The Influence of AI ChatGPT on Improving Teachers' Creative Thinking

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Abstract. The latest technologies, such as Artificial Intelligence (AI), have emerged as pivotal tools for fostering creativity, aiding in the development of novel and interactive pedagogical methods, and catalysing innovation within the educational process. The integration of technology into education opens avenues for creative expression and the cultivation of creative skills among students. Investigating the cognitive styles of educators is imperative for adapting instructional strategies, as divergent modes of thinking can impact the efficacy of teaching and facilitate the customization of approaches in pedagogy. In this article, the predominant type of thinking among student teachers is investigated, the average level of creativity is determined, and the potential influence of employing an innovative method - ChatGPT - on the creative abilities of future educators is explored. The study sample consisted of (450) university teachers at three universities, Udmurt State University (Izhevsk, Russia), Peoples' Friendship University of Russia (Moscow, Russia), and Beijing Institute of Technology (Beijing, China). Participants were invited to participate in two assessments: J. Bruner's test on thinking styles, and a proprietary questionnaire designed to gather additional insights into the perception and influence of ChatGPT on creative potential. This research employed a quantitative approach. The study revealed that 70% of the surveyed student teachers exhibited a sign-oriented type of thinking. The experimental findings indicated a moderate level of creativity among these students. Only 28% of the participants demonstrated a high degree of creativity. In contrast,

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educators who utilized the developed programme exhibited a higher level of creative ability and better performance compared to teachers in the control group. This suggests that the incorporation of ChatGPT in education exerts a positive influence on enhancing educators' outcomes when compared to conventional teaching methods. The practical significance of this study lies in its contribution to expanding knowledge about the impact of ChatGPT on the development of creative potential. It underscores the importance of employing contemporary information and communication technologies in the preparation of future teachers.

1. Introduction

The provision of high-quality higher education for teachers and the training of future educators to engage in creative professional activity are pressing concerns today (Bereczki & Kárpáti, 2018). It is vital to remember that teaching is a creative job, as it involves a holistic pedagogical process aimed at a group of personalities, each of which has a distinct personality and a distinct developmental path. Changes in group members' and students' mental and emotional states, and the variety and unpredictability of interpersonal relationships in the learning process, require the teachers to be responsive, adaptable, and creative in their job (Esteban & Laborda, 2018; Gurak-Ozdemir et al., 2019). The solution cannot be provided by solely mastering a set of professional knowledge and skills. A new approach must be created to achieve several objectives. These include raising the standard of higher teacher education, modernizing the education of university students while providing them the freedom to choose their career paths, fostering professional growth and development, and speeding up the implementation of educational initiatives. These initiatives collectively will guarantee the excellence of higher teacher education (Guslyakova & Guslyakova, 2017; Khairullina et al., 2017).

Society requires a creatively motivated teacher who can find non-standard solutions to professional problems, respond to student's needs, and meet their demands (Wicaksono & Wasis, 2017). The level of teachers' professional training significantly influences their creative thinking. To effectively realise their creative potential and to achieve a high level of creativity in future professional activity, future teachers need to develop their creative thinking in higher education settings (Rodríguez et al., 2019). The emergence of the novel information tool, ChatGPT, holds promise for potentially aiding them in this endeavour. The generative artificial intelligence tool, ChatGPT, has taken the world by surprise with its intricate ability to perform exceedingly complex tasks (Zhai, 2022). The extraordinary capabilities of ChatGPT in tackling intricate educational tasks have evoked mixed sentiments among educators, as this advancement in the realm of AI appears to revolutionize the existing educational practices.

Moreover, educators should employ innovative thinking and create pedagogical environments that nurture originality, aiding students in cultivating their creative abilities. Organising the process of forming students' creative thinking in a higher education institution's (HEI) educational environment entails researching the state of modern education, determining the prevailing type of thinking in creative individuals, determining the creativity level of future teachers, and identifying conditions and factors influencing how their creative potential unleashes (Watson, 2018).

1.1. Problem statement

Research Aim: This study was aimed at exploring the potential opportunities offered by ChatGPT to foster creative thinking among future educators.

Research Questions: What possibilities does ChatGPT present for stimulating creative thinking among prospective teachers? What impact does the utilization of ChatGPT have on the development and expression of ideas among educators? How do future teachers react to and perceive the incorporation of ChatGPT in the educational process?

Research Objectives:

1. To implement the use of ChatGPT in the educational process of prospective teachers.
2. To assess the current state of creative potential among future educators.
3. To evaluate the degree of development of creative thinking in educators through the use of ChatGPT.

2. Literature review

2.1. How scholars understand creativity

Including creativity among the twelve most essential competencies demonstrates the significance of creative thinking in today's society (Laborda, 2017). According to Khairullina et al. (2017), "creative thinking is a type of thinking whose primary characteristic is to yield a new thought product" (. Some researchers define pedagogical creativity as the capacity to think imaginatively and find novel solutions to pedagogical problems. The following characteristics define creativity: quickness (productivity), the flexibility of thought, originality, and audacity (Ibatova & Ilin, 2017; Intasao & Hao, 2018). Additionally, researchers list the following as characteristics of creative thinking: productivity (producing many unique and non-standard ideas), flexibility (using various techniques or strategies to solve a problem), originality (producing solutions that are not commonly found), development (expanding on ideas in detail), resistance to closure (rejecting stereotypes, being open to new ideas), and abstractness (recognising the root of the problem) (Wicaksono & Wasis, 2017). However, because it is a multifaceted, complex phenomenon, creative thinking cannot be characterised by just one quality. Six dimensions of creativity, or six different types of skills possessed by a person who thinks and acts creatively, have been identified by one researcher studying creativity theory. These include the capacity to recognise and formulate issues, produce numerous unconventional solutions, quickly come up with different original ideas, forge distant associations, enhance an object by adding details, and provide the capacity to see novel properties of an object and novel applications for it

(Watson, 2018). In a summary of the different approaches to identifying the characteristics of creative thinking, Bereczki and Kárpáti (2018) emphasised the importance of freedom from stereotypes, criticality, diversity of ideas, autonomy from the opinions imposed by others, and openness to new things. Some creativity researchers limit the essence of creative thinking to manifesting abilities such as generating original ideas, creating something new, understanding contradictions, and formulating hypotheses about a problem (Mustika et al., 2019).

2.2. The role of creative thinking in the teacher's profession
Higher education institutions that train people to become teachers must help students in developing their creative thinking skills (Maksić & Jošić, 2021). Indicators of teachers' creativity include creative initiative, the ability to broadly apply their knowledge and skills in professional activities, applying original and modern pedagogical solutions, original improvisation, the desire to put their ideas into action, inventive demands, and spiritual needs (Watson, 2018). Creativity training for educators should focus on assisting teachers in growing as individuals. The desire for professional success is a powerful motivator for students to cultivate their skills and pursue self-actualisation (Aguilar & Turmo, 2019; Benedek et al., 2018; Glaveanu, 2018).

Theoretical research on how to increase future teachers' creativity has ensued in the conclusion that students' academic performance depends on the creativity of their teachers (Rodríguez et al., 2019). One of the primary drawbacks of contemporary professional pedagogical education is its limited impact on fostering the creative potential and abilities of would-be teachers (Ibatova & Ilin, 2017). Researchers investigating creativity have identified two main groups of psychological and pedagogical factors that mould and develop students' creative thinking:

1) Subjective factors - a collection of personal characteristics affecting the development of creative abilities in future teachers (students' personalities, their motivation to be creative, and their outlook on creativity);
2) Objective factors allowing for targeted pedagogical action, and guiding it according to set objectives (Rodríguez et al., 2019).

The conclusion emerging from a literature study on teacher education was that creative thinking is broad and intricate. Deliberate actions are necessary to form high levels of creativity. Since pedagogy does not define the meaning of the general scientific concept of *forming*, it is necessary to do so in the context of this study. The formation is the process of a person's growth under the influence of all the aspects that affect a person's personality, including the teacher's actions. These include environmental, social, economic, pedagogical, objective, and internal, subjective factors (Watson, 2018). A person's level of success, or achievement of a particular maturity stage is called formation (Bozhkova et al., 2019; Suárez & Wechsler, 2019; Zulkarnaen & Jatmiko, 2017). Thinking formation is the process of increasing a person's intellectual capacity. This can happen through the normal flow of a person's daily life and learning new skills and knowledge in HEIs. The thinking process has no final stage because it is

constantly shaped and developed through human interaction with the environment (Rodríguez et al., 2019). These theories contend that developing future teachers' creative thinking requires personal growth and promotes total development. Engaging future educators in creative pursuits (in the context of professional endeavours), placing them in educational settings that require them to express their creative abilities fully, and designing the entire learning process centred on creative orientation principles all help to shape creative thinking (Kambey & Wuryaningrat, 2018).

2.3. Using ChatGPT to unleash the creative potential of future teachers
ChatGPT, a recently developed conversational chatbot created by OpenAI (Mhlanga, 2023), has the potential to streamline the application of AI in teaching and learning for educators. Leveraging natural language processing, ChatGPT generates responses akin to human-like answers based on user input. Its remarkable efficacy in providing coherent, systematic, and informative responses has garnered worldwide attention (Zhai, 2022).

The utilization of ChatGPT to unleash the creative potential of future teachers presents several potential advantages (Mhlanga, 2023; Sallam, 2023):
1. Idea Enrichment: ChatGPT offers novel ideas and perspectives that future teachers can integrate into their work. It has the capacity to generate diverse and original responses to questions and challenges, thereby aiding students and educators in nurturing their creative potential.
2. Interactive Learning: ChatGPT can facilitate interactive learning and dialogue, fostering the development of creative thinking. Users can pose inquiries, receive unpredictable responses, and stimulate their thinking through interactions with the model.
3. Personalized Learning: ChatGPT can be customized to meet the individual needs of students, enabling the provision of personalized support and guidance in cultivating their creative skills.
4. Idea Experimentation: Through ChatGPT, students can experiment with various ideas and concepts, test them in practice, and receive feedback. This empowers them to develop their creative thinking and discover innovative approaches to teaching.

Nevertheless, it is crucial to recognize that ChatGPT's capacity for critical information evaluation is constrained as it cannot serve as a replacement for real-world experiences and mentorship. Therefore, for the comprehensive development of the creative potential of future teachers, it is necessary to combine the utilization of ChatGPT with other methods of instruction and support.

ChatGPT exhibits both advantages and disadvantages. Potential benefits of ChatGPT in advancing teaching and learning encompass (García-Peñalvo, 2023; Willems, 2023):
- Personalized Learning: ChatGPT can be employed to offer tailored recommendations and assistance to educators based on their unique needs and knowledge levels. This capability enables the creation of individualized

learning experiences and supports the development of each student to their abilities and interests.

- Interactive Learning: ChatGPT can create interactive learning environments where educators can engage with the system, pose questions, receive explanations, and conduct dialogues. This fosters active participation in the teaching process and stimulates critical thinking, analytical skills, and problem-solving.
- Formative Assessment Prompts: Additionally, ChatGPT can provide immediate feedback and prompts to educators in real-time, aiding them in better understanding their mistakes, enhancing their teaching skills, and addressing challenges encountered during student learning processes (García-Peñalvo, 2023).

ChatGPT can offer continuous feedback and inform educators about the students' learning processes through data analysis and providing statistics and reports. These resources facilitate the monitoring of students' progress, the identification of areas requiring improvement, and the implementation of suitable measures to enhance the overall learning experience (Willems, 2023).

Despite its potential advantages, ChatGPT also possesses limitations that necessitate consideration (Thorp, 2023):

1. Generation of Misinformation: ChatGPT may occasionally produce incorrect responses. This requires vigilance and verification on the part of educators and learners to avoid disseminating inaccurate information.
2. Bias in Training Data: ChatGPT relies on training data, which might contain biases or inequalities. This can lead to unfair or biased outcomes. Caution and mindfulness are required when employing ChatGPT to prevent the reinforcement of existing prejudices.
3. Confidentiality Concerns: The use of ChatGPT in education may raise questions about student data confidentiality and protection. Measures must be taken to ensure the security and privacy of information.

3. Methods and materials
3.1. Research design
This study employed a quantitative method. Statistical data, derived from questionnaire responses, were gathered using a quantitative method to aid in drawing broad conclusions from the study. Furthermore, the quantitative approach made it possible to gauge the extent to which future teachers' creative potential and creative thinking with ChatGPT were assessed at the time of the study (March to July 2022).

3.2. Participants
As part of the research project, a questionnaire was compiled for 450 students from Udmurt State University, Peoples' Friendship University of Russia, and Beijing Institute of Technology. The invitation to complete the questionnaire was emailed to 1,500 students, with a request to respond within 24 hours. Subsequently, a sample of 420 students, aged between 17 and 23 years, enrolled for their first to fourth academic years at the respective higher education

institutions, was surveyed. The sample comprised 200 females and 220 males. The participants were divided into two groups: the experimental group, namely students that utilized ChatGPT, and the control group, that is, students who did not use ChatGPT.

3.3. Procedure
The instructional process for each group was designed to foster the development of students' creative thinking and facilitate their active participation in the learning process. Both groups of students received identical educational content aimed at nurturing their creative potential. However, a distinction was made regarding the utilization of ChatGPT, which was exclusively provided to participants in the experimental group.

Participants in the experimental group engaged in a learning process that involved the utilization of ChatGPT to support and enhance their creative potential. Students were granted access to ChatGPT, a text-generating model, which they could employ to seek advice, ideas, and assistance in tackling creative tasks and challenges. The instruction in the experimental group was conducted in an online format, wherein students interacted with ChatGPT through a web interface or a dedicated application.

Participants in the control group received instruction without the utilization of ChatGPT. They were taught by means of traditional teaching methods, such as lectures, practical tasks, and textbook work. The instruction in the control group also took place in an online format but without the use of ChatGPT or other interactive tools.

During the experiment, testing and surveying were conducted for both groups. The state of these students' creative thinking, type of thinking, creativity trends, and the effect on their creative abilities were determined based on the testing and questionnaires. During the study, there was no pedagogical influence on the subject groups, and no special circumstances were created that could inadvertently influence the manifestation of their creative potential. The respondents were informed of the anonymity of the collected data and reminded that their participation in the study was entirely voluntary and uncompensated. The written information from the questionnaire did not include the names of the respondents; all responses were subject to coding, which consisted of assigning numeric codes to the questions and the values of their responses. The data were coded to be sorted and analysed more efficiently. Participants were identified by the letter P (Participant), followed by a number (1, 2, 3). This means that P1 was Participant 1, and so on.

3.4. Data collection
The participants were invited to complete two tests. The first test was designed to identify future teachers' prevailing type of thinking and level of creativity, while the second was designed to determine how ChatGPT affected them. J. Bruner's 75-question special test, which reveals the dominant way of thinking and the degree of creativity, was used for the first test (see Ozdem-Yilmaz & Bilican, 2020). The researcher differentiated among four types of thinking: object-

oriented, visual, sign-oriented, and symbolic. The questions required a "Yes"/"No" or a "+"/"-" response. To gather additional information regarding the perception and impact of ChatGPT on the creative potential and outcomes of educators, the authors developed a questionnaire consisting of ten (10) items. The questionnaire included inquiries aimed at assessing the usage of ChatGPT, identifying its advantages and limitations, as well as its influence on creativity development and professional outcomes (see Table 1).

Table 1: Questionnaire for gathering additional information regarding the perception and impact of ChatGPT on the creative potential of educators

1	Have you utilized ChatGPT in your capacity as a teacher?
2	How frequently have you used ChatGPT during your work?
3	Did the use of ChatGPT contribute to the development of your creative potential as an educator?
4	How do you assess the influence of ChatGPT on your work outcomes?
5	Did your effectiveness change after implementing ChatGPT into your practice?
6	What advantages do you perceive in using ChatGPT in your work?
7	What drawbacks or limitations have you noticed during the use of ChatGPT?
8	How do you evaluate the convenience and ease of using ChatGPT?
9	Has the use of ChatGPT impacted your creativity and ideas for teaching?
10	How do you perceive the interaction with ChatGPT, that is, - do you consider it as an assistant or additional teacher?

The selection of these questionnaires for the study was strategic and scientifically grounded. The utilization of J. Bruner's test provided a reliable method for determining thinking styles and levels of creativity, ensuring objective outcomes. The questionnaire was aimed at determining the influence of ChatGPT, affording a deeper understanding of technology usage by identifying its advantages and limitations. This inclusive approach allowed for the collection of additional data on the perception and impact of ChatGPT, rendering the research more informative and wide-ranging.

3.5. Data analysis
The data were analysed as follows:
1) Google Form files containing interviewee responses about their creativity, type of thinking, how often they used ChatGPT and trends in creativity growth were reviewed and analysed. Interviews were also employed according to the research protocol.
2) The findings of the J. Bruner test were analysed by counting the number of positive responses. The results were interpreted using a specifically created scoring system.
3) The influence of the educational programme on the creative potential and outcomes of educators was evaluated through the use of statistical tests. A students' t-test was employed to compare the results between two groups, comprising teachers using the ChatGPT programme and the control group. It is important to note that all results of statistical data processing were confirmed to have a probability (p-value) of less than 0.05, indicating the statistical significance of the obtained findings.

Both questionnaires were assessed for reliability using Cronbach's alpha, yielding average measures of 0.86 and 0.91, respectively. Thus, the questionnaires were deemed reliable for the specific research.

All results were kept confidential, and participants were briefed on the experimental conditions.

4. Results

Figure 1 presents a compilation of statements along with the corresponding percentage of agreement from all 420 participants in the experiment.
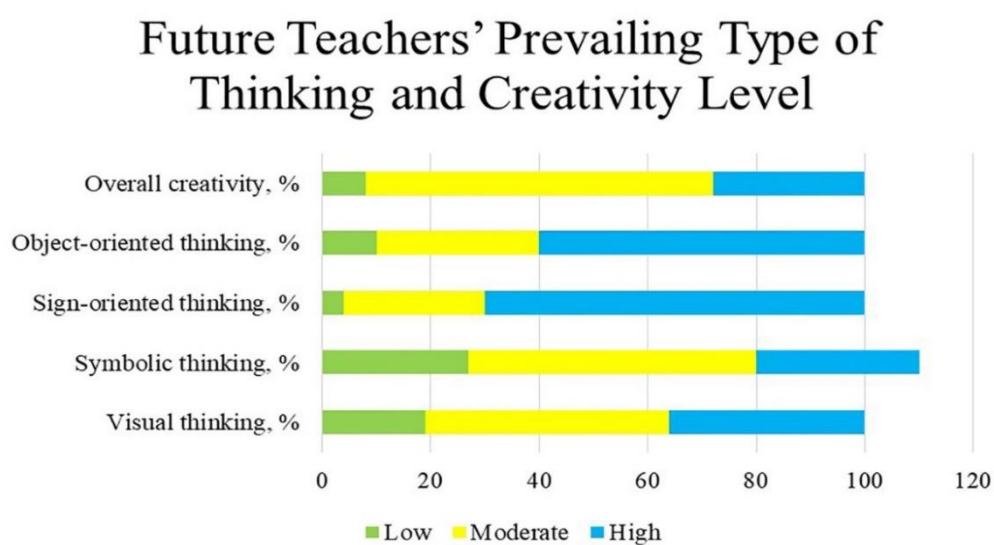

Figure 1: Future teachers' prevailing type of thinking and creativity level

Bruner's questionnaire was developed based on four types of thinking: object-oriented, visual, sign-oriented, and symbolic (Table 2).

Table 2: Results of covariance analysis (ANCOVA) for students' self-regulation competence

Types of Thinking	Group	N	Value	SD	Adjusted mean value
Object-oriented	Experimental Group	210	4.55	0.71	3.62
	Control Group	210	3.03	0.66	3.05
Visual	Experimental Group	210	3.21	0.65	3.23
	Control Group	210	3.04	0.51	3.00
Sign-oriented	Experimental Group	210	3.59	0.79	3.49
	Control Group	210	2.91	0.92	2.97
Symbolic	Experimental Group	210	4.25	0.68	4.20
	Control Group	210	3.65	0.79	3.69

The results of the Bruner test show that 70% of the surveyed students in the experimental group exhibited a sign-oriented type of thinking. The experiment results revealed that they had a moderate level of creativity. Only 28% of the students surveyed demonstrated a high degree of creativity. The experimental group rendered significantly higher scores than the control group across all indicators.

The impact of the ChatGPT programme on the creative potential and outcomes of educators was evaluated using statistical tests. A student's t-test was employed to compare the results between the two groups, namely teachers using ChatGPT and the control group. The results of this analysis revealed a statistically significant difference between the mean values of the two groups ($p < 0.05$). Teachers utilizing the developed programme exhibited a higher level of creative potential and achieved better results compared to teachers in the control group. This indicates that the integration of ChatGPT in education had a positive influence on improving educators' outcomes in comparison to traditional teaching methods.

Table 3 presents the results of the data analysis regarding the impact of ChatGPT on the creative potential of educators.

Table 3: Results of data analysis of impact of ChatGPT on educators' creative potential

	Control group	Experimental group
Number of Participants	210	210
Mean Value	60.2	72.8
Standard Deviation	8.4	6.9
p-value	0.032	0.001

The table provides the following statistical indicators: the number of participants in each group, the mean value of creative potential, the standard deviation, and the p-value. These values represent the average creative potential and outcomes in the control and experimental groups. Upon comparing the groups, it is observed that the experimental group exhibits higher mean values for creative potential and outcomes, indicating the positive impact of ChatGPT. These results confirm that the utilization of ChatGPT contributes to an enhancement of educators' creative potential and improvement in their outcomes compared to conventional teaching methods. The p-values being less than 0.05 in both cases signifies the statistical significance of the results.

Teachers using the programme exhibited higher levels of creativity and innovative thinking. The findings of the research demonstrated the effectiveness of ChatGPT in enhancing educators' creative potential and outcomes. The utilization of ChatGPT contributed to improved teaching quality and the development of innovative skills among teachers. The analysis revealed that the mean value of creative potential in the experimental group (72.8) was significantly higher than in the control group (60.2). This indicates the positive impact of ChatGPT on the development of participants' creative potential.

Therefore, the analysis results indicated the success of ChatGPT in enhancing participants' creative potential. The majority of respondents (93%) indicated that the utilization of ChatGPT contributed to the development of their creative potential as educators (Question 3). Concurrently, 78% reported a noticeable increase in their creative potential (Question 9). Educators generated a variety of new ideas for enhancing the teaching process and optimizing resource utilization. Additionally, it was observed that educators predominantly employed AI more for lesson preparation rather than directly integrating it into the instructional process.

In this study, the creative potential of teachers was considered as the dependent variable, while the utilization of artificial intelligence (AI) served as the independent variable. Analysis revealed that the independent integration of AI into the educational process influences the alteration of teachers' creative potential. The results point to a statistically significant impact of AI utilization on the enhancement of participants' creative potential, affirming the efficacy of this technology in the development and enrichment of teachers' professional skills.

5. Discussions

The investigation of the 21st-century teacher was underscored by a profound focus on creative thinking as an integral component of pedagogy. Creativity necessitates individuals' capacity to address complex issues and engage in critical thinking (Shafiee & Ghani, 2022). Furthermore, modern education is geared towards developing a creative personality with qualities such as inventing, making discoveries, solving problems in novel ways, observing contradictions, and becoming a creator of one's life (Thorp, 2023). An educator with a creative approach is essential in boosting students' motivation, engagingly presenting new knowledge, and employing diverse associative methods to enrich their understanding. This ensures that the learning process is both effective and valuable. At the Dongseo University (South Korea) and Mykolas Romeris University (Lithuania), it was found in a study that universities face new challenges to promote entrepreneurship, encourage creativity, give students the knowledge they need to develop their creative potential and introduce new technologies that support creative growth (Baubonienė et al., 2018; Černevičiūtė & Strazdas, 2018). Thus, current outcomes regarding the baseline level of creativity indicate individuals' unpreparedness for these processes, and that adequate resources and contemporary means to enhance these capacities are lacking.

On the other hand, self-awareness of creativity and the aspiration for its development play a noteworthy role in individuals (Schmaltz et al., 2017). The findings of Abdullah et al. (2021) indicate that primary school science teachers in Malaysia exhibit a high level of creativity and self-awareness. However, when it comes to the actual teaching practice, teachers reported employing relatively low levels of creativity. This suggests a potential disparity between teachers' perceptions of their creativity and their real teaching methodologies. Conversely, within the scope of our study, an enhancement of creative

pedagogical approaches is specifically affirmed. This can be attributed to the experimental integration of ChatGPT into the pedagogical domain, fostering the interaction of machine mechanisms with educators' creative tasks. Even those who considered themselves less creative enhanced their unconventional approaches to lesson development. The value of utilizing artificial intelligence is substantiated in a systematic review of innovations in the pedagogical process over the past 20 years. Ng et al. (2023) observe that AI can be a valuable tool to assist teachers in cultivating creativity in their classrooms. One of the paramount aspects is that AI can aid teachers in providing individualized feedback to students and in supporting their creative endeavours by infusing creativity into its functionality. Within the framework of the results of the study reported here, it was also identified that the stimulation of ChatGPT usage facilitated the generation of new ideas and solutions in the educational space. It is noteworthy, however, that this adaptation is an ongoing process, and, during the survey phase, pertained solely to teaching preparation rather than integration into the instructional system.

This study also demonstrated that the utilization of ChatGPT enhanced the creative abilities of the research participants. It was observed that students who frequently employed ChatGPT, or, at the very least, did so intermittently, exhibited moderate to high levels of creativity. Furthermore, investigations corroborated that the use of ChatGPT facilitated the development of creative potential in prospective educators, augmenting their capacity to generate ideas and implement innovative approaches to instruction (Lo, 2023). The findings indicated that the application of ChatGPT elevated the creativity of elementary school teachers.

Another study suggests that the impact of ChatGPT on the creative potential of teachers may be moderated by factors such as prior skills and the personal characteristics of the participants (Halaweh, 2023). In our research, we did not account for moderating factors, which potentially might have led to some discrepancies in our findings.

From a scientific standpoint, the results reported in this article can be elucidated through the lens of the socio-cultural approach to creativity (Sakenov, 2022). According to this perspective, creative potential emerges through the interaction of personal characteristics, the social environment, and educational technologies. The utilization of ChatGPT in this study fostered an environment conducive to unleashing the creative potential of prospective educators, enabling them to articulate their ideas and cultivate innovative approaches to instruction (Musah, 2023).

It may happen that the matter of fostering the creative potential of future teachers does not receive enough attention. Such an approach to managing the educational environment will harm students' development, preventing them from gaining independence, and from becoming imaginative, creative people. Developing students' creative thinking in pedagogical specialisation involves the intentional interaction of a teacher and a student under specially organised

educational conditions, using non-traditional forms and methods of educational process organisation. Consequently, information technologies can make the learning process more engaging and exciting for students. Specialised training, conferences, and competitions will also produce a positive effect, including professional skills competitions (WorldSkills championships in pedagogical competencies, pedagogical competitions), pedagogical practice in educational institutions, and discussions. Discussions in which students learn to convey their ideas and opinions should be given additional emphasis. Researchers argue that because solid communicative skills are one of the key characteristics of a creative person, more discussions, developing an inquisitive outlook, gaining new experiences and knowledge, and sharing skills are required. Teachers should share their knowledge and abilities with students to boost their motivation to study and learn new things. Academic, scientific, and professional-pedagogical tasks in lectures and seminars will play an important role in enhancing creativity. Students can defend their projects and present their ideas for lectures and seminars. Only then can a student pursuing a pedagogical specialisation become a competent teacher capable of freely operating and providing guidance in complex socio-cultural environments, acting responsibly and professionally in science and education, and fully expressing their creative potential.

6. Conclusion

This research was oriented towards exploring the potential opportunities presented by ChatGPT in fostering creative thinking among prospective educators. The research findings we obtained confirm the positive impact of utilizing artificial intelligence (AI) on the creative potential of teachers. The analysis reveals a statistically significant mean value of creative potential in the experimental group (72.8) when compared to the control group (60.2), affirming the positive influence of ChatGPT on the development of participants' creative potential. These results underscore the efficacy of AI in enhancing the creative potential of teachers and indicate the potential advantages of employing this technology (ChatGPT) in educational processes.

Our research substantiates that the implementation of ChatGPT holds the potential to unlock the creative aptitude of future educators (see Ibatova & Ilin, 2017). The findings demonstrate that the incorporation of this technology contributes to the enhancement of creative skills, innovative thinking, and the capacity to generate novel ideas. This holds significant practical and scientific value (see Esteban & Laborda, 2018).

This study might help methodologists in developing recommendations for structuring the process of encouraging creative thinking in future teachers. The practical value of this study lies in the potential application of its results by educational institutions to foster the development of creative skills among instructors and strengthen the innovative potential of educational establishments. The scientific value resides in the expansion of knowledge concerning the impact of ChatGPT on the cultivation of creative potential. It underscores the significance of integrating contemporary information and

communication technologies in the preparation of future educators (see Aguilar & Turmo, 2019).

The potential domains of application for the research findings encompass pedagogical universities and colleges, where they can be utilized to enhance the training of prospective educators and foster the development of their creative abilities. Furthermore, the results may prove beneficial for educational institutions and educational organizations seeking to implement innovative approaches to instruction and teacher development (see Bozhkova et al., 2019). The current ChatGPT utilization programme can be implemented within the framework of sustained practice at these universities. Additionally, it can be integrated into prototype practices for universities in other countries.

Therefore, the findings of this study corroborate with those of similar studies regarding the positive influence of utilizing ChatGPT on the unfolding of creative potential among future educators (see Lo 2023). The practical and scientific value of the results lies in the potential to be applied effectively in educational practice and further research endeavours. The findings underscore the significance of contemporary technologies in fostering creativity among educational participants and providing a foundation for future scientific investigations in this domain.

6.1. Limitations of the research
Potential limitations of this study may be found in the limited representativeness of the sample, as the participants were student-teachers from three universities in Russia and China, which may complicate the generalizability of the results. Additionally, the use of multiple universities may introduce diversity in pedagogical approaches and methodologies, potentially influencing the generalization of the findings. Furthermore, one should consider the potentially novel effect of the technology, which may result in a positive perception of ChatGPT, but may not account for its long-term impact on teachers' creativity. Moreover, the study incorporated a survey based on a single thinking-style questionnaire.

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