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Artificial intelligence integration into the process of teaching drawing to high school children

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Abstract

The topic research is due to the fact that artificial intelligence technologies integration into the educational process, in particular, in teaching drawing in high school, is a promising direction that allows adapting school teaching methods to the digital era conditions. The research goal is to analyze the possibilities of integrating AI technologies into the process of teaching drawing to high school children. To achieve this goal, the following tasks were solved: analysis of existing methods of teaching drawing in high school and identify their limitations in terms of personalization and objectivity of assessment; to identify the possibility of integrating AI technologies into the process of teaching drawing, taking into account the specifics of the subject and the age characteristics of children; to consider existing artificial intelligence tools (neural networks for image analysis, machine learning algorithms for personalization of learning). The research methodology includes methods of the general scientific group (analysis, synthesis, generalization, systematization), as well as special methods: historiographic analysis of scientific literature on the topic of the study; formal-logical method, as well as the method of pedagogical observation. During the study the following results were obtained: the introduction of AI technologies in teaching drawing will improve the quality of education, make it more personalized, interesting and diverse. The artificial intelligence application will allow school teachers to more accurately assess the progress of each student, identify problem areas and offer personalized recommendations to improve drawing skills in high school cholfren. Artificial intelligence technologies can also be used to develop new educational programs and teaching materials for the academic discipline «Drawing» in high school.

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Keywords

Artificial intelligence, integration, learning process, high school children, drawing.

Introduction

The research relevance lies in the fact that traditional approaches to teaching drawing in high school are often limited in providing personalized work with children and objective assessment of their academic success. The introduction of artificial intelligence (AI) can significantly empower both teachers and pupils, providing more effective and interactive learning.

As modern researchers note, artificial intelligence makes it possible to analyze the artistic sketches by schoolchildren in a short time, to identify the strengths and weaknesses of their drawing abilities [Hu, Zhan, 2024, p. 12]. Artificial intelligence can also offer personalized recommendations to improve the skills of depicting objects from memory, from nature, portrait painting skills, pencil sketches, etc. [Hussein, Elnagar, El-Bendary, 2020, p. 31]. The use of AI technology is especially relevant in the context of the development of creative industries, where specialists with not only artistic skills, but also the ability to use modern digital tools are in demand.

A wide range of teaching drawing methods are used in the upper grades of general education institutions and specialized art schools, ranging from traditional academic approaches to modern interactive techniques [Farber, 2023, p. 37].

Researchers include the following most common teaching methods:

– The copying method (reproduction of samples, portraits and so on);
– The method of sequential construction (based on the principles of perspective, proportions and composition);
– The tonal and color analysis (emphasis on the transfer of chiaroscuro and volume), as well as the method of stylization (transformation of the object's nature in accordance with a given artistic style).

Despite their prevalence in pedagogical practice, these traditional methods have significant limitations in the learning personalization context. The copying method, for example, often suppresses individual creative search, orienting schoolchildren to mechanical reproduction without understanding the basic principles of fine arts [Chetaieva, Vovkushevska, 2024, p. 6]. The sequential construction method, based on the technical aspects of drawing, can neutralize subjective perception and emotional expressiveness in high school pupils [Wan, 2024, p. 51].

The assessment objectives problem in teaching drawing also remains very relevant. In particular, such traditional evaluation criteria as the accuracy of proportions, the realism of the image and the competent use of chiaroscuro are often subjective and depend on the aesthetic preferences of the drawing teacher. At the same time, the lack of clear, measurable indicators makes it difficult to objectively compare the drawings of schoolchildren and can lead to bias in the assignment of academic scores [Ju, 2022, p. 120].

Such modern approaches, as digital tools and techniques (graphics tablets, drawing software), as well as project activities aimed at solving specific artistic problems, partially solve the problem of personalization, giving high schoolchildren more freedom in choosing means and expressing individual style.

However, these methods have some drawbacks: firstly, the availability of digital resources is limited, and secondly, the effective use of such equipment requires special training of drawing teachers and, thirdly, the assessment of the project activities is often based on subjective criteria related to the creativity and originality of the creative idea of the drawing.

To improve the effectiveness of teaching drawing in high school, it is necessary to develop a comprehensive methodology that combines traditional academic principles with modern artificial

intelligence technologies, as well as the introduction of objective evaluation criteria based on the analysis of the formal elements of the image, composition and color [Hu, Zhan, 2024, p. 14]. We can state that it is also important to the develop the individual creative potential of each high school child in drawing lessons.

The topic historiography is quite extensive and includes the works of Russian, Chinese and foreign authors.

The methodological foundations of the study of drawing are considered in the works by such authors as L. Chetaieva, O. Vovkushevska, M.A. Evstigneev, F. Farber, H. Hussein, A. Elnagar, N, El-Bendary, Lung-Wen Kuo, Chih-Chun Lai, et all.

The possibilities of integrating AI technologies into the process of teaching drawing in high school are analyzed in the studies by such authors as O.I. Paznikov, Ting Hu, Mengsi Zhan, Wan G, Wanying Ju, Yakou H , et all.

Nevertheless, the practical aspects of artificial intelligence application in school education in the field of teaching drawing in high school need to be considered in more detail.

Artificial intelligence integration into teaching drawing among high schoolchildren

The integration of artificial intelligence (AI) into the teaching of art to high schoolchildren opens up new opportunities for creativity and technical skills development. In particular, traditional copy-and-repetition teaching methods can be augmented and expanded with the use of AI tools capable of generating unique images, analyzing student work, and providing personalized feedback. This approach allows to create a more interactive and stimulating educational environment, adapted to the individual needs of each high schoolchildren [Wan, 2024, p. 46].

According to some researchers, one of the promising areas is the use of generative neural networks, such as GAN (Generative Adversarial Networks), to create images from a text description or sketch [2, p. 23]. High school children can experiment with different styles and techniques by entering the right parameters and watching how artificial intelligence interprets children’s ideas.

This process contributes to the development of creative thinking and understanding of the principles of visual design. Modern studies show that the use of Generative adversarial network (GAN) for educational purposes can significantly increase children's interest in art and stimulate their creative activity [Yakou, 2018, p. 434].

The AI-application in drawing teaching can also contribute to the development of critical thinking and creativity in high school children. Working with generative models such as DALL-E or Midjourney allows children to experiment with different drawing styles and techniques, broadening their artistic horizons. In addition, using AI to analyze high schoolchildren’s drawing work and provide constructive feedback can help pupils identify their drawing strengths and weaknesses, as well as develop strategies to improve their skills.

Another important aspect is the AI-technology application to automatically evaluate and analyze the drawings of high school children. There are algorithms that can evaluate the composition, color reproduction, proportions and other parameters of the image, providing high school children with objective feedback on the strengths and weaknesses of drawings. For example, the computer vision allows to evaluate the drawing process itself: the correctness of the brush movement, the correctness of the pencil placement in the fingers, as well as the correct use of paints and materials (paper, canvas, watercolor, oil paints, ink, pencil, etc.).

Furthermore, AI-algorithms can analyze large datasets of artwork to identify common misconceptions and areas where pedagogical approaches can be refined. This data-driven approach allows educators to tailor their instruction to address the specific needs of their children, optimizing the learning experience and fostering artistic growth.

The technical underpinnings of these AI systems often rely on convolutional neural networks (CNNs), which have demonstrated remarkable efficacy in image recognition and analysis [Wan, 2024, p. 47]. Also, CNNs can be trained on vast datasets of labeled artwork, enabling them to discern subtle nuances in composition, color palette, and technical execution. These networks can also be customized to evaluate specific artistic techniques, such as chiaroscuro or sfumato, providing children with targeted feedback on their mastery of these concepts.

Beyond static image analysis, AI can also be leveraged to analyze the dynamic aspects of the drawing process. By employing computer vision techniques, such as pose estimation and object tracking, AI-based systems can monitor the children hand movements, grip, and brushstrokes [Hussein, Elnagar, El-Bendary, 2020, p. 29]. This information can be used to identify potentially inefficient or incorrect techniques, providing children with real-time guidance on how to improve their form. Furthermore, AI also can assess the selection and application of such materials, as the appropriate layering of paint or the correct use of pencil pressure, offering insights into material handling and artistic craftsmanship.

The ethical AI-implications in art education must be carefully considered. It is crucial to ensure that AI-driven assessments are used as tools to enhance learning and not as gatekeepers that limit access to artistic opportunities. Transparency in the algorithms' evaluation criteria and the availability of human oversight are paramount to avoid bias and ensure fairness. Moreover, it is essential to safeguard children's data and maintain privacy, adhering to ethical guidelines and regulations pertaining to the AI in educational settings [Paznikov, 2017, p. 49]. Ultimately, the goal is to leverage AI-capabilities to empower pupils and foster a deeper appreciation for the artistic process.

The AI technologies in the teaching of drawing can also contribute to the development of critical thinking and media literacy. High school pupils need to understand how AI algorithms work, what data is used for machine learning (patterns and exceptions), and what limitations exist for the application of artificial intelligence technologies. This approach allows pupils to consciously use AI tools, critically evaluate images generated by a neural network, and understand the potential risks and benefits of using AI in art in general. The issue of copyright is very important in this case, since neural networks are trained to draw on the basis of paintings by world-famous artists, which can create a situation of plagiarism. Therefore, already in high school, schoolchildren should understand exactly how artificial intelligence learns in the field of drawing, so as not to copy machine-generated samples.

Of course, artificial intelligence should not replace traditional teaching methods, it should complement them. The art teacher still plays a key role in the learning process, providing children with the necessary knowledge and skills, guiding creative inquiry and helping high school children develop their own artistic style. AI should be a tool, not a substitute for creativity in school in drawing lessons.

Conclusion

Based on the results of the study, the following conclusions can be formulated:

1) The integration of artificial intelligence technologies into the process of teaching drawing in high school opens up new horizons for personalizing the educational experience and improving the effectiveness of learning. The introduction of AI tools, such as generative models and image

analysis systems, makes it possible to adapt curricula to the individual needs and pace of learning of each student. This is especially important in the context of heterogeneous classes, where children may have different levels of training and different artistic preferences.

2) An analysis of existing research conducted in the field of AI-powered education demonstrates that personalized learning trajectories based on data on student performance and preferences can significantly improve learning outcomes. For example, adaptive systems based on AI are able to adjust the complexity of tasks and provide individual feedback, which contributes to a deeper understanding of the material and the development of artistic skills.

3) However, the potential risks associated with the use of artificial intelligence in education should be considered. It is important that AI-tools are used as an auxiliary tool for the teacher, and not as a replacement for traditional teaching methods. Thus, it can be stated that the AI-technologies integration into the process of teaching drawing in high school is a promising direction that can significantly improve the quality of education in the field of artistic culture. Further research in this area should focus on developing effective and ethically sound methods for using AI in education.

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Интеграция искусственного интеллекта в процесс обучения рисованию старшеклассников

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Аннотация

Актуальность исследуемой темы обусловлена тем, что интеграция технологий искусственного интеллекта в образовательный процесс, в частности в обучение рисованию в школе, является перспективным направлением, позволяющим адаптировать методы обучения к условиям цифровой эпохи. Цель исследования состоит в выявлении возможностей интеграции технологий искусственного интеллекта в процесс обучения рисованию старшеклассников. Для достижения поставленной цели были решены следующие задачи: 1) анализ существующих методик преподавания рисования и выявление их ограничений с точки зрения персонализации и объективности оценки; 2) выявление возможности интеграции технологий ИИ в процесс обучения рисованию с учетом специфики предмета и возрастных особенностей учащихся; 3) рассмотрение существующих инструментов искусственного интеллекта (нейронные сети для анализа изображений, алгоритмы машинного обучения для персонализации обучения). Методология исследования включает методы общенаучной группы (анализ, синтез, обобщение, систематизация), а также специальные методы: историографический анализ научной литературы, формально-логический анализ и метод педагогического наблюдения. В ходе исследования получены следующие результаты: внедрение технологий искусственного интеллекта в обучение рисованию позволяет повысить качество образования, сделать его более персонализированным, интересным и разнообразным. Применение искусственного интеллекта поможет учителям точнее оценивать прогресс учеников, выявлять проблемные зоны и предлагать индивидуальные рекомендации по совершенствованию навыков рисования у старшеклассников. Технологии ИИ также могут быть использованы для разработки новых образовательных программ и учебно-методических материалов.

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Ключевые слова

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