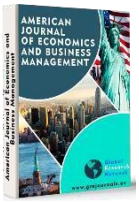

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Article

Training Future Fine Arts Teachers In The Context Of Digitalization

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Abstract: The article discusses the specifics of training future fine arts teachers in the context of digitalization of education. An analysis of methods and tools, including the use of graphic tablets, 3D modeling, and augmented and virtual reality (AR/VR) technologies, is conducted. As part of an experiment conducted at the Gulistan State Pedagogical Institute with the participation of 124 students and 9 master's students, a positive impact of digital technologies on the educational process was revealed, including increased motivation, improved academic performance, and the development of digital competencies. The main problems, such as insufficient technical base and the need to improve the qualifications of teachers, are noted. Recommendations are offered for the integration of digital technologies into curricula, advanced training of teachers, and improvement of infrastructure. Prospects for further development of digitalization, including the integration of artificial intelligence and hybrid learning, are considered.

Keywords: Digitalization Of Education, Fine Arts, Digital Technologies, Graphic Tablets, 3D Modeling, Augmented Reality, Virtual Reality, Educational Process, Pedagogical Education

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1. Introduction

The Digitalization is one of the key trends in modern society, significantly affecting various areas of activity, including education. In particular, in the Republic of Uzbekistan, comprehensive measures are being implemented to actively develop the digital economy, as well as the widespread introduction of modern information and communication technologies in all sectors and areas, primarily in public administration and education [1, p. 1]. The introduction of digital technologies in the educational process has become an important tool for improving the quality of education, increasing its accessibility and adaptation to the needs of the modern economy. In the context of training teaching staff, digitalization plays a decisive role, as it requires future teachers to develop new competencies and working methods. Digitalization in the pedagogy of creative and artistic disciplines has a number of features that distinguish it from other areas. Unlike traditional subjects, where digital technologies are mainly used to automate processes and increase the accessibility of knowledge, fine arts require direct interaction with creative tools. A teacher of fine arts working in the context of digitalization faces a number of new

challenges, such as mastering digital methods of creating works, introducing multimedia approaches and using interactive technologies to visualize artistic ideas [4, p. 120].

Digitalization is especially significant in the field of fine arts, where traditional teaching methods are transformed under the influence of technology. The use of graphic tablets, digital drawing programs, 3D modeling, augmented and virtual reality expands the possibilities of creative expression, making the learning process more exciting and interactive. In this regard, the training of future teachers of fine arts requires a revision of traditional approaches to ensure the integration of modern digital tools into the educational process [6, 7].

According to UNESCO, digitalization is one of the priority tasks of educational systems in the 21st century. State programs and initiatives, such as the Digital School in Uzbekistan or the Future Classroom Lab in the European Union, are aimed at creating an educational environment that meets the challenges of the digital age. However, the successful implementation of these initiatives depends on the level of training of teachers and their ability to effectively use digital technologies in the educational process [4, p. 121].

Digitalization in pedagogy has a number of specific features for creative disciplines, such as fine arts. Unlike general subjects, art education requires not only the transfer of knowledge, but also the development of creative abilities, as well as the mastery of specialized tools. Digital technologies open up new horizons for creative activities, such as:

- *Digital art*: using drawing programs (Procreate, Adobe Photoshop) and 3D modeling (Blender, ZBrush).
- *Augmented reality (AR):* visualization of complex artistic concepts and creation of interactive lessons.
- *Virtual museums:* studying world cultural heritage through the Google Arts & Culture and Artsteps platforms.

However, the integration of technology into the educational process requires solving a number of problems, including updating curricula, improving the qualifications of teachers and providing access to the necessary resources [8, pp. 870-879].

A future modern teacher of fine arts should not only master traditional teaching methods, but also be ready to integrate technology into their professional practice. This requires:

1. Development of digital competencies: the ability to work with graphic tablets, digital drawing programs and other tools.
2. Flexibility and adaptability: the ability to use new technologies to solve educational problems.
3. A creative approach: the use of digital tools to reveal the creative potential of students.

In the era of digitalization, the training of fine arts teachers is of strategic importance, since they must become the conductors of innovation in educational practice, helping students master new ways of self-expression and interaction with the world.

Objective of the study

The objective of the study is to analyze the digitalization methods and tools used in the training of future art teachers. Particular attention is paid to the study of digital technologies, such as graphic tablets, drawing software, 3D modeling, as well as AR / VR, and their impact on the educational process.

To achieve this goal, the following tasks have been defined:

2. **To study modern digital tools in art:** to consider the capabilities of graphic tablets, drawing and 3D modeling programs in the educational process; to explore the potential of augmented and virtual reality in teaching fine arts.
3. **To assess their impact on the learning process:** to analyze how digital technologies change teaching methods and interaction with students; to compare the results of students who studied using digital technologies with those who studied art using traditional methods.
4. **To offer recommendations for the effective integration of technologies into the educational process:** to develop methodological approaches to the inclusion of digital technologies in

teacher training programs; to formulate recommendations for the creation of a digital infrastructure for educational institutions.

Thus, the study is aimed at solving practical problems related to the digitalization of training future fine arts teachers and developing strategies for their successful professional adaptation in the digital age.

2. Materials and Methods

Theoretical analysis

To study the features of digitalization in the training of future teachers, a theoretical analysis of domestic and foreign scientific publications devoted to the integration of digital technologies into the educational process was conducted. A review of scientific literature on the topic of digitalization of education was conducted [2, 3, 5].

Key aspects were considered, such as: the role of digital tools in teaching creative disciplines; the formation of digital competencies in future teachers; the experience of implementing augmented and virtual reality technologies (AR / VR), graphic tablets and 3D modeling in pedagogical practice [9, pp. 152-153].

The review showed that digitalization is a global trend that stimulates the development of new approaches to teaching. However, there is a lack of research on its impact on the training of fine art teachers, which emphasizes the relevance of this study [10].

The existing methods of training future teachers using digital technologies and methods focused on the integration of modern technologies were studied, including: courses in digital drawing based on the use of Adobe Photoshop, Procreate and other programs; methods for introducing graphic tablets into practical classes in fine arts; integration of AR/VR into teaching anatomy, perspective and composition. A comparative analysis of these approaches helped to determine the most effective methods for implementation in the educational process.

Pedagogical experiment.

The pedagogical experiment was conducted at the **Gulistan State Pedagogical Institute in the educational** direction of «**Fine Arts and Engineering Graphics».** The study involved 1st, 2nd and 3rd year undergraduate and graduate students. A total of 124 students and 9 graduates were involved in the experiment. The experiment included the introduction of digital technologies, such as graphic tablets, 3D modeling, augmented and virtual reality, into the educational process. The purpose of the experiment was to study the impact of these technologies on the development of creative competencies, motivation and academic performance of students. The results were evaluated based on mathematical and statistical analysis methods [11].

As part of the experiment, the following **digital tools** were introduced in the educational institution:

- Graphic tablets: used to teach students the basics of digital drawing.
- 3D modeling: used to create digital sculptures and models of architectural objects.
- AR/VR technologies: used to visualize artistic concepts and create virtual exhibitions.

Training modules were developed and conducted, including:

1. Theoretical part: familiarization with the basics of working in digital programs and devices.
2. Practical part: completing tasks related to the creation of digital content (drawings, models, animations).
3. Reflection: discussion of work results, analysis of errors and achievements.

The pilot classes were conducted in a mixed format: some of the material was studied remotely through training platforms, and some - in person using equipment [12].

To assess the effectiveness of digital technologies, the following were used:

1. Questionnaires for students: questions related to the perception of technologies, their ease of use, impact on the creative process and motivation level.
2. Interviews with teachers: changes in teaching methods, difficulties in implementing technologies and their impact on the educational process were discussed.

Based on the collected data, key aspects of perception were identified: advantages, such as increased interest in classes and availability of new opportunities; problems, including lack of time to master the tools and technical difficulties [7, p. 113].

Qualitative and quantitative analysis

The achievements of two groups of students were analyzed:

- **The first group** was taught using traditional methods (hand drawing, classical materials).
- **The second group** used digital tools (graphic tablets, 3D modeling programs).

The results of the analysis included:

- Comparison of grades for completing assignments.
- Level of involvement and satisfaction with training.
- Ability to apply the acquired knowledge in practice.

At the end of the pedagogical experiment, the obtained data were processed using descriptive statistics and comparative analysis. This allowed us to identify patterns and determine the effectiveness of the integration of digital technologies [3, p. 26]. Thus, the use of an integrated approach, including theoretical analysis, a pedagogical experiment, a questionnaire, and a comparative analysis, allowed us to study the impact of digitalization on the training of future fine arts teachers. The use of digital tools has shown their importance for improving the quality of education, despite the difficulties identified [13].

3. Results

The Achievements of students of Gulistan State Pedagogical Institute.

1) Development of digital competencies

The introduction of digital technologies in the training process of students of the Fine Arts and Engineering Graphics Department contributed to the significant development of their digital skills. As part of the experiment, students mastered:

- Using graphic tablets (Wacom, XP-Pen) to create digital sketches and illustrations.
- 3D modeling programs (Blender, SketchUp), which allowed them to develop architectural objects and sculptures.
- Augmented reality (AR) technologies used to visualize complex artistic concepts such as perspective and anatomy.

Over 80% of experiment participants noted that mastering digital tools expanded their understanding of the possibilities of fine arts and increased confidence in their professional skills [14].

2) Increasing interest in the subject and motivation

The use of digital technologies made the learning process more exciting and motivating. The greatest interest was generated by classes related to the use of graphic tablets for creating illustrations and VR/AR technologies for studying world artistic heritage.

According to the survey results:

- 88% of students noted that classes using digital technologies contributed to an increase in their interest in studying the discipline.
- 74% of students admitted that digital tools stimulate their creativity and desire to master new areas.

3) Successful use of technology in project work.

Digital technologies have become an integral part of students' project work. As part of the experiment, students developed:

- **Digital paintings and illustrations:** Completing course projects using Procreate and Adobe Photoshop.
- **3D models:** Creating digital models of architectural structures and sculptures using Blender.
- **Virtual galleries:** Organizing online exhibitions on the Artsteps platform, where students' work was presented.

These projects received positive feedback from teachers and also attracted interest from participants in competitions and exhibitions [15].

Efficiency of digital tools.

Improving the quality of teaching with AR/VR, graphic tablets and 3D modeling.

The integration of digital tools has significantly improved the quality of learning, making it more interactive and productive.

- **AR/VR technologies:** allowed students to work with virtual objects, studying complex aspects of art, such as spatial construction and composition.
- **Graphic tablets:** simplified the transition from traditional drawing to digital art, which is especially important for training modern artists and designers.
- **3D modeling:** formed spatial thinking and design skills in students, which are in demand in modern professions (Figure 1).

AR/VR technologies

3D modeling

Using graphic tablets

Figure 1.

Results of the pedagogical experiment

As already mentioned, 124 undergraduate students and 9 graduate students of Gulshu State Pedagogical University took part in the experiment. The study was aimed at assessing the impact of digital technologies on the creative potential and academic performance of students [16].

Key results

During the experiment, academic performance increased, the level of success in completing practical assignments in the experimental group increased by **27%** compared to the control group. Students using graphic tablets and 3D programs showed higher results in completing project assignments. In the pedagogical experiment, more than **90%** of students in the experimental group actively participated in discussions and project work. The use of AR/VR generated significant interest among students, increasing attendance at practical classes [17].

Creativity increased

analysis of completed work showed that students working with digital technologies offered more creative and innovative solutions. The effectiveness of the experiment was confirmed by statistical methods, including analysis of average academic performance and student engagement.

There were problems with limitations, insufficient technical base [18].

The main problem was the lack of modern equipment necessary for the full implementation of digital technologies. In some classrooms there were no graphic tablets, VR headsets and powerful computers for working with 3D programs. Limited access to stable Internet in some classrooms and fine art studios made it difficult to use online resources. During the pedagogical experiment, the need for advanced training of teachers was revealed. Not all fine art teachers have the necessary knowledge to work with digital tools. Some of them experienced difficulties in implementing digital technologies, which reduced the effectiveness of the educational process. To solve these problems, we proposed organizing regular advanced training courses for teachers. Involving experts from the IT industry to conduct master classes [19].

We conducted a survey and interviews with students on this issue, which revealed some barriers in the perception of digital technologies. Some students and teachers expressed skepticism about the use of digital tools. The main reasons:

- Fear of the complexity of technology.
- The belief that traditional teaching methods are more effective.

To solve this problem, we proposed:

- Introduction of introductory courses dedicated to mastering basic skills in working with digital technologies.
- Phased introduction of new tools so that students and teachers can gradually adapt.

An experiment conducted at the Gulistan State Pedagogical Institute confirmed the importance of digitalization in teaching fine arts. Despite the existing problems, the use of graphic tablets, AR / VR technologies and 3D modeling programs contributes to a significant increase in the creative potential and professional competencies of students. Solving infrastructural and methodological problems will ensure a more effective integration of technology into the educational process [20].

4. Discussions

A pedagogical experiment was conducted at the Gulistan State Pedagogical Institute among students of various courses and master's degree students in the field of "Fine Arts and Engineering Graphics: **1st year:** 20 students; **2nd year:** 26 students; **3rd year:** 70 students; **Master's degree students:** 9 people. A total of 125 students and master's degree students took part in the study. Dividing the participants into groups made it possible to assess the impact of digital technologies on different stages of professional training.

Experimental assessment of the level of basic knowledge and skills before the introduction of digital technologies, the average result of completing tasks among the participants was **62-75 points**. After using the technologies (graphic tablets, 3D modeling, AR/VR), the average result increased to **75-88 points**, which confirms their effectiveness (Table 1).

Average improvement in each group:

- 1st year: +10 points
- 2nd year: +12 points
- 3rd year: +14 points.
- Master's students: +11 points.

Table 1.

Groups	Number of students	Average score before the experiment	Average score before the experiment
1st year	20	62	75
2nd year	26	65	78
3rd year	70	68	82
Master's students	9	75	88

The greatest increase was noted among 3-year students, who had more practical experience and were able to use technology in project work as effectively as possible (diagram 1).

Digitalization had a positive impact on the educational process, improving:

1) **Quality of educational content:** Students gained access to virtual museums, interactive lessons and 3D models, which increased the visibility of the material being studied.
2) **Practical focus:** The use of graphic tablets and 3D programs allowed students to work with real projects.
3) **Motivation:** The interactive format of classes encouraged students to actively participate in the educational process.

Digitalization provides unlimited access to educational resources, increases the interactivity of learning and develops key 21st century skills in students, such as working with modern technologies. It makes the learning process more adaptive and engaging, increasing student motivation and engagement. Digital tools also allow teachers to automate routine tasks and focus on individual work with students.

Benefits of digitalization:

1) Interactivity: AR/VR and 3D modeling technologies have made the learning process more engaging
2) Availability of resources: Online courses and digital platforms have provided students with access to international experience.
3) Development of professional skills: Mastering digital drawing and modeling programs has opened up new opportunities for students.

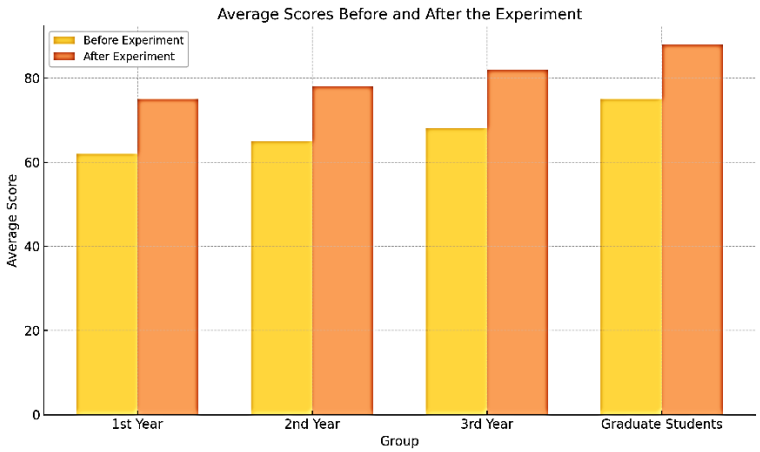

Diagram 1.

There were challenges in this area for some respondents:

- Insufficient technical base: the lack of equipment (graphic tablets, VR headsets) limited the possibilities of implementing technologies.
- The need for teacher training: not all teachers were ready to use new tools.
- Resistance to change: Some teachers and students expressed skepticism about the effectiveness of technologies.

We recommended the following in this area:

Including courses on digital technologies in the curriculum; developing special modules dedicated to digital tools such as Procreate, Blender and VR/AR technologies; including the basics of digital design and 3D modeling in the mandatory part of the curriculum; organizing project assignments focused on creating digital content; improving the qualifications of teachers; regularly holding advanced training courses focusing on working with graphic tablets, 3D modeling programs and AR/VR tools; organizing master classes with the participation of experts in the field of digital art; creating teaching aids that will help teachers adapt technologies to their disciplines.

Improving the technical base of universities. Updating the infrastructure of educational institutions is an important condition for successful digitalization. It is necessary to:

- Equip classrooms with modern equipment (graphic tablets, VR headsets, powerful computers).
- Provide access to high-speed Internet.
- Develop long-term financing programs to maintain the technical base.

Digitalization of education opens up new horizons for the training of fine arts teachers. Key prospects include:

Integration of artificial intelligence (AI). Using AI to analyze student progress and personalize educational materials. Using intelligent systems for automatic assessment of work. Development of virtual and augmented reality.

Creation of virtual laboratories for studying anatomy and architectural design. Virtual exhibitions where students can demonstrate their work to a wide audience. A combination of face-to-face and online classes, which will increase the availability of education for students from remote regions. Development of international educational platforms for the exchange of experience.

Increasing the competitiveness of students. Mastering digital technologies will help graduates successfully compete in the labor market. Developing skills that are in demand in the industry: digital design, animation, 3D sculpture. The results of the experiment showed that digitalization of education helps improve the quality of training of future fine arts teachers. Despite existing challenges, such as the lack of technical facilities and the need to train teachers, the benefits of digitalization are obvious. To achieve maximum effect, it is necessary to continue developing the infrastructure, implement innovative methods and provide access to modern educational technologies.

5. Conclusion

The conducted study, based on an experiment involving students and postgraduates of the Gulistan State Pedagogical Institute, confirmed the importance of digitalization in the training of future fine arts teachers. Key findings include:

The introduction of graphic tablets, 3D modeling programs, and augmented and virtual reality (AR/VR) technologies improved the quality of teaching and contributed to the development of key digital competencies in students.

Increased student motivation and engagement. Interactive teaching methods increased students' interest in the subject, improving their academic performance and participation in educational projects. The use of digital technologies in project work allowed students to offer more creative and innovative solutions, which is especially important for their future professional activities.

Despite the successes, the experiment revealed problems such as a lack of technical facilities, the need to improve the qualifications of teachers, and barriers to the perception of digital technologies.

6. Recommendations

Inclusion of courses on digital art, 3D modeling and the use of AR/VR. Organization of project assignments aimed at developing digital content. Conducting regular advanced training courses for teachers, including training in modern technologies. Creating teaching aids for the effective implementation of digital tools in the educational process. Developing infrastructure, i.e. providing educational institutions with graphic tablets, VR headsets and powerful computers. Organization of digital art centers in universities. Digitalization in the training of fine art teachers opens up prospects for the integration of innovative technologies, such as artificial intelligence, virtual exhibitions and hybrid learning. These steps will help create a higher-quality educational environment that meets the requirements of the modern world and prepare teachers who can work effectively in the digital age.

The study confirms the need to continue working in this direction so that digitalization becomes an integral part of the training of future teachers, ensuring their competitiveness in the labor market and high qualifications.

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