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Artistic and aesthetic component in project activities with computer science students

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Abstract. *Problem statement*. Computer science lessons are traditionally associated with the development of computer programs, processing of various types of information, communication and cooperation. Meanwhile, the modern stage of society's development is characterized by a wide digital environment, the penetration of technology into many areas of human life, including art. Thanks to the improvement of computer tools, a special kind of digital art has appeared. Despite the wide opportunities for the formation of aesthetic taste of students, teachers face difficulties in using information technologies aimed at introducing students to both artistic values and the creation of graphic creative projects. *Methodology*. The main research methods were a critical analysis of foreign and Russian scientific and methodological sources, systematization and classification of techniques for using modern technologies in creating and displaying works of art, experience in using programs, applications and services to develop students' creative abilities. *Results*. It offers forms of extracurricular activities in computer science, types of project work, as well as computer tools for developing students' creative abilities. *Conclusion*. The purposeful and meaningful use of modern technologies, the analysis of the connections between artistic creativity and modern digital tools, and the system of integrative project assignments contribute to the development of students' creative abilities, forming their holistic view of digital art as a monolithic unity of talent and skill of an artist who is proficient not only in traditional techniques, but also digital tools. This opens up unique approaches for both teaching and organizing extracurricular activities in computer science.

Keywords: creativity, digital art, extracurricular activities in computer science, online tools for teachers, programming, Python, WebTurtle Art

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Художественно-эстетический компонент в проектной деятельности с учащимися по информатике

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Аннотация. *Постановка проблемы*. Уроки информатики традиционно связаны с освоением компьютерных программ, обработкой различных видов информации, коммуникацией и сотрудничеством. Между тем современный этап развития общества характеризуется широким цифровым окружением, проникновением технологий во многие сферы человеческой жизни, в том числе и в искусство. Благодаря совершенствованию компьютерных инструментов появился его особый вид – *digital art*. Несмотря на широкие возможности по формированию эстетического вкуса учащихся, педагоги сталкиваются с трудностями по использованию информационных технологий, направленных на приобщение обучающихся как к художественным ценностям, так и на создание графических творческих проектов. *Методология*. Основными методами исследования послужили критический анализ зарубежных и российских научно-методических источников, систематизация и классификация приемов использования современных технологий в создании и демонстрации произведений искусства, опыт применения программ, приложений и сервисов для развития творческих способностей учащихся. *Результаты*. Предлагаются формы проведения внеклассной работы по информатике, виды проектных работ, а также компьютерные средства для развития творческих способностей школьников. *Заключение*. Целенаправленное и осмысленное использование современных технологий, анализ связей художественного творчества и современных цифровых инструментов, система проектных заданий интегративного характера способствует развитию творческих способностей учащихся, формирует у них целостное представление о цифровом искусстве как монолитном единстве таланта и мастерства художника, умело владеющего не только традиционной техникой, но и цифровыми инструментами. Это открывает уникальные подходы как для проведения интегрированных уроков, так и для организации внеклассной работы по информатике.

Ключевые слова: творчество, цифровое искусство, внеклассная работа по информатике, онлайн-инструменты для учителя, программирование, Python, WebTurtle Art

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Problem statement. The most important tasks solved in the process of teaching computer science are to teach students how to work with various types of information, navigate the modern information space, and use applied software products in their daily, professional, and creative activities. They are solved in various ways, including when performing project tasks. As you know, the project method, which is actively used in school practice, is a complex process that allows you to form general academic and subject skills, as well as technological literacy and information culture. Students who carry out creative projects master new content, learn to think, discover new things, analyze and systematize information, and bring fresh ideas to life. As a rule, the project topics are somehow related to the thematic content of the school course. So, in the *Modeling* section, the following topics can be used: Modeling in a graphical editor environment, Modeling function graphs, My Dream House, etc. At the same time, computer graphics, the elements of which are introduced to students, suggest a broader range of research areas. Moreover, many school course topics lead students into areas that are not directly related to the main content. By studying programming, students can create graphic paintings, interesting visual compositions, and applied models. On the one hand, there is a large amount of information devoted to the relationship of information technology with digital art; moreover, there are many tools – application programs, mobile applications and online services for creating art projects – visual, musical, multimedia. On the other hand, the computer science course says almost nothing about its role in human creative activity. There is a clear lack of project work topics dedicated to the connection of modern information technologies with digital art. And not only the topics themselves, but also the methodological techniques and approaches that can be used in the preparation of creative projects. Based on the above, it is necessary to consider the formation of the content of the topics of project work in computer science, in which there is an artistic and aesthetic component, very relevant.

The purpose of the study is to identify the potential of computer science project activities, the content of which, along with traditional topics, would include an artistic and aesthetic component.

What is meant by the artistic and aesthetic component when talking about computer science as a school subject? To begin with, it is worth recalling that the symbiosis of artistic creation and scientific research is not new. Let's remember the story. Great thinkers, scientists and creators organically combined artistic activity with scientific research. Let's recall the most famous Renaissance artist, Leonardo da Vinci. His notebooks contain drawings and mathematical descriptions – drawings, sketches, analytical calculations. They blur the line between artistic creativity and accurate knowledge. In the age of high technology, the connection between science and art has become even closer. Computer science is an interdisciplinary field that includes information from mathematics, logic, linguistics, and engineering. Considering its applied areas – 3D graphics, animation or computer installations, it should be noted that it also covers artistic fields. And if we also take into account that computer science plays a leading role in the development of immersive technologies, including virtual reality, then this once again underlines its applied

importance, speaks of unique opportunities for the development of artistic creativity. Today, artists are able to create virtual spaces, immersing themselves in which the viewer acts not just as a passive observer, but also as an active participant in the visual action. Computer science is not devoid of aesthetics. It manifests itself in various forms: the nature of the presentation of information, the specifics of the subject itself, the connection with the beauty of nature and art. Her interdisciplinary educational potential is far from exhausted.

Let's return to the question raised above about the artistic and aesthetic component in computer science project activities. It should be understood not only as the inclusion in the content of projects of issues related to purely artistic fields – painting, sculpture, architecture, music, but also a special methodological approach aimed at forming students' understanding of science as a means of creating aesthetically attractive products of artistic creation.

Methodology. Using scientific methods, a person explores the world around them. In this multifaceted and continuous process, artistic vision is no less significant. It means interpreting reality through art. O. Benesch (1896–1964), an Austrian art theorist of the twentieth century, tried to find certain stylistic phases in the images created by artists that would be inherent in science. There are many examples where science has helped art, and vice versa, art has inspired scientists to search and discover. One way or another, the symbiosis of science and art presupposes the complementarity of two spheres, two ways of reflecting and understanding the world. It happens that an artist has a certain scientific and technical background, which helps him create new works. Or vice versa – a scientist, realizing that his activity cannot take place only in a scientific environment, tries to push the boundaries of research in order to solve the tasks set and get the desired result. These arguments are also applicable to teaching, because the teacher tries to introduce non-traditional techniques and methods into educational practice. Computer science, as a synthetic science, allows for the integration of different fields, opening up unlimited opportunities for students to realize creative ideas and innovative ideas.

Results and discussion. When starting to implement approaches to teaching computer science based on the connection between scientific knowledge and artistic vision, it is worth highlighting the most acceptable areas of research. This will help to further shape the content of the school projects that students will have to prepare [1].

It makes sense to show this with a concrete example. Suppose a teacher has commissioned the development of a project *Computer Science and Art: facets of creativity*. On the one hand, students can find a lot of materials on this topic, on the other hand, questions arise – in what form should they be presented, how to put together the content, what kind of structure can there be? Different approaches are possible here: historical, scientific, artistic or combined [2]. However, the content of the project should be meaningful, logically structured and strictly balanced in relation to all thematic lines, while the subject should be the leading one (each time it should be remembered that we are talking about computer science). In regular lessons, students are taught topics related to application software. When working in

MS Word, MS Excel, or other software environments, they should understand that computer science is a multitude of tools that help bring to life a wide variety of human ideas, from financial calculations to digital images [3].

In the process of searching, collecting and processing information, students immerse themselves in history. You can't do without it. Every discovery, scientific or artistic, is the result of hard work. How can we not remember Benjamin Laposky (1914–2000), a pioneer of computer art? After the end of World War II, this American scientist worked with an oscilloscope, examining Lissajous curves[1] (Figure 1). His electronic abstractions were the first digital paintings [4].

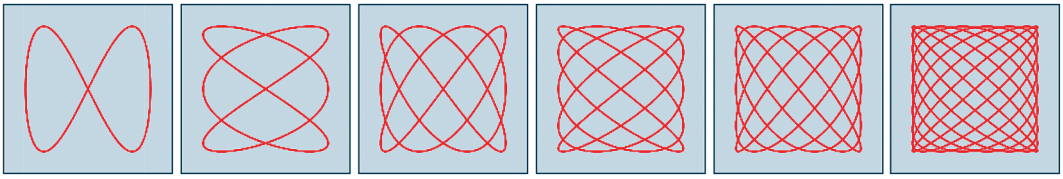

Figure 1. Lissajous curves

Source: Lissajous curves. WikipediA. Available from: https://inlnk.ru/dn84mm (accessed: 23.03.2026).

He became a pioneer in the field of computer art. The exhibition *Electronic Abstractions* was organized with the direct participation of the scientist. It was held in 1953. Electronic signals and a computer became the means of creating the first digital drawings. Back then, such solutions were revolutionary, and computer-generated paintings now seem simple and featureless compared to the works of modern artists. Then a new era of science and art development began. Unusual information processing tools were created, interesting trends in the field of art appeared, and new ideas were born in the minds of scientists and artists.

Since then, technology has advanced far, with powerful computers, applications, and services. All this has changed the artistic environment [5]. New types of art have emerged: video art and digital painting, computer graphics and animation, digital photography and electronic music. Each of the fields is related to computer science, because it serves as the basis for the training of specialists in various fields, including in the field of artistic creativity. New interdisciplinary disciplines have appeared, for example, music informatics (it is studied by future performers), art informatics (it is intended for specialists in the field of culture and art), computer graphics (designers cannot do without it), computational linguistics (for future philologists).

When forming the topics of interdisciplinary project work, it is important to take into account not only the content of the computer science course, but also the interests of the students. Some of them draw, some sing, and some are passionate about game design. Everyone has their own tastes and preferences. "Artists" can immerse themselves in digital painting and computer graphics, "musicians" can explore new directions of electronic music, "designers" can master modeling

[1] Lissajous figures are closed trajectories constructed by a virtual mathematical point that performs two harmonic oscillations simultaneously with a shift in amplitude, phase, and frequency.

programs. There is a place for computer science, music, and painting in every project work. And how many interesting discoveries can students make with such an integrated approach. Traditional forms of project work protection – exhibitions, conferences, performances will be filled with new ideas and vivid content.

The implementation of projects as part of extracurricular activities in computer science helps to unleash the creative potential of students [5; 6]. The specifics of the organization of such activities are related to both the formation of integrated content and the forms of its presentation. Computer science can be integrated with various school subjects: music, world art culture, literature, and history. The initial topics related to the basic computer science course can be: algorithms, human information activity, working with presentations, graphics, programming, etc. For example, when learning Python programming, students can not only master basic functions and algorithms, but also draw graphic pictures using the Turtle library. Getting acquainted with the codes, thinking over the composition and color combinations, students create their first digital drawings.

As an experiment, such an artistic and aesthetic component was included in a course related to the use of modern technologies in educational activities. Graphic drawings were made by students of the Institute of Foreign Languages of the Moscow City University as part of the course *Information and telecommunication technologies in education* (Figure 2, Figure 3). In the course of its passage, it was necessary to prepare two creative projects: in the visual-block WebTurtle Art environment and directly in Python. More than 200 students took part in the work. What was the essence of the project assignments? In each project, you need to program a certain number of drawings, ranging from simple to very complex. This could only be done if the basic programming skills and the desire to combine, try, and fantasize were formed. The students' work was different. Some of them strictly followed the teacher's recommendations and tried to work as described in the manual. However, there were many who showed rich imagination, creative imagination and fiction. It took a lot of effort for the students to "paint" the original paintings. While working on the project, it was necessary not only to think over the composition of the drawing and the color combination, but also to write the appropriate program.

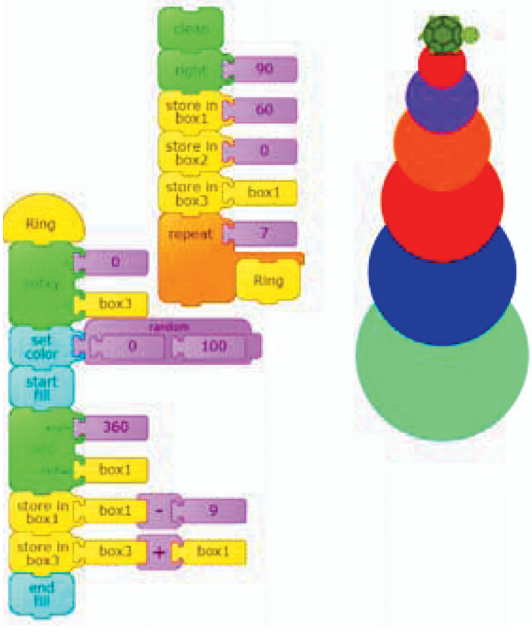

Figure 2. Student work in the WebTurtleArt environment

Source: personal archive by Alexey I. Azevich.

The experience of using the Web-Turtle Art environment and the Turtle module has shown that algorithmics and programming is a fascinating field

in which understanding code, writing programs, and preparing creative projects is accompanied by active search, deep reflection, and original solutions. The students, future foreign language teachers, have shown considerable interest in learning programming and building digital drawings. They tried to find the components of beauty, without which it is impossible to imagine any work of art. In addition, such work helped them feel like children who think, feel and create [7; 8].

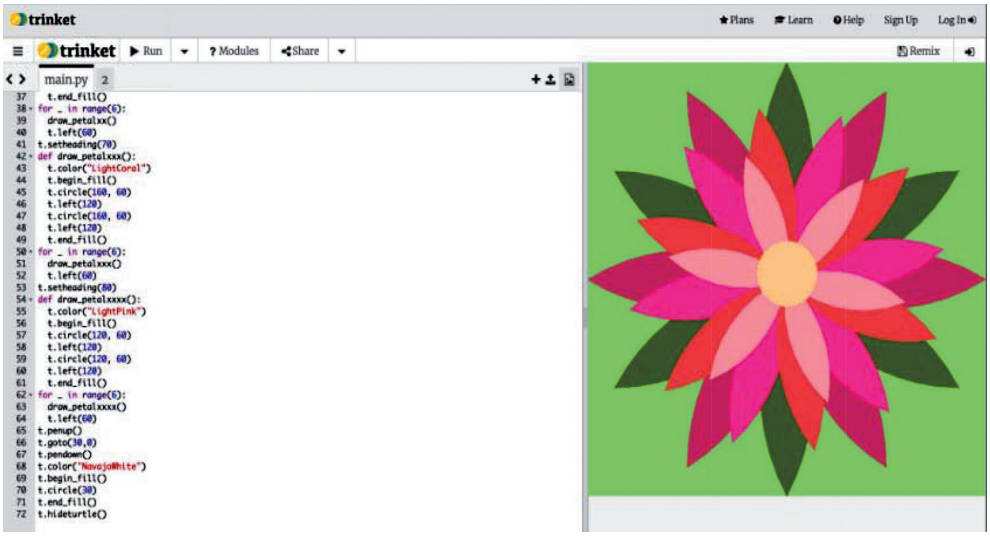

Figure 3. Student work in the Python environment

Source: personal archive by Alexey I. Azevich.

Of course, they are still far from the masters of computer painting. But it's only a matter of time. It is important that they discover the aesthetics of science, learn to see and create beauty [9–11]. Each age has its own approach and its own tool: high school students learn programming and computer graphics; younger students create paintings in a visually blocky environment. At the same time, everyone learns the codes, discovers an interesting composition, combines colors, and finds new ideas and solutions. It is unlikely that the students' work can be called digital paintings. In our view, a painting is the result of the work of an artist who is proficient in technique, tools, and materials [12]. Meanwhile, the students' graphic works have an original idea, artistic vision and, of course, knowledge of the program code [13–16]. And that's a lot! We must not forget that they are taking their first steps, studying computer science and related fields, discovering new ways of development and ways of creative self-realization. This is the main task of the interdisciplinary project.

Conclusion. As part of extracurricular activities in computer science, students prepare various projects – informational, research, applied and creative. Speaking of the latter, it is worth noting that they are complex in nature. By completing project tasks and implementing emerging ideas, students search for and systematize information, consider applied and creative aspects of the topic, and try different tools – from computer programs to mobile applications. This kind of research

demonstrates cultural and technological approaches in the preparation of a wide variety of educational projects. Artistic vision becomes a unifying factor influencing the content and form of presentation of the work. The aesthetic component, without which it is difficult to imagine a creative computer science project, helps not only to make the research look attractive, but also to demonstrate its importance for the formation of a holistic view of the world among students. Computer science, as a synthetic science, is an effective tool for unlocking the creative potential of a person, opening up new perspectives in cognition and development.

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