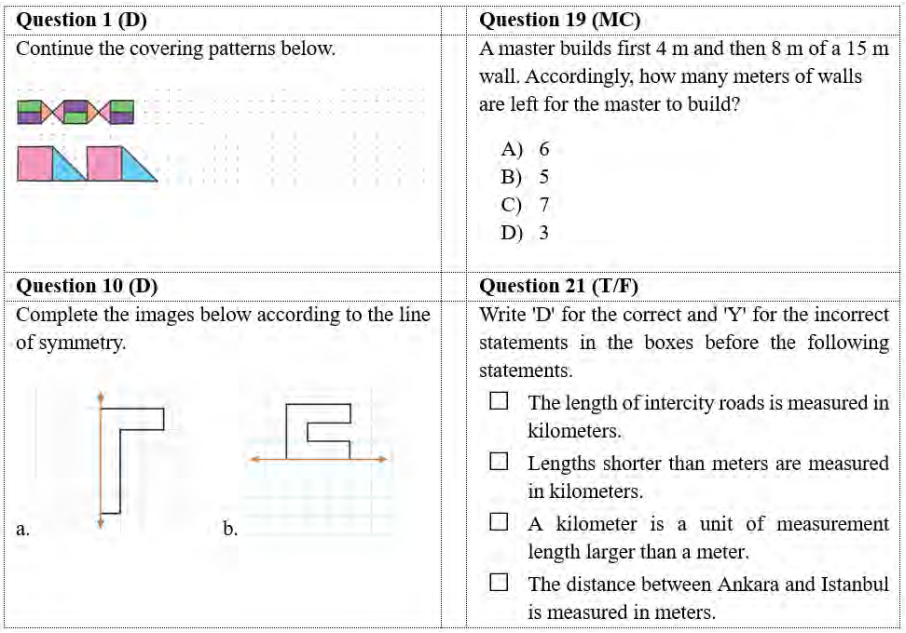

Figure 1. Sample Questions

The achievement test covers the topics "Geometric Patterns", "Basic Concepts in Geometry", "Spatial Relations" and "Length Measurement" in the primary school 3rd-grade math curriculum. The researchers prepared test questions using the questions published by the Ministry of National Education and according to the learning objectives. There are at least two questions for each learning objective in the test. A linguist and four field experts checked test instructions and items. In addition, the Kuder-Richardson 20 (KR20) reliability coefficient for the academic achievement test was calculated as 0.78. Question distribution according to learning objectives is presented in Table 2.

Table 2. Distribution of Questions According to Learning Objectives

	Learning Objectives	**Question Id**	**Question Type**
1	M.3.2.3.1. Şekil modelleri kullanarak kaplama yapar, yaptığı kaplama örüntüsünü noktalı ya da kareli kâğıt üzerine çizer [They make coatings using shape models and draw their coating pattern on dotted or squared paper].	1	D
2	M.3.2.4.1. Noktayı tanır, sembolle gösterir ve isimlendirir [They recognize the point, show it with symbols, and name it].	2, & 3	MC, MC
3	M.3.2.4.2. Doğruyu, ışını ve açıyı tanır [They recognize line, ray, and angle].	4, & 5	MC, MC
4	M.3.2.4.3. Doğru parçasını çizgi modelleri ile oluşturur; yatay, dikey ve eğik konumlu doğru parçası modellerine örnekler vererek çizimlerini yapar [They create line segments with line models; They draw horizontal, vertical, and inclined line segment models by giving examples].	6, & 7	MC, MC

	Learning Objectives	Question Id	Question Type
5	M.3.2.2.1. Şekillerin birden fazla simetri doğrusu olduğunu şekli katlayarak belirler [They determine that shapes have more than one line of symmetry by folding the shape].	8, & 9	MC, MC
6	M.3.2.2.2. Bir parçası verilen simetrik şekli dikey ya da yatay simetri doğrusuna göre tamamlar [They complete the symmetrical shape, a part of which is given according to the vertical or horizontal symmetry line].	10	D
7	M.3.3.1.1. Bir metre, yarım metre, 10 cm ve 5 cm için standart olmayan ölçme araçları tanımlar ve bunları kullanarak ölçme yapar [They define non-standard measuring tools for one meter, half a meter, 10 cm, and 5 cm and make measurements using them].	11, & 12	MC, MC
8	M.3.3.1.2. Metre ile santimetre arasındaki ilişkiyi açıklar ve birbiri cinsinden yazar [They explain the relationship between meters and centimeters and write them in terms of each other].	13, & 14	MC, MC
9	M.3.3.1.3. Cetvel kullanarak uzunluğu verilen bir doğru parçasını çizer [They draw a line segment of given length via a ruler.].	15	MC
10	M.3.3.1.4. Kilometreyi tanır, kullanım alanlarını belirtir ve kilometre ile metre arasındaki ilişkiyi fark eder [They recognize the kilometer, indicate its uses, and recognize the relationship between kilometers and meters].	16, & 21	MC, T/F
11	M.3.3.1.2. Metre ile santimetre arasındaki ilişkiyi açıklar ve birbiri cinsinden yazar [They explain the relationship between meters and centimeters and write them in terms of each other].	17	MC
12	M.3.3.1.5. Metre ve santimetre birimlerinin kullanıldığı problemleri çözer [They solve problems using meter and centimeter units].	18, 19 & 22	MC, MC, MC
13	M.3.3.1.2. Metre ile santimetre arasındaki ilişkiyi açıklar ve birbiri cinsinden yazar [They explain the relationship between meters and centimeters and write them in terms of each other].	20, 23 & 25	MC, MC, MC
14	M.3.2.2.1. Şekillerin birden fazla simetri doğrusu olduğunu şekli katlayarak belirler [They determine that shapes have more than one line of symmetry by folding the shape].	24	D

M: Math, MC: Multiple choice, D: Drawing, T/F: True/False, e.g., 3.2.3.1 means 3rd grade 2nd teaching unit, third subject and first learning objective

Implementation Process

The research aims to reveal the effect of applying lesson plans prepared using ChatGPT on students' academic achievement. The study covers the entire fifth unit of the primary school 3rd-grade math curriculum and the first

subject of the sixth unit, "Length Measurements". Each topic in the lesson plans prepared with ChatGPT-4.0 was applied to the students within the time specified in the plans, and the implementation process lasted five weeks (See Figure 3). The implementation was carried out according to the current annual plans and the learning objectives of the relevant week. Although the principle of knowing the student is ignored in the lesson plans prepared using ChatGPT-4.0, teachers implemented the lesson plans considering this principle. The interface of ChatGPT, an example of prompt and ChatGPT response, is given in Figure 2.

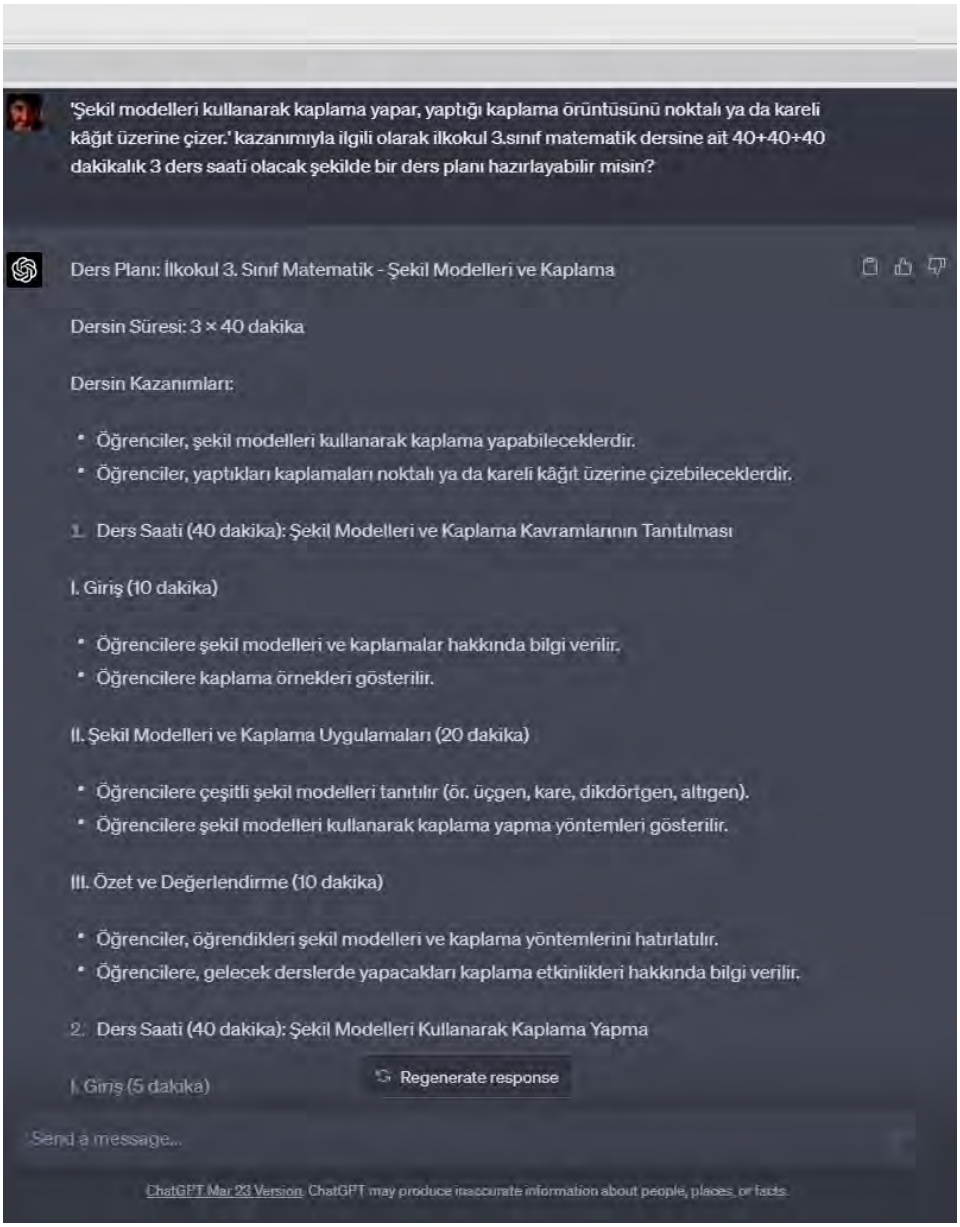

Figure 2. Example of Prompt and ChatGPT Response

To prepare a lesson plan in ChatGPT-4.0, as seen in Figure 2, "*Can you prepare a lesson plan for three 40-minute courses for the 3rd grade primary school mathematics course regarding 'They make coatings using shape models and draw the coating pattern on dotted or squared paper' learning objective?*" prompt was used. ChatGPT's detailed lesson plan response to this prompt is presented in Table 3:

Table 3. A Sample of Detailed Lesson Plan

Lesson Plan: 3rd Grade Mathematics - Shape Models and Covering **Lesson Duration:** 3 x 40 minutes	
Learning Objectives: Students will be able to create coverings using shape models. Students will be able to draw their coverings on dotted or grid paper.	
ChatGPT's Plan (Experimental)	**Teachers' Plan (Control)**
Lesson 1 (40 minutes): Introduction to Shape Models and Covering Concepts	
I. Introduction (10 minutes) - Provide students with information about shape models and coverings. - Show examples of coverings to students. II. Shape Models and Covering Applications (20 minutes) - Introduce various shape models to students (e.g., triangle, square, rectangle, hexagon). - Demonstrate methods for creating coverings using shape models. III. Summary and Assessment (10 minutes) - Recap what students have learned about shape models and covering methods. - Provide information to students about covering activities they will do in future lessons.	- Information is given about patterns and coatings through various geometric shapes. - Tells which geometric shapes are used in the patterns using the cobblestone visuals on page 193 of the textbook. - Creates a pattern and covers it by using relevant visuals. - Explain the rules of the pattern they create and paint it.
Lesson 2 (40 minutes): Creating Coverings Using Shape Models	
I. Introduction (5 minutes) - Review the previous lesson and remind students of the covering methods. II. Application (30 minutes) - Provide students with dotted or grid paper, rulers, pencils, and erasers. - Give instructions to students on creating coverings with their chosen shape models. - Students carry out covering work under the supervision and assistance of the teacher. III. Summary and Assessment (5 minutes) - Students present their coverings to the class and receive feedback from their peers.	- Remembers information about patterns and coatings. - Draws a coating pattern by taking the pattern created with geometric shapes on page 194 of the textbook as a model. - Creates a pattern with the squares and rectangles on page 194 of the textbook and paints this pattern.
Lesson 3 (40 minutes): Drawing Coverings on Dotted or Grid Paper	
I. Introduction (5 minutes) - Review the previous lesson and remind students of their covering work. II. Application (30 minutes)	- Completes a covering pattern consisting of geometric shapes on page 195 of the textbook. - Completes and paints various patterns consisting of geometric shapes on page 195 of the

- Instruct students to draw their coverings on dotted or grid paper. - Students draw their coverings on paper under the supervision and assistance of the teacher. - Emphasize essential aspects (e.g., straight lines, accurate measurement, scaling). III. Summary and Assessment (5 minutes) - Students present their drawn coverings to the class and receive feedback from their peers. - The teacher evaluates students' covering drawings and provides feedback. - At the end of the lesson, review the knowledge and skills students have acquired.	textbook according to the rules.

* The teachers prepared this plan according to the book and curriculum offered by the Ministry of National Education.

Figure 3. Sample Images of Activities from the Application Process (Experimental Group)

Data Analysis

It was examined whether the data obtained in the study showed normal distribution. The results of the Kolmogorov-Smirnov analysis are presented in Table 4.

Table 4. Normality Test Results

Variable	Groups	Pre-test			Post-test		
		Kolmogorov-Smirnov			Kolmogorov-Smirnov		
		Statistics	*df*	*p*	Statistics	*df*	*p*
Math achievement	Experimental	0.166	24	.087	0.118	24	.200
	Control	0.181	15	.200	0.172	15	.200

* $p < .05$

According to Table 4, the data is normally distributed ($p > 0.05$). In addition, the Skewness and Kurtosis values

of the post-test scores of the experimental and control groups are between -1.186 and .248. Therefore, parametric tests were used for analysis; a paired-sample *t*-test was used to compare the experimental and control groups' pre-test and post-test mean scores; and an independent samples *t*-test was used to compare the score means of the experimental and control groups. We also calculated Cohen's d to determine the effect size of the significant difference we obtained due to the t-test. According to Sawilowsky (2009), an effect size of 0.1 is interpreted as very small, 0.2 as small, 0.5 as medium, 0.8 as large, 1.2 as very large, and 2.0 as huge. Independent samples *t*-test results for the pre-test means of the groups are given in Table 5.

Table 5. Experimental and Control Group Pre-Test Score Means

Variable	**Groups**	**N**	**M**	**SD**	***df***	***t***	***p***
Math achievement	Experimental	24	38.42	11.949	37	1.027	0.311
	Control	15	34.00	14.716			

* $p < .05$

Table 5 shows no statistically significant difference between the academic achievement pre-test score means of the experimental group and the control group ($t(37) = 1.027$; $p > 0.05$). According to this result, the experimental and control groups are equal in math achievement.

Results

This research experimentally examined whether lesson plans prepared using the ChatGPT artificial intelligence tool affected academic achievement in math courses at the primary school level. This study covers the learning objectives of a 5-week math course, and while the lessons in the experimental group were taught according to the lesson plans prepared using ChatGPT, lessons in the control group were taught according to existing lesson plans (prepared by teachers). The data of this study, which was conducted with an experimental-control group design, was collected from 39 students. The data was analyzed using the *t*-test to determine whether the groups had a statistical difference. Considering the pre-test and post-test averages of the experimental group, the paired-sample *t*-test was conducted, and the findings are presented in Table 6.

Table 6. Comparison of Experimental Group Pre-Test and Post-Test Scores Means

Variable	**Test**	**N**	**M**	**SD**	***df***	***t***	***p***	***d***
Math achievement	Pre-test	24	38.42	11.949	23	6.465	.000*	1.268
	Post-test	24	61.21	22.434				

*$p < .05$, *d*: Cohen's d

According to Table 6, there is a statistically significant difference between the pre-test and post-test score means of the experimental group students in the achievement test ($t(23) = 6.465$; $p < .05$). According to the significant difference, the post-test score means (M = 61.21; SD = 22.434) is significantly higher than the pre-test score means (M = 38.42; SD = 11.949). In other words, the teaching in the experimental group, according to the ChatGPT's lesson plans, significantly improved the students' achievement. The calculated effect size (d = 1.268)

shows that ChatGPT's lesson plan has a "very large" effect on math achievement.

A paired-sample *t*-test was conducted, considering the control group's pre-test and post-test means, and the findings are presented in Table 7.

Table 7. Comparison of Control Group Pre-Test and Post-Test Scores Means

Variable	Test	N	M	SD	*df*	*t*	*p*	*d*
Math achievement	Pre-test	15	34.00	14.716	14	5.540	0.000*	1.250
	Post-test	15	55.27	19.028				

* $p < .05$, *d*: Cohen's d

According to Table 7, it is seen that there is a statistically significant difference between the pre-test and post-test achievement test mean scores of the control group students ($t(14)= 5.540$; $p < .05$). According to the significant difference, the post-test score means (M = 55.27; SD = 19.028) is significantly higher than the pre-test score means (M = 34.00; SD = 14.716). In this context, the calculated effect size ($d = 1.250$) shows that the effect is "very large", and the existing lesson plans (prepared by teachers) applied in the control group are effective in math achievement.

Finally, an independent samples *t*-test was conducted to determine whether the post-test means of the experimental and control groups showed a statistically significant difference, and the findings are presented in Table 8.

Table 8. Comparison of Post-Test Mean Scores of the Experimental Group and the Control Group

Variable	Groups	N	M	SD	*df*	*t*	*p*
Math achievement	Experimental	24	61.21	22.434	37	0.851	0.400*
	Control	15	55.27	19.028			

According to Table 8, there was no statistically significant difference between the post-test mean scores of the experimental group and control group ($t(37) = 0.851$; $p > .05$). These results show that the effect of the implemented plans (teachers' plan, ChatGPT's plan) on mathematics achievement does not differ statistically. In other words, the effects of both plans on mathematics achievement are close.

Discussion, Conclusion, and Recommendations

This study was conducted to reveal the effect of math lesson plans prepared with ChatGPT on the academic achievement of 3rd-grade primary school students. It was carried out with the participation of 24 students in the experimental group and 15 students in the control group, and the process lasted five weeks. The means of achievement test applied at the end of the process revealed that although there was no significant difference in academic achievement between the groups, the lesson plans suggested by ChatGPT were as effective as the existing lesson plans applied in schools to increase academic achievement.

In addition, this study also contains essential clues for teachers and practitioners to create effective lesson plans using ChatGPT and similar artificial intelligence models and to apply them in the teaching process. In this context, it can be said that ChatGPT and similar language models can be applications that have facilitating and beneficial qualities in the teaching process for both teachers and students. However, since ChatGPT is a machine and carries the risk of producing false information without having up-to-date data and causing some problems in terms of bias and ethical violations, it may be more effective to improve and develop the training process if the outputs are constantly checked by experts and put into practice.

Trust and Whalen (2023) state that among the potential benefits of ChatGPT for educators include preparing lesson plans, creating course schedules, and designing various instructions and activities for learning objectives. ChatGPT can be trained on learning objectives with original writing skills and can prepare lesson plans appropriate to the students' levels and needs. Kılınç (2023) states that lesson plans created with ChatGPT can contribute to integrating unique teaching methods and technologies into the curriculum and support teachers in this context. Gupta et al. (2023) emphasize that instructors creating lesson plans using ChatGPT brings many advantages. For example, lesson plans created with ChatGPT can be prepared for individual learning, planning can be done in a short time and quickly, the most appropriate topics and activities can be determined by the course contents, feedback for evaluation studies can be provided, the subjects are sequenced appropriately for the purpose, and a plan can be made depending on preliminary learning such as making suggestions that shed light on future learning.

Gupta et al. (2023) also state that despite all these positive aspects, ChatGPT produces content with limited data, is open to biases, sometimes produces wrong information, and causes misconceptions; therefore, expert educators must review and check the lesson plans. Cooper (2023) also states that ChatGPT outputs should be evaluated by field experts in the context of the course. When evaluated in this context, the findings obtained from this study show that lesson plans prepared with ChatGPT have a high potential to increase students' academic achievement. The results are parallel to the studies found in the literature. In this study, although the post-test averages of the groups were in favor of the experimental group, no significant difference was found between the groups. The lack of a difference may be due to differences in factors such as the fact that different teachers necessarily implemented lesson plans in the experimental and control groups, the number of students, the activities carried out, time management, student level, attitudes towards the course and students' communication with each other.

This study shows how safely and appropriately applying lesson plans created by ChatGPT, one of the artificial intelligence tools, increases students' academic achievement. In addition, the research results provide clues to researchers working on the subject to understand the benefits of using artificial intelligence tools in a controlled and safe manner in the teaching process and the potential of artificial intelligence tools to transform education. Studies on ChatGPT's potential to revolutionize education are available in the literature. Carr (2023) states in his study that instructors can design individualized learning environments that suit the needs of students by using ChatGPT. Wardat et al. (2023) state that ChatGPT has the potential to change current teaching techniques in math education and encourage reforms in education shortly. Adiguzel et al. (2023) state that educators, researchers, and politicians should cooperate to ethically and responsibly include the opportunities provided by ChatGPT in education systems. They also state that a more technological and forward-looking education system can be created

by solving some problems created by artificial intelligence technology and taking advantage of the opportunities offered by this technology. However, while benefiting from these advantages, thinking critically and protecting human creativity is necessary (Barrot, 2023).

ChatGPT's lesson plans and teacher-prepared lesson plans have a similar effect on mathematics achievement (both "very large" effect sizes), possibly due to many reasons. ChatGPT's reliance on big data available in the literature (Abdullah et al., 2022) may have enabled it to propose inclusive activities with high teaching potential. When ChatGPT's lesson plans are examined, it has been observed that factors such as emphasizing the importance of the learning objectives at the beginning of the lesson, associating them with daily life, inclusive learning, cooperative learning, giving feedback, following the process from simple to complex, discussion groups, peer learning, associating new learnings with previous, creativity and feedback, and informing about the learning objectives of next lesson are taken into consideration by ChatGPT. In addition, ChatGPT's plans use time effectively and have a flexible structure. It was expected that such a comprehensive and effective plan would have a statistically significantly higher impact than the plan prepared by teachers. However, the instructional design also requires considering the student's readiness level, the characteristics of the learning environment, the available learning contents, and many other characteristics of the students. A more effective plan will emerge if ChatGPT learns this data. This suggestion may be considered in the subsequent research.

On the other hand, it is seen that the plans implemented in the control group and prepared by the teachers have a similar effect. These plans are not as flexible as ChatGPT's plans and are prepared mainly according to the textbook and course curriculum offered by the Ministry of National Education. However, considering factors such as the student's readiness level, the learning environment's characteristics, and many other characteristics of the students mentioned above may have increased the teachers' plan's effectiveness. According to Keiper (2023), ChatGPT does not offer solutions that can be used instantly, and personal touches are still needed. Therefore, teachers' consideration of ChatGPT and their plans together, combining them, and benefiting from both can minimize the disadvantages of both plans. However, when writing prompts in ChatGPT, care should be taken not to write superficial and short expressions. Teachers can ask ChatGPT to elaborate on its answers further by writing not just one prompt but several consecutive prompts. When writing prompts, teachers can include descriptive features of the learning environment and average characteristics of the students and emphasize students with disabilities. Also, teachers must maintain critical thinking and human creativity while utilizing ChatGPT (Barrot, 2023) and should use ChatGPT as a tool rather than a goal (Kim & Adlof, 2023). In addition, considering that the big data on which ChatGPT is based is universal and, as far as we know, ChatGPT does not yet make a quality classification for the data it uses, some of its recommendations may not be based on scientific data, and may not be objective. Finally, ChatGPT can also ignore cultural differences (Barrot, 2023). All these concerns must be taken into account by teachers.

Although this study shows that the lessons taught with lesson plans prepared using ChatGPT are at least as effective as those taught with existing lesson plans, it has some limitations. The first of these is that some of the 3rd-grade students could not be included in the research due to absenteeism, and therefore, the study was limited to 39 students (Experiment = 24, Control = 15). The second limitation is that suggested lesson plans by ChatGPT

may not reflect the school culture and students' readiness levels due to their nature. Thirdly, the fact that the teacher in both groups is different (in the Turkish education system, all lessons in primary school are generally carried out by the class teacher) can also be considered a limitation. This limitation can be eliminated in future experimental research by changing the teachers of both classes in the relevant course (math, science, or others) where the experimental intervention is carried out after obtaining institutional permission. Since there is no statistically significant difference between ChatGPT and teachers' lesson plans, we cannot generalize that "ChatGPT prepares better plans than teachers". However, it is clear that ChatGPT affects math success at a "very large" level. Qualitative research using observation and interview techniques can also support these quantitative findings regarding the effect of ChatGPT's lesson plans on achievement. For example, the contribution of such applications to the teaching process can be observed, or students' perspectives on the course process can be examined. There is a need for more research on using such artificial intelligence tools, which develop due to the advancement of technology, as supporting tools to integrate them into the teaching process more qualifiedly. As a result, this experimental research provides the first evidence that the lesson plans suggested by ChatGPT are at least as effective as existing lesson plans. Based on these results, teachers considering ChatGPT's recommendations while preparing lesson plans in primary school will contribute to creating a more effective and efficient learning environment in terms of academic performance in math lessons.

References

Abdullah, M., Madain, A., & Jararweh, Y. (2022). ChatGPT: Fundamentals, applications and social impacts. *2022 Ninth International Conference on Social Networks Analysis, Management and Security (SNAMS)*, Milan, Italy, pp. 1-8. https://doi.org/10.1109/SNAMS58071.2022.10062688

Adiguzel, T., Kaya, M. H., & Cansu, F. K. (2023). Revolutionizing education with AI: Exploring the transformative potential of ChatGPT. *Contemporary Educational Technology*, *15*(3), ep429. https://doi.org/10.30935/cedtech/13152

Ali, J. K. M., Shamsan, M. A. A., Hezam, T. A., & Mohammed, A. A. Q. (2023). Impact of ChatGPT on learning motivation: Teachers and students' voices. *Journal of English Studies in Arabia Felix*, *2*(1), 41-49. https://doi.org/10.56540/jesaf.v2i1.51

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. *Journal of AI, 7(1), 52-62*. https://doi.org/10.61969/jai.1337500

Barrot, J. S. (2023). ChatGPT as a language learning tool: An emerging technology report. *Technology, Knowledge and Learning*. https://doi.org/10.1007/s10758-023-09711-4

Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2018). *Eğitimde bilimsel araştırma yöntemleri [Scientific research methods in education]*. Pegem Akademi.

Carr, B. (2023). *Revolutionizing education: Unleashing the power of Chat GPT/AI to empower educators. Technology and the Curriculum: Summer 2023*. Retrieved from https://pressbooks.pub/techcurr2023/chapter/revolutionizing-education-unleashing-the-power-of-chat-gpt-ai-to-empower-educators/ on 16 Sep 2023.

Chiu, T. K. F., Moorhouse, B. L., Chai, C. S., & Ismailov, M. (2023). Teacher support and student motivation to

learn with Artificial Intelligence (AI) based chatbot. *Interactive Learning Environments*. https://doi.org/10.1080/10494820.2023.2172044

Choi, J. H., Hickman, K. E., Monahan, A., & Schwarcz, D. B. (2022). ChatGPT goes to law school. *Journal of Legal Education, 71*(3), 387-400.

Cooper, G. (2023). Examining science education in ChatGPT: An exploratory study of generative artificial intelligence. *Journal of Science Education and Technology*, *32*, 444-452. https://doi.org/10.1007/s10956-023-10039-y

Essel, H. B., Vlachopoulos, D., Tachie-Menson, A., Johnson, E. E., & Baah, P. K. (2022). The impact of a virtual teaching assistant (chatbot) on students' learning in Ghanaian higher education. *International Journal of Educational Technology in Higher Education*, *19*, 57. https://doi.org/10.1186/s41239-022-00362-6

Farrokhnia, M., Banihashem, S. K., Noroozi, O., & Wals, A. (2023). A SWOT analysis of ChatGPT: Implications for educational practice and research. *Innovations in Education and Teaching International*. https://doi.org/10.1080/14703297.2023.2195846

Firat, M. (2023, January 12). *How Chat-GPT can transform autodidactic experiences and open education?* https://doi.org/10.31219/osf.io/9ge8m

García-Peñalvo, F. J. (2023). The perception of artificial intelligence in educational contexts after the launch of ChatGPT: Disruption or panic*? Education in the Knowledge Society,* 24. https://doi.org/10.14201/eks.31279

Gilson, A., Safranek, C. W., Huang, T., Socrates, V., Chi, L., Taylor, R. A., & Chartash, D. (2023). How does ChatGPT perform on the United States medical licensing examination? The implications of large language models for medical education and knowledge assessment. *JMIR Medical Education*, 9, e45312. https://doi.org/10.2196/45312

Grájeda, A., Burgos, J., Córdova, P., & Sanjinés, A. (2024). Assessing student-perceived impact of using artificial intelligence tools: Construction of a synthetic index of application in higher education. *Cogent Education, 11*(1), 2287917. https://doi.org/10.1080/2331186X.2023.2287917

Gupta, P. K., Raturi, S., & Venkateswarlu, P. (2023). *ChatGPT for designing course outlines: A boon or bane to modern technology*. SSRN. https://doi.org/10.2139/ssrn.4386113

Halaweh, M. (2023). *ChatGPT in education: Strategies for responsible implementation*. *Contemporary Educational Technology, 15*(2), ep421. https://doi.org/10.30935/cedtech/13036

Han, J. W., Park, J., & Lee, H. (2022). Analysis of the effect of an artificial intelligence chatbot educational program on non-face-to-face classes: a quasi-experimental study. *BMC Medical Education*, 22, 830. https://doi.org/10.1186/s12909-022-03898-3

Haristiani, N., Dewanty, V. L., & Rifai, M. M. (2022). Autonomous learning through chatbot-based application utilization to enhance basic Japanese competence of vocational high school students. *Journal of Technical Education and Training*, *14*(2), 143-155. https://doi.org/10.30880/jtet.2022.14.02.013

Hirsh-Pasek, K. & Blinkoff, E., 2023. *ChatGPT: Educational friend or foe?* Brookings Institution. United States of America. Retrieved from https://policycommons.net/artifacts/4140137/chatgpt/4949117/ on 16 Sep 2023.

Hong, W. C. H. (2023). The impact of ChatGPT on foreign language teaching and learning: opportunities in education and research. *Journal of Educational Technology and Innovation*, *5*(1), 37-45.

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences, 103,* 102274. https://doi.org/10.1016/j.lindif.2023.102274

Keiper, M. C. (2023). ChatGPT in practice: Increasing event planning efficiency through artificial intelligence. *Journal of Hospitality, Leisure, Sport & Tourism Education*, *33*, 100454. https://doi.org/10.1016/j.jhlste.2023.100454

Kılınç, S. (2023). Embracing the future of distance science education: Opportunities and challenges of ChatGPT integration. *Asian Journal of Distance Education, 18*(1), 205–237. https://doi.org/10.5281/zenodo.7857396

Kim, M., & Adlof, L. (2023). Adapting to the Future: ChatGPT as a means for supporting constructivist learning environments. *TechTrends*. https://doi.org/10.1007/s11528-023-00899-x

Koçyiğit, A., & Darı, A. B. (2023). Yapay zekâ iletişiminde ChatGPT: İnsanlaşan dijitalleşmenin geleceği [ChatGPT in artificial intelligence communication: The future of humanized digitization]. *Journal of Strategic and Social Researches, 7*(2), 427-438. https://doi.org/10.30692/sisad.1311336

Kohnke, L., Moorhouse, B. L., & Zou, D. (2023). *ChatGPT for language teaching and learning. RELC Journal, 54*(2), 537–550. https://doi.org/10.1177/00336882231162868

Kuhail, M. A., Al Katheeri, H., Negreiros, J., Seffah, A., & Alfandi, O. (2023). Engaging students with a chatbot-based academic advising system. *International Journal of Human–Computer Interaction, 39*(10), 2115-2141. https://doi.org/10.1080/10447318.2022.2074645

Kuhail, M. A., Alturki, N., Alramlawi, S., & Alhejori, K. (2023). Interacting with educational chatbots: A systematic review. *Education and Information Technologies*, *28*(1), 973-1018. https://doi.org/10.1007/s10639-022-11177-3

Kuo, Y. C., & Chen, Y. A. (2022). The impact of chatbots using concept maps on correction outcomes–a case study of programming courses. *Education and Information Technologies*, 28, 7899-7925. https://doi.org/10.1007/s10639-022-11506-6

Liang, Y., Zou, D., Xie, H., & Wang, F. L. (2023). Exploring the potential of using ChatGPT in physics education. *Smart Learning Environments, 10*, 52. https://doi.org/10.1186/s40561-023-00273-7

Lo, C. K. (2023). What is the impact of ChatGPT on education? A rapid review of the literature. *Education Sciences, 13*(4), 410. https://doi.org/10.3390/educsci13040410

Mateos-Sanchez, M., Melo, A. C., Blanco, L. S., & García, A. M. F. (2022). Chatbot, as educational and inclusive tool for people with intellectual disabilities. *Sustainability, 14*(3), 1520. https://doi.org/10.3390/su14031520

Mhlanga, D. (2023, February 11). *Open AI in education, the responsible and ethical use of ChatGPT towards lifelong learning*. http://dx.doi.org/10.2139/ssrn.4354422

Mondal, H., Marndi, G., Behera, J. K., & Mondal, S. (2023). ChatGPT for teachers: Practical examples for utilizing artificial intelligence for educational purposes. *Indian Journal of Vascular and Endovascular Surgery, 10*(3), 200-205. https://doi.org/10.4103/ijves.ijves_37_23

Newton, P. M., & Xiromeriti, M. (2023, February 21). ChatGPT performance on MCQ exams in higher education. A pragmatic scoping review. https://doi.org/10.35542/osf.io/sytu3

Nguyen, H., Lopez, J., Homer, B., Ali, A., & Ahn, J. (2023). Reminders, reflections, and relationships: insights

from the design of a chatbot for college advising. *Information and Learning Sciences*, *124*(3/4), 128-146. https://doi.org/10.1108/ILS-10-2022-0116

Nurtayeva, T., Salim, M., Basheer, T., & Khalilov, S. (2023). *The influence of ChatGPT and AI tools on the academic performance. 22, 247-258*. https://doi.org/10.37896/YMER22.06/26

OpenAI. (2023). ChatGPT. OpenAI. https://openai.com/blog/ChatGPT

Rahman, Md. M., & Watanobe, Y. (2023). *ChatGPT for education and research: Opportunities, threats, and strategies. Applied Sciences, 13*(9), 5783. https://doi.org/10.3390/app13095783

Rasul, T., Nair, S., Kalendra, D., Robin, M., Santini, F. de O., Ladeira, W. J., Sun, M., Day, I., Rather, R. A., & Heathcote, L. (2023). The role of ChatGPT in higher education: Benefits, challenges, and future research directions. *Journal of Applied Learning & Teaching, 6*(1), 41-56. https://doi.org/10.37074/jalt.2023.6.1.29

Rudolph, J., Tan, S., & Tan, S. (2023). ChatGPT: Bullshit spewer or the end of traditional assessments in higher education? *Journal of Applied Learning & Teaching, 6*(1), 342-363. https://doi.org/10.37074/jalt.2023.6.1.9

Rukhiran, M., Phaokla, N., & Netinant, P. (2022). Adoption of environmental information chatbot services based on the internet of educational things in smart schools: Structural equation modeling approach. *Sustainability, 14*(23), 15621. https://doi.org/10.3390/su142315621

Sallam, M. (2023). ChatGPT utility in healthcare education, research, and practice: *Systematic review on the promising perspectives and valid concerns. Healthcare, 11*(6), 887. https://doi.org/10.3390/healthcare11060887

Sawilowsky, S. S. (2009). New effect size rules of thumb. *Journal of Modern Applied Statistical Methods, 8*(2), 597–599. https://doi.org/10.22237/jmasm/1257035100

Sriwisathiyakun, K., & Dhamanitayakul, C. (2022). Enhancing digital literacy with an intelligent conversational agent for senior citizens in Thailand. *Education and Information Technologies*, *27*, 6251-6271. https://doi.org/10.1007/s10639-021-10862-z

Su, J., & Yang, W. (2023). Unlocking the power of ChatGPT: A framework for applying generative AI in education. *ECNU Review of Education, 6*(3), 355–366. https://doi.org/10.1177/20965311231168423

Susnjak, T. (2022). *ChatGPT: The end of* online *exam integrity? ArXiv*. https://doi.org/10.48550/arXiv.2212.09292

Tlili, A., Shehata, B., Adarkwah, M.A., & et al. (2023). What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education. *Smart Learning Environments, 10*, 15. https://doi.org/10.1186/s40561-023-00237-x

Trương, H., Nguyễn, P., Cao, L., Nguyễn, T., & Nguyễn, P. (2023, June 28). Role of ChatGPT in Vietnamese education. https://doi.org/10.35542/osf.io/52smv

Trust, T., Whalen, J., & Mouza, C. (2023). Editorial: ChatGPT: Challenges, opportunities, and implications for teacher education. *Contemporary Issues in Technology and Teacher Education*, *23*(1), 1-23.

Wardat, Y., Tashtoush, M. A., AlAli, R., & Jarrah, A. M. (2023). ChatGPT: A revolutionary tool for teaching and learning mathematics. *Eurasia Journal of Mathematics, Science and Technology Education*, *19*(7), em2286. https://doi.org/10.29333/ejmste/13272

Zhai, X. (2022). *ChatGPT user experience: Implications for Education.* SSRN.

https://doi.org/10.2139/ssrn.4312418

Zhang, R., Zou, D., & Cheng, G. (2023). Chatbot-based training on logical fallacy in EFL argumentative writing. *Innovation in Language Learning and Teaching*, *17*(5), 932-945. https://doi.org/10.1080/17501229.2023.2197417

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