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The impact of art technologies on teachers' professional preparation in fine arts: an exploratory study in the context of Kazakhstan

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Abstract

The professional preparation of teacher candidates to teach the fine arts in primary schools requires fundamental changes. The effective use of innovative teaching technologies, including art technologies, remains insufficiently studied. The study aims to investigate the impact of art technology on the effectiveness of teacher candidates' professional preparation for teaching fine arts in elementary schools. The study used qualitative and quantitative methods. The study included 120 respondents. Despite relatively good theoretical knowledge in the field of fine arts, the majority of students were identified as having a low level of practical skills in fine arts. In this regard, training a fine arts teacher required changes in the content, procedural, and personal aspects of pedagogical assistance based on art technology. The study's findings revealed that the integration of art technological advances in the process of training teacher candidates improved their artistic and professional training, which was required for the success of teaching fine arts in primary schools. The study's findings on the distinct effects of art technologies on the effectiveness of professional training for candidate teachers can be incorporated into artistic and aesthetic cycle subjects in pedagogical educational institutions.

Keywords: Art technologies, Exploratory, Fine arts, Impact, Teachers' professional training.

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Contents

Contribution of this paper to the literature
This study adds to the existing literature by examining the impact of art technology on the effectiveness of teacher candidates' professional preparation for teaching fine arts in elementary schools.

1. Introduction

The professional preparation of pedagogical university students for art education and aesthetic education of schoolchildren is a priority area of the country's personnel policy. Many researchers have addressed the problem of the artistic training of future fine arts teachers (Krasovska, Miskova, & Veremchuk, 2020). Numerous empirical studies have been conducted to address the issue of professional preparation for teacher candidates who teach visual arts in elementary schools. Hipp and Sulentic Dowell (2019) define the integration and integrative approach as a unification based on interdependence, complementarity, and optimization of the structural elements of teaching students the visual arts. Several levels of integration of educational content, as well as the conditions for organizing an integrative lesson, have been identified as critical to success. They believe that visual materials and other teaching aids can contribute to a creative environment in fine arts classes. Shockley and Krakaur (2021) examined the potential for improving student teaching methodology and practice based on art's artistic and aesthetic value. Researchers created a program for students' creative development that is based on an integrative approach and art-pedagogical principles. Kim (2019) and Bae (2020) investigated and described the modern system of continuous art education, emphasizing the importance of constant improvement and renewal, the search for long-term mechanisms, and the criteria for determining effectiveness when introducing innovations. According to the researchers Shih (2020) and Feng (2024), objective, reliable, theoretically based measurements and assessments of learning outcomes can provide teachers with information about the progress of the pedagogical process and each student's educational achievements. Studies have shown that modern teaching technologies contribute to a modern fine arts teacher's professional development. (Sa'Diyev & Sultonov, 2023). Fink, Reim, Benedek, and Grabner (2020) believe that an artistically trained primary school teacher has a significant impact on a student's aesthetic and artistic upbringing. A fine arts teacher must have an effective tool to directly awaken students' creativity. To do so, the teacher must not only be able to recognize and comprehend beauty in everyday life and works of art but also have an emotional and aesthetic attitude toward cognizable objects and phenomena. Of course, a pedagogical educational institution does not undertake the task of training artists. At the same time, it is critical to shape the future teacher's personality, ability, and readiness for independent pedagogical development. This study revealed the following main contradictions: (i) insufficient use of the potential of art technologies in university practice; (ii) insufficient readiness of university teachers to teach students through the use of art technologies. The problem becomes more acute when we consider the almost complete lack of research aimed at studying the patterns of harmony in art education and aesthetic education among school children, as well as proper methodological training for teacher candidates. Therefore, an integrated approach to mastering the fine arts for primary school teacher candidates requires a completely different approach to the organization of the university educational process, as well as new types, forms, and teaching technologies.

1.1. Problem Statement

Along with the undeniable achievements of Kazakhstan's educational system in the field of fine arts, it is important to note that there are ongoing issues that require resolution. The quality of teaching decreases as the number of educational programs in the fine arts increases. Universities have inadequate materials and artistic equipment. Often, basic conditions are not met for students to successfully master their artistic and methodological skills. One such technology is art technology, which is used to enhance the creative potential of teacher candidates in pedagogical areas. The issue of effective use of innovative teaching technologies, including art technologies, is also not widely addressed, and the arguments presented support the topic's relevance to this research. There is a lack of research in Kazakhstan on the importance of visual activity in the artistic training of teacher candidates as a factor in professional development, including preparation for teaching fine arts in primary schools (Nagima et al., 2023; Zhakupova, Mankesh, Kyakbaeva, Karimova, & Omarova, 2022). Researchers believe that incorporating art technologies into a pedagogical university's educational process helps to (1) reveal future teachers' creative abilities and personal potential; (2) develop future teachers' reflective abilities; and (3) develop competence in solving pedagogical problems that may arise in professional activities (Fan & Zhong, 2022; Lucas & Vicente, 2023; Rapanta, Botturi, Goodyear, Guàrdia, & Koole, 2021). However, determining the impact of artistic technologies on the artistic training of potential teachers is difficult due to the lack of research in Kazakhstan at this time. Therefore, a focused study of the issues surrounding the professional training of teacher candidates to teach fine arts in primary schools, particularly the use of art technology, is needed. Using university student professional training as an example, examine the pedagogical capabilities of art technology in shaping a future teacher's readiness for professional activity to better manage teacher-candidate training programs.

1.2. Research Questions

Question 1: What are the students' creative abilities and personal potential?
Question 2: What are the artistic and aesthetic necessities of the students?
Question 3: What is the level of development of reflexivity?
Question 4: Is there a certain level of readiness among students to teach the fine arts in elementary schools?

1.3. Objectives

The study aims to investigate the impact of art technology on the effectiveness of teacher candidates' professional preparation for teaching fine arts in elementary schools.

The hypothesis is that incorporating art technologies into the educational process to prepare teacher candidates will improve their professional preparation, which is necessary for the success of teaching fine arts in elementary schools.

1.4. Significance of the Study

This study is significant because it addresses the current problem of the professional preparation of teacher candidates for teaching fine arts in elementary schools (Kangalgil, Özgül, Kocaekşi, & Dönmez, 2022; Reisman et al., 2019). In most schools, the subject of "fine arts" is taught by primary school teachers, whose artistic training falls short of modern Kazakh elementary school standards. The lack of artistic and professional training undermines the concept and essence of professional training for students: future primary school teachers in universities. Another fact that confirms the study's relevance is that practicing teachers use outdated forms and methods of teaching the fine arts. The present research was conducted to add to the body of knowledge by filling this gap. The insufficient development of problems associated with the professional training of learners requires the adjustment of educational programs using the potential of art technology. The study's findings on the distinct effects of art technologies on the effectiveness of professional training for candidate teachers can be incorporated into artistic and aesthetic cycle subjects in pedagogical educational institutions.

2. Review of the Literature

Researchers are actively exploring the issues of developing positive attitudes towards the profession of art teachers in primary schools (Dilmaç & Dilmaç, 2020; Özalp & Gökay, 2018; Yige, 2019). Jin and Ye (2022) are convinced that art has the potential to transform students' lives. Mollaoğlu's (2023) study on art education in modern education highlighted the importance of promoting aesthetics among students. The researcher believes that art education issues should be considered in light of their impact on students' lifestyles (Du et al., 2020; Egana-delSol, 2023). Royston and Reiter-Palmon (2019) discuss the fundamental concepts that underpin the process of developing students' pedagogical readiness, such as professional, artistic, and pedagogical orientation. Analyzing the content of basic concepts, we relied on studies that examine the concept of readiness for activity (Predyk, Shevchuk, Falynska, Loik, & Dziuba, 2020). Gong, Zhang, and Tsang (2020) defined an artistic and pedagogical orientation as a student's consistently positive attitude toward the teaching profession, knowledge of the characteristics of the work of a fine arts teacher, a positive perception of everything related to the fine arts, and a preference for this kind of activity.

A review reveals that some professional competence content and methods of formation in a future fine arts teacher, as well as the methodological preparation of students to master the specific features of managing schoolchildren's artistic and creative development, have remained outside the scope of the studies. Vodianyi et al. (2023) argue that the professional preparation of a fine arts teacher has not been thoroughly examined in terms of its constituents. Huang and Zheng (2023) support the claim that the full range of professional knowledge, skills, and abilities has not been thoroughly investigated. According to Crispel and Kasperski (2021), special education for students is frequently treated separately from psychological and pedagogical training. Yang (2022) contends that teacher preparation, which combines pedagogical and fine arts training, is one of the most important conditions for furthering artistic training and professional development. In posing and discussing the issue of the essence and ways of implementing artistic, pedagogical, theoretical, and practical teacher training, the following areas are highlighted: representatives of one of them prioritized artistic training for future teachers (Ghamrawi, Shal, & Ghamrawi, 2024; Idroes et al., 2023; Kadyjrova, Mukhametzyanova, & Kadyirov, 2020), supporters of the other undervalued its importance. However, both sides considered visual activity to be the most important aspect and the essence of artistic training. Researchers believe that the meaning of art technologies should not be limited to teaching drawing skills but should also include the formation of the foundations of artistic culture and the individual's social adaptation through the medium of art (Fava, 2020; Simmons, 2019). Art technologies include means and methods that promote better and more effective learning and foster a positive, motivated learning and education process, as well as providing conditions for personal development. These issues can be addressed by raising awareness and activating vital resources, developing and activating creative potential, training in self-regulation skills, communication skills training, and expanding the perception sphere.

3. Methods

3.1. Research Methods

The study employed both qualitative and quantitative methods. The goal of combining methods is to capitalize on each method's strengths while minimizing its weaknesses. Traditionally, combining qualitative and quantitative techniques in a single project helps to obtain targeted sampling. First, it establishes the criteria for identifying cases in a research investigation. Second, a systematic comparison is carried out in cases that differ from the original data. Third, quantitative data are used to identify interesting and relevant resources. Finally, both theoretical and practical developments identify data points that can help advance the theory.

3.2. Collection of Research Samples

According to the purpose of the experiment, two groups were formed using random sampling: the CG (control group) and the EG (experimental group). The experiment involved 120 respondents studying in the direction "6B01303: Primary education using information and communication technologies." There were two groups: experimental (n = 60) and control (n = 60). The study included second-year students aged 18–24 years (18.37±23.93). Only girls study in this field, so boys do not participate (see Table 1).

Table 1. Descriptive data of the respondents.

Name of university	Total			Samples size			Description	
	M	F	T	M	F	T	Course	Group
Kazakh National Pedagogical university named after Abai	-	120	120	-	60	60	2	Experimental group
				-	60	60	2	Control group

3.3. Experimental Research Design

From 2022 to 2023, the study was conducted at Kazakh National Pedagogical University named after Abai in Almaty, Kazakhstan. The university administration granted permission to conduct the study. The students were then sent an informed consent form. The study only included students who volunteered to participate.

Due to the fact that each method is created in a specific country and is intended to study sociocultural and psychological phenomena specific to a given ethnic group, the question arises about the validity of the methods and the comparability of the results obtained. Therefore, our objective was to use valid and reliable diagnostic tools.

The features of a specific diagnostic situation were then considered, which undoubtedly influenced the technique's success, the subjects' motivation, their mental state, and, through these personal characteristics, the diagnostic results. In this regard, the conditions for group and individual tests were structured based on the type of training session, so the subjects did not have to adjust to the testing procedure. Because diagnostic techniques were used for scientific purposes, confidentiality of the results was ensured by anonymity.

The experimental group was trained according to the model developed using art technologies, but without changing the main curriculum or increasing the load on the students. The training of experimental group (EG) participants is carried out within the framework of several disciplines, namely 'artistic work' and 'fine arts with teaching methods', in which students take classes in the third semester, following the curriculum. These disciplines require an approach that combines high-quality theoretical training with practice, that is, the application of knowledge to solving artistic and professional problems in the field of art. This helps to solve problems and expand knowledge of the fundamentals of fine art, including through a variety of types of artistic and creative activities: painting, graphics, sculpture, design, architecture, folk, and decorative arts. The control group followed the traditional model curriculum.

3.4. The Procedure of Instruction

The lack of scientifically based technology to train primary school teachers in this field of education and the needs of pedagogical reality required the development and experimental testing of an optimal model for the professional training of fine arts teachers. As shown in Figure 1, the model is a process that includes three stages: information development, visual development, and professional orientation.

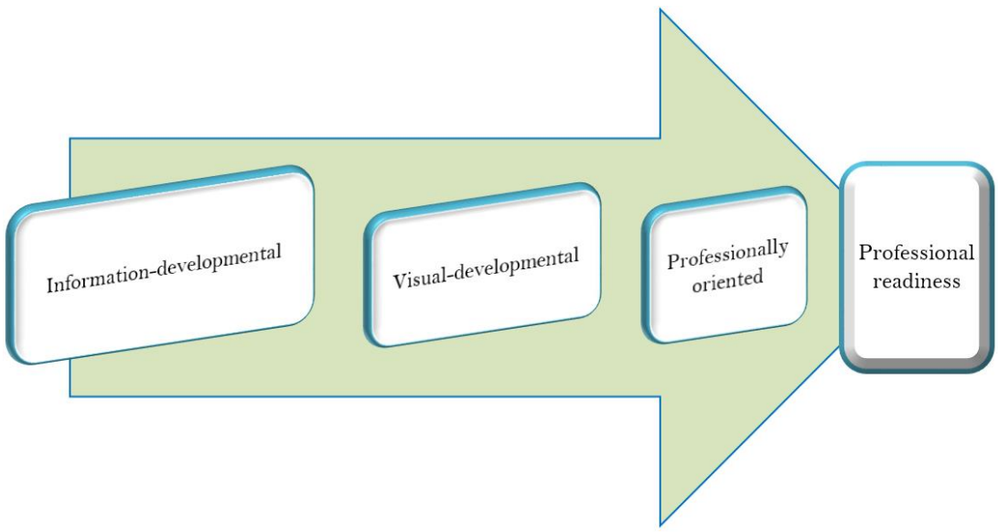

Figure 1. Model of professional training for fine arts teachers.

The information and development phase is characterized by the accumulation of theoretical knowledge in the fine arts through the artistic and professional training of the students. The visual-developmental phase aims to study the basics of visual and compositional literacy and methods to teach students the visual arts. At this stage, participants in the EG are invited to master a modular system of creative tasks aimed at developing practical skills in the field of visual arts. The professionally oriented phase completes the artistic and professional training of students and includes the study of methods of teaching the fine arts in primary school. Their integrity is a necessary condition for the professional and pedagogical orientation of student learning.

3.5. Data Collection

Step 1: Ascertaining stage (AS). This stage of the experiment, which was partially diagnostic, was associated with the preliminary determination of the most important components and stages of the continuous methodological training of the candidate fine arts teachers. All respondents were found to have a basic general education and had not completed art school while attending a comprehensive school. Although they had relatively good theoretical knowledge in the field of fine arts, the respondents lacked practical skills. In this regard, active work has been launched to find optimal training options with the correction of training content for participants in EG.

Step 2: Formative stage (FS). This stage's task was to introduce the model into the educational process through (i) multimodal content of art classes based on the integration of different types of art technologies; (ii) familiarization of EG participants with the areas of application of art technologies in the pedagogical workshop; and (iii) training in the scientific and technological fundamentals of using art technologies.

3.6. Data Collection Tools

The study used the following collections to gather data: (1) a test to assess students' levels of creative abilities and personal potential; (2) a test for the diagnosis and measurement of artistic and aesthetic needs; (3) a test for

diagnosing the level of development of reflexivity; (4) a survey to determine the readiness of teacher candidates to teach visual arts in elementary schools.

3.7. A Test to Assess Students' Level of Creative Abilities and Personal Potential

Purpose: Assess students' creative abilities and personal potential.

The test consists of 11 statements that constitute the main qualities of creativity. The test taker must select one of the extended answer options proposed (see Table 2).

Table 2. The content of statements.

No.	Question
1	Do you believe the world around us could be improved?
2	Do you believe you can influence significant changes in the world around you?
3	Do you think that in the future, when you hold a high position, you will be able to fundamentally change everything?
4	When you start a new business, are you confident in your ability to succeed?
5	Do you want to do something completely different in business?
6	If you like the business you do, will you try to learn everything you can about it?
7	If you fail, then:
8	Can you remember what was discussed immediately after the end of the conversation?
9	When you are alone:
10	When an idea grabs your attention, you try to think about it
11	When you defend an idea, then:

The points are classified as follows:

23 points or less: creative abilities and personal potential are limited.

24 to 48 points for the average level of creative ability and personal potential of the students.

49 points or higher: Creative abilities and personal potential are inherent, allowing the student to pursue a wide range of creative opportunities.

3.7.1. Diagnostic Test for Measuring Artistic and Aesthetic Needs of the Students

The test assesses the artistic and aesthetic needs of students. Artistic and aesthetic needs are defined as the internal factors that influence a student's artistic and aesthetic creativity.

The test consists of a series of statements. If this statement coincides with the personal opinion of the participant, then they answer "yes"; if it does not, they answer "no" (see Table 3).

Table 3. The content of a series of statements.

No.	Statements
1.	I believe that it is entirely possible to do without communicating with works of art.
2.	I don't like poetry
3.	I collect classical music records
4.	I consider participation in amateur art groups a waste of time
5.	I won't go to the theater without pleasant company, even if the performance attracts me.
6.	I prefer pop music to classical music.
7.	I think people are pretending when they say they like symphonic music
8.	The saying "Architecture is frozen music" seems far-fetched to me
9.	Silent movies are boring to watch
10.	I think that a good engineer is much more useful to society than a good composer.
11.	If I were a journalist, I would rather write about incidents than art
12.	Choosing between artistic and rhythmic gymnastics, I would prefer the first
13.	Science teaches a person more than art
14.	I love film adaptations of literary works more than the works themselves
15.	Listening to classical music relieves my bad mood
16.	I think opera is becoming obsolete
17.	I think that pop music is becoming the most popular art form
18.	I collect art albums and reproductions
19.	When I'm in a group, I usually do not engage in conversations about art.
20.	A scientist's love for art contributes to his scientific activity
21.	I like old romances
22.	I like people who are reasonable rather than emotional.
23.	Today, ballroom dancing is just ridiculous
24.	I like watching and listening to radio and television programs about composers, actors, directors, and artists.
25.	In my free time, I am constantly engaged in painting, sculpting, playing musical instruments, writing poetry, artistic embroidery, etc.
26.	I would take up art if I had more free time
27.	I go to theaters all the time
28.	I participate in amateur art groups
29.	I don't like classical ballet
30.	I read art books
31.	It seems to me that there is no need to watch in the theater a performance that has already been broadcast on TV.
32.	I would like to work in professional art

Processing of results and conclusions.

The artistic and aesthetic need is indicated by agreement (answers 'yes') with statements 3, 15, 18, 20, 21, 24, 28, 30, 32, and disagreement (answers 'no') with statements 1, 2, 4, 14, 16, 17, 19, 22, 23, 29, 31.

Each answer that matches the key is worth 1 point.

1 – 10 points: low level of artistic and aesthetic needs;

11 – 21 points - average score;

22–32 points, high level.

3.7.2. A Test for the Diagnosis of Reflexivity

The test defines the general interpretation of reflexivity, as well as several other important aspects of this property.

1. When I am thinking about something or talking with another person, I find it interesting to suddenly remember what started the chain of thoughts.

2. The main thing for me is to present the ultimate goal of my activity, and the details are of secondary importance.

3. It happens that I cannot understand why someone is unhappy with me.

4. I often put myself in the shoes of another person.

5. It is important for me to imagine in detail the progress of the upcoming work.

6. It would be difficult for me to write a serious letter if I had not made a plan in advance.

7. I prefer to act rather than reflect on the reasons for my failures.

8. I can easily make decisions about expensive purchases.

9. As a rule, having conceived something, I go over my plans in my head, clarifying the details and considering all the options.

10. I worry about my future.

11. I think that in many situations, you need to act quickly.

12. Sometimes I make rash decisions.

13. If a conflict occurs, then, when thinking about who is to blame for it, I first start with myself.

14. Before making a decision, I always try to think and weigh everything carefully.

15. I have conflicts because sometimes I cannot predict what behavior others expect of me.

16. It happens that while thinking about a conversation with another person, I seem to be mentally conducting a dialogue with him.

17. I try not to think about what thoughts and feelings my words and actions evoke in other people.

18. Before making a remark to another person, I will think of the words that would be better to use to not offend them.

19. When solving a difficult problem, I think about it even when I am doing other things.

20. If I disagree with someone, then, in most cases, I do not consider myself a blamer.

21. It rarely happens that I regret what I say.

Processing the results.

Of these 21 statements, 11 are direct (question numbers: 1, 4, 5, 6, 9, 10, 13, 14, 16, 18, and 19).

The remaining 10 are inverse statements, and they need to be taken into account when processing the results. To calculate a final score, the numbers corresponding to test-takers' responses are added to direct questions and reverse questions, and the values are replaced by those obtained by inverting the response scale.

3.7.3. A Survey to Determine the Ability of Teacher Candidates to Provide Instruction in Fine Arts in Elementary Schools

The survey included written responses to six questions about students' attitudes toward artistic technologies and the effectiveness of their professional preparation.

Question 1: How do you evaluate your level of knowledge, skills, and abilities in the fine arts before and after training?

Question 2: How do you evaluate your understanding of the fundamentals of visual and compositional literacy before and after training?

Question 3: How do you assess your knowledge of visual arts teaching methods before and after training?

Question 4: How do you assess the multimodality of art class content based on the use of various types of art technologies?

Question 5: What areas of application for art technologies did you learn about in the pedagogical workshop?

Question 6: How do you assess your ability to implement art technologies in an elementary school setting?

The survey will provide material on the readiness of teacher candidates to teach the fine arts in elementary schools.

All empirical manifestations were evaluated at three levels of teacher candidate readiness to teach fine arts in elementary schools.

The low level (I) was characterized by the presence of knowledge of some individual psychological characteristics (this knowledge is not broad and deep enough to use them in educational and professional activities) and is also characterized by the ability to only record the implementation of one's activities and the lack of desire for self-improvement and enhancement in ways of activity. Students belonging to the first level have unstable professional readiness, which fluctuates depending on the situation, and the ability to evaluate their activities manifests itself only in cases of success. Negative aspects are most often not noticed; practical skills of professional readiness are present, but they do not differ in stability and commitment. Pedagogical activity is seen at the level of individual functions.

The average level (II) was characterized by the ability to correlate the characteristics of the individual with the conditions to achieve the goals of the individual in educational and professional activities, to evaluate oneself through the perception of others, and the ability not only to record but also to correct the implementation of professional activities. The professional readiness among students at this level is unstable, but practical self-regulation skills are present. They know how to make plans for professional development.

A high level (III) of professional readiness development is characterized by students whose knowledge about professional activity is deep, extensive, differentiated, presents a holistic picture, and is used in educational and

professional activities. They are able not only to analyze their activities and their results but also to see the reasons for successes and failures and to understand the features and specificity of pedagogical activity. The professional readiness of high-level students is adequate, determining the prospects for their personal growth in educational and professional activities and developing an individual style.

3.8. Data Analysis

The quantitative analysis employed mathematical statistical methods to identify differences, such as the Mann-Whitney U test and the Wilcoxon W test, and correlation was calculated using Spearman's r; in some cases, Student's t-test. Additionally, qualitative analysis of the research findings was conducted. All statistical analysis procedures were performed using the SPSS Statistics 19 program.

4. Results

The results of an evaluation of the degree of creativity and personal potential of the participants (see Table 4).

Table 4. Indicators of average results and students' t-criterion for students' creative abilities and personal potential.

Data	EG (n=60)		CG (n=60)	
	AS	FS	AS	FS
Average result for the group	21.6	53.6	22.3	32.7
Student's t-test	2.78**		2.12*	

Note: **significance level at 1% level, at $p \leq 0.01$, $t = 2.6$.
*significance level at 5% level, at $p < 0.05$, $t = 1.97$ at f=more than 200.

Referring to Table 4, the average score of the groups at the start of the study ranged between 21.6 and 22.3 points. Following the intervention, the participants' EG scores increased to 53.6 points. Student's t-test results confirm these findings ($t_{emp} = 2.78 > t_{0.01} = 2.6$).

Table 5 shows the average values to measure the artistic and aesthetic needs of the students.

Table 5. Indicators of average results and Student's t criterion to measure the artistic and aesthetic needs of students.

Data	EG (n=60)		CG (n=60)	
	AS	FS	AS	FS
Average result for the group	14.8	28.6	11.6	22.7
Student's t-test	2.7**		2.01*	

Note: **significance level at 1% level, at $p \leq 0.01$, $t = 2.6$.
*significance level at 5% level, at $p < 0.05$, $t = 1.97$ at f=more than 200.

Referring to Table 5, the findings allow us to identify the dynamics of artistic and aesthetic needs of the students. At the beginning of training, the students scored, on average, 14.8 or slightly below average (11.6) on artistic and aesthetic requirements. Furthermore, we discovered an increase in this need during the formative stage among EG participants with high levels of severity (28.6); there was also statistical significance at the 1% level of severity ($t_{emp} = 2.7 > t_{0.01} = 2.6$).

Diagnostics of the level of development of reflexivity are shown in Figure 2.

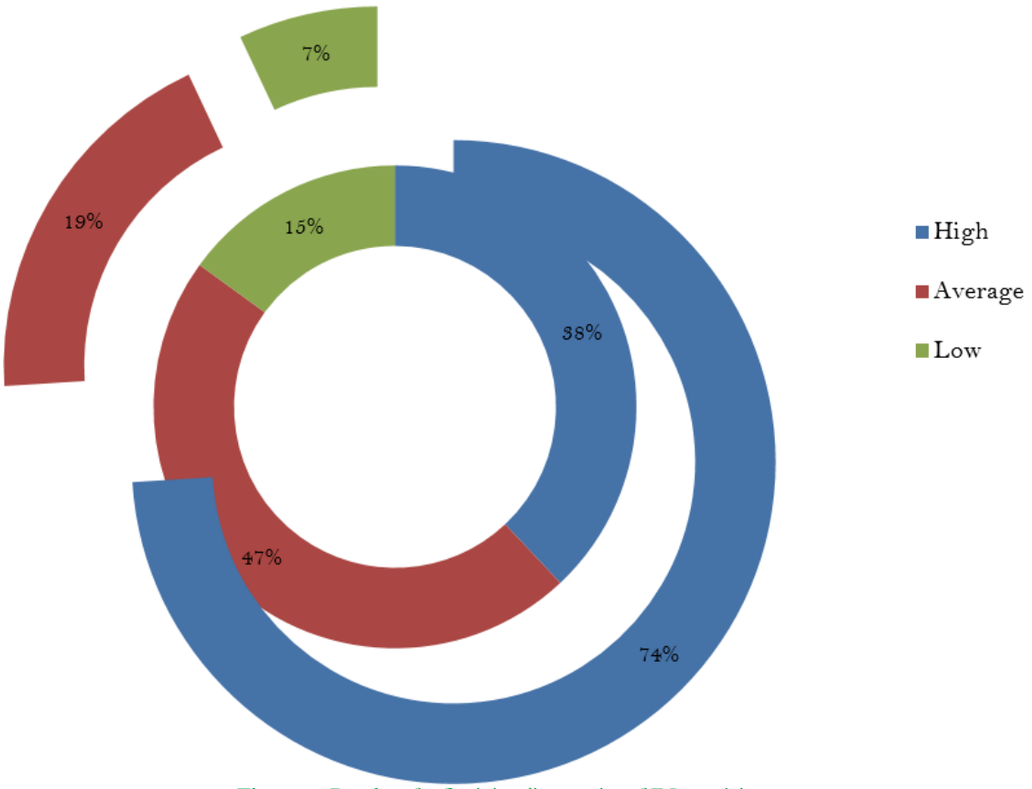

Figure 2. Results of reflexivity diagnostics of EG participants.

Referring to Figure 2, which indicates the level of reflexivity, the formative stage outcomes in EG were qualitatively and quantitatively improved. The high level of EG of the participants increased from 38% to 74%.

Thus, an increase of 36% was observed. The average level of EG among participants increased from 19% to 47% (a 28% increase). The low EG levels of the participants decreased from 15% to 7%, representing a decrease of 8%. It should be noted that the experimental group has a wider range of individual growth rates than the control group. The EG has the highest standard deviation value, indicating a high level of development of reflexive skills in the experimental sample. During the formative experiment, significant changes occurred in the level of reflexive skill development among students in EG.

A comparison of the severity of the main indicators measured in the subjects at the beginning of the study with the same indicators at the end of the study revealed highly significant changes ($p < 0.008$ according to the Wilcoxon W test).

The results of the determination of the readiness of teacher candidates to teach fine arts in elementary schools are shown in Table 6.

The reliability of the data was assessed using the non-parametric criterion χ^2, which can be applied to ordinal indicators of students' professional readiness. The χ^2 criterion was calculated using the following formula:

$$X^2=\sum\frac{(P_1-P_2)^2}{(P_1+P_2)}$$

P_1: Represents participants in the EG.
P_2: Represents participants in the CG.
$\sum$ is the sum sign.

Table 6. Distribution of participants by level of professional readiness to teach fine arts in the control and experimental groups.

Level	CG		EG		Indicates			
	Quantity	%	Quantity	%				
Low	8	10	-	-	-	-	-	-
Average	32	59	14	36	12	36	59	1.5
High	20	31	46	64	20	64	59	2.66
χ^2 (Crit)=2.84 χ^2(Act) =4.16								

Referring to Table 6, the results of the formative stage in the EG were qualitatively and quantitatively improved, indicative of the high level of readiness of the participants to teach fine arts in elementary schools. The EG's readiness (64%) is 33% higher than the control group (CG)'s (31%). The average level of readiness in the CG (59%) exceeds that of the EG (36%) by 23%. However, participants' low EG levels are lacking, but in the CG, they are 10% (see Figure 3).

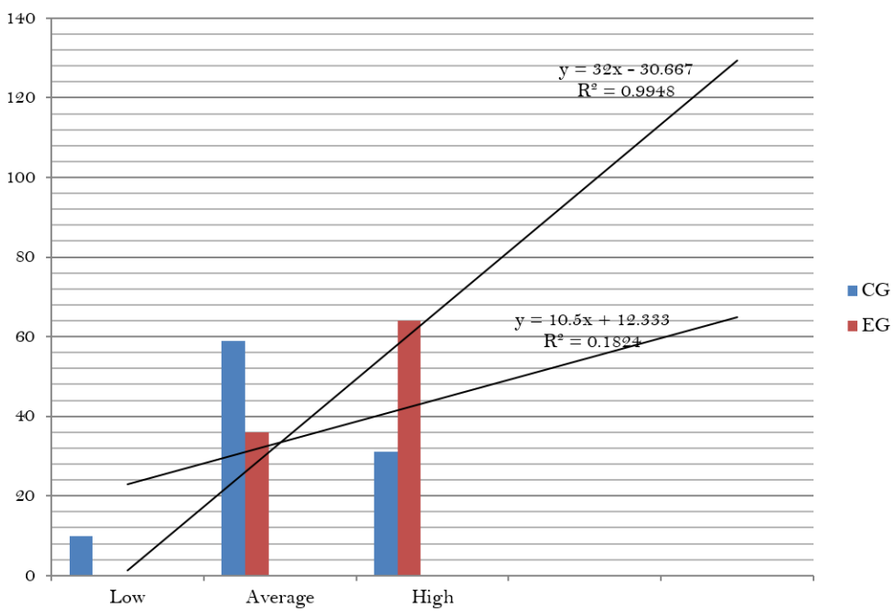

Figure 3. Comparison of professional readiness levels between the control and experimental groups.

Diagnostic studies show that in EG, compared to CG, there were noticeable changes in the level of readiness of teacher candidates to teach fine arts in primary schools. According to the $\chi 2$ criterion, the changes that have occurred cannot be attributed to random causes but are a consequence of the adjustment of educational programs using the potential of art technology, which significantly increases student motivation and creative abilities.

5. Discussion

The study investigated how art technology affected the effectiveness of teacher candidates' professional preparation for teaching fine arts in elementary schools. The first question on the intervention program to improve students' creative abilities and personal potential revealed that in the EG, there was a significant increase in creative orientation, creative pedagogical activity, and creative self-realization. This was made possible through classes in the author's special course "Creativity and Self-Expression: Art Technologies in Teaching," as well as other aspects of model testing. The relationship between personal potential, creative self-realization, and teacher competence has been demonstrated. It was discovered that a high level of creativity and personal potential ensures the success of professional activities. These data are consistent with previous research on improving creativity and personal potential (Ariratana, Ngang, & Sirisooksilp, 2019; Koyuncuoglu, 2021; Prabahar & Jerome, 2023).

Furthermore, the current study, like others, emphasizes the importance of art technology in developing students' creativity and personal potential (Iqbal, Mangina, & Campbell, 2022). To develop creative abilities and personal potential, an individualized, differentiated, and creative approach to students is valued and implemented; the possibilities of the emotional factor and the positive emotional background of training sessions; freedom of choice of actions and methods for solving educational problems; and students' creative initiative, activity, desire for novelty, and unconventional behavior (Valverde, Thornhill-Miller, Patillon, & Lubart, 2020).

The second research question, which asked whether the training program was effective in fostering students' artistic and aesthetic needs, revealed that the model's implementation influenced students' ability to identify processes in the environment and works of art that evoke aesthetic feelings through art technology content. On this foundation, a comprehensive perception of artistic and aesthetic phenomena was established, requiring students to have a subtle understanding of form, color, and composition, while the culture of aesthetic perception contributed to the development of students' aesthetic feelings. Aesthetic feelings arose as a result of educational activities organized as aesthetic events, resulting in aesthetic experiences during educational activities. Aesthetic experiences contributed to the emergence and development of spiritual and aesthetic needs, manifested as a desire to communicate with artistic and aesthetic values, primarily in academic disciplines. As a result, students learned to plan analytically to overcome obstacles in their personal, interpersonal, and educational development. The results of this work, which support providing students with opportunities to develop artistic creativity, sensory-emotional skills, artistic tastes, and the ability to understand and appreciate works of art, are consistent with previous research (Barton, 2023; Heybach, 2020). In fact, it demonstrated the importance of incorporating art technology as a key factor in improving professional preparation for successful visual arts teaching in primary schools.

In terms of the third question, the data revealed that the EG participants have a subjective view of their professionalization. The participants' self-assessment abilities were improved. The leading factor in the development of reflexive skills in the EG participants was specially organized learning conditions based on their analytical understanding of their practical experience. This required them to be able to regulate their existing ideas about themselves as subjects of educational and professional activities, as well as the results and methods of improvement that determine the success of self-development activities (Colognesi et al., 2021; Perez Garcias, Tur, Darder Mesquida, & Marín, 2020). This trend in understanding professional development as an active qualitative transformation of the subject's inner world necessitates the search for and study of the main methods of their professional training, as other researchers argue (Shavit & Moshe, 2019; Smolinska & Dzyubynska, 2020).

Regarding the study's fourth question, to the extent that the course of action in determining teacher candidates' readiness to teach visual arts in elementary schools was sufficient, statistical analysis revealed that the EG performed better than the CG. The professional training of the participants was closely linked to the development of their professional pedagogical knowledge. Most of the participants noted an improvement in their skills and abilities to implement art technologies in primary school conditions, enriching their knowledge of the scientific and technological foundations of the use of art technologies. These data are consistent with prior research (Fahy, 2023; Morrissey & Kenny, 2023; Peppler, Davis-Soylu, & Dahn, 2023).

Overall, this study found that art technology improves the effectiveness of teacher candidates' professional preparation for teaching visual arts in elementary schools. The study also found that incorporating art technology into teacher candidate education enhances the professional preparation required for success in teaching elementary school art.

6. Limitations of the Study

This study is limited to students studying at the same university, only with Kazakh language instruction, and only females living in the same area. This study does not claim to be a complete disclosure of the problem under investigation. The research can be expanded to include the development of monitoring of the process under study and the use of innovative technologies, as well as instructional materials, to guarantee the effectiveness of the formation of professional competence in future fine arts teachers during the subject training process.

7. Conclusion

The study investigated how art technology affected the effectiveness of teacher candidates' professional preparation for teaching fine arts in elementary schools. To achieve this goal, the experimental group was taught according to a model using art technologies but without changing the main curriculum or increasing the workload for students. The control group followed the traditional model curriculum. The AS of the experiment, partly diagnostic, was associated with the preliminary determination of the most important components and stages of the methodological training of candidates for fine arts teachers. It was revealed that, against the background of a relatively good possession of theoretical knowledge in the field of fine arts, they lack practical skills in fine arts. The professional training of the EG participants was carried out according to the developed model with the active use of art technologies through (i) multimodal content of art classes based on the integration of different types of art technologies; (ii) familiarization of the EG participants with the areas of application of art technologies; (iii) training in the scientific and technological basics of using art technologies; and (iv) developing skills in the implementation of art technologies in a primary school setting. The training was carried out within the framework of several disciplines, namely 'artistic work' and 'fine arts with teaching methods'. These disciplines assumed an approach that combines high-quality theoretical training with practice, that is, the application of knowledge to solving artistic and professional problems in the field of art. The study showed that the participants in the EG expanded their knowledge of the basic school of fine arts, including through a variety of types of artistic and creative activities: painting, graphics, sculpture, design, architecture, folk, and decorative arts. The data showed that the use of art technologies in the training of teachers increased their artistic and professional training, which was a necessary condition for the success of teaching fine arts in elementary school.

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