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Nursing Students' Utilization of ChatGPT in Developing Health Education Materials on Immunization: A Randomized Controlled Study

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ABSTRACT

Background: The use of Chat Generative Pretrained Transformer (ChatGPT) in AI programs is gaining popularity. In addition, the use of ChatGPT in the field of health education is steadily increasing. ***Purpose*****:** The aim of this study was to determine the effect of using ChatGPT, an artificial intelligence program, on the appropriate use, correct use, structural properties and quality of student material design in the development of health materials on immunization by senior nursing students. ***Methods*****:** This study was conducted as a randomized controlled study with an experimental group n=63 students and a control group n=77 students. Data was collected using the 'Descriptive Data Form' and 'Visual Design Principles and Elements Evaluation Form' and 'Global Quality Score'. The students in the experimental group were given 1-hour counseling for the use of ChatGPT. ***Results*****:** The distribution of the groups in terms of socio-demographic data was homogeneous. At the end of the intervention, a statistically significant difference was determined between the experimental group and the control group in terms of appropriate use, correct use, structural features and global quality of the material developed (p<0.05). ***Conclusion*****:** There was a statistically significant difference between the experimental group and the control group in terms of appropriateness, correctness, structural properties and global quality in the material developed by the students with the support of ChatGPT program (p<0.05). ***Implications for Nursing*****:** According to the research findings, the use of ChatGPT among nursing students could support nurses in community education and patient education processes by improving the quality and design of educational materials.

Keywords: Artificial intelligence, Public health nursing, Health education.

What does this paper add?

1. It identifies that the use of ChatGPT makes a significant difference in the educational materials prepared by nursing students in terms of appropriate use, correct use, and structural features.
2. It highlights that educational materials developed using ChatGPT make a significant difference in terms of quality.

Introduction

Artificial intelligence (AI) uses algorithms in an innovative way to mimic human intelligence and abstract reasoning, as well as cognitive abilities, such as learning, autonomous decision-making, communicating in natural languages, perceiving the physical world and interacting with it (Chen et al., 2022; O'Connor et al., 2023). Samoili defined AI as "software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension

by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information derived from this data and deciding the best actions to take to achieve the given goal. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analyzing how the environment is affected by their previous actions" (Samoili et al., 2020). Currently, AI is widely used in various fields and especially in the field of health, the use of AI in the field of nursing is becoming increasingly widespread (Chen et al., 2022; O'Connor et al., 2023; Van Bulck et al., 2023). AI applications in nursing are used in various fields to improve patient care, support nurses' clinical decision-making and reduce workload (Akhu-Zaheya, 2024). In addition, AI-based chatbots facilitate nurses' communication and care processes by providing fast and accurate answers to patient questions (Wei et al., 2025). It is reported that the use of the Adaptation Model developed by Roy in AI-driven immersive virtual reality applications for cancer pain management in patients with advanced breast cancer has a positive impact from a nursing care perspective. It is reported that the use of Roy's Adaptation Model serves as a conceptual framework that plays a highly effective role in guiding the use of AI-driven immersive virtual reality, thereby making significant contributions to patient care (Alhusamiah et al., 2024). Sherani et al. stated that the use of AI is effective in identifying necessary interventions for underrepresented groups, identifying disadvantaged communities, and reducing health care disparities by reducing bias and increasing transparency. They also stated that the inclusion of AI in vaccination programs is a paradigm for effective, equitable and personalized healthcare (Sherani et al., 2024). Zhu et al. found that technology will have a positive impact on nurses' decision support system for childhood immunization (Zhu et al., 2012).

The use of Chat Generative Pretrained Transformer (ChatGPT) in AI programs is gaining popularity. ChatGPT is a language model and it was developed by OpenAI in 2022 as a chatbot and many consider ChatGPT to be the first true AI created in a universal sense (Miao & Ahn, 2023). ChatGPT is a motivated algorithm program that is more knowledgeable than the expert in its field in almost every discipline, basic and intermediate level subjects. It responds in a shorter time and finds solutions to the results (Dwivedi et al., 2023).

However, the widespread use of AI systems in the technological era also raises concerns. Fears that it will reduce human interaction, that AI may replace the functions of nurses, and ethical issues raise controversial issues, such as ethical problems (Miao and Ahn, 2023). According to USA Today, many schools and universities have banned the use of ChatGPT (Jimenez, 2023). Some educational institutions have banned the use of ChatGPT in students' essays and assignments. The American Psychological Association calls on schools to educate educators and students about ChatGPT rather than ban its use (Abramson, 2023). While the underlying reason may be ethical concerns (e.g., about plagiarism), it seems likely that the ChatGPT ban will not last long (Miao & Ahn, 2023). However, the use of ChatGPT in the nursing field can also lead to certain disadvantages. One of the most important issues is the concern about the possibility of technology replacing human nurses. Although ChatGPT can offer significant assistance to nurses, it cannot replace the personal interaction and empathic care that nurses offer to their patients (Abdulai & Hung, 2023).

In nursing, which is a constantly evolving profession, including ChatGPT in education can offer creative methods and new opportunities (Gunawan et al., 2024). Considering the potential impact of ChatGPT, some studies advocated integrating the use of AI in education to develop and impart skills to nursing students (Ahmed, 2023; Gunawan et al., 2024).

Aim

This study aims to determine the effect of using ChatGPT, an artificial intelligence program, on the appropriateness, accuracy, structural features, and material quality of student-designed health education materials on immunization, developed by senior nursing students.

Hypotheses

H0-1: There is no difference between the experimental and control groups in terms of student material design appropriateness, accuracy and structural features of using ChatGPT in the health materials developed on 'immunization'.

H0-2: There is no difference between the experimental and control groups in terms of material quality when ChatGPT is used in health materials developed on 'immunization'.

Methods

Study Design

This study was conducted as a randomized controlled study. The CONSORT 2010 statement was used for reporting the randomized controlled trials. The study was recorded at clinicaltrials.gov.tr (Registration Number and Date: NCT06894888, 2025-03-25).

Population and Sample of the Study

The study population consisted of senior students (N=156) enrolled at a nursing faculty in Northern Cyprus. The sample size was calculated using the G*Power 3.1.9.2 program at an 80% power level and a 5% significance level; Cohen's effect size (d=0.70) was taken as the basis (Saatçi et al., 2024). As a result of the calculation, a minimum of n=34 participants was deemed necessary for each group. However, no sampling was conducted in the study; the aim was to reach the entire population to prevent selection bias and enhance the representativeness of the study. Accordingly, 78 participants were included in each group. During the study, a total of 16 participants were excluded from the research due to unwillingness to continue participation in the intervention and assessment processes. In the experimental group, 15 participants were excluded, because they did not wish to participate in the intervention procedures. In the control group, 1 participant was excluded, because he did not wish to continue participating in the study. The study was completed with a total of N=140 students, comprising n=63 in the experimental group and n=77 in the control group.

Place and Time of Study

The study was conducted in a nursing faculty in Northern Cyprus. The research was conducted between November 2024 and February 2025.

Research İnstruments

The data was collected with the 'Descriptive Data Form' which was prepared by the researchers, by reviewing the literature, and the 'Visual Design Principles and Elements Evaluation Form (VDPEEF)' and the 'Global Quality Score (GQS)'.

- **Descriptive Data Form:** The descriptive data collection form includes 6 questions created by the researchers (age, gender, nationality, status of developing health materials with AI before, internet usage status, digital device usage status).
- **Visual Design Principles and Elements Evaluation Form (VDPEEF)**: It was developed by Yalın in 2003. VDPEEF has three sub-dimensions. These sub-dimensions are named as "appropriate use of design elements", "correct use of design principles" and "structural features", respectively. The form contains a total of 19 items, 10 in the "appropriate use of design elements (1-10 items)" dimension, 6 in the "correct use of design principles (11-16 items)" dimension and 3 in the "structural features (17-19 items)" dimension. The form is a 3-point Likert-type form with three categories as "very good (3 points)", "acceptable (2 points)" and "poor (1 point)" (Yalın, 2003).
- **Global Quality Score (GQS):** The scale includes 5 items. These are: "1) Poor quality, poor flow of the site, most information missing, not at all useful for patients; 2) Generally poor quality and poor flow, some information listed, but many important topics missing, of very limited use to patients; 3) Moderate quality, suboptimal flow, some important information is adequately discussed, but others poorly discussed, somewhat useful for patients; 4) Good quality and generally good flow, most of the relevant information is listed, but some topics not covered, useful for patients; and 5) Excellent quality and excellent flow, very useful for patients". During the evaluation of the measurement tool, the item that best expresses the quality of the material is selected and scored according to the selected items (Bernard et al., 2007).

Randomization

Within the scope of the course taken by the students, 'immunization' topics were taught as a theoretical course through traditional teaching. The students were given the task of designing educational materials related to the topic. Then, randomization was applied and the intervention was started. A lecturer, other than the researchers, performed the randomization using a simple randomization technique (via randomizer.org website). The assignment of the students to the groups was completed as (n=78) in the experimental group and (n=78) in the control group. It was sent to one of the researchers (DN) by closed envelope method. 15 students from the experimental group and 1 student from the control group were excluded from the study. The

study was completed with experimental group (n=63) and control group (n=77) students. Within the scope of a course taken by the students, the topic of 'immunization' was explained to the class as a theoretical lesson through traditional lecturing.

Implementation of the Study

✓ ***Experimental Group İmplementation***

Prior to the intervention, the researchers prepared an intervention protocol to be followed by the participants. The protocol, designed as semi-structured, comprised 3 modules (each of them 20 minutes), totalling 60 minutes. These modules included explaining the purpose of the intervention, its ethical aspects, prompt writing, and asking open-ended questions.

The intervention applied to the experimental group in the study was conducted by one of the researchers (DN). In the first module, the aim of the intervention was to develop nursing students' ability to use ChatGPT, an artificial intelligence tool, effectively and consciously in the process of developing health education materials on immunisation. From an ethical perspective, students were informed that they must not share personal data when using artificial intelligence and that the generated content would be used within the framework of academic integrity. Furthermore, the necessity of verifying any incorrect or incomplete information that ChatGPT might produce was emphasized.

In the second module, students were provided with information on the process of developing health education materials using effective prompt-writing techniques and semi-structured open-ended questions within the ChatGPT program. Three key terms to be used during the research process were communicated to the students: "*nursing*", "*health material*" and"*immunisation*". These key terms were maintained consistently throughout the intervention. Subsequently, sample prompts were provided to the students. These included: *"How can I design an effective health education material on immunisation?", "What should the visual elements of the material include?", "Which colours are most appropriate?", "How should I organize the content?",* and *"How can I design a brochure or model for educational purposes?".*

In the third module, a practical application was carried out, and the student was given free rein using a flexible prompt approach. The aim was thus to enable the student to develop both guided and creative applications. Students were asked to develop health education materials (such as a brochure, information card or educational content design) based on the information they obtained via ChatGPT.

✓ ***Control Group İmplementation***

✓ One of the researchers (DN) arranged a meeting with the group of students assigned to the control group and asked the students to design health material(s) on 'immunization' using their own creativity without any information about ChatGPT. They gathered in the classroom on the same day and time as the experimental group and introduced the health materials they designed.

The health materials developed by the students were evaluated by one of the researchers (KE) who was not involved in the randomization assignment and who was present in the classroom by filling in the VDPEEF and GQS measurement tools. The process of the study is shown using the CONSORT 2025 flowchart. (Figure 1).

Inclusion Criteria

- Volunteering to participate in the study
- Being literate in Turkish
- Being in the last year of the nursing program
- Attending the course on accessing evidence-based knowledge in nursing.

Exclusion Criteria

- Previously prepared health materials using an AI program
- Those who did not attend the lesson.

Variables of the Study

While the independent variables of the study consisted of the adolescents' descriptive data, the dependent variable was the mean scores obtained from the VDPEEF and the GQS.

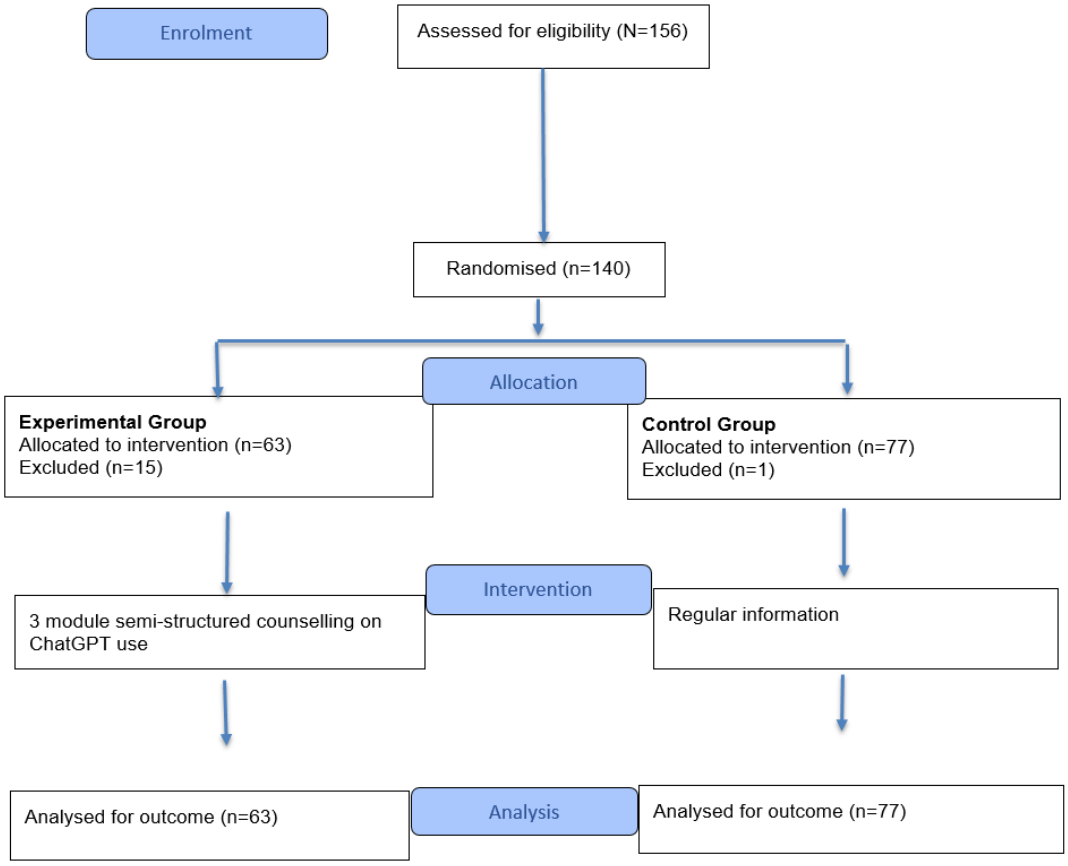

Figure 1. CONSORT 2025 flow diagram

Ethics Approval and Consent to Participate

For the implementation of the data collection forms, "Ethics Committee Permission" (NEU/2024/127-1888) was obtained from the Near East University Ethics Committee and institutional permission was obtained from Faculty of Nursing. The necessary permissions to use the scales and informed verbal and written consents were obtained from the participants. This research was conducted in accordance with the Declaration of Helsinki.

Data Evaluation

SPSS 25.0 software package was used for statistical analysis. Percentage and frequency tests were applied in the evaluation of the data.The study data was primarily examined using the Kolmogorov-Smirnov test, and the distribution was found to be normal. Accordingly, the t-test for independent samples was used for comparisons between groups. Furthermore, Cohen's d effect size was reported to assess the magnitude of the intervention's effect. Data was evaluated with 95% confidence interval and *p*-value of 0.05 margin of error.

Power Analysis

In this study, post-hoc analysis was performed to determine the power of the study with the G*power 3.1 program. The power of the study was determined as 98% with a 5% type-1 margin of error and an effect size of 0.7.

Results

The socio-demographic characteristics (sex, nationality, previous material development using an AI program, digital device usage, internet access status) of the experimental and control groups are presented in Table 1. When the groups were analyzed in terms of sex, it was determined that 50.8% (n=32) were female and 49.2% (n=31) were male students in the experimental group and 49.4% (n=38) were female and 50.6% (n=39) were male students in the control group (p=0.865). It was determined that 77.8% (n=49) of the students in the experimental group were Turkish and 22.1% (n=14) were local; 81.8% (n=63) of the students in the control group were Turkish and 18.2% (n=14) were local (p=0.552). It was determined that all of the students in

the experimental and control groups had not developed health materials using an AI program before, and all of them had digital devices and internet access (p<0.05). The mean age of the students in the experimental group was 22.54 ± 2.55, while the mean age of the control group was 22.22 ± 3.03 (t=0.685; p=0.495). There was no statistical difference between the mean ages of the groups. In this study, no statistical difference was found between the socio-demographic data of the participants in the experimental and control groups. It was determined that the distribution of the groups in terms of socio-demographic data was homogeneous.

Statistical relationships between the mean scores of the experimental and control groups from the VDPEEF data tool are shown in Table 2. A statistical difference was found between the mean scores of the experimental group (51.0±4.19) and the control group (42.36±8.42) as the total score from the VDPEEF form measured after the application (t=-7.415; p<0.001). In addition, a statistical difference was found between the mean scores of the experimental group (4.77±0.41) and the control group (3.81±1.03) on the GQS measured after the experimental (t= -6.905; p<0.001). Analyses of the total scores and sub-dimensions of the VDPEEF scale and the total score of the GQS revealed that the Cohen's d values indicated a large effect size (>0.80).

Table 1. Socio-demographic characteristics of experimental and control groups

Variable		Experimental Group (n=63)		Control Group (n=77)		Test Statistic	*p*
		n	%	n	%		
Sex	Female	32	50.8	38	49.4	χ^2*=00.29	0.865
	Male	31	49.2	39	50.6		
Nationality	Turkish	49	77.8	63	81.8	χ^2=0,354	0.552
	Local	14	22.2	14	18.2		
Previous Material Development Using AI	Yes	0	0	0	0	-	<0.05
	No	63	100	77	100		
Internet Access	Yes	63	100	77	100	-	<0.05
	No	0	0	0	0		
Age		22.54 ± 2.55		22.22 ± 3.03		*t**=0.685	0.495

χ^2*=Chi-square Test.
t**=Independet Sample t-Test.

Table 2. Distribution of experimental and control group participants' scores on measurement tools

Measurement Tool		Experimental Group Mean±SD	Control Group Mean±SD	df	*t**	*p*	*Cohen's d*
VDPEEF	Total Point	51.0±4.19	42.36±8.42	138	-7.415	0.001	1.29
	Appropriate Use	27.88±1.74	23.90±4.53	138	-6.581	0.001	1.15
	Correct Use	15.66±2.42	12.63±2.62	138	-7.041	0.001	1.20
	Structural Features	7.44±1.78	5.81±2.00	138	-5.014	0.001	0.86
GQS	Total Point	4.77±0.41	3.81±1.03	138	-6.905	0.001	1.22

t=Independet Sample t-Test.*

Discussion

In this study, it is aimed to emphasize the role of technology in education and especially the potential of AI tools in developing health materials. With technological developments, the use of AI in both health and patient education is increasing day by day (Lee & Yoon, 2021). According to the literature, ChatGPT stands out as the most used AI program among students (Arbel et al., 2024, Gosak et al., 2024, Rossettini et al., 2024). In the study conducted by Saatçi et al. with nursing students, it was determined that the majority of the participants had better comprehensibility, applicability and quality of patient education materials developed with the support of ChatGPT (Saatçi et al.,

2024). In another study, ChatGPT and Google Bard were used as patient education materials for obstructive sleep apnea. According to the results of the study, ChatGPT was reported to have superior comprehensibility and actionability of the responses generated compared to Google Bard (Cheong et al., 2024). Another study conducted in India stated that ChatGPT can be an effective method for the preparation of patient education materials for public health problems in India (Mondal et al., 2023). In a research conducted with university students in Turkey, students' writing skills were examined using traditional teacher feedback and feedback from PaperRater and ChatGPT AI programs. According to the results of the study, it was found that students using AI support had higher writing scores than those of students using the traditional approach (Cöp, 2025). In contrast, in a study examining the accuracy, readability and likelihood of use of ChatGPT for ten common medication and disease states, it was reported that the AI-generated training material was moderately safe by pharmacists (Armstrong et al., 2024). In this study, it was determined that the experimental group, which received AI (ChatGPT) support, had a higher mean score than the control group in the criterion evaluating the visual design principles and elements of the health education materials developed by nursing students on immunization. This result is parallel to the literature. Overall, it shows that the ChatGPT program enables nursing students to use visual elements in health materials more effectively.

In addition, in this study, a statistical difference was found between the experimental group and the control group in terms of 'appropriate use', 'correct use' and 'structural features'. On the other hand, the experimental group was found to have a higher effect size. It is interpreted by the students that using the ChatGPT program during the development of health education materials on immunization can contribute to the development of more effective teaching tools in a critical area, such as nursing education. It also suggests that the use of ChatGPT as a tutorial guide helps students make correct and effective applications in the material development process.

The high quality of health education materials which are prepared for patient education positively affects the quality of education (Ghorbani et al., 2014). When the literatüre is examined, it is stated that the quality of health information obtained by using AI programs is high (Hershenhouse & Cacciamani, 2024; Pan et al., 2023). Kirchner et al. reported that there was no change in content quality and accuracy when the readability of the patient education materials used was evaluated by recreating them with AI (Kirchner et al., 2023). Similarly, Kalla et al. stated that editing and reviews using AI reduced inconsistencies and errors in the materials and improved the overall quality of the material (Kalla et al., 2023). In the study conducted by Saatçi et al. with nursing students, when the health education materials prepared with AI support were evaluated in terms of quality, the material quality in the group that did not receive AI support was below average, while the health education materials prepared with AI support were found to be above average (Saatçi et al., 2024). Similar to the literature, this study found that the quality of health education materials developed using ChatGPT was higher and had a high effect size. This result indicates that the use of ChatGPT program is effective in increasing the overall quality of health education materials and producing quality content.

This study once again reveals the opportunities offered by technology integration in education. In particular, it shows that the use of artificial intelligence-based tools in health material development is a more effective alternative way in the design and productivity process compared to traditional methods. However, various limitations and ethical concerns regarding the use of these tools are frequently discussed in the literature. In order for AI programs to be used effectively and ethically in educational environments, some basic conditions must be met. In order to produce and use the material correctly with AI programs, students must have professional technical knowledge. In addition, it is of great importance that they have basic digital literacy competencies.

Implications for Nursing

According to the research findings, it is believed that the use of ChatGPT among nursing students could support nurses in community education and patient education processes by improving the quality and design of educational materials. It is argued that this could be beneficial not only for nursing students, but also for nurses working in clinical settings. However, it is essential that the materials produced be reviewed by a nurse or an academic who observes nursing students.

Conclusion

The primary outcomes of this study indicate an increase in students' scores. In addition, materials developed with the support of the ChatGPT program were of higher quality than those produced by the control group, particularly in terms of appropriateness, accuracy, and structural coherence. In light of these primary outcomes, it is recommended that AI programs be introduced to students and integrated into education in a controlled manner.

Limitations

This study has several limitations. Firstly, the study was conducted with only a specific group of students at a single centre, and the generalizability of the results to students at different educational levels is limited. Furthermore, although randomization was applied to minimize selection bias, this method does not provide complete control over students' external learning processes. The accuracy of the content of the educational material wasn't reviewed by experts in the field. There was no follow up on the effect of the educational material on patients, and the outcomes of the study were only short-term outcomes. Another limitation of this study is that statistical blinding was not applied.

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Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Study Registation

The CONSORT 2010 statement was used for reporting the randomized controlled trials. The study was recorded at clinicaltrials.gov.tr (Registration Number and Date: NCT06894888, 2025-03-25).

Conflict of Interests

The authors declare that they have no conflict of interests.

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Authors' Contributions

Study Design: **KE, DN**. Data Collection: **KE, DN**. Data Analysis: **KE, DN**. Study Supervision: **KE, DN**. Manuscript Writing: **KE, DN**. Critical Revision for Important Intellectual Content: **KE, DN**.

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