

Harmonizing Code and Canvas: The Role of Generative AI in Aesthetic Education for Vocational Students

Suhan Wu¹, Min Luo^{2*}

¹School of Economics and Management, Nanjing Polytechnic Institute, No.188 Xinle Road, Jiangbei New Area, Nanjing 210048, Jiangsu Province, China.

²School of Management, Shenzhen Institute of Information Technology, No.2188 Longxiang Avenue, Longgang District, Shenzhen 518172, Guangdong Province, China.

*Corresponding author: Min Luo, luom@szit.edu.cn

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Abstract: This paper delves into the pivotal role of generative artificial intelligence (AI) within vocational aesthetic education, specifically focusing on its capacity to augment artistic expression and cultivate technical proficiency. As AI undergoes continuous evolution, it catalyzes significant transformations in educational paradigms by amalgamating creativity with digital acumen, thereby equipping the workforce with adeptness in navigating technologically driven landscapes. The study critically examines how AI reconfigures educational frameworks, enriching learning experiences through tailored, collaborative, and globally oriented approaches. Additionally, it scrutinizes the ethical, pragmatic, and pedagogical hurdles intrinsic to AI integration, encompassing concerns such as data privacy, bias mitigation, and the imperative for perpetual curriculum innovation and educator empowerment. The findings underscore that the realization of AI's potential in advancing vocational aesthetic education hinges upon strategic deployment, ongoing evaluation, and inclusive discourse among all educational stakeholders, ensuring alignment with educational objectives and responsiveness to global labor market exigencies. This analysis underscores AI's capacity to optimize educational outcomes and equip students for a multifaceted and evolving future, advocating for proactive and inclusive strategies to harness AI's advantages within educational milieus.

Keywords: Generative artificial intelligence; Aesthetic education; Vocational education; Artistic expression; Skill acquisition

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1. Introduction

The advent of generative artificial intelligence (AI) heralds a significant paradigm shift in educational methodologies, particularly within the sphere of aesthetic education ^[1-3]. This paper delves into the transformative influence of generative AI on aesthetic education frameworks in vocational training settings, with a focus on its dual utility for enhancing artistic expression and technical skill acquisition.

Defined by its capacity to autonomously generate novel content from extensive data inputs, generative AI offers unprecedented opportunities for creative exploration ^[4]. In vocational educational contexts, where practical skill development is paramount, AI not only augments the creative process but also prepares students for a future dominated by digital fluency ^[5]. However, this technological integration is fraught with challenges, including ethical quandaries and the necessity for innovative teaching strategies ^[6].

The relevance of this inquiry is underscored by its potential to provide educators, curriculum designers, and policymakers with critical insights into effective AI utilization for optimizing educational outcomes in the arts ^[7]. This investigation aims to thoroughly assess how AI can act as a facilitative tool in aesthetic education, enhancing both the creative and vocational capabilities of students.

This paper is structured, beginning with an extensive review of existing literature on the application of generative AI in various educational contexts. Subsequently, it will delve into the theoretical frameworks that justify integrating AI into aesthetic education. The later sections will explore AI's specific roles and impacts, confront the challenges it presents, and propose directions for its integration into educational practices. This layout allows for a thorough exploration of AI's transformative potential in aesthetic education, particularly within vocational training environments.

This paper finally seeks to elucidate the symbiotic relationship between advanced technology and artistic pedagogy in vocational settings, encapsulated in the conceptual fusion of "code" and "canvas." By dissecting the strategic incorporation of AI into educational practices, it aims to highlight how such technologies can enrich learning experiences and equip students with the skills necessary for navigating the complexities of a rapidly evolving professional environment.

2. Literature review

This section delves into the significant literature regarding the application of generative AI in both creative and educational spheres, highlighting how these technological advances are redefining aesthetic education and integrating seamlessly with established arts education.

2.1. Generative AI in creative contexts

The influence of AI in creative domains is profound, transforming artistic expression and educational approaches ^[8]. Studies indicate that advanced technologies like deep learning algorithms and neural networks are being harnessed to create innovative forms of art, music, and literature, thereby extending the frontiers of traditional creative processes ^[9-11]. Within educational settings, AI plays a pivotal role in developing customized learning environments and interactive tools that enhance creativity among students ^[12]. Further analysis, such as Ragot *et al.* and Utz and DiPaola highlight the utility of AI-generated artworks as pedagogical resources, enriching students' grasp of art history and creative practices ^[13,14].

2.2. Aesthetic education theories

Muzyka *et al.* have profoundly influenced aesthetic education, emphasizing the critical role of the arts in developing sensory and emotional capacities that are crucial for personal and cognitive growth ^[15]. Advocating for experiential learning, other scholars have championed direct, active engagement with artistic works. However, the emergence of digital technologies, particularly AI, is reshaping these established educational frameworks ^[16-18]. Fan and Zhong examined how AI is revolutionizing the way students interact with and interpret art, introducing innovative methods that broaden and enrich these engagements ^[19]. This shift in aesthetic education is not merely expanding the reach but also enhancing the depth of educational experiences

through the integration of advanced technological methods ^[20].

2.3. Technology and artistic integration

The integration of technology within arts education is not a novel concept, as evidenced by the historical use of film and television in educational settings. However, the advent of AI introduces a novel dimension to this integration. Contemporary theoretical models, such as those articulated by Aris *et al.*, posit that AI can function both as a medium and a method within the realm of artistic creation and critique ^[21]. These models advocate for AI's capability to seamlessly integrate technical skills with creative pursuits, thereby enriching the educational landscape for students ^[22]. Moreover, scholarly discussions extend beyond AI's utility in creating digital art; they explore its capacity to enable more profound analytical and interpretative experiences of artwork through advanced interactive technologies ^[23].

The literature review reveals a dynamic interplay between generative AI, aesthetic education, and the integration of technology in the arts, highlighting significant advancements and the broadening of educational and creative horizons. However, despite these insights, there remains a notable gap in the comprehensive understanding of how these technologies are practically implemented within vocational training environments specifically. Much of the existing research focuses on theoretical potential or isolated case studies without addressing the systemic integration of AI into curricula that cater to vocational students' unique needs.

The gap between theory and practice in educational technology underscores the significance of this investigation, which endeavors to meld theoretical frameworks with tangible applications. This research conducts a thorough exploration of how AI can simultaneously foster creativity and enhance technical skills in vocational education settings. By delving into this intersection, the study contributes a nuanced view of the academic discourse on technological integration in education. It provides critical insights into the adept use of AI tools that not only augment aesthetic education but also bolster practical training. This work aims to not only advance academic discussions but also offer practical guidance for educators, curriculum planners, and policymakers dedicated to effectively weaving these technologies into educational structures.

3. Role of generative AI in aesthetic education for vocational students

This section scrutinizes the transformative impact of generative AI in refining aesthetic education for vocational learners. As educational institutions increasingly deploy advanced AI technologies, they catalyze significant enhancements in student creativity and collaboration. These technological tools are crucial for fostering a workforce adept at navigating a digitally enriched professional landscape.

3.1. Theoretical framework

The incorporation of generative AI into aesthetic educational practices is underpinned by a hybrid theoretical approach that integrates educational psychology, advances in technology, and vocational training objectives. Diverging from traditional educational tools, generative AI actively engages in the educational dynamics, serving as a robust catalyst in the learning process. This methodology is anchored in constructivist learning theories, which advocate for an immersive, hands-on learning experience enriched by AI interaction. It also incorporates digital pedagogy principles, highlighting the indispensable role of cutting-edge technology in augmenting educational effectiveness. By positioning AI at the core of educational strategies, this framework not only boosts the interactive quality of learning experiences but also ensures they are more aligned with evolving professional demands.

3.2. Creative facilitation

Generative AI significantly boosts the creative abilities of vocational students by incorporating a range of tools that not only simplify but also refine the entire artistic process. This technological adoption enriches students' engagement, allowing them to delve deeply into both innovative expressions and extensive artistic explorations. For instance, in design and visualization realms, AI algorithms lend a hand by crafting complex designs and visualizations that marry historical insights with current trends. These AI tools advise on color schemes, layouts, and design elements, empowering students to either refresh traditional styles or create completely new artworks.

Additionally, generative AI's capabilities extend to simulation and modeling, especially beneficial in areas like architectural design and fashion. In these disciplines, AI aids in the virtual visualization and testing of materials and settings, promoting a broad exploration of creative concepts without the usual limits set by physical resources. This feature not only conserves materials but also speeds up the experimental stages of creative projects, allowing students to refine their designs through fast-paced iterations. This process of iterative creativity is supported by AI's ability to swiftly produce various iterations of a concept, encouraging a deep dive into a myriad of creative possibilities.

AI tools are also equipped with dynamic feedback mechanisms that actively transform the learning landscape. These systems deliver critiques in real time, each tailored to a wide range of aesthetic standards, which is instrumental for students as they refine their artistic techniques. This on-the-spot guidance is essential—it not only helps students adjust their creative methods but also illuminates subtle areas for improvement that might otherwise go unnoticed. Moreover, these AI systems extend the reach of learning by demystifying complex artistic techniques, making them accessible and manageable for students across all skill levels and physical capabilities. This inclusivity ensures that every student has opportunities to engage deeply with the artistic process and develop their skills effectively.

For educators, generative AI acts as an invaluable ally by serving as a co-instructor. It supplies comprehensive analytics about each student's creative journey and progress, which enables educators to tailor their instructional approaches with greater precision. This customization not only advances personalized learning but also assures that educational strategies are aligned accurately with each student's unique needs and learning styles.

3.3. Personalization of learning

In the varied world of vocational education, where students come with distinct career ambitions and varied educational histories, the customization capabilities of AI stand out as a game changer. By tapping into a wealth of data from student interactions, AI systems are tailored to individualize the learning journey, adjusting content and its presentation to meet each student's specific needs. This flexible approach doesn't just cater to different learning styles; it also ensures that the course content is directly relevant to the precise skills required across various vocational disciplines.

For instance, in a graphic design program, AI can track each student's progress with design tools and concepts, adjusting project difficulty and providing targeted resources as needed. This responsive system keeps students consistently challenged, encouraging continuous engagement and steady advancement. Similarly, in technical fields like automotive mechanics, AI-powered simulations introduce a series of diagnostic challenges that replicate real-life issues, gradually increasing in complexity. This method allows students to build their problem-solving skills progressively, in scenarios that closely simulate actual work environments.

Beyond adapting to individual competencies, AI significantly shapes career-oriented learning pathways.

By analyzing labor market trends and the evolving demands of specific industries, AI systems can recommend specialized courses and skills training that directly correlate with students' intended career paths. This targeted educational strategy ensures that learning is not only relevant but also pragmatically applicable to students' future professional environments, thereby boosting their motivation and engagement.

Integrating augmented reality (AR) and virtual reality (VR) with AI-driven tools significantly enriches the educational landscape. These technologies immerse students in interactive and controlled virtual environments where they can tackle complex vocational tasks without the usual risks or costs. For instance, students in electrical engineering or plumbing can use VR simulations to practice detailed installations and repairs. This safe, virtual practice space allows them to hone their skills confidently and efficiently.

In addition to these immersive experiences, AI plays a crucial role in mentoring. Through natural language processing, AI mentors provide tailored feedback, advice, and emotional support that align with each student's current progress and specific circumstances. This tailored mentorship does more than refine skills—it boosts confidence and fosters a nurturing learning environment that is essential for student success in vocational training programs.

By leveraging these sophisticated capabilities, AI revolutionizes vocational education into a highly adaptive and personalized journey, effectively equipping students for the demands of their chosen careers. This strategic application of AI not only optimizes educational outcomes but also significantly improves student satisfaction and retention, which are critical for the success of vocational programs.

3.4. Collaborative learning

Generative AI profoundly transforms the collaborative learning environment within vocational education, particularly within aesthetic disciplines, by providing advanced tools that facilitate both synchronous and asynchronous interactions. These AI-powered platforms allow students in fields such as graphic design, multimedia arts, and other creative sectors to engage in real-time activities like brainstorming on digital whiteboards and editing projects collaboratively, irrespective of their physical locations. This flexibility is crucial for students who often juggle academic schedules with internships or part-time creative roles, enabling them to participate in group projects at their convenience.

AI also bolsters team dynamics, particularly in environments focused on creative education. It taps into detailed analyses of each student's unique strengths and educational background, assigning roles within group projects that best utilize their individual artistic and technical skills. This strategy not only enhances the overall effectiveness of the team but also cultivates an environment ripe for creative growth and learning. Moreover, the AI continuously oversees and fine-tunes team interactions, suggesting improvements that can lead to better harmony and increased productivity among group members. Such active management of team dynamics ensures that collaborative artistic endeavors are well-balanced and supportive, making them ideal spaces for creative exploration and development.

In addition to improving team collaboration, AI provides students with realistic simulated work environments that mirror the challenges found in actual creative projects. For example, students enrolled in vocational courses like interior design or architecture might find themselves navigating virtual project sites. Here, they collaboratively tackle design challenges, manage resources, and ensure compliance with aesthetic standards. These simulations are intricately designed to reflect the complex and unpredictable nature of real-world artistic endeavors, offering students vital practice in handling creative pressures and making collaborative decisions. This type of simulation is invaluable, as it prepares students to navigate the complexities of professional artistic environments, fostering skills that are crucial for their future careers in the creative

industries.

Furthermore, AI systems significantly advance the learning experience by establishing an ongoing feedback mechanism. They meticulously evaluate both individual learners and entire groups, providing detailed critiques focused on enhancing communication skills, resolving conflicts, and embracing diverse artistic perspectives. This precise feedback is crucial for developing the collaborative skills that are essential in today's creative industries.

Additionally, AI-driven tools facilitate global connections, exposing students to a wider array of international artistic norms and practices. This global exposure is vital in a job market that increasingly values cross-cultural collaborations and understands diverse artistic expressions, preparing students to effectively engage and succeed in international creative ventures.

Through these integrated approaches, generative AI does not merely enhance the collaborative capabilities of vocational students in aesthetic fields but also thoroughly prepares them for the complexities of modern creative professions. This seamless integration of advanced technology into educational settings not only improves educational outcomes but also equips students with the interpersonal and professional skills essential for their future artistic careers.

The previous sections have delineated the transformative role of generative AI in aesthetic education, particularly within vocational training contexts. AI technology fosters dynamic team environments, engages students in detailed immersive simulations, and supports personalized learning trajectories essential for cultivating both artistic sensibilities and technical proficiencies. By incorporating advanced tools such as AR, VR, and sophisticated AI-driven feedback mechanisms, this technology equips students to navigate the complexities of modern creative professions effectively. It prepares them comprehensively for the challenges of a globally interconnected job market. The subsequent section will delve into the broader implications of embedding AI within vocational aesthetic education frameworks. It will scrutinize potential challenges and critical considerations, aiming to enrich our understanding of AI's optimal integration strategies. This discussion will ensure that the deployment of AI technologies not only maximizes educational outcomes but also addresses ethical, practical, and pedagogical issues effectively.

4. Implications and considerations

The adoption of generative AI within vocational aesthetic education introduces a complex array of implications that necessitates scrutiny. This section delves into the ethical, practical, and pedagogical challenges integral to effectively harnessing AI in these educational settings. It aims to outline the necessary considerations that educators, policymakers, and technologists must evaluate to ensure that AI integration is conducted ethically, effectively, and with a clear educational purpose.

4.1. Ethical considerations

As we integrate artificial intelligence into aesthetic education programs, safeguarding student data emerges as a paramount concern. Institutions dedicated to the arts must implement robust data protection strategies to ensure that students' personal and creative work remains secure. Moreover, the risk of AI systems reflecting societal biases presents a unique challenge in fields driven by subjective interpretation and creative expression. Art and design schools must deploy AI algorithms that are transparent and continually assessed for fairness. This vigilant approach helps prevent any unintentional reinforcement of biases that could influence artistic evaluation and student success. Regular oversight and adjustments to these algorithms are essential to ensure they enrich the educational landscape, promoting an equitable learning environment where all students can

thrive creatively.

4.2. Practical challenges

Successfully implementing AI within vocational arts education necessitates not only robust technological infrastructure but also a dynamic approach to curriculum development. Institutions must prioritize significant investments in high-quality hardware and reliable internet access to accommodate AI functionalities effectively. Additionally, the rapid pace of AI technology development demands that educational curricula are adaptable, incorporating new technological advancements as they become available. This requirement extends to educator training—ensuring that instructors are well-equipped to integrate AI tools into their teaching practices requires continuous professional development focused on the intersection of technology and educational methodology.

4.3. Pedagogical adjustments

Adopting AI within educational settings, particularly in the arts, calls for a profound revision of existing teaching methodologies. Educators must not only refine their technical acumen but also deeply embed these sophisticated tools into their teaching practices. This evolution in pedagogy demands carefully designed professional development programs that blend contemporary technological applications with traditional educational strategies. These programs should empower educators to think creatively and modify their teaching approaches dynamically, incorporating AI as a core element of the curriculum rather than merely an adjunct resource. By doing so, they can create enriching learning environments that promote both creative inquiry and technical proficiency, utilizing AI to enhance the educational experience profoundly.

4.4. Preparing for a globalized job market

In the realm of aesthetic education within vocational settings, AI-driven tools are pivotal for enabling global collaboration and exposing students to international artistic standards and practices. As the global job market becomes increasingly interconnected, educators need to cultivate intercultural competencies among students. Integrating global artistic trends and cultural insights into the curriculum equips students for cross-cultural collaborations and opens up international career opportunities, ensuring they are well-prepared to navigate and succeed in diverse, multinational environments.

4.5. Long-term sustainability

For AI to effectively benefit aesthetic and vocational education, institutions must be committed to ongoing evaluation and flexibility. It's essential to build structured frameworks for continuous assessment, which will scrutinize the impacts of AI on how educators teach and students learn. These assessments should leverage solid empirical data, embrace extensive feedback from all involved in the educational process, and remain attuned to the shifting landscapes of the creative industries. By instituting a regular cycle of updates and refinements, educational institutions can ensure AI tools not only retain their relevance but also actively contribute to enriching the educational environment. This ongoing process of review and enhancement is crucial for perpetually improving student preparedness and securing enduring educational advancements.

This section delved into ethical concerns such as safeguarding data privacy and combating algorithmic bias, alongside practical challenges like upgrading infrastructure and revising curricula. Such discussions underscore the critical need for a carefully strategized approach to the integration of AI in educational settings. Additionally, it spotlighted the necessary pedagogical shifts, advocating for educators to adeptly weave AI into creative educational frameworks. Moving forward, we will consolidate these insights and formulate strategic recommendations that aim not merely to augment the educational landscape but to align it with the expansive

goals of preparing students for an increasingly globalized job market. The concluding segment will distill the core themes explored throughout this paper and chart a future course for AI's role in advancing educational practices.

5. Conclusions

The discussions within this paper have highlighted a significant shift in educational approaches, particularly through the use of generative AI in vocational aesthetic education. This concluding section draws together the ethical, practical, and pedagogical considerations discussed earlier to project a future path for AI's role in educational systems.

Generative AI offers remarkable potential to transform aesthetic education, merging creative and technical skills development in ways uniquely suited to the modern workforce's needs. This technology's integration into vocational programs not only broadens the scope of artistic and technical instruction but also equips students to succeed in a diverse, globally interconnected professional world. AI tools enhance learning by breaking through the confines of traditional education settings, promoting intercultural skills, and enabling worldwide collaboration.

However, the introduction of AI technologies into the educational systems brings significant challenges. Ethically, the utmost importance must be placed on protecting student data and addressing biases that AI systems may perpetuate. Practically, deploying AI effectively calls for a robust technological foundation and continuous updates to educational content, which require a committed investment and strategic foresight. Pedagogically, AI necessitates a fundamental shift in how education is delivered, pushing educators to continuously refine their methods and adapt to new teaching models.

Looking forward, it is imperative for educational institutions to actively shape the integration of AI into teaching and learning processes. This involves establishing continuous evaluation mechanisms to refine AI applications, ensuring they remain aligned with educational goals and responsive to the evolving needs of the academic community. Moreover, fostering a multidisciplinary dialogue among educators, technologists, policymakers, and students is essential for leveraging AI to its fullest potential in aesthetic education. Such collaborative efforts will ensure that AI not only enhances educational practices but also progresses in harmony with broader educational and societal objectives. Embracing this proactive and inclusive strategy will enable the effective and ethical transformation of educational landscapes through AI.

In conclusion, as artificial intelligence advances, its careful integration into vocational aesthetic education promises to reshape educational practices and outcomes profoundly. Addressing both the challenges and opportunities that AI presents is crucial for educational institutions aiming to leverage it as a force for innovation and a foundational tool for student preparation in a diverse and evolving global landscape. This endeavor will demand a dedicated commitment to ongoing enhancement and collaborative efforts, ensuring that the merger of technology and artistic expression within educational settings not only bolsters learning but also catalyzes creativity and innovation across society.

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