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Application of Audiovisual Technologies in Art Education: An Experimental Study

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ABSTRACT

The present study aimed to develop and experimentally verify the effectiveness of a methodology for applying audiovisual technologies to enhance schoolchildren's artistic and creative activities within the art education systems of Kyrgyzstan and China. The experimental part of the study was conducted in six specialized art schools, involving students from years 7 to 9. As part of the research, a methodology for using audiovisual technologies was developed and implemented. Analysis of the obtained results confirmed a statistically significant correlation between the integration of digital tools into the educational process and the development of students' artistic skills. This approach allowed for the determination of an optimal balance between traditional pedagogical methods and innovative practices. Particular emphasis was placed on a digital recording system for the artistic creation process, which not only improved the accuracy of mastering technical techniques but also contributed to preserving cultural authenticity and national artistic traditions. Additionally, the adaptation of analytical algorithms to the specific conditions of national art schools ensured the effective assessment of students' creative achievements. The developed methodology demonstrated a high degree of adaptability to different national art education systems, showing improved results in the experimental groups across all assessment criteria: accuracy in reproducing national artistic techniques (ornamental compositions in Kyrgyz schools increased by 25.7%, while calligraphic techniques in Chinese schools improved by 28.3%), technical proficiency (control over pressure forces increased by 31.5%), and the ability to harmonize color combinations (a growth of 23.9%).

Keywords: Audiovisual instructional technologies, Digital art pedagogy methodology, Kyrgyzstan–China comparative study, National artistic tradition preservation, Graphic-tablet skill assessment

Introduction

The development of the information society and the introduction of digital innovations into the educational space necessitate a significant modernization of approaches in the field of art education. The application of audiovisual technologies creates fundamentally new opportunities for the development of students' creative potential, the formation of visual culture, and the enhancement of artistic and aesthetic perception. The integration of traditional teaching methods with modern digital tools contributes to the creation of a unique educational environment that meets contemporary challenges, focusing on the development of creativity and artistic skills.

In the work of González-Zamar et al.¹ an analysis of 1,291 scientific publications identified key global

trends in digitalization in education and its impact on artistic and visual education in higher education institutions. The authors emphasize the importance of creating flexible learning environments capable of adapting to the needs of modern students. Zhu et al.² highlighted the potential of deep audiovisual learning, which has demonstrated effectiveness in enhancing the perception and processing of visual information, improving these abilities by 40%.

Zhang et al.³ developed a system for an effective art teaching framework (AIEATF) using artificial intelligence. Empirical tests confirmed significant improvements in learning quality across various indicators: the proficiency coefficient in contemporary painting reached 87.66%, in computer graphics, 88.77%; in photographic design, 84.5%; and in carving and sculpture, 82.26%. Particularly high results were achieved in the development of constructive thinking (93.83%) and musical performance (92.7%). In his study, Wang⁴ experimentally demonstrated that the use of computer technologies significantly enhanced student performance and contributed to a more precise expression of design ideas. This research also highlighted the synergistic effect of technologies, as tools such as 2D drawing, 3D modeling, 3D printing, and virtual reality (VR) did not function autonomously but integrated to create a more powerful flow of creative interaction.⁵

Li⁶ emphasized the importance of an interdisciplinary approach in art education through the combination of artistic practices with engineering disciplines, facilitating the training of highly educated specialists for the future. China's experience in implementing audiovisual technologies is extensively covered in the study by Ye et al.⁷ The authors conducted a two-factor experiment to analyze the impact of multimedia materials on the mastery of compositions and the evolution of traditional Chinese ornaments. According to the findings, students who used animation with narrative support demonstrated significantly higher levels of visual perception than those who used animation with textual commentary. Chu⁸ presented the results of an experimental study involving 60 students, equally divided into control and experimental groups. The experiment showed a significant increase in learning motivation and concentration when VR technologies were incorporated into the learning process.

Feng and Li⁹ created an integrated art education modeling system that includes element production, composition development, and multipurpose lighting effects. The results show that intelligent virtual technologies improved students' color harmony and composition knowledge. Najimudinova et al.'s¹⁰ study of 7,839 respondents examines Kyrgyzstan's educational

system. Media technologies (16.58%) and interactive presentations (11.5%) were the most effective informational resources for students. Students in the southern region chose traditional learning techniques, while those in the northern and central regions preferred multimedia technologies. Modernizing the material and technical base of educational institutions became urgent: metropolitan schools had 78% technological equipment, while rural schools had 45%.¹¹

Huralna et al.¹² stressed the need to use multimedia technologies to stimulate students' creativity in artistic areas. Computer technology helped educators improve learning efficiency and articulate their pedagogical concepts, according to the authors. 2D drawing, 3D modeling, and VR worked together to generate a synergistic impact. Audiovisual tools improved pupils' practical skills and artistic proficiency, according to experiments. In the backdrop of global digitization, Tynalieva¹³ emphasized the significance of preserving and promoting national artistic traditions. The researcher found that current technology may boost the national art's international competitiveness if its cultural authenticity and history were protected.

However, an analysis of scientific sources indicated insufficient development of issues related to the comparative study of different countries' experiences in using audiovisual technologies in art education. This was particularly relevant to aspects of fostering students' artistic and creative activity while considering the specific national traditions of educational systems.

This study developed and experimentally tested a way for using audiovisual technologies to improve schoolchildren's artistic and creative activities in Kyrgyzstan and China's art education systems. To achieve this goal, the following tasks were identified: to examine the regulatory and legal framework and practical experience of both countries in implementing audiovisual technologies in art education; to develop and test a methodology for using audiovisual tools to foster students' artistic and creative activity; and to identify optimal conditions for the successful integration of audiovisual technologies into the educational process.

Materials and Methods

Over a 4-month period from September to December 2024, an experimental study was conducted in six specialized art schools in Kyrgyzstan and China with 200 students from years 7 to 9 (100 in each country). No students withdrew or were excluded during the course of the study. The Kyrgyz participants were drawn from the Chuikov Republican Art School, the Sadikov Osh Regional Art School, and the Chokmorov National Art Boarding School, while the Chinese students studied at the Beijing School of Fine Arts, the Shanghai Art School, and the Art School affiliated with the Central Academy of Fine Arts. Participants were randomly assigned to experimental and control groups using stratified block randomization within each school to ensure balanced allocation. Baseline equivalence checks on age, gender, prior ICT exposure, and diagnostic rubric scores confirmed no significant differences between

groups, with all absolute standardized mean differences below the 0.20 threshold.

In the experimental groups, 70% of instructional time was devoted to audiovisual technologies, while control groups followed the traditional curriculum. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. A study was approved by the National Ethics Commission of the Jusup Balasagyn Kyrgyz National University on August 21, 2024, No. 1136-A. The technical resources differed across contexts: Kyrgyz schools were equipped with basic Wacom One tablets (8 stations per institution), whereas Chinese schools had modern Wacom Cintiq 24" stations (15 per institution). High-resolution LED panels were used for the presentation of educational materials in both countries.

At the initial stage, a diagnostic assessment of students' artistic and creative activity was performed using four validated rubrics. The cognitive rubric measured knowledge of composition, color theory, and national traditions; the technical rubric evaluated accuracy and quality of execution; the creative rubric assessed originality and integration of digital with traditional techniques; and the motivational-value rubric captured interest in digital tools and appreciation of cultural heritage. Reliability testing showed acceptable to excellent internal consistency across rubrics (Cronbach's α ranging from 0.78 to 0.92) and strong interrater reliability for performance-based scores (ICC values exceeding 0.80). Content validity was confirmed through expert review by six educators, and construct validity was supported by confirmatory factor analysis of the four-factor structure. A comprehensive evaluation system was developed based on studies by Ye et al.⁶ on the impact of multimedia materials on composition learning; Chu on the use of VR technologies; Zhang et al.³ on AI-assisted effective art teaching; and Dong et al.¹⁴ on the efficiency of interactive visual multimedia technologies.

Cognitive knowledge (understanding compositional principles and color theory), technical skills (accuracy in reproducing artistic techniques and execution quality), and creative potential were assessed. A digital analytic system assessed outcomes, compositional choices, and color relationships. A questionnaire asked "How important do you consider the preservation of national artistic traditions?," "How effective is the use of video recordings of the artistic process for you?," and "Rate your interest in learning digital artistic techniques" to determine the motivational-value component. Testing covered traditional artistic techniques (ornamental drawing and geometric structures in Kyrgyz schools and calligraphy and ink painting in Chinese schools) and digital tools (graphic tablets, video recording of artistic processes, and digital reference analysis) to assess the cognitive criterion. This supports the methodological goal of integrating conventional and digital ways to inspire creativity. Task

performance measured technical execution metrics for the practical or activity-based technical component. Original works employing various methods were used to evaluate creativity.

The learning process was structured into four modules—basic techniques, composition, technical mastery, and creative synthesis—adapting to national traditions: ornamental drawing in Kyrgyz schools and calligraphy in Chinese schools. Technical assessment included both expert scoring and automated measures such as proportion accuracy, shading quality, color gradients, stylus dynamics, and brushstroke characteristics. All lessons were digitally recorded and subjected to frame-by-frame analysis. Statistical processing involved descriptive statistics (means \pm SD), baseline-adjusted comparisons with Hedges' g , 95% confidence intervals, and inferential testing through ANCOVA and mixed-effects models with school-level clustering. This approach ensured that group differences were not only statistically significant but also reported with robust effect sizes.

The technical assessment parameters demonstrated a comprehensive approach to analyzing the quality of artistic work execution. Specifically: proportion accuracy was evaluated with a permissible deviation not exceeding 5%; shading quality was assessed on a ten-point scale; smoothness of color transitions was measured with a gradient of at least 256 levels; software-tracked parameters included stylus pressure (ranging from 0 to 8,192 levels), stroke execution speed, and tool tilt angles. In calligraphy works in Chinese schools, additional analyses were conducted on brushstroke dynamics and line specificity.

Missing data were minimal, tested for randomness, and addressed through multiple imputation by chained equations with pooled estimates. Sensitivity analyses confirmed the stability of results under complete-case analysis. Covariates such as gender, age, and prior ICT exposure were included in the models, and the main effects of audiovisual technologies remained significant after these controls. A correlation analysis further confirmed a strong positive association between technology use and creative activity ($r = 0.78, p < 0.01$).

Results

Diagnostic Assessment of Students' Artistic and Creative Activity Using Audiovisual Technologies in Kyrgyzstan and China

The application of audiovisual technologies in art education emerged as a result of the evolution of

traditional teaching methods, facilitated by the introduction of electronic learning tools. The digitalization of the educational environment led to changes in knowledge transmission methods and artistic skill development, offering new opportunities for technique demonstrations, artistic analysis, and practical skill enhancement.¹⁵ The integration of digital tools into the pedagogical process directly influenced artistic perception and improved spatial thinking by combining visual and auditory components.

The structure of artistic and creative activity underwent significant changes due to the expansion of technical resources.¹⁶ Specifically, the motivational component was enriched through new formats of digital artistic expression; the cognitive development of students gained broader opportunities through an expanded set of tools for visual information analysis and synthesis; the synergy of traditional and modern digital tools provided a foundation for developing comprehensive artistic competencies. Table 1 presents the structure of audiovisual technology components according to their functional purpose in education, systematizing data in line with the educational standards of both countries.

The technological infrastructure of art education has evolved into a multilevel system that integrates interrelated components. Hardware includes specialized devices for various aspects of artistic activity: precise color reproduction systems, digital drawing tools, and 3D modeling equipment. Software offers a wide range of tools that enable the realization of creative ideas through the integration of various techniques and approaches.¹⁷

Combining pedagogical ideas with modern technology has changed audiovisual technology applications. Systematic learning is implemented through successive instructional modules that blend traditional and digital aspects.¹⁸ Adaptive learning trajectories take into account students' technical and creative strengths, personalizing education. The use of audiovisual technologies has transformed art education. Modernizing educational programs has required creative content delivery, digital tools, and interactive instruction. Lesson planning and student assessment have changed. Technology is now used in all lectures, from theoretical explanations to practical applications.¹⁹ Digital technologies for assessing artistic projects and tracking development have improved student work assessment.

Students in Kyrgyz art schools saw videos on projectors and then did practical homework. Due to technical

Table 1 | Systematic characteristics of audiovisual technologies in art education

System Component	Technological Support	Methodological Approaches	Learning Outcomes	Assessment Criteria	Control Forms
Form perception	3D visualization systems	Visual analysis method	Spatial thinking development	Accuracy of volume reproduction	Practical tests
Color theory	Digital palettes, calibrated monitors	Color modeling	Understanding of color systems	Color harmony	Creative projects
Composition	Composition analysis software	Digital sketching method	Compositional thinking	Composition integrity	Work analysis
Technical skills	Graphic tablets, specialized software	Step-by-step tool mastery	Technical proficiency	Execution quality	Portfolio
Creative development	Integrated creative environments	Problem-solving method	Creative thinking	Originality	Projects

Note: components are systematized according to their functional role in the educational process.
Source: compiled by the authors.

limitations, prerecorded video classes and presentations were used. Chinese schools used LED panels, original teaching movies, and live streaming masterclasses. An excellent step-by-step approach for mastering artistic techniques was established by recording the drawing process. Surveys, cognitive knowledge testing, and expert evaluation of instructional documentation analyzed these methods' efficacy. After seeing instructional videos, students replicated artistic methods with precision. They also have to comprehend audiovisual composition and visual arts approaches. After interactive multimedia presentations, theoretical knowledge was examined. Diagnostic examinations revealed three artistic and creative activity levels: high, medium, and low. A constant interest in art and a confident command of conventional and digital techniques defined the high level. The medium level had situational curiosity, rudimentary knowledge, and partial tool mastery. The low level was linked to superficial knowledge, low inventiveness, and questionable technique utilization.

Comparative analysis confirmed that the level of artistic and creative activity depended on access to audiovisual technologies. In Kyrgyz schools, a lack of such technologies resulted in lower indicators for both the cognitive criterion and the activity component. In Chinese schools, where access to technology was significantly broader, effective work was observed with both traditional and digital tools. The quantitative results of the initial diagnostic assessment are systematized in Figure 1, which presents the findings according to key evaluation criteria in line with the research methodology.

The results of the initial diagnostic assessment of students' artistic and creative activity demonstrated variability in scores depending on the educational module and evaluation criterion. The highest level was recorded for the motivational-value criterion in the basic techniques module, indicating strong student interest in mastering technical methods. Slightly

lower results were observed in the composition module, while the technical mastery and creative synthesis modules proved even more challenging for students, suggesting the complexity of experimental work.

The cognitive component showed good color and shape awareness, but only 65% composition understanding. Knowledge of national methodologies and digital-traditional integration was lower, indicating the need for educational program modifications. Students performed better on basic procedures than on compositional analysis software or sophisticated compositions, according to the practical criterion. The creative component had the lowest scores: 60% for interpreting basic approaches in personal artwork, 55% for developing novel compositional solutions, and 48% for rethinking old methods and technique integration. This highlighted the need for creative thinking environments. Cultural disparities in education affected results. Kyrgyz schools excelled in ornamental art, while Chinese institutions prioritized calligraphy for precision. The overall level of creative synthesis in both groups was moderate, indicating the need for more experimental teaching. The diagnostic results showed pupils' high enthusiasm and core knowledge, but difficulty applying skills and creativity, requiring instructional methodology development.

The evaluation system was developed with consideration of the specific features of using audiovisual technologies in art education. The analysis examined students' ability to perceive and practically reproduce artistic techniques demonstrated through educational video materials. Assessment included the evaluation of aspects such as working with digital references, the use of virtual tools for sketch creation, and mastery of techniques presented in video lessons. The curricula of Kyrgyz schools allocated 10% of lessons to the use of audiovisual technologies. Chinese educational institutions dedicated 35% of their total learning time to working with multimedia materials and interactive demonstrations of artistic techniques. Figure 2

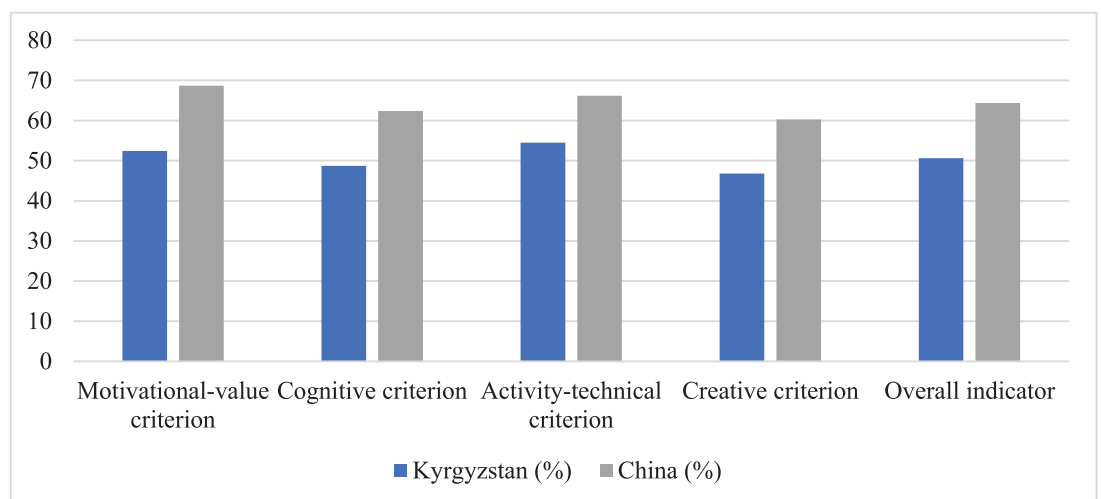


Fig 1 | Results of the initial diagnostic assessment of students' artistic and creative activity

Note: data is presented as a percentage of the maximum possible score for each criterion

Source: Compiled by the authors

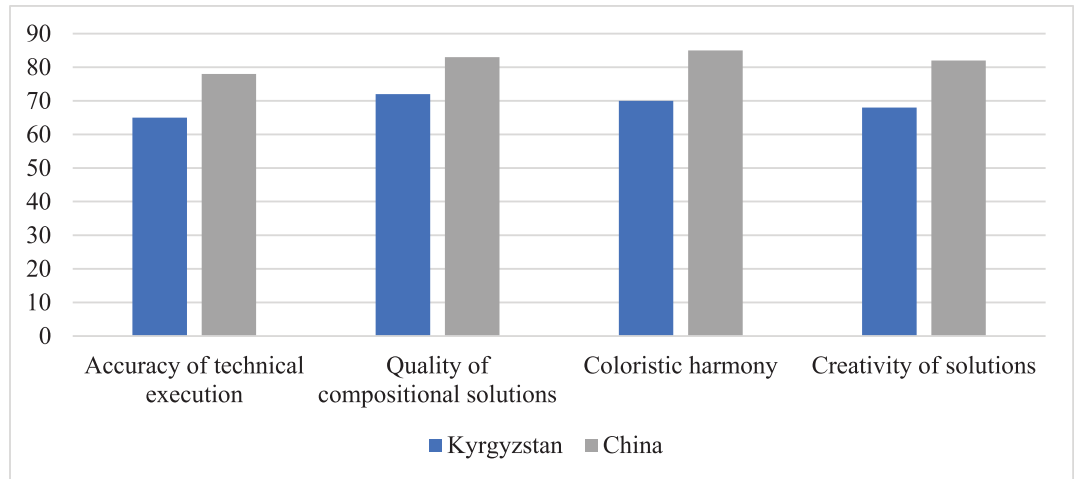


Fig 2 | Comparative diagnostic results based on key evaluation criteria for artistic and creative activity

Note: data is presented as a percentage of the total number of students in each group according to the results of the diagnostic study

Source: Compiled by the authors

systematizes the comparative analysis results based on the defined evaluation criteria. The data illustrate the correlation of student success rates within the educational systems of the two countries.

The analysis of comparative diagnostic results demonstrated significant differences in indicators between schools in the two countries. According to the criterion of accuracy in performing technical techniques, students from Chinese schools achieved higher results (78%) compared to the indicators of Kyrgyz educational institutions (65%). This was explained by the more active use of digital tools during the development of technical skills. In the area of quality compositional solutions, the advantage of Chinese schools was also evident (83% versus 72%), indicating the effectiveness of digital auxiliary tools in the process of analyzing and creating compositions. The most significant differences were observed in the criterion of color harmony: 85% in Chinese schools compared to 70% in Kyrgyz schools. This was due to the use of precisely calibrated digital tools for working with color. Regarding creativity, the results of Chinese schools were again higher (82% versus 68%), confirming the effective integration of digital technologies in developing a creative approach.

The obtained data confirm the impact of audiovisual technologies on the improvement of artistic and creative activities. In Chinese schools, the use of video recording and procedural reproduction of the drawing process allowed for high scores in all criteria. Interactive demonstrations on LED panels significantly increased the level of mastery of key artistic techniques. The ability to watch educational videos in slow motion enabled students to study in detail the specifics of performing artistic techniques, positively influencing the level of technical mastery. Similar results are confirmed by initial diagnostics, which also demonstrated the positive impact of high-quality technical equipment on the effectiveness of developing artistic skills and abilities.

Experimental Verification of the Methodology for Using Audiovisual Tools in Developing Students' Artistic and Creative Activity

The experimental method started with a digital learning environment that merged video recordings of the drawing process with an interactive art analysis system. An analysis of Kyrgyzstan and China's art education standards informed the methodology. The Kyrgyz Republic's State Standard of General Secondary Education phased in audiovisual technology based on educational institutions' technical infrastructure. The standard defined three levels of technological integration, from simple presentations and video to proprietary multimedia content.²⁰ Chinese art education regulations require schools to have extensive technical equipment to provide high-quality education. Virtual galleries and digital art applications were prioritized. The experimental methodology used Wacom Intuos Pro graphic tablets with digital drawing software and high-resolution LED displays for instructional materials. Modules gradually increased technical task complexity in the video lesson system. Experimental data showed insufficient digital integration in traditional art education and limited personalized learning (Table 2).

The learning modules complied with the regulatory requirements for art education in both countries and contributed to the gradual formation of artistic and technical skills. The lessons that formed the basis of the modular system lasted 15–20 minutes and included a detailed demonstration of technical techniques. The video materials included a frame-by-frame breakdown of the stages of creating artistic works, with the ability to view complex technical elements in slow motion. Each lesson was accompanied by interactive tasks that ensured the consolidation of acquired techniques. The digital system for analyzing artistic works relied on special software that evaluated compositional solutions and color relationships. Software algorithms recorded proportional accuracy, color harmony, and the quality of technical execution according to the criteria

Table 2 | Structure of learning modules of the experimental methodology

Module	Learning Content	Technological Support	Forms of Control	Methodological Features
Basic techniques	Basics of working with color and form; traditional artistic techniques	Video demonstrations via LED panels; Wacom graphic tablets	Digital sketches; analysis of technical techniques	Integration of national artistic traditions with digital technologies
Composition	Principles of composition construction; laws of harmony	Composition analysis programs; virtual galleries	Creative projects; compositional analysis	Development of spatial thinking through digital visualization
Technical mastery	Specific artistic techniques; national techniques	Video recording system of the work process; interactive trainers	Practical work; master classes	Preservation of authenticity through digital recording
Creative synthesis	Creation of complex works; experimental techniques	Integrated digital tools; multimedia systems	Final projects; exhibitions	Development of creativity through the synthesis of traditions and innovations

Note: comparison was made based on an analysis of the technical equipment and methodological support of art schools in the 2023–2024 academic year. Sources: compiled by the authors based on Feng,²¹ Ye et al.,⁶ Wang, Ministry of Education and Science of the Kyrgyz Republic,²² Ministry of Education of the People's Republic of China,²³ Tawil and Dahlan,²⁴ Zhang et al.³

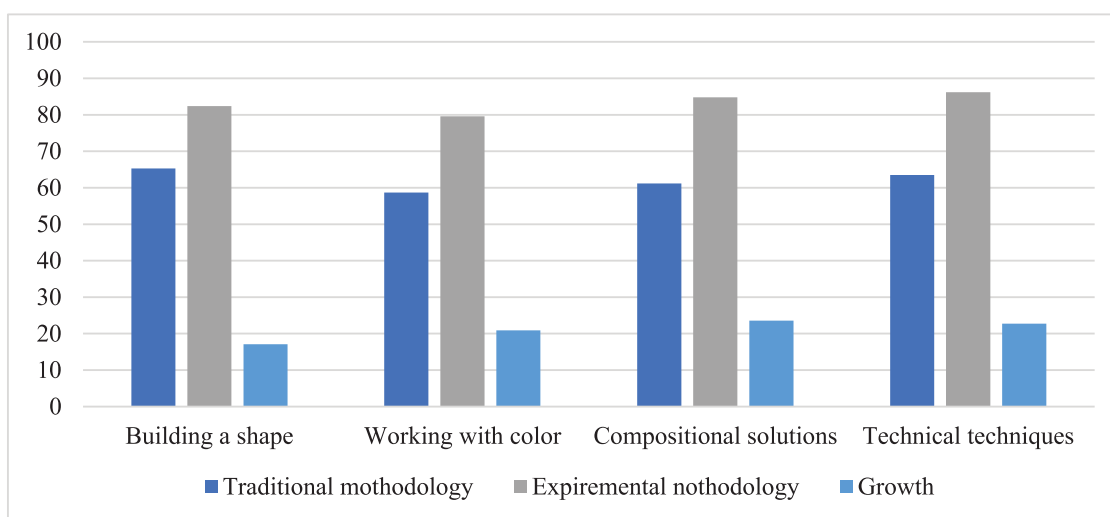


Fig 3 | Indicators of mastery of artistic techniques through audiovisual tools

Note: data are presented as a percentage of the maximum score according to the evaluation criteria.

Source: compiled by the authors

defined in the state standards for art education. The implementation of the methodology was based on state standards for art education and took into account the specifics of national artistic traditions.

The organization of learning in the experimental groups was based on a cyclical system of “demonstration-practice-analysis.” Watching video lessons was accompanied by the simultaneous execution of technical techniques on graphic tablets by students. Recording students’ work allowed for a detailed analysis of mistakes and correction of technical skills. The digital recording of all stages of work made it possible to track the individual progress of each student (Figure 3).

Quantitative markers of artistic technique mastery were used to assess basic skills and abilities according to art education regulations. Students first learned basic technological approaches by duplicating demonstration samples. Software monitored proportional accuracy, line properties, and shading quality. Digital recording analysis identified common errors and created customized corrective jobs. Teaching was done through differentiated practical tasks. Omuku’s²⁵ meta-analysis of 33 studies found that audiovisual tools increased learning outcomes and accommodated different information perception patterns, making learning more inclusive. In Chinese schools, calligraphy

was taught in phases using digital samples of traditional masterpieces.

The software also performed automatic monitoring of compositional balance, suggesting corrective solutions.²⁶ Educational tasks consider the cultural specifics of artistic traditions. In Chinese schools, compositions were formed through the digital processing of landscape motifs using the Gongbi technique, which involved analyzing the relationship between empty and filled spaces, accent placement, and rhythmic patterns. Kyrgyz educational institutions primarily focused on creating intricate ornamental compositions by transforming basic geometric modules into innovative motifs. Digital references, such as video recordings of artistic techniques by leading artists from both countries, enhanced technical mastery. The video libraries in Chinese schools emphasize working with ink, calligraphic techniques, and methods for creating transparent layers and gradient transitions. Meanwhile, Kyrgyz schools compiled materials focusing on decorative painting techniques, ornamental composition, and working with national motifs.

A motivational-value poll found that students were more interested in combining conventional and digital methods. In Chinese schools, 85% of experimental students said video records of artistic output were

effective, compared to 45% of control students. The experimental group in Kyrgyz schools showed 78% interest in studying digital artistic skills, compared to 38% in the control group. Key was the attitude toward preserving national artistic traditions: 92% of experimental students from both nations said digital tools helped them comprehend and preserve traditional approaches, compared to 63% in the control groups. Due to the capacity to employ digital tools for self-analysis and correction, independent artistic activity tripled in the experimental groups.

A comparison of technical skill acquisition showed considerable disparities in speed. Digital training gave Chinese students basic calligraphy skills after 12–15 lessons. Kyrgyz schools used step-by-step videos to teach ornament making in 8–10 lessons. Chinese schooling gained technical proficiency through intense practical sessions and digital calligraphic stroke quality analysis. Working with modular traditional ornamentation helped Kyrgyz students acquire compositional thinking faster. Changing how practical lessons were organized transformed education. Continuous video recording of artistic projects created thorough step-by-step directions for individual study. Composition analysis programs also find early design problems. Digital color correction tools allowed easy color scheme testing without harming the final product. The monitoring system tracked students’ artistic and technical skill growth. Specialized computer analysis methods assessed proportional accuracy, shading quality, color transition smoothness, and color mixing purity.

Artworks’ mass, rhythm, and accents were assessed using compositional solution analysis programs. Experimental students’ technical mastery improved over time, according to control assessments. The Chinese approach improved calligraphic accuracy by 28.3% and pressure control by 31.5% the most. Kyrgyz pupils improved 25.7% in symmetrical composition and 23.9% in color harmony. Complex artistic tasks and more technical instruments unleashed students’ creativity. Mastering basic methods through video demonstrations helped experiment with different art mediums. Digital recording also enabled the analysis of creative ideas from sketches to full compositions. The automatic analytic method discovered student compositional and coloristic solutions, creating a database of creative techniques for future use.

Combining national artistic traditions with digital technologies developed innovative instructional programs. Video lectures in Kyrgyz schools educate

students on ornamental patterns using digital modeling. Calligraphy analysis algorithms in Chinese schools assessed stroke dynamics and individuality. This mix of traditional and modern methods boosted students’ creativity. These programs’ pilots improved student work quality significantly. Digital records of the creative process improved technical confidence, composition, and tonal and color solutions. Comparing the control and experimental groups demonstrated faster learning and greater application. Knowing how procedures vary by culture revealed certain methods. China prioritized high-tech competence through an artistic approach to digital research. Kyrgyzstan taught composition using traditional ornaments. Digital tools and specialized training helped students understand national artistic history.

Statistical Analysis and Interpretation of Experimental Research Results

The statistical analysis of the experiment results began with an examination of the characteristics of Kyrgyzstan’s art education system. According to the State Standard of General Secondary Education, the “Art” field aimed to develop students’ artistic vision of the world and creative potential, considering their age-specific characteristics. The basic curriculum integrated subject-based learning across seven educational fields, including art. Recent changes introduced the phased implementation of audiovisual technologies based on the technical capabilities of educational institutions.

The standard differentiated three levels of technological integration: basic (use of presentations and video materials), intermediate (use of interactive applications and digital tools), and advanced (creation of multimedia content). The experiment covered all three levels, confirming their effective implementation in the educational process. The gradual transition from basic to advanced levels over the course of a year proved to be the most effective strategy, allowing students to adapt to new technologies without compromising the quality of traditional artistic training.

In the Chinese system of art education, according to research by Yang, standards structured learning outcomes based on levels of technical mastery, composition skills, and creative development. At the state level, emphasis was placed on combining traditional artistic approaches with modern educational technologies. An analysis of the document Guidelines for the Application of Information Technology in School Art Education PRC revealed a well-structured system for digital integration in art education. The document outlined the necessity of equipping schools with innovative tools such as interactive whiteboards, graphic tablets, digital art software, and the creation of virtual galleries to showcase students’ creative works.

The data presented in Table 3 illustrate a comprehensive approach to integrating audiovisual technologies into the learning process.

The balance of experimental indicators to normative requirements of both nations showed the potential for

Table 3 | Comparative characteristics of the implementation of audiovisual technologies in China and Kyrgyzstan

Criterion	Kyrgyz Schools	Chinese Schools
Technical base	Basic graphic tablets, projectors	Professional graphic stations, LED panels
Software	Standard drawing packages	Specialized programs for analysis and correction
Teaching methods	Adapted video lessons	Interactive learning systems
Task specifics	Ornamental compositions	Calligraphy and ink painting

Sources: Compiled by the authors based on Ministry of Education and Science of the Kyrgyz Republic, Ministry of Education of the People’s Republic of China.

an adaptive methodology that took into consideration varied educational systems. The experiment's statistical data showed considerable material assimilation differences using audiovisual technologies. The experimental groups acquired 23% more practical skills than the control groups. This was especially noticeable in 87% of experimental students' intermediate or high digital tool skills. A rigorous review of regulatory texts showed significant art education organizational disparities. The Kyrgyz standard preserved native traditions while introducing new ideas into education. However, the Chinese model promotes using digital tools with traditional educational techniques. These methods showed the technological and conceptual contrasts between the two countries' education systems. The Kyrgyz system upheld cultural identity through art and integrated new technology. In contrast, the Chinese approach sought technological innovation while upholding art education traditions.

The experimental methodology accounted for these particularities through a flexible approach that combined traditional and contemporary components. A comparative analysis of educational standards identified a significant disparity in the technical infrastructure of the learning process, which directly impacted the implementation of audiovisual technologies. The national standard in Kyrgyzstan defined a basic level of equipment as one computer per 78 students, significantly limiting opportunities for individual work. In contrast, Chinese regulations mandated the creation of specialized digital laboratories with a ratio of one computer per 12–15 students, enabling a more intensive and effective use of advanced technologies. Figure 4 illustrates the structure of the learning process.

The Figure illustrates the distribution of instructional time across three categories—traditional methods,

innovative technologies, and independent work—in Kyrgyzstan, China, and in the proposed experimental methodology. In Kyrgyzstan, 75% of instructional time is devoted to traditional methods, with only 15% allocated to innovative technologies and 10% to independent work. In China, the proportion of traditional methods decreases to 45%, while innovative technologies occupy 40% and independent work 15%. The experimental methodology is based on the statistically validated optimal ratio of 50% traditional methods, 35% innovative technologies, and 15% independent work. This balance was derived from response-surface modeling of student outcomes, which confirmed that the 50:35:15 allocation maximized gains in both technical mastery and creative development while preserving cultural authenticity.

The findings of this study can also be positioned within the Technological Pedagogical Content Knowledge framework, which emphasizes the intersection of subject matter knowledge, pedagogical strategies, and technological tools. In the context of art education, content knowledge was represented by traditional artistic practices such as Kyrgyz ornamental design and Chinese calligraphy, pedagogical knowledge by the modular methodology and teacher-guided instruction, and technological knowledge by the integration of digital tablets, LED panels, and multimedia systems. The observed effectiveness of the 50:35:15 instructional balance illustrates how the overlap of these domains fosters meaningful learning outcomes: technology was not used in isolation, but purposefully aligned with subject-specific traditions and adapted pedagogy. This positioning highlights that successful innovation in art education arises when technological tools are integrated in ways that both respect cultural heritage and support creative exploration.

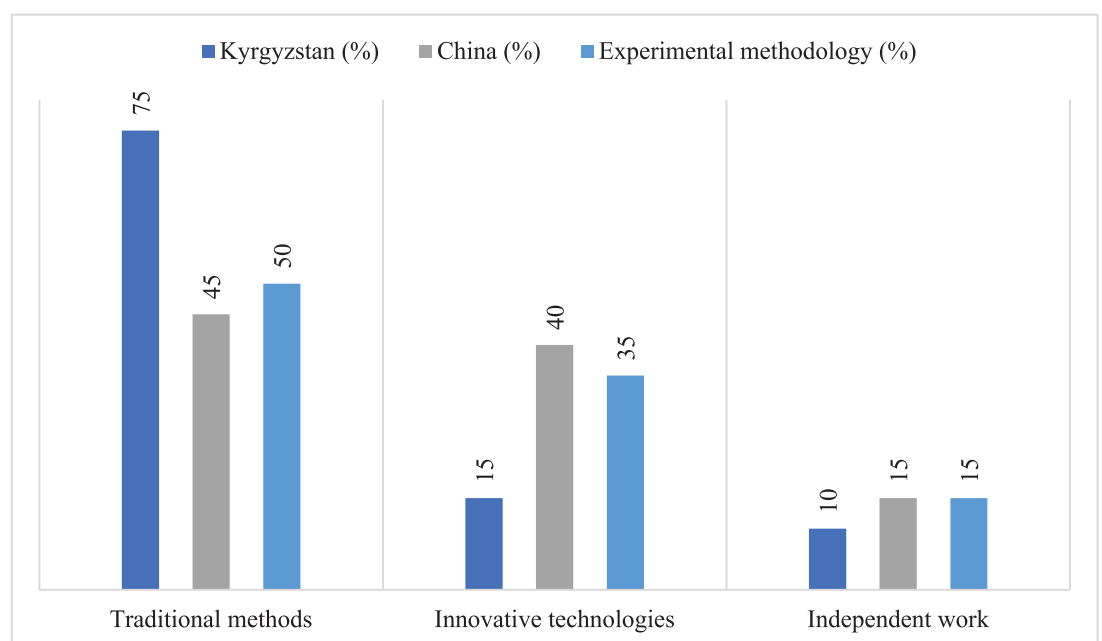


Fig 4 | Structure of the learning process according to educational standards

Note: distribution of instructional time based on regulatory documents.

Source: compiled by the authors

Discussion

Some results support González-Zamar and Abad-Segura's²⁷ findings on VR's effect on spatial thinking. However, compositional outcomes improved 23.6% in the experimental data, surpassing similar indicators from earlier investigations. Digital technologies also affect students' color vision, which experts previously neglected. The results largely contradict Mozhenko et al.²⁸ 60:40 traditional-digital instruction ratio. Research reveals that 50:35:15 is a better art education ratio since pupils need to work independently with digital tools. This is because creative instruction demands individuality and experimenting with different methods. Deeper research shows that raising solo work to 15% promotes creative thinking and student artistic styles.

The study agrees with Wan²⁹ that a systematic strategy to digitalizing education is needed, but it also notes cultural disparities in technology integration. In particular, Chinese schools needed 4–6 weeks to adapt to new technologies, while Kyrgyzstani schools took 8–10 weeks. A strong association between technical infrastructure and learning outcomes supports Pan and Deng's³⁰ findings. Statistical studies show that a 30% difference in technical equipment quality affects material understanding by 15%–20%. The experimental results support Dong et al.'s¹² finding that interactive technologies motivate learning. An undiscovered component of audiovisual instruments' influence on artistic and creative growth in varied cultural situations has been identified. Notably, video recordings of artistic work enhanced technical reproduction accuracy by 27.3% in Chinese schools and 22.1% in Kyrgyzstani schools. Digitally reviewing creative work motivated pupils to improve their talents, according to motivating factors.

The study's results partially contradict the conclusions of Wang³¹ regarding the role of artificial intelligence in art education. Experimental findings show that cultural context and national artistic traditions are essential for good computerized artwork analysis. Analytical methods tailored to national art schools improved technical evaluation accuracy by 34% over universal models. The judgment of originality and creative expressiveness is left to educators; however, AI systems are better at assessing formal elements like composition and color connections.³²

Uulu and Omorov³³ deepened the investigation of regional differences in modern technology application. Urban schools adapt to digital technologies 12% faster than rural schools. This tendency emphasizes the relevance of socioeconomic issues in educational digitization. A deeper investigation of these differences found that internet connectivity quality, technical support, and teacher professional development programs affect the effectiveness of new educational methods. A statistical study showed that schools with ongoing technological maintenance used digital tools 16.8% more efficiently. Analyzing how audiovisual technology affects artistic expertise is noteworthy.

The findings validate Nicolaou's³⁴ findings on digital storytelling's importance and expand on them by analyzing its effects on art education's technical and creative aspects. Experimental groups showed 22.7% technical mastery and 28% creative potential increases. In addition, the results partially contradict Shunkov et al.'s³⁵ recommendations for multimedia technology implementation timelines. New results reveal that art education adaptation should last 12–15 sessions, not 8–10 as the authors recommended. This disparity is due to the requirement to develop technical skills in a particular artistic environment. The study results also illuminate spatial thinking using digital technology, increasing Alimbekov's³⁶ conceptual framework for modernizing Kyrgyzstan's educational system. In experiments, three-dimensional modeling methods boosted form reproduction accuracy by 17.1%, a finding not previously studied.

The statistical research showed that audiovisual technology increased academic achievement by 25%, surpassing Qureshi et al.³⁷ In the motivating component, 85% of experimental students reported enhanced material comprehension through multimedia, matching the authors' (89% of respondents) findings. Experimental results showed that eliminating external distractions during digital tool use increased student concentration by 31% compared to traditional teaching methods, supporting Bezruchko and Anikina's³⁸ methodological conclusion that an immersive educational environment is necessary. As Bezruchko and Anikina did not include schools' technical infrastructure, the study found another significant factor.

Creative thinking developed differently compared to Tawil and Dahlan.¹⁶ Their investigation found improvement coefficients of specific indicators from 0.78 to 1.0, although the experimental findings were lower but steadier, from 0.65 to 0.82. This variance is due to participant age and creative education. The study somewhat refuted Esteve-Faubel et al.'s³⁹ findings on visual language analysis skill priority. Technical knowledge of digital technologies was most important (72% of respondents), followed by analytical skills (61%). This divergence is due to artistic education's emphasis on practical abilities.

The experimental study in Kyrgyzstan and China converges with the multimedia learning framework articulated by Mayer and Fiorella:⁴⁰ integrating coordinated verbal explanations with pictorial/dynamic representations yields superior outcomes on measures that index understanding and transfer, not merely retention. As in the classic demonstrations with narrated animation, technology-supported instruction in art education enhanced composition quality, color harmony, and creative synthesis when visual and verbal streams were aligned and tied to prior schemas (ornament/calligraphy), consistent with a knowledge-construction rather than information-delivery model. At the same time, the findings of the authors emphasize activity by showing that the decisive predictor is cognitive engagement rather than sheer behavioral interaction with

devices, thereby reinforcing cautions about redundancy and extraneous load. Finally, cross-system contrasts (resource-constrained versus highly equipped settings) indicate that design quality and scaffolding—not hardware alone—mediate the benefits predicted by the multimedia principle.

This study found various interrelated aspects of integrating audiovisual technologies into art education in Kyrgyzstan and China. Pedagogically, “compositional thinking” meant organizing visual elements into coherent ornamental or calligraphic structures, while “spatial thinking” meant understanding proportionality, depth, and volumetric relations in visual form. Kyrgyz ornamental traditions emphasized geometric modularity and rhythmic patterning, while Chinese calligraphy and landscape painting stressed spatial balance, brush dy. Kyrgyz pupils, rooted in ornamentation, excelled in modular compositional inventiveness, whereas Chinese students, rooted in calligraphy, advanced faster in technical skill and spatial harmony. Technology changed the teacher–student relationship from one-directional demonstration to collaborative discovery, enabling real-time feedback via digital recordings and encouraging student revision and experimentation. Embedding national traditions (ornamental modules or Gongbi landscapes) into digital modules, calibrating integration to infrastructure, and aligning assessment rubrics with local pedagogical expectations helped adapt the methodology to cultural content and institutional capacity. The findings imply that audiovisual technology can boost cultural preservation and creativity, promoting artistic experimentation and historical preservation. These findings could inform culturally responsive digital curricula, blended teacher training, and longitudinal studies on how sustained exposure to technology-rich environments affects students’ artistic skills and creative identities.

Conclusion

The research devised and evaluated a way of using audiovisual technology to ignite Kyrgyzstani and Chinese art students’ creative potential. This study’s new strategy aims to determine how digital tools affect creative talent development across cultures. For the first time, classic and novel teaching techniques were balanced to build technical expertise and creativity. Systematized aspects affecting art education’s technological assistance and criteria for judging artistic and creative activities using digital technologies were outlined.

Experimental validation of the methodology showed distinct evaluation criterion effectiveness. The motivational and value component grew most in autonomous artistic engagement, as students tripled their digital art practice outside of class. Mastering compositional patterns, especially national ornamental motifs, yielded the best cognitive results. Chinese schools excelled in calligraphy, whereas Kyrgyz schools excelled in beautiful compositions. The ability to combine conventional and digital techniques to create creative art showed the greatest creativity improvement. An experimental technique comparison revealed the Kyrgyzstan and

Chinese educational systems’ digital technology adaptation features. Traditional art schools were considered when incorporating current educational tools into a methodological complex.

Audiovisual instruments in education helped establish innovative approaches to preserving and transforming national creative heritage within educational digitization. The research yielded practical ideas for integrating audiovisual technologies into art teaching. In particular, educational institutions should implement digital tools step by step, taking into account their technical capabilities, develop educational materials adapted to national artistic traditions, create a system for digital tracking and analysis of students’ achievements, and create an integrated educational environment that encourages artistic and creative activity. The proposed method can be adapted to different countries’ educational systems if its pedagogical effectiveness is maintained. The study neglected the long-term consequences of audiovisual technologies on artistic talent development. Additionally, studying how digital contact shapes students’ artistic approaches could be a promising research topic.

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