

IMPROVING THE TECHNOLOGY FOR DEVELOPING AESTHETIC EDUCATION OF PRE-SERVICE TEACHERS IN AN INFORMATIZED EDUCATIONAL ENVIRONMENT

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Abstract. The digital transformation of higher education has changed the conditions in which pre-service teachers form their aesthetic views, tastes and values. Although digital platforms provide unprecedented access to art, visual culture and creative tools, their pedagogical potential for aesthetic education remains insufficiently systematized in teacher training. This article aims to substantiate and experimentally test an improved technology for developing the aesthetic education of pre-service teachers in an informatized educational environment. The technology is built on four interrelated components (motivational-value, cognitive-informational, activity-creative and reflective-evaluative) and is implemented through three stages: aesthetic immersion, digital co-creation and reflective self-assessment. A quasi-experimental study was conducted at Termez State University with 126 pre-service teachers (experimental group $n = 64$; control group $n = 62$). Data were collected through an aesthetic education questionnaire, expert evaluation of students' digital creative products and reflective e-portfolios. After one semester, the proportion of students at the high level increased from 14.1% to 35.9% in the experimental group and from 12.9% to 19.4% in the control group, and the post-test difference between the groups was statistically significant. The findings show that virtual museums, digital storytelling, multimedia projects and reflective e-portfolios are effective when they are integrated into a coherent pedagogical technology rather than used episodically.

Keywords: aesthetic education; pre-service teachers; informatized educational environment; pedagogical technology; digital creativity.

1. INTRODUCTION

Over the last several years, education systems around the world have passed through an accelerated and in many respects irreversible process of digitalization. International reviews emphasize that digital technologies can widen access to learning resources and enrich teaching, but that their real effect depends on pedagogical design, teacher preparation and the cultural context in which they are used (UNESCO, 2023; OECD, 2023). In Uzbekistan, the Development Strategy of New Uzbekistan for 2022–2026 sets the improvement of the quality of teacher training and the wide introduction of digital technologies into education among the priority directions of state policy (President of the Republic of Uzbekistan, 2022). Consequently, universities that prepare future teachers face a double task: they must equip students with digital competence and, at the same time, preserve and develop the humanistic, value-based and aesthetic foundations of the teaching profession.

Aesthetic education, which in the Uzbek pedagogical tradition is expressed by the concept of *nafosat tarbiyasi*, is understood in this study as the purposeful formation of a person's ability to perceive, experience, evaluate and create beauty in nature, art, human relations and professional activity. For a teacher this ability is not an optional cultural addition but a professional quality. The teacher's speech, appearance and manner of communication, the visual design of learning materials, the atmosphere of the classroom and the ability to reveal the beauty of subject content to learners all carry aesthetic messages that influence students' attitudes towards knowledge and towards one another. Philosophical work on education for flourishing argues convincingly that aesthetic

experience and the arts must be part of any education that aims at the full development of the person (D'Olimpio, 2022), while research in the learning sciences demonstrates that learning in and through the arts has distinct cognitive, emotional and social value (Halverson & Sawyer, 2022).

The informatized educational environment is, however, ambivalent with respect to aesthetic education. On the one hand, it offers virtual museums, digital collections of world and national art, open multimedia libraries, creative software and, most recently, generative artificial intelligence tools that can produce images, texts and music on demand (Kasneci et al., 2023; Mishra et al., 2023). On the other hand, it produces information overload, fragmented “clip” perception, the dominance of mass-culture patterns and the superficial consumption of images, which can weaken genuine aesthetic experience and critical judgement. Henriksen et al. (2021) describe the relationship between creativity and technology in teaching as an “uneasy space” in which the promise of digital tools is often not realized because teachers lack coherent pedagogical approaches. Moreover, the rapidly growing body of research on teachers’ digital competence concentrates mainly on technical, informational and didactic aspects (Zhao et al., 2021; Lucas et al., 2021; Hämäläinen et al., 2021), whereas the aesthetic dimension of teachers’ digital activity remains marginal.

Observation of the educational process in pedagogical higher education institutions shows that digital tools are already used in courses that contribute to aesthetic education, yet they are used episodically, without an explicit pedagogical technology, without clearly defined stages and without diagnostic criteria that would allow teachers to monitor students’ progress. The contradiction between the high aesthetic potential of the informatized environment and the absence of a systematic technology for realizing this potential in teacher training determines the relevance of the present study.

The aim of the article is to substantiate theoretically and to test experimentally an improved technology for developing the aesthetic education of pre-service teachers in an informatized educational environment. The study addresses three research questions: (RQ1) What components, stages and digital tools should constitute a technology for developing pre-service teachers’ aesthetic education in an informatized environment? (RQ2) Does the implementation of this technology lead to statistically significant changes in the levels of students’ aesthetic education compared with traditional teaching? (RQ3) How do pre-service teachers themselves interpret the changes in their aesthetic attitudes and practices that occur during the implementation of the technology?

1.1. Theoretical background

Three bodies of literature form the theoretical basis of the study. The first concerns the nature and purpose of aesthetic education. Contemporary philosophy of education treats aesthetic experience not as a luxury or a narrow artistic specialization but as a mode of attentive engagement with the world. D'Olimpio (2022) links aesthetic education with eudaimonia, arguing that the arts cultivate perception, imagination and emotional understanding that are indispensable for a flourishing life. Biesta (2021) proposes a “world-centred” view of education in which the main task of the teacher is to help students encounter the world and to take an interest in it, which presupposes the capacity for attentive, non-instrumental perception characteristic of aesthetic experience. Halverson and Sawyer (2022) show that learning in and through the arts involves specific forms of representation, embodied practice and collaborative meaning-making that can be transferred to other domains of learning. For teacher education, these ideas imply that aesthetic education should be built into the professional preparation of every future teacher, not only of art teachers.

The second body of literature deals with digital transformation and teacher preparation. Sailer et al. (2021) demonstrate that the educational effect of digital technology depends less on the equipment itself than on the learning activities that teachers design, especially activities that require students to construct, create and interact. Timotheou et al. (2023), in a comprehensive literature review, identify teacher competence, leadership, infrastructure and a shared pedagogical vision as

key factors in schools' digital capacity. Pettersson (2021) interprets digitalization as a change in activity systems, meaning that new tools transform the goals, rules and division of labour in education. Greenhow et al. (2022) stress that online and blended learning create new possibilities for community, presence and authentic participation, but also require careful instructional design. Studies of teachers' digital competence (Zhao et al., 2021; Lucas et al., 2021; Hämäläinen et al., 2021) show that competence levels vary considerably and are associated with personal attitudes and institutional support, which confirms the need for purposeful preparation already at the pre-service stage.

The third body of literature concerns digital creativity, art education and immersive environments. Researchers of post-digital art education argue that the boundary between “digital” and “non-digital” aesthetic experience is increasingly blurred, so that art education must address the ways in which young people live, see and create in a digitally saturated world (Tavin et al., 2021). Hwang and Chien (2022) and Mystakidis (2022) describe the educational potential of the metaverse and virtual worlds, including immersive visits to cultural heritage sites and collaborative creation of virtual spaces. Mishra et al. (2023) reconsider the TPACK framework in the era of generative artificial intelligence and emphasize that teachers need not only technological skills but also the ability to judge the quality, appropriateness and ethical implications of machine-generated content. This judgement has an obvious aesthetic component: to evaluate an image, text or presentation produced with the help of artificial intelligence, a teacher must possess developed taste and criteria of beauty and harmony.

Analysis of these studies allows us to formulate the key premise of this research: in an informatized environment, aesthetic education of pre-service teachers should be organized as a pedagogical technology, that is, as a reproducible sequence of goal-oriented stages, methods and digital tools with diagnosable results. Such a technology must combine aesthetic perception of high-quality cultural content, active digital creativity and reflective evaluation, and it must connect aesthetic development with the future professional activity of the teacher.

2. MATERIALS AND METHODS

2.1. Research design and participants

The study employed a quasi-experimental pretest–posttest design with an experimental and a control group, supplemented by qualitative analysis of students' reflective texts. The experiment was carried out during the autumn semester of the 2022–2023 academic year at Termez State University. The participants were 126 second- and third-year pre-service teachers studying in the bachelor programmes of primary education, foreign language teaching and pedagogy. Academic groups were assigned as a whole to the experimental group (EG, $n = 64$) or the control group (CG, $n = 62$), taking into account comparable academic performance and course schedules. The composition of the sample is presented in Table 1.

Table 1. Characteristics of the sample

Characteristic	EG ($n = 64$)	CG ($n = 62$)	Total ($N = 126$)
Primary education	24	23	47
Foreign language teaching	22	21	43
Pedagogy	18	18	36
Female / male	49 / 15	46 / 16	95 / 31
Mean age, years	19.8	19.9	19.8

Participation was voluntary. Students were informed about the purpose of the study, and all questionnaire data were processed anonymously. The control group studied the same courses according to the standard curriculum, in which digital resources were used in the usual, unsystematic way.

2.2. The improved technology

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The technology developed in the study integrates four structural components of aesthetic education. The *motivational-value component* reflects the student's interest in beauty, need for aesthetic experience and recognition of the value of national and world culture. The *cognitive-informational component* covers knowledge of aesthetic categories, art forms, national cultural heritage and principles of visual and media design. The *activity-creative component* expresses the ability to create aesthetically valuable products, including digital ones, and to apply aesthetic principles in professional tasks. The *reflective-evaluative component* reflects the capacity for aesthetic judgement, critical evaluation of digital content and self-assessment of one's own aesthetic development.

The technology is implemented in three consecutive stages. At the *stage of aesthetic immersion*, students engage in guided perception of high-quality cultural content: virtual tours of museums and architectural monuments, including the historical heritage of Termez, Samarkand and Bukhara; digital collections of miniature painting, applied arts and national crafts; and recordings of classical and national music. The methods of this stage are guided viewing, aesthetic dialogue and comparative analysis. At the *stage of digital co-creation*, students work in small groups to create digital products with a clear professional purpose: digital stories, visually designed learning materials, virtual exhibitions and short educational videos devoted to aesthetic topics. At the *stage of reflective self-assessment*, students maintain reflective e-portfolios, evaluate each other's products according to agreed aesthetic criteria and critically analyse examples of low-quality digital content. The structure of the technology is summarized in Table 2.

Table 2. Structure of the technology for developing aesthetic education in an informatized environment

Stage	Leading goal	Methods	Digital tools
1. Aesthetic immersion	Awaken interest and enrich aesthetic perception	Guided viewing, aesthetic dialogue, comparative analysis	Virtual museum tours, digital art collections, audio and video archives
2. Digital co-creation	Develop the ability to create aesthetically valuable professional products	Project method, digital storytelling, collaborative design	Presentation and graphic editors, video editors, online whiteboards, virtual exhibition platforms
3. Reflective self-assessment	Form aesthetic judgement and self-evaluation	Peer review by criteria, critical analysis of digital content, reflective writing	E-portfolio, learning management system forums, online rubrics and surveys

The technology was implemented within the courses “Pedagogy”, “Pedagogical skill” and the English-language practical classes during 16 weeks (one module of two academic hours per week in each group). Each of the stages covered approximately one third of the semester, but elements of reflection were included in all stages.

2.3. Instruments and data analysis

Three instruments were used. First, an *aesthetic education questionnaire* consisting of 32 statements rated on a five-point Likert scale was developed on the basis of the four components described above (eight statements per component). The internal consistency of the scales in the pilot sample was acceptable (Cronbach's α ranged from 0.79 to 0.87). Second, three independent experts (university teachers of pedagogy and fine arts) evaluated students' digital creative products using a rubric with the criteria of content accuracy, compositional harmony, colour and typographic culture,

originality and pedagogical appropriateness. Expert scores were converted to the same five-point scale and averaged with the questionnaire scores of the activity-creative and reflective-evaluative components. Third, students' *reflective e-portfolios* were analysed qualitatively using thematic content analysis.

On the basis of the integral index (the mean score of the four components), three levels of aesthetic education were distinguished: high (4.00–5.00), medium (3.00–3.99) and low (below 3.00). The distribution of students by levels in the two groups was compared using Pearson's chi-square test, and mean scores for each component were compared using Welch's independent-samples t-test. Effect sizes were calculated as Cohen's d. The significance level was set at $p < 0.05$.

3. RESULTS

3.1. Levels of aesthetic education before and after the experiment

At the beginning of the experiment the distribution of students by levels of aesthetic education was practically identical in the two groups (Table 3). Only about one in seven students demonstrated a high level, while more than a third of students in each group were at the low level. The chi-square test did not reveal statistically significant differences between the groups at the pretest stage ($\chi^2(2) = 0.04$, $p = 0.978$), which confirms the comparability of the groups.

Table 3. Distribution of pre-service teachers by levels of aesthetic education, n (%)

Level	EG pretest	EG posttest	CG pretest	CG posttest
High	9 (14.1)	23 (35.9)	8 (12.9)	12 (19.4)
Medium	31 (48.4)	33 (51.6)	30 (48.4)	32 (51.6)
Low	24 (37.5)	8 (12.5)	24 (38.7)	18 (29.0)
Total	64 (100)	64 (100)	62 (100)	62 (100)

Note. Pretest: $\chi^2(2) = 0.04$, $p = 0.978$; posttest: $\chi^2(2) = 7.29$, $p = 0.026$.

After the experiment the situation changed considerably. In the experimental group the share of students at the high level increased by 21.8 percentage points (from 14.1% to 35.9%), and the share of students at the low level decreased threefold (from 37.5% to 12.5%). In the control group positive changes were also observed, which is natural given the general progress of students during the semester, but they were much more modest: the high level increased by 6.5 percentage points and the low level decreased by 9.7 percentage points. The difference in the posttest distributions between the groups was statistically significant ($\chi^2(2) = 7.29$, $p = 0.026$).

3.2. Dynamics of the components

Table 4 presents mean scores for each component of aesthetic education. At the pretest stage there were no significant differences between the groups for any component (all $p > 0.78$). At the posttest stage, students of the experimental group outperformed the control group on all four components, with large or close to large effect sizes.

Table 4. Mean scores (M $\pm$ SD) of the components of aesthetic education and posttest comparison

Component	EG pre	EG post	CG pre	CG post	t (post)	d
Motivational-value	3.12 $\pm$ 0.61	3.84 $\pm$ 0.55	3.09 $\pm$ 0.63	3.33 $\pm$ 0.60	4.97***	0.89
Cognitive-informational	3.05 $\pm$ 0.66	3.79 $\pm$ 0.58	3.08 $\pm$ 0.64	3.36 $\pm$ 0.62	4.02***	0.72
Activity-creative	2.87 $\pm$ 0.70	3.71 $\pm$ 0.62	2.90 $\pm$ 0.68	3.18 $\pm$ 0.66	4.64***	0.83
Reflective-evaluative	2.94 $\pm$ 0.68	3.68 $\pm$ 0.60	2.92 $\pm$ 0.71	3.21 $\pm$ 0.65	4.21***	0.75
Integral index	3.00	3.76	3.00	3.27	—	—

Note. Welch's t-test; *** $p < 0.001$; d – Cohen's effect size.

The largest gain in the experimental group was observed for the activity-creative component (+0.84 points), which is directly connected with the stage of digital co-creation. Students learned to design learning materials in which content, composition, colour and typography formed a harmonious whole; they created digital stories about national crafts and historical monuments of Surkhandarya, and organized virtual exhibitions for their peers. The motivational-value component showed the largest effect size ($d = 0.89$), which indicates that systematic contact with high-quality cultural content in an engaging digital format strengthened students' interest in aesthetic experience and their appreciation of cultural heritage. The comparatively smaller effect for the cognitive-informational component suggests that knowledge of aesthetic categories develops more slowly and requires sustained work beyond one semester.

3.3. Qualitative findings

Thematic analysis of 64 reflective e-portfolios of the experimental group revealed four recurring themes. The first theme, *from consumption to interpretation*, reflected students' recognition that previously they had "scrolled through" images on social networks without stopping, whereas now they had learned to look at a work of art or an architectural detail for a long time, to notice composition and symbolism and to formulate their impressions in words. The second theme, *the aesthetics of professional communication*, concerned students' new attention to the visual and verbal culture of their own teaching: the design of slides, the clarity and beauty of speech, and the organization of classroom space. The third theme, *cultural identity*, showed that virtual tours of national monuments and work with digital collections of national art strengthened students' pride in cultural heritage and their desire to transmit it to future pupils. The fourth theme, *critical attitude towards digital kitsch*, reflected students' growing ability to distinguish aesthetically valuable digital content from low-quality, vulgar or overloaded materials, including content generated with the help of artificial intelligence tools.

At the same time, the portfolios revealed certain difficulties. Some students reported that at the beginning they found it hard to work on collaborative projects because of differences in digital skills within groups, and several students noted that the abundance of available tools initially distracted them from the aesthetic goal of the task. These difficulties decreased during the semester as groups developed shared criteria and roles.

4. DISCUSSION

The results provide an affirmative answer to the second research question: the systematic implementation of the improved technology led to statistically significant positive changes in the levels of aesthetic education of pre-service teachers compared with traditional teaching. This finding is consistent with the conclusion of Sailer et al. (2021) that the effect of digital learning depends on the nature of the activities organized by the teacher rather than on the mere availability of technology. In our study, the control group also had access to digital resources, but only the experimental group used them within a purposeful sequence of perception, creation and reflection, and it was precisely this sequence that produced the difference.

The strongest effects on the motivational-value and activity-creative components support the view of Halverson and Sawyer (2022) that active participation in artistic and creative practice is a powerful mechanism of learning. They also resonate with the findings of Henriksen et al. (2021), who argue that the integration of creativity and technology requires deliberate pedagogical support. Our data suggest that the "uneasy space" between digital tools and creativity can be reduced when creative tasks are connected with the students' future profession and when the aesthetic criteria of evaluation are made explicit and shared.

The qualitative findings concerning the transition from consumption to interpretation and the critical attitude towards digital kitsch are particularly important in the context of generative artificial

intelligence. As Mishra et al. (2023) and Kasneci et al. (2023) point out, the growing availability of AI-generated content increases the importance of human judgement about quality, appropriateness and meaning. Our results indicate that aesthetic education can contribute to this judgement: students who had developed criteria of harmony, proportion and expressiveness were more confident in evaluating digital content, regardless of whether it had been created by people or by machines. This extends the discussion of teachers' digital competence (Zhao et al., 2021; Lucas et al., 2021) by showing that it has an aesthetic dimension which deserves explicit attention in teacher education.

The theme of cultural identity corresponds to Biesta's (2021) idea of world-centred education and to the post-digital perspective of Tavin et al. (2021): digital tools did not replace students' relationship with real cultural heritage but, on the contrary, brought them closer to it, especially to monuments and collections that are geographically distant. Immersive and virtual formats described by Hwang and Chien (2022) and Mystakidis (2022) were used in our study in a simplified form, through virtual tours and exhibitions, yet even this level of immersion proved effective for enriching aesthetic perception. At the same time, the findings confirm international warnings (UNESCO, 2023) that technology should serve clearly formulated educational goals; without the reflective stage, virtual tours could easily have become another form of passive consumption.

The study has several limitations. First, it was conducted in one university and the groups were formed from existing academic groups rather than randomly, which limits the generalizability of the results. Second, the duration of the experiment (one semester) does not allow conclusions about the long-term stability of the changes. Third, self-report questionnaires may be affected by social desirability, although this risk was partly reduced by using expert evaluation of students' products. Future research should examine the technology in other institutions, include delayed posttests and investigate how the aesthetic education of pre-service teachers is manifested in their teaching practice at schools.

5. CONCLUSION

The study substantiated and experimentally tested an improved technology for developing the aesthetic education of pre-service teachers in an informatized educational environment. The technology is based on four interrelated components (motivational-value, cognitive-informational, activity-creative and reflective-evaluative) and is implemented through three stages: aesthetic immersion, digital co-creation and reflective self-assessment, each supported by a specific set of methods and digital tools. Its implementation led to a statistically significant increase in the share of students with a high level of aesthetic education and to significant gains in all components compared with traditional teaching.

The practical value of the research lies in the possibility of using the proposed technology, the criteria and the diagnostic instruments in the teaching of pedagogical, psychological and language disciplines in teacher education institutions. It is recommended to include special modules on the aesthetics of digital learning materials and on the critical evaluation of digital and AI-generated content in the curricula of pedagogical universities, and to develop teachers' own aesthetic and digital culture through professional development programmes. The informatized educational environment thus becomes not a threat to the aesthetic education of future teachers but a resource for it, provided that it is organized as a coherent pedagogical technology.

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