Д. А. Шабалина, Е. В. Соболева, З. В. Шилова, Н. В. Гавриловская, В. Л. Снежко

Использование средств технологии дополненной реальности в обучении специалистов сферы культуры как важное условие их подготовки

Проблема и цель. Подготовка специалистов в области культурологии предполагает использование иммерсивных технологий при формировании востребованных профессиональных компетенций выпускников в соответствии с их будущими трудовыми функциями и международными аспектами культурной политики. Цель исследования – выявить особенности применения средств технологии дополненной реальности при обучении специалистов сферы культуры и искусства для повышения качества их подготовки.

Методы исследования. Методология основывается на анализе потенциала технологии дополненной реальности для высшего образования, поддержки инициатив ЮНЕСКО, подготовки профессионалов в сфере культуры. При разработке системы заданий в среде дополненной реальности учтены положения профессиональных стандартов специалистов области искусства, стратегии государственной культурной политики в России. Применяется приложение SketchAR – программа, с помощью которой пользователь в реальном мире манипулирует с виртуальными изображениями на поверхности. Зафиксировано 92 студента факультета истории, политических наук и культурологии Вятского государственного университета (Российская Федерация). Приложения AR включены в изучение дисциплин «Современные информационные технологии», «Медиакультура», «Медиаобразование» и практику студентов. Использованы авторские материалы для контрольного теста, включающего 40 заданий. Метод статистической обработки: критерий \( \chi^2 \) (хи-квадрат) Пирсона.

Результаты. Применение AR в экспериментальной группе реализовано по алгоритму: этап проверки технического обеспечения и тестирования работы камеры; этап изучения интерфейса, функциональных возможностей; этап применения AR на занятиях «Медиакультура», «Медиаобразование»; этап реализации AR-проектов в рамках ознакомительной, учебной практики. Выявлены статистически достоверные различия в качественных изменениях, произошедших в педагогической системе (\( \chi^2 = 6,821; p < 0,05 \)).

В заключении описываются особенности применения средств технологии дополненной реальности в деятельности специалистов по культурологии (визуализация информации, установление временных и эмоциональных связей и т.п.). Сформулированы трудности предлагаемых нововведений: высокая стоимость, технические сбои оборудования в учреждениях культуры.

Ключевые слова: культурная политика, коммуникация, цифровая технология, трудовые функции, учреждения культуры и искусства, виртуальные объекты, SketchAR

Ссылка для цитирования:
The usage of augmented reality technology tools as an important condition for the training of specialists in the field of culture

The problem and the aim. The training of specialists in the field of cultural studies implies the use of immersive technologies in the formation of demanded professional competencies of graduates in accordance with their future labor functions and international aspects of cultural policy. The purpose of research is to identify the features of the usage of augmented reality technology in the training of specialists in the field of culture and art to improve the quality of their training.

Research methods. The methodology is based on an analysis of the potential of augmented reality technology for higher education, support for UNESCO initiatives, and the training of specialists in the field of culture. When developing a system of tasks in the environment of augmented reality, demands of professional standards for specialists in the field of art, the strategy of state cultural policy in Russia were considered. The SketchAR application, with which a user manipulates virtual images on a surface in the real world is used. 92 students of Vyatka State University (Russian Federation). AR applications were included in the study of the disciplines “Modern Digital Technologies”, “Media Culture”, “Media Education” and students’ practice. The authors have developed materials for a control test, including 40 tasks. The statistical data processing used Pearson's $\chi^2$ (chi-square) test.

Results. The usage of AR in the experimental group is implemented according to the algorithm: the stage of checking the technical support and testing the operation of the camera; the stage of studying the interface, functionality; stage of AR application in classes “Media culture,” “Media education”; stage of implementation of AR projects within the framework of introductory and educational practices. Statistically significant differences in qualitative changes in the pedagogical system have been identified ($\chi^2 = 6,821; p < 0,05$).

In conclusion describes the peculiarities of the use of augmented reality technology in the activities of cultural scientists (visualization of information, establishment of time and emotional connections, etc.) are presented. The difficulties of the proposed innovations are formulated: high cost, technical failures of equipment in cultural institutions.

Keywords: cultural policy, communication, digital technology, labor functions, cultural and art institutions, virtual objects, SketchAR

UNESCO, within the framework of international cooperation, performs such functions as: the implementation of advanced research on the forms of education, science, culture, and communication claimed by the world of the future; supports the promotion, transfer and sharing of knowledge [1].

In 2021 the President of the country announced the next year being a Year of Folk Art and Intangible Cultural Heritage of the Peoples of Russia. This was done to popularize folk art and preserve cultural traditions, monuments of history and culture, ethno-cultural diversity, cultural identity of all peoples and ethnic communities [2].

The Plan and Program for 2022 broadly cover all intersectoral areas and include major creative event projects, scientific, educational, publishing projects, involve the support of folk arts and crafts, artisans, the preservation of objects of tangible and intangible cultural heritage, systemic comprehensive measures to improve the legislative framework and regulatory and legal support of the industry.

The main tasks are updating book funds, repairing buildings, attracting young specialists, and providing cultural institutions with uninterrupted Internet [3]. Important areas, according J. Li, are scientific and methodological support, the usage of digital technologies, including augmented reality (AR) technologies [4].

The achievement of all these purposes, according to the conclusions of E. A. Pleshkevich, implies an improvement of the quality of training of future specialists in the field of cultural policy and management or in the field of mass communications: the inclusion of innovative means in the training and organization of students’ practice, the interaction of all participants in the didactic process [5].

K. V. Cherkasov, N. S. Chistyakova, V. V. Chernov conclude that the training model in the modern digital world should involve the formation of a creative personality that will be capable of independent creative search for solutions to professional problems, the usage of augmented reality technology in various areas of information and communication and sociocultural activity [6].

J. Bakka, S. Baldiris, R. Fabregat, K. Kinshuk argue that augmented reality technology has significant educational potential and is a universal means for the development of memory, attention, thinking [7]. This technology achieves a new form of digital data management and ordering; new quality of information visualization; higher level of communication [8].

However, the usage of augmented reality technology tools in teaching students, according to A. V. Grinshkun et al., causes many problems of technical (cost of equipment), methodological (finding a relationship between traditional didactic methods, means and capabilities of AR), psychological character (headaches, aggression, "immersion" in the virtual world) [9].

Despite the fact that the authors described the conditions for training teachers of digital school for the usage of augmented reality technology, and that E. V. Soboleva, N. L. Karavaev identified the conditions for effective professional-oriented communication in the context of virtual network interaction [10], significant problems for the use of AR technology in training cultural specialists could be as follows:
correlation of planned training results, formed competencies of specialists combining humanitarian training in the field of art and cultural policy with applied skills of AR project management;

• selection of AR application, which corresponds to the labor functions included in the professional standard of specialists in the field of cultural policy and management or in the field of mass communications, and to directions of the state cultural policy strategy in Russia as much as possible.

These conclusions largely coincide with the conclusions formulated by T. V. Silina-Yasinskaya based on the results of studies at the Faculty of Journalism of the Belarusian State University [11]. She describes the range of organizational problems, the difficulties of methodical support of the educational process and technical failures during industrial practice.

The hypothesis of research – the use of AR applications in the training of future cultural specialists will provide additional conditions for the development of demanded digital skills (compilation of automatic requests for user parameters; data search in assumed sources; analysis and assessment of information quality; organization and storage of cultural funds; uphold the ethics during virtual interaction, etc.).

So, the purpose of the work is to identify the peculiarities of the usage of augmented reality technology when training specialists in the field of culture and art to improve the quality of their training.

The following main tasks were defined:

• to describe the specifics of labor functions according to the professional standards of specialists in the field of culture (and in particular for the promotion and distribution of media products), taking into account the capabilities of AR technology applications;

• to supplement the existing system of requirements for the usage of augmented reality technology in the training of highly qualified specialists in the field of culture and art, taking into account the directions of the strategy of state cultural policy in Russia;

• to describe specific ways of using applications and tools of augmented reality technology to train in-demand employees in the field of culture and art;

• to confirm the effectiveness of the proposed training option experimentally.

Materials and methods

The following methods were used: theoretical analysis and generalization of literature when describing the potential of augmented reality (AR) technology for higher education, to support UNESCO initiatives, when identifying problems of their introduction into the training of specialists in the field of cultural policy and management or in the field of mass communications. Applications and means of augmented reality technology, which are used in higher education for the training profile "Culture of mass communications" (bachelor's degree), were analyzed.

The authors consider augmented reality as a technology that includes virtual information into the real world, which "visually" coexists in the same space as the person himself.

The practical experience of using AR tools in the field of art and cultural policy of Russia was studied: 3D BOOM applications, ARTEFACT augmented reality platform, Paleo AR-tour,
Anna Akhmatova AR, HP Reveal, mono-application Conteng AR, Quiver, Live Coloring, book "Cave People" with AR-technology on Blippar application base, (DEVAR kids/DEVAR), Mind Map AR, ZOME, JigSpace, SketchAR, etc.

The provisions of professional standards for cultural workers, strategies of state cultural policy in Russia were considered when developing a system of training tasks based on AR applications.

The following criteria for the analysis and selection of AR tools were used: resource type (application/platform), financial basis (paid/free), functionality (considering the specifics of the specialist's work), interface and design, existing experience in using the AR tool in practice.

The SketchAR service was selected on the base of proper analytical work. Its advantages are free functionality, an intuitive interface, the opportunity to "revive" static images, to attach your own (or from the program database) 2D and 3D objects to objects and illustrations, and the presence of methodological developments for installation with programs. The application can be used in the audience, online, and in individual training.

The test form with 40 tasks was used to evaluate the input conditions. Types of questions: correlate values, select the correct answer, fill out omissions in the table/sentence, arrange actions in the correct order, etc. Testing included the following blocks "Fundamentals of Cultural Studies" (20 points), "Modern Information Technologies" (20 points).

So, during the initial diagnosis each student scored from 0 to 40 points. To determine the level of training (by the sum of 2 blocks), "low" (from 0 to 19 points (inclusive)), "medium" (from 20 to 34 points (inclusive)), "high" (more than 35 points) levels were introduced.

The study was attended by 92 students of Vyatka State University (Faculty of History, Political Sciences and Cultural Studies). All respondents are first-year or second-year students. Field of training: 03.01.02 Cultural studies (bachelor's degree). AR applications are used in the study of the disciplines "Modern Information Technologies," "Media Culture," "Media Education" and during various types of practices (educational, introductory).

Practice bases: regional and city libraries, creative houses, regional and city museums. The study was conducted in 2021-2022. The average age of respondents was 20 years (60% of female and 40% of male).

Statistical data processing was performed using Pearson's $\chi^2$ (chi-square) test.

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**Literature review**

The 2030 Agenda for Sustainable Development [12] notes that the spread of information and communication technologies has opened opportunities to accelerate socio-economic progress and bridge the "digital gap." Augmented reality, according to J. Martín-Gutiérrez et al., is one of the promising innovative technologies to improve the quality of the educational process at the university, the development of science and culture [13].

According to the conclusions of S. G. Grigoriev, M. A. Rodionov, O. A. Kochetkova, virtual reality and its derivatives, such as augmented reality, have significant potential for the development of public relations and educational sphere [14].

G. A. Kameneva, T. A. Bondarenko convincingly prove that digital means of training graduates at the university have powerful didactic potential for the formation of
multilingualism and intercultural communication [15]. The authors describe and analyze the possibilities of video materials, virtual walls, online excursions. However, as shown by M. Fan, A. N. Antle, J. L. Warren, teachers and students in higher school use augmented reality tools mainly for modeling or studying phenomena and processes that are difficult to implement in real conditions [16].

V. Marín-Díaz, M. López-Perez, B. Fernández-Robles note that augmented reality is a special information and educational environment that is directly or indirectly supplemented by elements of the physical world using digital data in the "here and now" mode [17]. The didactic potential of modern digital means of technology (AR, VR, 3D) is described by Z. I. Ivanova [18]. The author presents forms of creating new educational materials that would be interesting and clear to a modern young man and at the same time would give systematic knowledge about the subject.

A. V. Grinshkun determines that augmented reality technology is a set of means and methods that allow you to create a visible three-dimensional space for a person. In this space new objects are embedded in the real environment in which a person is currently located. Moreover, the generated virtual objects change together with the real environment. By the combination of these factors, virtual objects are perceived as elements of reality [19]. The author emphasizes that the usage of augmented reality technology in the training of highly qualified specialists allows superimposing computer graphics or text information into the content of the real physical world in the present tense. Indeed, there is a feeling that information virtual objects exist in a real environment. These circumstances contribute to the intensification of interest, cognition, research, and creativity [20].

A. V. Ivanova also offers a structure of augmented reality applications for studying at a university. The designed structure includes the following modules: cameras for tracking, storing objects, visualization devices and the user interface [21].

H. Papagiannis, summarizing the experience of specialists in the field of AR, concluded that most often in higher education, the augmented reality technology is presented by following means: interactive digital objects in text, video or audio format expressed using computer graphics [22].

F. Marsel, describing the capabilities of AR technology for training engineers, defines augmented reality as a system that provides the ability to fill real physical space with 3D models, text, images and other virtual objects in the most realistic way [23].

V. V. Letkov analyzes the didactic capabilities of the simulator to study and understand the structure of volumetric figures [24].

If we directly consider the experience of training specialists combining humanitarian training in the field of art and cultural policy with applied skills in managing AR projects, then important results are formulated in the work of N. V. Vasilyeva [25]. She notes that to organize the information space, attract readers, enrich funds, it is necessary to introduce AR funds and applications into library activities. For example, to combine the real and virtual worlds. The new "augmented" space will allow you to visualize the necessary information and simplify access to it. N. V. Vasilyeva analyzes a variety of applications based on the principles of AR, and comes to the conclusion that generally accepted AR solutions that optimize the processes of librarianship have not yet been developed.

C. Diez Carrera, studying the problems of training cultural specialists in demand in the international labor market, points out that at present the functions and services of a
traditional library relate to the functions and services of a digital library. This direction of development of librarianship should be reflected in the qualitative change in the higher education system [26].

According to the professional standard cultural and art workers (curator of museum values, guide, animator artist, etc.) should perform the following functions: organizational and information support; organization of works on formulating the artistic plan of the project and management of its implementation; holding cultural and educational events; administrating of sites/portals, network social services; organization of work with the fund of rare and valuable exhibits, etc. [10]. All these kinds of activity involve the use of digital technologies, including AR tools [27].

Analyzing the various functions of augmented reality applications that stimulate the development of a specialist in demand by the digital society, we conclude that most of them correspond to the labor actions of a cultural worker and the directions of the strategy of state cultural policy in Russia and the world.

However, as E. A. Ignatiev shows, there are practical difficulties in implementing the identified potential capabilities and functions of AR applications for their application in practice in the training of future cultural specialists [28]. There is an objective need for the teacher of higher education to change the entire methodological training system.

Indeed, considering a system of educational tasks based on AR applications in the training of specialists for a modern cultural institution should include a stage of comprehension and selection of digital resources. Digital resources, according to M. Fan, A. N. Antle, J. L. Warren, cannot be limited by the current (momentary) interests of didactic application [16]. They must comply with the labor functions included in the professional standard of cultural and art workers and the directions of the strategy of the state cultural policy of Russia as much as possible. As A. V. Grinshkun et al. cogently prove, it is necessary to carry out a set of works on the organization of an "augmented" information space of a cultural institution (library, museum, circus, theater, concert hall, exhibition hall), the orientation of its content, both for the purposes of education and on specific features of future professional activity [9].

The "augmented" information environment should contribute not only to achieving the priorities of the state cultural policy strategy in Russia, but also to being personal oriented. The "augmented" environment should consider the needs of cultural workers themselves and consumers of their services.

Thus, there is an objective problem, which is expressed in the need to identify the peculiarities of the use of applications and AR tools when training specialists in the field of culture and art to improve the quality of their training.

**Research program**

The main purpose of the experiment was to test the effectiveness of the usage of augmented reality tools in training future cultural specialists to improve the quality of their training.

Preparatory phase. Modern achievements of science and technology regarding the spectrum of application and specific possibilities of augmented reality technology for studying at the university were analyzed: games, recording 360-degree cameras (parachute
jumping, attractions, wildlife, underwater world, dinosaurs, etc.), AR applications for changing the faces of users, measuring the distances of actual objects, various puzzles, as well as training programs (mainly on anatomy and astronomy).

The didactic possibilities of augmented reality tools were determined, working to form the demanded professional skills and skills of future specialists in the field of culture and art as effectively as possible.

In accordance with the register of collective agreements on the practical training of students between universities and enterprises, it was evaluated if city cultural institutions are ready and able to use AR funds in their activities (technical, organizational and management, information).

To evaluate the input conditions, a test form of 40 tasks was used. Testing included the blocks "Fundamentals of Cultural Studies" (20 points), "Modern Information Technologies" (20 points).

When designing tasks for the block "Fundamentals of Cultural Studies," the materials of the fund for assessing the residual knowledge of students in disciplines that form general professional competencies were used.

Examples of tasks from the "Fundamentals of Cultural Studies" block are as follows:
1) choose one formula from the proposed ones that corresponds to the calculation of book availability per registered reader;
2) establish the correspondence between the scientific method used in cultural studies and its characteristics;
3) fill in the table "Basic cultural schools" (fields - "Name of the theory," "Authors," "Content of the theory").

Examples of tasks from the "Modern Information Technologies" unit are as follows:
1) there is a sequence showing the procedure for starting the PowerPoint application. Arrange the actions in such an order that the user can actually open the editor to create informative slideshows or presentations;
2) correlate the tools of the Review tab on the Quick Access toolbar with their functions;
3) correct the mistake that was made in writing the address of the search engine site.

So, as a result of the starting diagnosis, each student scored from 0 to 40 points.

To determine the level of training (by the sum of 2 blocks), the levels "low" (from 0 to 19 points (inclusive)), "medium" (from 20 to 34 points (inclusive)), "high" (more than 35 points) were initiated.

Based on the test materials, control and experimental groups were formed. Each has 46 people. The average age of respondents is 20 years (60% of female and 40% of male).

Experimental phase. In order to implement the conclusions obtained during the training of specialists in the field of culture and art, a decision was made to study the course "Modern Information Technologies" (theoretical analysis of the topic "Message, data, signal, attribute properties of information, indicators of information quality, forms of information presentation," "Information Transmission Systems," etc.) to consider in detail the technology of usage of augmented reality and AR applications of educational purpose.

The authors chose the SketchAR application of the entire range of tools (Quiver, Star Walk, Mind Map AR, HISTARS, BBC Civilisations AR, AR Ruler, Arloon chemistry, Arloon geometry, ZOME, JigSpace, SketchAR).
SketchAR (https://sketchar.io/) is an application with an intuitive and user-friendly interface. It allows to visualize information, make 3D drawings. The official website is entirely in English. The service has no age restrictions. The application can be downloaded to a smartphone. It is fully customizable to suit the interests of the user. The program is being regularly improved and introduces new technologies and functions. For example, creating your own mask on Snapchat (face reconstruction, change in appearance). The program is free for educational organizations.

SketchAR is an application with which the user sees a virtual image on the surface on which he plans to translate the picture. In other words, SketchAR is a "virtual copy paper." The user holds the phone in one hand, "sees" the virtual drawing and outlines the virtual lines on paper with the other hand. So, the tools and functions of SketchAR application correspond to the didactic goals of training of specialists in the field of culture and art as much as possible.

Further, while studying the topics "Media Education and Personality Socialization" (2 hours), "Internet and Virtual Reality" (2 hours), "Media Management as an Integrating System of the Information Era" (2 hours), students of the experimental group used the acquired skills to work in augmented reality when developing author's media projects about culture. During the introductory and educational practices students of the experimental group received applied skills in managing sociocultural projects in augmented reality.

Interpretation stage. Assessment and analysis of the results of the experiment, formulation of conclusions about the peculiarities of the usage of AR technology in the activities of a specialist in the field of culture and art were made.

**Research results**

Summarizing the concepts above we can conclude that augmented reality is a technology that appends virtual information into the real world, which "visually" coexists in the same space as the user himself.

The real experience of using AR in the activities of cultural and art institutions was studied. At the preparatory stage of the experiment, it was revealed that AR applications have a certain didactic potential for training specialists in the field of culture and art: the ability to gain theoretical knowledge within various virtual worlds and simulations; increase of involvement, motivation; development of intercultural communication; improvement of academic performance, quality of material understanding.

For example, the project "Time in Digital" was developed and implemented in the library service department of the Regional Scientific Universal Public Library named after I. A. Bunin. The idea is to send readers virtually through several floors to the library treasury - a book depository. The plot of the story "Late Hour" by I. A. Bunin was chosen for virtual delivery. The library space is revealed in two realities. Physical space, time where the author lives. The second reality is a non-physical memory space, where the hero reader is sent by strong-willed effort. The project was implemented by HP Reveal.

It is important to emphasize in the frames of the study that the information received by the user is not limited only to visual perception. Both hearing and touch can connect, contributing to the feeling of "immersion" in another reality.
AR tools in training allow you to:
• replace or supplement existing spatial objects;
• combine computer-generated information with a real environment;
• work with AR-based applications interactively and in real time.

Technological aspect. To come into contact with augmented reality, it is enough to have a smartphone, tablet, computer or AR-glasses, which are the technical shell of the technology. Gadgets must have special software and a camera.

Aspect of professional training of cultural and art specialists. Specific labor functions of specialists combining humanitarian training in the field of art and cultural policy with applied skills in managing socio-cultural projects, the implementation of which is possible with the support of AR applications, include:
• information service (exhibitions, excursions, films, etc.);
• organization of materials storage on various media;
• organization of work of funds and reference devices of cultural institutions in traditional and automated mode;
• conducting scientific research and educational and entertainment activities, etc.

So, for the development and subsequent implementation of an AR application in the field of culture and art, you will need: special equipment; software selection; creating the necessary scenarios to support various cultural activities; defining content.

Since SketchAR was chosen within the framework of the preparatory stage its capabilities precisely for the training of specialists in the field of culture and art should be noted:
• development of artistic skills, creation of works of art;
• support of research, engineering, design individual and collective work;
• creation of additional conditions for the integration of science technologies into the arts;
• expansion of physical reality horizons beyond the observed one.

Next, an algorithm was developed. Guided by him, teachers at Vyatka State University organized the study of AR technology within the framework of the discipline "Modern Information Technologies"; used AR funds at the topics "Media Culture," "Media Education," during the practice of students.

Stage I. Checking and setting up the technical support.
1.1. Within this stage, the student, with the support of the teacher, prepared a technical tool (computer/smartphone/tablet). Its operability is an important condition so that the user can analyze the surrounding space using the camera.

A set of requirements: if you need to draw on large surfaces, you will need a smartphone with TANGO technology, such as: Lenovo Phab 2 Pro or Asus ZenFone AR. For other smartphones SketchAR only works with A4/A5 paper formats.

1.2. Testing the work of the gadget and camera when working with ready-made augmented reality projects.

Stage II. Learning the interface, the main functionality.
2.1. Install the application and study the functionality of the AR tool, capable of finding real-world objects "necessary" at the request of the user.

Contradictions that the students of the experimental group had to solve were:
• hand in the frame could knock down sensors and the picture simply "comes out" of the frame;
• TANGO technology at the execution stage prohibits the use of the main camera and blocks it during operation. Students had to turn on the TANGO sensors and the main camera differently;
• TANGO technology does not work well and keeps virtual objects at close distances. However, the main advantage is the ability to draw on paper, traversing the contours of a virtual image.

2.2. Interaction with a cyberphysical device that recognizes a physical object and displays its "virtual" image on the computer screen.

In the study the interaction of specialists in the field of culture and art with the described AR system is considered as intellectually directed and cognitive activity, taking into account the specific features of future work and the direction of the strategy of state cultural policy in Russia.

AR applications provide certain didactic opportunities for training cultural specialists: the ability of obtaining theoretical information within a variety of virtual spaces and simulations; increased intensity, engagement and motivation; maintenance of multiculturalism; possibility of higher academic performance, improving in the quality of understanding the material.

2.3. "Binding" of a virtual object to a real one in a software environment for manipulation.

"Binding" by students of the experimental group was implemented due to label technology. The main advantage of label technology is the wide coverage of devices and stable operating. Today, smartphones are poorly oriented in space at relatively short distances. The camera must navigate the labels to clearly position and hold the virtual object on the real plane. The optimal label for SketchAR is a Circle. It turned out that for computer vision a square is a circle where angles are smoothed and weakly affect the quality of detection.

2.4. Then transform the object (rotate or move) and track changes in the user's coordinate system.

This part of the work was carried out by the students of the experimental group as follows: using four calibration marks, the application rebuilt the drawing according to the movement. In addition, Sketch AR can be reconfigured if the user is left-handed.

Stage III. Application of AR for topics "Media Culture," "Media Education."

With the help of Sketch AR students of the experimental group mastered methods of communication based on non-verbal forms of communication and using technical means and modern information technologies.

AR was included in the study of media reality, in the establishment of sociocultural connections between humans and mediacultural processes, in the study of patterns of mass communications, human interaction in the world of media; learning the language of media.

With the support of AR students of the experimental group were involved in the modeling of the roles and functions of specialists in the field of culture and art. There was an active formation of digital competencies in the future specialty. The conditions for the functioning of certain types of old and new media, an understanding of various ways of meaning and a variety of cultural interactions in the modern global information world were studied.
With all the conditions fulfilled, the students of the experimental group were able to immerse themselves in the world of Lewis Carol, see various ghost cities, visit the Island of the Dead Ships and Nautilus. With the help of an interactive guide they got acquainted with the history of various architectural structures, monuments, exhibits. The user can feel the world from the "fabulous" side that existed only in the Emerald City.

Stage IV. Application of AR in the framework of introductory, educational practice.

Let's give an example implemented by students of the experimental group.

Project "Technical support of the exhibition of books on history in persons." The capabilities of SketchAR were used for 3D models and the creation of "augmented reality". In the virtual world, a dinosaur waved its tail in the pictures, and an alien descended to the taking-off spacecraft. With the help of SketchAR various masks of kings and commanders were created, which visitors tried on to make a photo. So there was a "reconstruction" of events.

Activities of students of the experimental group were:
1) searching and collecting of information.
2) developing of design for "virtual" images;
3) preparing of printing material about events, people;
4) selection and purchasing of racks for working with the application, information stands;
5) posting information on social networks, the media about the AR-capabilities of the project;
6) monitoring the satisfaction of the population with the result of the AR project.

In Kirov, students of the experimental group offered residents of the city to "plunge" into the atmosphere of digital virtuality in the program "Art-Engineering. Art in Number/Figure in Art." The event was held in VyatSU as part of the international action "Night of the Arts." The concept of the project was built around three artistic trajectories: "Figure in Art," "Art in Digital," "Escape from Digital". Viewers could immerse themselves in the atmosphere of AR and VR reality, comprehend the role of "numbers" in the art and life of consumer society, as well as learn the possibilities for "escape" from the world of digital technologies.

The university held an art night together with the Exhibition Hall of the Vyatka Art Museum named after Vasnetsov brothers. As part of the event, virtual walks around the museum, installations, performances, effects of "revitalizing" the famous paintings of world art, master classes from robots to create works of art, reading plays, quests and much more were available.

However, the main purpose of using AR applications in the activities of cultural institutions is not limited by obtaining "augmented reality". The history, its emotional effect on the education of the reader or viewer, the formation of its personal characteristics (patriotism, curiosity, hard work, etc.) are really in focus. Students in the control group also studied new digital technologies, materials of the discipline "Modern Information Technologies," "Media Culture," "Media Education." However, they were not involved in special work on the usage of augmented reality technology in the activities of cultural and art institutions.

A systematic presentation for each participant before and after the use of AR means in the training of specialists in the field of culture and art is made in table 1.

Thus, $\chi^2_{\text{obsrv.1}} < \chi^2_{\text{critical}}$ (0.118<5.991), and $\chi^2_{\text{obsrv.2}} > \chi^2_{\text{critical}}$ (6.821> 5.991).

Therefore, the shift towards increasing the level of training of specialists in the field of culture and art in the experimental group can be considered non-accidental.
Table 1

Results of the use of AR tools in the training of specialists in the field of culture and art

<table>
<thead>
<tr>
<th>Level</th>
<th>Groups</th>
<th>Experimental group (46 students)</th>
<th>Control group (46 students)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BEFORE THE EXPERIMENT</td>
<td>AFTER THE EXPERIMENT</td>
<td>BEFORE THE EXPERIMENT</td>
</tr>
<tr>
<td>High</td>
<td>5</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Medium</td>
<td>19</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>Low</td>
<td>22</td>
<td>12</td>
<td>22</td>
</tr>
</tbody>
</table>

Discussion of the results

Summarizing the experience of students in the study and usage of AR technology in the field of culture and art, we note the undoubted positive effect in terms of the emergence of additional conditions for the use of theoretical information in organizing cultural events and entertainment events; for the educational integration of the real and virtual worlds; to expand the experience of students, to gain new knowledge in the chosen field.

Making a quantitative analysis of the obtained data, it can be concluded that after the completion of the experiment 39% of students in the experimental group had a high level of training (18 out of 46 students). While initially this percentage was equal to 11% (5 respondents out of 46).

The number of students with a "low" level has dropped significantly from 48% to 26%. For the control group, the following was recorded: the indicator for the "high" level changed qualitatively from 13% to 22%, and for the "low" level - from 48% to 46%.

Regarding the capabilities of SketchAR, many opinions and recommendations have been made: "the application so far only works with the vertical A4 format"; "good lighting is needed for the iPhone camera (a regular smartphone camera, not Tango) to orient itself correctly"; "it is necessary to draw circle marks carefully for clear positioning"; "to use a paper holder where possible"; "it is rarely possible to make everything correctly at first time".

Students noted the following facts, summarizing the experience of using augmented reality technology in teaching and in practice in cultural institutions:

1. Getting information in the context of the "augmented" world improves communication, allows you to make more balanced and rational decisions when implementing large-scale cultural projects. The analogy "green emerald glasses" is in work. The AR application allows people of all ages and cultures to find mutual understanding and equally emotionally perceive the "augmented" world.

2. Each participant in the "augmented" world could create their own performance/exhibition, choosing not only the trajectory of movement between the characters/exhibits, but also the way to interact with them.

But along with contradictions and problems, there were opportunities to use SketchAR on large surfaces, for example, for drawing on a wall.

The research materials correspond to the UNESCO activities in the framework of the development of science, culture and communication [1]. In addition, some AR projects from
student practice were included in the events of the cultural program of the Year of Folk Art and Intangible Cultural Heritage of Russia. The conclusions obtained on the didactic potential of AR technology in terms of improving the quality of training, the formation of demanded digital skills confirm the results of J. Martín-Gutiérrez, C. E. Mora [13]. The description of the basic ideas of the approach, expanding the ideas of N. V. Vasilyeva about the possibilities of digital technologies and augmented reality applications for the sphere of culture in Russia could be called a significant result of the study [25].

**Conclusion**

So, the described system of actions for the usage of AR tools in training specialists in the field of culture and art allows:

- to form the required digital skills (preparation of automatic requests; search for data analysis of information and assessment of its quality; organization and storage of funds of cultural institutions; compliance with ethical standards during virtual interaction, etc.);
- to gain an experience in project research and educational activities;
- to simulate the performance of labor functions;
- to support a new way of visualizing of some abstract concepts (digital culture, digital artifact, software method of creating cultural texts, etc.);
- demonstrate additional properties of the art object or the possibility of its application in the real world;
- arrange virtual excursions to assess infrastructure and destination;
- to intensify information interaction in the performance of future labor functions between trainees, employees of the cultural institution, visitors of events in AR projects.

During the discussion, the participants of the experiment highlighted the following features of the usage of AR technology tools, considering the specifics of the librarian's activities: visualization of information at a qualitatively new level, establishing a connection between times (historical eras) and generations; increasing emotional engagement; supporting for interest in reading; the development of erudition, long-term and RAM, attention to details, numbers, symbols, signs, etc.

The participants of the experiment indicated the following difficulties that complicate the use of AR applications in the activities of cultural institutions:

1) high cost of licensed programs and full package of functions;
2) technical failures of equipment in halls and funds;
3) coordination of the work of personnel accustomed to working according to traditional methods, and representatives of the "digital" library.

As options for resolving the indicated difficulties following the results of the experiment, it was proposed: searching for investors interested in large AR-projects; cooperating with technology start-ups and software developers on favourable terms; receiving state funding in the form of cash grants for the implementation of technological AR-projects in culture and art; interacting with talented students of technical universities; sharing experiences with colleagues from other cities; demonstrating positive experience with AR to management of cultural and artistic institutions.
Graduates used an interdisciplinary analytical apparatus and their creative skills in AR projects. AR tools and applications have enabled future art and cultural professionals to explore cultural processes at the modern professional conceptual level; to set and solve significant scientific, practical and social-practical problems independently. The results of the study can be used to organize the research activities of students at the master’s level and in the work of cultural institutions.

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**Information about the authors**

**Darya A. Shabalina**
(Candid. Sci. (Educ.), Associate Professor at the Department of Digital Technologies in Education Vyatka State University)  
E-mail: darya.expo@yandex.ru  
ORCID ID: 0000-0002-5156-3036

**Elena V. Soboleva**
(Candid. Sci. (Educ.), Associate Professor of the Department of Digital Technologies in Education Vyatka State University)  
E-mail: sobolevaevl@yandex.ru  
ORCID ID: 0000-0002-3977-1246

**Zoia V. Shilova**
(Cand. Sci. (Educ.), Associate Professor, Department of FN-12 Bauman Moscow State Technical University)  
E-mail: zoya@soi.su  
ORCID ID: 0000-0003-1715-2513

**Information about the authors**

**Darya A. Shabalina**
(Russia, Kirov)  
Cand. Sci. (Educ.), Associate Professor at the Department of Digital Technologies in Education Vyatka State University  
E-mail: darya.expo@yandex.ru  
ORCID ID: 0000-0002-5156-3036

**Elena V. Soboleva**
(Russia, Kirov)  
Cand. Sci. (Educ.), Associate Professor of the Department of Digital Technologies in Education Vyatka State University  
E-mail: sobolevaevl@yandex.ru  
ORCID ID: 0000-0002-3977-1246

**Zoia V. Shilova**
(Russia, Moscow)  
Cand. Sci. (Educ.), Associate Professor, Department of FN-12 Bauman Moscow State Technical University  
E-mail: zoya@soi.su  
ORCID ID: 0000-0003-1715-2513