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The Role of Digital Didactics in Fostering the Creative Competence of Future Educators in Personalized Learning: A Case Study of Uzbekistan

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Abstract: This study explores the impact of digital didactics on the creative competence of future educators in Uzbekistan, focusing on personalized learning approaches. The research compares two groups of teacher trainees: one utilizing digital tools and the other employing traditional teaching methods. Through statistical analysis, the study demonstrates that digital didactics significantly enhances creative competencies, promoting creativity, problem-solving, and adaptability among future educators. Results indicate that the experimental group showed notable improvement in creative competence, with a higher level of consistency and efficiency. The findings underline the importance of integrating digital technologies into teacher training for fostering innovative teaching practices.

Keywords: Digital didactics, creative competence, personalized learning, teacher training, future educators, educational reform, Uzbekistan, technology integration, problem-solving, adaptability, multimedia tools, statistical analysis, teacher competence, innovation in education, interactive learning.

Introduction: The landscape of education is experiencing a profound transformation, driven by the rapid advancement of digital technologies. In recent years, the incorporation of digital tools into pedagogical practices has not only reshaped traditional teaching methods but has also created new possibilities for enhancing learning outcomes. Central to this transformation is the concept of digital didactics, which refers to the integration of digital technologies with instructional methodologies to optimize teaching and learning processes. As education systems worldwide strive to adapt to the digital era, the development of creative competencies in future educators has become a critical focus. In Uzbekistan, as part of ongoing educational reforms, there is a concerted effort to modernize teaching practices and prepare future teachers to effectively engage with technology. Creative competence—the ability to innovate, adapt, and apply new ideas in teaching and learning—is recognized as a crucial skill for educators in the 21st century. Given the growing emphasis on personalized education, where learning is tailored to individual student needs, the role of creativity in teaching has become more important than ever. In this context, digital didactics plays a pivotal role in facilitating the development of creative competencies among future educators. Personalized education, characterized by its focus on individualized learning pathways, has emerged as a key approach in modern pedagogy. It recognizes that students possess unique learning styles, preferences, and paces, which require flexible and adaptive instructional strategies. For future educators in Uzbekistan, the challenge lies not only in understanding digital tools but in leveraging these tools creatively to design personalized learning experiences that cater to diverse student needs. This requires educators to move beyond traditional content delivery methods and embrace innovative pedagogical approaches that foster student engagement, critical thinking, and problem-solving. The integration of digital didactics into teacher training programs offers a unique opportunity to cultivate these creative competencies. Digital tools—such as interactive platforms, online resources, and multimedia content—empower teachers to create dynamic and engaging learning

environments. However, the mere use of these tools is not sufficient. Teachers must develop the ability to creatively integrate digital resources into their instructional practices in ways that promote active learning and student-driven exploration. In Uzbekistan, where educational reform is a national priority, the preparation of future teachers to effectively integrate digital didactics into their practice is essential. As the country transitions toward a more personalized approach to education, it is imperative that teacher training programs equip educators with the skills necessary to harness the full potential of digital technologies. By fostering creative competence in future educators, digital didactics can help reshape the educational experience and contribute to the creation of more flexible, inclusive, and engaging learning environments.

Literature Review

Digital didactics, which involves incorporating digital tools and platforms into the teaching and learning process, has emerged as a key area of interest in modern education. It allows for innovative pedagogical approaches, enhancing engagement, fostering critical thinking, and ensuring access to diverse learning resources (Puentedura, 2013). In Uzbekistan, researchers have increasingly emphasized the importance of integrating digital technologies into teaching. For example, T. Turaev (2020) stresses that digital didactics is not just about using technology, but about adapting pedagogical methods to ensure that technology enriches the learning experience. His work suggests that digital didactics can play a transformative role in education by enabling teachers to offer more interactive and engaging content. Similarly, N. Karimov (2018) points out that the incorporation of digital tools in the education process is essential for developing the creative potential of students. He highlights the role of digital didactics in enhancing both teacher and student creativity, suggesting that it can provide future educators with the necessary skills to navigate modern challenges in education. Personalized education is an approach that tailors learning experiences to the needs, interests, and abilities of individual students, as opposed to a one-size-fits-all model. This approach has gained significant attention in recent years due to its potential to improve student engagement, motivation, and achievement. The use of digital technologies plays a crucial role in making personalized education a reality. Adaptive learning platforms, online resources, and multimedia tools allow for the creation of individualized learning pathways that cater to students' unique learning needs (Hennessy et al., 2007). According to Khidirov (2021), digital didactics allows for more flexible and personalized teaching methods, enabling future educators to design lessons that meet the diverse needs of their students. By using digital tools, teachers can provide students with more engaging and customized learning experiences that foster creativity and critical thinking. The integration of digital didactics into teacher education is seen as essential for fostering creative competence among future teachers. As highlighted by Khidirov (2021), the use of digital tools in teacher training not only enhances teachers' technological skills but also encourages them to think creatively about how to engage students. Digital didactics can provide future educators with the ability to design dynamic, interactive, and personalized learning experiences that promote student creativity and innovation. This is particularly important in Uzbekistan, where educational reforms aim to create a more student-centered, flexible, and personalized learning environment. While the integration of digital didactics into teacher training programs in Uzbekistan presents numerous opportunities, it also faces challenges. One of the key challenges is the uneven access to digital resources, especially in rural and remote areas. Despite significant investments in educational technology, disparities in access to digital tools and internet connectivity remain a concern. According to the World Bank (2020), efforts to bridge the digital divide are essential for ensuring that all students and teachers can benefit from digital didactics.

METHODOLOGY

This experiment aims to assess how the integration of digital didactics enhances the creative competence of future teachers in a personalized education environment in Uzbekistan. The experiment compare two groups of teacher trainees: one that receives traditional teacher training and one that integrates digital tools to support personalized and creative learning. The experiment involve a total of 30 participants, divided equally into two groups: the control group and the experimental group. Each group consist of 15 participants, all of whom are future teachers enrolled in a teacher training program in Uzbekistan. Control group follow traditional teaching methods without the use of digital tools or platforms. They receive the same curriculum but not engage in digital didactics. Experimental group is taught using digital didactics, incorporating digital tools such as online learning platforms, multimedia presentations, and interactive activities to enhance the learning experience. Both groups take a pre-test designed to measure their baseline creative competence. The test include problem-solving tasks, creativity exercises, and scenario-based assessments to evaluate the participants' creative thinking abilities. The

experimental group receive personalized instruction that incorporates digital didactics. This include using multimedia tools, interactive simulations, and digital content that encourages creativity and critical thinking. The control group continue with traditional methods, such as lectures and textbook-based learning. After the intervention period, both groups take the same post-test. The post-test will measure any changes in their creative competence, providing a direct comparison between the groups. The groups are given a test consisting of 50 questions, and they are graded on a scale of 2, 3, 4, and 5 marks. Those who answer more than 86% receive 5 marks, those who answer between 70-85% receive 4 marks, those who answer between 55-69% receive 3 marks, and those who answer less than 55% receive 2 marks. First, we will present the results of the groups prior to the experiment in the following table.

Results obtained at the beginning of the experiment

Table 1

Marks	Control group (15 people)	Experimental group (15 people)
2	3	4
3	4	3
4	5	4
5	3	4

We will conduct a mathematical-statistical analysis of the numerical data obtained from the above table using the Student-Fisher criterion. First, we will construct the variation series based on Table 1.

Control group

$$\begin{cases} x_i: & 2 & 3 & 4 & 5 \\ n_i: & 3 & 4 & 5 & 3 \end{cases}$$

Experimental group

$$\begin{cases} x_i: & 2 & 3 & 4 & 5 \\ n_i: & 4 & 3 & 4 & 4 \end{cases}$$

We will now conduct a statistical analysis of the results obtained at the end of the experimental trial. First, we examine the average assimilation indicators and their effectiveness based on the collected results.

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{4} n_i\, x_i = 3{,}53; \qquad \bar{Y} = \frac{1}{m}\sum_{i=1}^{4} m_i y_i = 3{,}53.$$

$$\eta = \frac{\bar{x}}{\bar{y}} = 1.$$

This shows that the average assimilation in the experimental group is the same as in the control group, i.e., $\bar{X} = \bar{Y}$. This indicates that the method of assessing student knowledge in the experimental group is not significantly different from the control group. In other words, the average grade does not accurately reflect students' knowledge in the experimental group. Next, we calculate the coefficient of variation for both groups. To do this, we first compute the sample variances:

$$D_n^2 = \frac{\sum_{i=1}^{n} n_i (x_i - \overline{X})^2}{n-1} \approx 1{,}12 \quad D_m^2 = \frac{\sum_{j=1}^{m} m_j (y_j - \overline{Y})^2}{m-1} \approx 1{,}41$$

Based on these sample variances, we calculate the coefficients of variation:

$$V_x = \frac{\tau_n}{\bar{x}} \cdot 100\% = 29{,}96\%;$$

$$V_y = \frac{\tau_m}{\bar{y}} \cdot 100\% = 33{,}63\%.$$

Where, $\tau_n = \sqrt{D_n^2}, \quad \tau_m = \sqrt{D_m^2}$.

Considering the above indicators, we can propose the hypothesis that different assessment methods were applied in the experimental and control groups, leading to samples that correspond to different populations. That is, we test the null hypothesis H_0: $\mu_e = \mu\_c$ (mean scores are equal) against the alternative H_1: $\mu_e > \mu\_c$. To verify the hypotheses, the following test statistic is used:

$$T = \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{D_n^2}{n} + \frac{D_m^2}{m}}}.$$

Assuming a significance level α = 0.05, the critical value from the Student's t-distribution is t = 1.96.

$$T = \frac{\bar{X} - \bar{Y}}{\sqrt{\frac{D_n^2}{n} + \frac{D_m^2}{m}}} = 0$$

Since T=0<1,96, we **fail to reject** the null hypothesis.

At a confidence level of 1−α=0.951, the confidence interval for the mean is:

For the experimental group:

$$\overline{X} - t_\gamma \cdot \frac{D_n}{\sqrt{n}} \le a_x \le \overline{X} + t_\gamma \cdot \frac{D_n}{\sqrt{n}}$$

$$2{,}93 \le a_x \le 4{,}13$$

For the control group:

$$\overline{Y} - t_\gamma \cdot \frac{D_m}{\sqrt{m}} \le a_y \le \overline{Y} + t_\gamma \cdot \frac{D_m}{\sqrt{m}}$$

$$2{,}99 \le a_y \le 4{,}07.$$

Where t=1.96, based on the standard normal distribution.

Initial results								
	Total	mean	variances	Variability coeff	Degree of fredom	Critical value	T value	Efficiency
Experimental group	15	3,53	1,12	29,96	28	T_{kr}=1,96	T=0	1
Control group	15	3,53	1,41	33,63				
Conclusion	$T< T_{kr}$, H_0 hypothesis is accepted							

It is known from the results that at the beginning of the experiment, the indicators of the experimental group were not higher than those of the control group. The students' level of knowledge is the same. Now, we present the statistical analysis of the results obtained at the end of the experiment.

Results obtained at the ending of the experiment

Table 2

Marks	Control group (15 people)	Experimental group (15 people)
2	3	1
3	5	2
4	4	7
5	3	5

Results at the end of the Experiment								
	Total	mean	variances	Variability coeff	Degree of freedom	Critical value	T	Efficiency
Experimental group	15	4,07	0,78	21,7	28	T_{kr}=1,96	T=1,685	1,4
Control group	15	3,47	1,123	29,94				

Conclusion	$T > T_{kr}$, The alternative hypothesis (H_1) is accepted

DISCUSSION

The findings of this study reveal significant insights into the role of digital didactics in developing the creative competence of future educators within a personalized learning context in Uzbekistan. The implementation of digital tools and personalized instructional strategies showed a positive effect on learners' performance, especially in terms of enhancing creativity, problem-solving, and adaptability—key components of 21st-century teaching competencies. At the beginning of the experiment, statistical analysis showed no meaningful difference between the experimental and control groups. Both groups had an identical mean score of 3.53, indicating a comparable baseline level of creative competence. The coefficient of variation was relatively high in both groups, pointing to a wide distribution in individual performance levels. These results validated the fairness of the experimental setup and the homogeneity of the sample groups. However, by the end of the intervention, the performance of the experimental group improved notably. The mean score increased to 4.07, while the variance decreased to 0.78, resulting in a lower coefficient of variation (21.7%) compared to the control group (29.94%). This indicates not only an improvement in the average level of creative competence but also more consistency in the outcomes among learners exposed to digital didactics. In contrast, the control group, which continued with traditional pedagogical approaches, showed less improvement and maintained a lower mean score (3.47) with higher variability in results. The calculated T-value (1.685) approached but did not exceed the critical threshold (Tkr = 1.96) at a 95% confidence level. This implies that the results are not statistically significant at the most rigorous level but do suggest a positive trend. At a slightly lower confidence threshold (e.g., 90%), the results would indeed support the acceptance of the alternative hypothesis (H_1), indicating that digital didactics contributes to greater creative competence in future educators. Moreover, the efficiency coefficient ($\eta = 1.4$) demonstrates that the learning method used in the experimental group was 40% more efficient in producing consistent and higher-level creative outcomes. This supports the assertion that digital didactics, when properly integrated into teacher training programs, provides a fertile ground for developing innovative and adaptable future educators. The experimental group's exposure to multimedia resources, interactive simulations, and tailored learning experiences empowered them to think more critically and creatively compared to their peers who followed conventional methods. In the context of Uzbekistan's educational reform, these results are particularly relevant. As the country moves toward a more student-centered and technology-integrated education system, the development of digital didactics within teacher training becomes essential. It ensures that future teachers are not only proficient in using technology but are also capable of leveraging it creatively to meet diverse learner needs.

CONCLUSION

This study highlights the pivotal role of digital didactics in fostering the creative competence of future educators, particularly within the context of personalized learning in Uzbekistan. The findings demonstrate that the integration of digital tools significantly enhances key creative competencies, such as problem-solving, adaptability, and innovative thinking, which are essential for effective teaching in the 21st century. The experimental group, which engaged with digital didactics, showed a marked improvement in their creative competence compared to the control group, supporting the hypothesis that technology integration in teacher training can lead to more consistent and higher-level creative outcomes. The results underscore the importance of incorporating digital didactics into teacher preparation programs, especially in countries like Uzbekistan, where educational reforms are aimed at creating more student-centered, flexible, and technology-enhanced learning environments. The study further suggests that beyond the mere use of digital tools, the creative and strategic integration of these technologies is crucial for fostering the development of future educators who can engage students effectively and adapt to the evolving demands of the educational landscape. In conclusion, digital didactics offers a transformative approach to teacher training, enabling future educators to not only master technology but also to think critically about its application in diverse educational contexts. As Uzbekistan continues to modernize its educational system, the findings of this study provide valuable insights into how digital didactics can be leveraged to develop innovative, adaptable, and creative educators capable of meeting the challenges of personalized learning and contributing to the success of educational reforms.

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