

Perfection and Development of Infocommunication Competencies of Students Studying in the Conditions of Creative Laboratory of Computer Graphics and Digital Photography

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ABSTRACT

This work is devoted to the study of the laws of development of the cognitive and creative activity, the development and consolidation of creative thinking skills of students of middle and senior school age, as well as students in the creative laboratory of computer graphics and digital photography.

In modern conditions of the active use of network information technologies in almost all areas of human life, areas related to the creation and processing on a computer of graphic images (drawings, drawings, photographs, etc.) are developing. According to the authors, this phenomenon can be explained by the following factors: 1) the prevalence of visual-figurative perception of the surrounding reality by students of middle and senior school age, as well as students (the age groups with which the authors worked) are listed; 2) the growing influence of the information and telecommunication network "Internet" on the development of modern media culture with a predominance of computer graphics and digital photography.

The significance level of the study is determined by the requirements of federal state educational standards (FSES) of basic general and secondary general education in terms of the formation and development of competence in the use of information and communication technologies in education. Similar requirements are presented by the Federal State Educational Standard of Higher Education in the areas of undergraduate training. Based on the pedagogical experience of teaching disciplines related to objects of computer graphics and digital photography for a number of years, the authors analyze the characteristics of the course, the structure of knowledge, and some problems in teaching and popularizing this area. The article also analyzes the experience of conducting research activities in the conditions of a student's scientific society and creative circle activities. In order to address these issues, this paper proposes a computer graphics training system. The role of the underlying graphics system and graphics software is carefully analyzed.

The following are distinguished as the expected results: 1) introducing the younger generation to modern media culture through immersion in the environment of computer graphics and professional digital photography; 2) the formation of creative personality traits of students who actively and purposefully know the world, as well as being aware of the value of science and creativity for man and society; 3) improvement and development of infocommunication competencies of students in relation to self-presentation.

Keywords: *computer graphics, digital photography, information technologies in education, information and communication competencies, educational and cognitive activities of students*

1. INTRODUCTION

In the information age, in which modern society abides, interdisciplinary integration takes place in various fields of

knowledge, industry, and culture [1]. Therefore, we need a new training system under the general background of a new creative chain. The popular expressions “Big Data”, “Digitalization” and “Mediatization” are exactly typical characteristics of our era, which is now experiencing an information explosion [3]. Big data and a lot of information

invades our life and makes changes at an amazingly high speed. The direction of CG (computer graphics) is rapidly popularizing [11], is actively developing in the digital field, and can change the whole scheme of work in existing sectors of labor and life [9]. Thus, this leads to a change in all human activity, including the system of basic training of future specialists for the development of competencies in the field of digital literacy [5].

The course of computer graphics should develop students' ability to spatial imagination, train to use software for drawing and modeling, train to develop innovative design [1, 2]. The formation of the first two abilities is relatively easy to achieve since they represent the goal of teaching a traditional course in engineering graphics [4]. However, training in the formation of innovative design ideas seems to be quite a challenge [1].

From the point of view of students, three approaches to learning can be distinguished to become, for example, an excellent engineer:

- from passive learning to active learning,
- from subject-based learning to project-based learning,
- from traditional learning to blended learning.

The aim of the study is to determine the formed competencies of future specialists who are to work in the conditions of the Industry 4.0 industrial revolution [7] and their formation system.

The Chuvash Republic is characterized by a high level of development of information and telecommunication technologies (ICT) and their intensive use by citizens, business, public authorities of the Chuvash Republic and local governments. In addition, the Chuvash Republic is among the ten leaders among the regions of Russia in terms of readiness for the information society. In connection with the foregoing, the issue of the development of students' cognitive interest in computer graphics and digital photography as a popular area of ICT, and, as a consequence, the development of a modern system of scientific and technical creativity of children and youth, is becoming relevant.

2. METHODOLOGY OF THE STUDY

In the work, general scientific methods of the empirical level were used: description, observation, analysis of creative works, as well as the method of pedagogical experiment.

The main research method is a description that allows you to get more meaningful information. The choice of this method was justified by the fact that it allows you to check the developed training strategies using observation and interviews with study participants. This method was supplemented by a quantitative approach using a series of dynamics.

Also we applied systemic, personal and activity approaches. The need for a systematic approach is due to the fact that the goals of work in a creative laboratory, the content of classes, methods, forms, means of the pedagogical process are considered as a set of interconnected components. The requirement to recognize the student's personality as a

carrier of the present and future media culture, creating conditions for self-development of the makings and creative potential of the student's personality explains the need for a personal approach [4]. An active approach is necessary due to the fact that students will be motivated to awareness, goal-setting, planning, and organization of creative activity, capable of evaluating results and introspection [6].

The authors expect the following results to achieve this goal:

- 1) The development of visual culture and the introduction of the younger generation to modern media culture through immersion in the environment of computer graphics and professional digital photography;
- 2) The formation of creative personality traits of students who actively and purposefully know the world, as well as being aware of the value of science and creativity for man and society;
- 3) Improvement and development of infocommunication competencies of students in relation to self-presentation.

3. RESEARCH RESULTS

The team of authors has scientific and pedagogical experience in areas related to computer graphics and digital photography. For ease of perception, we will consider them separately later.

3.1. Computer Graphics

In the process of training university students in the Chuvash Republic, the role of computer graphics becomes especially noticeable for the automation of the design and design process, the creation of drawings and design documentation. With the development of art and graphic faculties, faculties of art, technology, and economics departments of universities, the opening of new directions for the use of computer graphics in the educational process is of particular relevance [6].

In the process of training specialists in the field of graphics, environmental design, interior designers, fashion designers, and others, the development of CAD and computer graphics by students is of equal importance [8]. Given the current trends in teaching computer graphics, it is conditionally possible to distinguish the main groups of software that correspond to the areas of specialist training:

- 1) For technical and construction specialties they are Microsoft Visio, KOMPAS-3D, AutoCAD, ArCon, Arhi CAD, 3D Studio MAX, and others;
- 2) For pedagogical specialties, art specialties in the areas of "Art", "Decorative and Applied Art and Design" - CorelDraw, CorelPainter, AdobePhotoshop, AdobeIllustrator, AdobeInDesign, 3D Studio MAX, and others.

The work was carried out according to the plan:

- 1) The creation of a creative laboratory;
- 2) Teacher training;
- 3) Conducting training workshops;

- 4) Participation of students in conferences;
- 5) Holding contests of creative works.

3.2. Digital Photo

Digital photography is a trend direction in modern information and communication technologies [10]. This is facilitated by the widespread use of digital photographic equipment, including SLR. Almost all phones, smartphones, tablets are equipped with built-in cameras. Therefore, with confidence, we can talk about the emergence of mobile photography, a genre that is gaining popularity. Of course, for the purpose of professional advancement, photographers use high-quality expensive optics. The public is successfully using the most simple cameras. However, with due diligence, according to the authors, it is possible to develop an eye, a sense of harmony, balance, rhythm in the frame. In addition, mobile photography, as a form of digital photography, can serve as a rehearsal venue with the subsequent transformation into the space of a professional: photographer, designer, engineer. Unusual for classics, but spectacular and in demand in the social network space genres: flat lay, food photo, lifestyle, selfie, subject shooting, travel. The motivation for learning such genres is quite high since they are necessary for any expert, business, blog.

The scientific and practical groundwork of the team has the potential for further development:

1. At the Faculty of Informatics and Computer Engineering, the work of the circle for schoolchildren and students "Digital Photography" is carried out.
2. As part of the annual student research conferences (Regional Festival of Students and Youth "An Individual. A Citizen. A Scientist", the All-Russian Scientific Student Conference on Technical, Humanitarian and Natural Sciences, the Interregional Scientific Conference "Youth and Cooperation ", etc.) the section is organized for schoolchildren and college students "First Steps in IT".
3. Authors have experience in conducting creative contests. Work with students of different educational levels is specific, for this reason, we will consider them separately.

3.2.1. School

The federal-state educational standards of basic general education (FSES BGE) and secondary general education (FSES SGE) of the Russian Federation impose clear requirements on the results of mastering basic educational programs. The personal results of mastering the main educational program should reflect: the development of aesthetic consciousness through the development of the artistic heritage of the peoples of Russia and the world, creative activities of an aesthetic nature.

In particular, the development of the individual creative abilities of students, the formation of a steady interest in creative activity should be formed in the process of studying the subject field "Art" (in the section "Fine Art").

The formation of the foundations of the artistic culture of students as part of a common spiritual culture, the development of visual memory, artistic taste, and creative imagination are part of the subject results of the study of subject areas "Art" and "Technology". The children gain experience in creating an artistic image in various types and genres of visual and spatial arts. They also gain experience working with various art materials and in various techniques in various types of visual and spatial arts, in specific forms of artistic activity, including those based on information and communication technologies (ICT): digital photography, video recording, computer graphics, animation, and animation.

Along with the study of the material of educational subjects, FSES BGE provides for the organization and conduct of extracurricular activities in the areas of personality development (spiritual, moral, physical, sports and recreational, social, general intellectual, general cultural) in various forms: circles, art studios, sports clubs and sections, scientific-practical conferences, school scientific societies, etc.

In relation to the FSES BGE, it is worth noting a special form of organization of students' activities, an individual project that is carried out by students on their own under the supervision of a tutor on a selected topic. Implementation of the project is possible within the framework of one or more studied subjects in any subject area (cognitive, practical, educational research, social, artistic and creative, etc.). The requirements for the results of the implementation of an individual project are clearly regulated by the FSES, as applied to our work, we note some: the formation of the skills of educational and research activities, the ability to creative, intellectual activity; formation of skills in project activities, presentation of results. The completed individual work of the student can be represented in the form of a creative, social, applied, design, engineering or other type of project.

3.2.2. Undergraduate College

Federal state educational standards of higher and secondary vocational education impose serious requirements on future graduates of almost all areas of training in the development and application of modern information technologies in professional activities. For example, the bachelor of the direction 19.03.04, "Product Technology and Organization of Catering," must master modern information technologies, be able to manage information using applied programs in the business sphere, use network computer technologies and databases in the professional subject area; the bachelor of the training direction 38.03.05 "Business Informatics" should be able to solve standard tasks of professional activity based on the information and bibliographic culture using information and communication technologies and taking into account the basic requirements of information security; The technician-programmer of the training direction 09.02.05 "Applied Informatics (by branches)" must be able to process static and dynamic information content. Similar requirements are present in the

Federal State Educational Standard of almost all areas of secondary vocational education and undergraduate education. In addition, the graduate should be able to carry out self-presentation, be able to prepare scientific and technical reports, presentations, and scientific publications based on the results of research. To achieve a given goal, in particular, to increase the degree of visibility, it is advisable to use means and methods of computer graphics.

The curricula of universities of the Chuvash Republic provide for the study of similar disciplines, according to the author, implying the development of creative visual abilities of students in combination with the use of modern means of information and communication technologies: "Computer graphics in the economy" (specialty "Finance and credit", "Taxes and taxation"), "Computer Graphics" (the direction of preparation is "Technology of products and the organization of public catering", specialty "Applied Informatics (by industry)", "Computer design" (training areas "Applied Informatics", "Business Informatics"), "Computer graphics and graphic editors" (training direction "Business Informatics"), "Computer graphics in advertising and public relations" (training direction "Advertising and public relations in the commercial sphere"), "Computer design" (training direction "Technology of light industry products"), "Interior design" (training direction "Decorative and applied art and design"). We have gained extensive experience in teaching special disciplines in this field, the main results of pedagogical experience are described in a number of publications, for example, [11]. Along with the traditional laboratory work in display classes using freely available graphic editors, interactive forms were used, in particular, field classes, participation in student scientific conferences and forums, as well as creative contests.

In modern conditions, the role of a practice-oriented approach in training is of great importance, which pursues the goal of forming the necessary competencies of future specialists, the implementation of which is possible, for example, by "immersion" in an environment close to professional.

As an illustration, we give an example of a retreat on the interdisciplinary course "Computer Graphics" with students in the field of training "Applied Informatics (by industry)". This course is part of the module "Processing industry information", as a result of successful completion of which the student should have the following professional competencies: the ability to process static information content and dynamic information content, prepare equipment for work, configure and work with industry equipment for processing information content, control the operation of computer, peripheral devices and telecommunication systems, ensure their correct operation. The basic category of computer graphics is a digital image, and in turn, one of the available hardware for obtaining a digital image is a digital camera. In order to form the above-mentioned professional competencies, laboratory exercises are held on the theme "Fundamentals of Digital Photography" with a visit to Work Studio, which is a spacious and comfortable room with natural light. It should be noted that the presence of the latter is a relevant trend in

the activities of organizations of the modern photo industry. Work Studio is equipped with modern shooting and lighting equipment, which allows professional photography at a high-quality level.

Students acted as photographers and models, appreciated the shooting on the background of the cyclorama, creating a smooth background. The cyclorama is also interesting because, during further processing of the photo, a uniform background is easily removed from the frame. The guys got the opportunity to work with an infrared synchronizer and nozzles for lighting devices: soft-box, octo-box, reflectors with color filters, and curtains.

After returning to the display class, students had to continue working on captured digital material using special software and, as a result, master the full range of professional competencies in working with digital content. The processing of personally shot frames is of much greater interest than the use of abstract material proposed by the teacher. The guys with appreciable pleasure performed color and light correction, adjustment, and retouching photos of friends and classmates.

Another frequently used form of conducting classes and increasing the creative cognitive activity of students is participation in student scientific conferences. Students independently, taking into account personal preferences, choose the topic of the presentation, prepare colorful presentations designed using their own creative works, going the creative way from idea to its implementation.

In addition, it has become a good tradition to hold a competition of creative works dedicated to the celebration of the professional holiday "Programmer's Day," which is still young enough. Recall that on September 11, 2009, President of Russia Dmitry Medvedev signed Decree No. 1034, which established an official holiday - "Programmer's Day". On the eve of the 256th day of the year, students create creative graphic works in which they express their own vision of the inner world of programmers, note that humor and irony are not alien to the representatives of such a serious profession.

We believe that such an approach to the teaching of graphic disciplines is intended to facilitate familiarization with modern technical tools and technology for working with digital information content, the development of creative potential, and the formation of a professional of the future.

4. DISCUSSION OF RESULTS

Modern photography is distinguished by a wide variety of specific genres: reporting, travel, family, children's, documentary, architectural, walking, macro, beauty, fashion, glamor, interior, animal photography (photo hunting), split, luminography, advertising, etc. Classic and always in demand are genres borrowed from painting: portrait, landscape, still life. Specific ones are based on them. For example, one of the interesting genres of photography is the reportage, which has incorporated elements of other popular trends: portrait, documentary photography, photojournalism. Working in this role, the photographer can not only display a fragment of reality, but

also show a personal attitude to the event. Family, children's photography, beauty, fashion, glamour are based on a portrait design. Walking and architectural views can combine portrait and landscape, while documentary can also be a still life.

As experience has shown, the specific genre of reporting turned out to be the most acceptable for schoolchildren and students. School competitions, family holidays, meetings with friends - these and other events do not require financial costs in the form of photo studio rental fees. However, portraiture lovers appreciated the benefits of a professionally equipped photo pavilion space.

Over the years, the authors conducted questionnaires, surveys, interviews, observations and analysis of the creative activity of students (schoolchildren, college and university students) in the process of teaching graphic disciplines, conducting circle and student research work. Many subjects differed in a number of characteristics; we list the most important ones:

- the level of preparedness in terms of knowledge of modern ICT hardware and software (initial, confident, advanced);
- the level of motivation for extracurricular activities (low, medium, high);
- the specifics of the direction of preparation (humanitarian, technical, creative).

Despite the rather strong scatter in the value of the input characteristics, we obtained the following conclusions in relation to the field of artistic and creative activity. The competencies formed by the means of information and communication technologies in the conditions of a creative laboratory were noted (Table 1). Thus, the author's experience has shown a good level of development of information and communication competencies, trained in a creative laboratory of computer graphics and digital photography

Table 1 Competencies formed by means of information and communication technologies in a creative laboratory

Form of work in a creative laboratory	Formed competencies
Section work with schoolchildren and students	<ul style="list-style-type: none"> - readiness for self-development, - willingness to use information technology for the development of creative abilities outside school hours, the development of a creative-minded person; - willingness to develop non-standard techniques for solving educational problems; - the ability to take pictures with the classic schemes of lighting and compositional solutions in the studio and outside it; - the ability to perform correction of photographic images by computer technology; - the ability to perform computer-assisted editing of photographic images;
Student conferences in which sections are organized for schoolchildren and college students;	<ul style="list-style-type: none"> - the ability to realize self-presentation; - readiness for a conscious choice of a future profession; - the ability to search, store, process and analyze information using ICTs, including network; - the ability to design educational and creative materials (text and graphic, work, and presentation) using ICT in the required format.
Competitions and exhibitions of creative works	<ul style="list-style-type: none"> - possession of modern ICT for the implementation of creative ideas in the selected subject area; - the ability to healthy rivalry, as well as the demonstration of personal and collective achievements; - willingness to further develop creative abilities.

REFERENCES

- [1] W. Bu, Teaching Study of Engineering Graphics for Expressions of Innovative Design, in: M. Majewski, W. Kacalak (Eds.), *Lecture Notes in Mechanical Engineering*, International online Conference on Innovations Induced by Research in Technical Systems, Springer, Cham, 2020, pp. 181-190. DOI: https://doi.org/10.1007/978-3-030-37566-9_17
- [2] L. Medina Herrera, J. Castro Pérez, S. JuárezOrdóñez, Developing spatial mathematical skills through 3D tools: augmented reality, virtual environments and 3D printing, in: X. Fischer (Ed.), *International Journal on Interactive Design and Manufacturing (IJIDeM)*, Springer-Verlag France, 2019, pp. 1385-1399. <https://doi.org/10.1007/s12008-019-00595-2>
- [3] F. Yu, A new basic teaching mode for artistic disciplines under the information, in: age 14th International Conference on Computer Science and Education, ICCSE 2019, Institute of Electrical and Electronics Engineers Inc., 2019, pp. 212-215. DOI: <https://ieeexplore.ieee.org/abstract/document/8845428>
- [4] I. Taras, Features of Teaching the Graphic Discipline Courses for Different Specialty Students, in: *Proceedings of the 18th International Conference on Geometry and Graphics, ICGG 2018*, vol. 809, pp. 2257-2261, Springer, Milan, Italy, 2019. DOI: https://link.springer.com/chapter/10.1007/978-3-319-95588-9_215
- [5] N.I. Fokina, Methodology for creating methodology guidelines on computer disciplines at different levels of student's expertise, in: *Transilvanian Association for the Literature and Culture of Romanian People (ASTRA)*, Astra Salvensis, Supplement no. 1, 2019, pp. 171-179.
- [6] H. Chemerys, V. Osadchyi, K. Osadcha, V. Kruhlyk, Increase of the level of graphic competence future bachelor in computer sciences in the process of studying 3D modeling, in: V. Ermolayev, F. Mallet et al., (Eds.), *15th International Conference on ICT in Education, Research and Industrial Applications. Integration, Harmonization and Knowledge Transfer, ICTERI 2019*, CEUR-WS, 2019, vol. 2393, pp. 17-28.
- [7] S. Gao, Z. Liu, Teaching Research on Undergraduate Computer Graphics Course Based on 'Professional Skill Driven', in: *Proceedings - 9th International Conference on Information Technology in Medicine and Education, ITME 2018*, Institute of Electrical and Electronics Engineers Inc., 2018, pp. 636-641. DOI: <https://ieeexplore.ieee.org/document/8589378>
- [8] O.K. Zaripov, Pedagogicheskie usloviya obucheniya komp'yuternoj grafike studentov v vy'sshem uchebnom zavedenii, *Sborniki konferencij NICz Sociosfera*, 2020, № 8, Praga, Chexiya, s. 29-34. DOI: <https://elibrary.ru/item.asp?id=42459543>
- [9] D.A. Arkabaev, A.S. Moxova, Komp'yuternaya grafika i sfery ee primeneniya, *Molodoj uchenyj*, 2020, № 4 (294), Kazan', Rossiya, s. 14-18. DOI: <https://elibrary.ru/item.asp?id=42380195>
- [10] Itogi XVIII Vserossijskogo konkursa cifrovyx izobrazhenij i fotografij Foto 1-2020, *Informatika v shkole*, 2020, № 1 (154), s. 60-63. DOI: <https://www.elibrary.ru/item.asp?id=42490732>
- [11] T.V. Mitrofanova, Populyarizaciya IT-obrazovaniya shkol'nikov (opyt raboty Associacii «Informacionnye tekhnologii v CHuvashskoj Respublike») / T. V. Mitrofanova, T.N. Kopysheva, S.S. Sorokin // *Informatizaciya obrazovaniya: sbornik materialov mezhdunarodnoj nauchno-prakticheskoy konferencii (CHEboksary, 15-17 iyunya 2017 g.)*. – CHEboksary: CHuvashskij gosudarstvennyj pedagogicheskij universitet im. I.YA. YAKovleva, 2017. – S. 199–205. DOI: <https://www.elibrary.ru/item.asp?id=29774727>