

Exploration of the Application of Generative Artificial Intelligence in Calligraphy Education in Higher Education Institutions under the Background of "New Liberal Arts"



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Abstract: Under the "New Liberal Arts" background, Generative Artificial Intelligence (GAI) presents new opportunities and challenges for calligraphy education in higher education institutions. This paper explores the applications of generative artificial intelligence in calligraphy teaching, including the use of virtual teachers, personalized teaching designs, instant feedback, and creative assistance. By analyzing the technical characteristics of generative artificial intelligence and its innovative applications in the art of calligraphy, this paper indicates that it can effectively enhance students' learning interests and practical abilities while also emphasizing the issues that need to be addressed during its implementation. Finally, future research directions are proposed to provide references for the reform and development of calligraphy education.

Keywords: New Liberal Arts; Generative Artificial Intelligence; Calligraphy; Higher Education; Teaching Applications

1. Background

Calligraphy, as an important specialized course in humanities in colleges and universities, occupies an important position in the inheritance and innovation of traditional Chinese culture. Calligraphy is not only a form of artistic expression, but also a carrier of cultural identity and historical inheritance. With the advancement of the construction of new liberal arts, calligraphy teaching faces greater opportunities and challenges (Teng, 2024; Li, 2024; Si & Lin, 2024; Xiao, 2024; Li & Xiao, 2023; Pang, 2024).

In 2019, the Ministry of Education issued the Opinions of the Ministry of Education on Strengthening and Improving the Cultural Quality Education of College Students, proposing to strengthen the cultural quality education of college students and encouraging colleges and universities to offer calligraphy and other related courses in order to improve students' cultural cultivation (Ministry of Education, 2019a). The document emphasized the

importance of calligraphy education in the inheritance of traditional culture, the enhancement of students' cultural literacy and aesthetic education, and provided policy support and guidance for the development of calligraphy education in colleges and universities. In the same year, the Ministry of Education issued the Opinions on Accelerating the Construction of High-level Undergraduate Education and Comprehensively Improving Talent Cultivation Capability, which explicitly put forward the acceleration of the construction of "new engineering, new medical science, new agricultural science, and new liberal arts" (Ministry of Education, 2019b). This policy background points to the innovative requirements for educational content and methods, in which Calligraphy, as a representative of traditional culture, is inevitably included in the reform and innovation framework of the new liberal arts. The new liberal arts emphasize integration and innovation, requiring the cultivation of composite talents with traditional cultural heritage and modern innovation ability to meet the cultural needs of the new era.

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However, teaching practice has proved that although the current traditional teaching mode of Calligraphy has certain advantages, there are still many problems, which seriously restrict the improvement of teaching effect. Specific problems include: ① insufficient teaching resources, many colleges and universities lack of rich teaching resources; ② lack of personalized teaching, traditional teaching is often used in a “one size fits all” approach, making it difficult for some students to keep up with the progress or feel uninterested; ③ feedback mechanism is not perfect, the lack of timely feedback from the students, the teacher is difficult to comment on the works of each student one by one; ④ practice opportunities, although some advantages, there are still many problems, these problems seriously limit the enhancement of teaching effectiveness. Limited opportunities for practice, students do not have enough time to practice calligraphy due to the schedule of the curriculum, etc.; ⑤ Insufficient innovativeness, traditional teaching focuses too much on the teaching of techniques and neglects the cultivation of students' creativity and personalized expression; ⑥ Insufficient cultural understanding, students do not know enough about the cultural connotation and historical background of calligraphy, which affects the attractiveness of teaching.

Generative Artificial Intelligence (GAI), as one of the most revolutionary and disruptive technologies in recent years, is becoming a key in the development of the times. On March 5, 2024 at the second meeting of the 14th National People's Congress, the government's work report mentioned not only three times On March 5, 2024, at the second meeting of the fourteenth national people's congress, the government work report not only mentioned “artificial intelligence” three times, but also proposed for the first time to carry out the action of “artificial intelligence +”, which also indicates that artificial intelligence will usher in a new opportunity for the development of thousands of industries (State Council, 2024). The second session of the 14th National People's Congress mentioned in the press conference on the theme of people's livelihood: “For the education system, artificial intelligence is a ‘golden key’, which not only affects the future of education, but also affects the future of education, with both opportunities and challenges.” To better

seize the opportunities and meet the challenges, it is necessary to actively embrace technological and industrial changes, and actively embrace the era of intelligence (National People's Congress, 2024). GAI will provide strong technical and intellectual support for the main body of education and teaching activities, and it will have an important role in promoting the “advancement of education digitization, the construction of a lifelong learning society for all people, and a large country of learning” put forward in the report of the Twentieth National Congress of the party. “ has an important role in promoting.

Therefore, it is of great theoretical significance and practical value to explore the application of Generative Artificial Intelligence (GAI) in the teaching of Calligraphy in higher education, especially the innovative mode and solutions in practical teaching. The purpose of this paper is to analyze GAI to solve the problems in the teaching of calligraphy, put forward the corresponding innovative application scenarios, promote the inheritance of calligraphy culture and the modernization and transformation of the education model, and provide new ideas and practical paths for the reform of calligraphy teaching in the context of new liberal arts.

2. Analysis of the Application of GAI in the Education of Calligraphy

The application of GAI in calligraphy education is gradually becoming an important means to improve teaching quality and enrich learning experience. With the arrival of the digital era, traditional calligraphy teaching faces many challenges, including lack of resources, lack of personalized teaching, imperfect feedback mechanism, insufficient practice opportunities, insufficient innovation, and insufficient cultural understanding, etc. The introduction of GAI provides effective solutions to these problems and promotes the inheritance and development of the art of calligraphy. The following will analyze in detail the application of GAI in calligraphy education from multiple dimensions.

2.1 Acting as a virtual teacher and enriching teaching resources

Generative AI can act as a virtual teacher and provide rich calligraphy teaching videos, demonstrations and explanations to make up for the

shortage of professional teachers and help students obtain more learning resources and guidance. It can provide targeted teaching support, especially in the basic knowledge, skills and styles of calligraphy.

For example, in the teaching process of “character structure analysis”, GAI can analyze the structure of different Chinese characters and provide demonstrations of character disassembly and combination. For example, for the character “汉”, GAI can show the order and technique of writing its components “讠” and “又” to help students master the overall beauty of the character. In the teaching process of “basic strokes”, GAI can generate detailed calligraphy teaching videos to show how to write each basic stroke, such as “horizontal”, “vertical”, “horizontal”, “vertical”, “skimming”, “pressing” and so on. Through slow-motion demonstrations and step-by-step explanations, students can clearly understand the techniques of starting, moving and finishing each stroke. In the teaching process of “styles and genres”, GAI can provide teaching content on different styles of calligraphy (e.g. Regular Script, Running Script, Cursive Script, etc.), introducing the historical background, representative figures and their works of each style. Through video demonstrations, students can learn how to use brushwork and ink colors in different styles to enhance their calligraphic expression. In addition, GAI can assist teachers in providing personalized feedback and guidance - using image recognition technology, GAI can analyze students' writing works and provide personalized feedback and suggestions for improvement. GAI can identify common mistakes made by students when writing a certain character and give targeted practice suggestions to help students continuously improve.

Through these applications, GAI can not only make up for the shortcomings of professional teachers, but also provide students with rich learning resources and personalized guidance, which greatly enhances the effectiveness of calligraphy teaching and students' learning experience.

2.2 Assisting personalized teaching and enhancing learning effectiveness

Personalized teaching is one of the key points and difficulties of teaching reform in colleges and universities. GAI can make personalized learning plans and practice contents according to each student's level of calligraphy and learning progress, so as to meet the needs of different students and enhance the learning effect.

For students of different levels, GAI can develop personalized learning plans. For example, for beginners, the learning plan may include the practice of basic strokes, the writing of simple Chinese characters and basic calligraphy theories; while for intermediate students, the learning plan may involve the in-depth analysis of character

structures, the practice of different styles of calligraphy, and so on. For advanced students, the learning plan may focus on the creation of works, stylistic innovations and theoretical discussions on the art of calligraphy. GAI can recommend personalized exercises based on students' interests and needs. For example, if a student is interested in running script, GAI can provide relevant running script posters, copying exercises of classic works, and videos of running script techniques to help the student learn in-depth in his/her area of interest. GAI can also track students' learning progress and practice results in real time, and dynamically adjust the learning program. For example, if a student has repeated problems in writing the “horizontal” stroke, GAI can increase the frequency of practicing that stroke and provide targeted instructional videos to help the student overcome the difficulties. At the same time, GAI can also adjust the difficulty and depth of the learning content based on the student's feedback and performance, ensuring that the learning program always meets the student's needs.

Through these applications of personalized learning, GAI can effectively meet the needs of different students, enhance the effectiveness of calligraphy teaching, and help students make greater progress in the study of the art of calligraphy.

2.3 Provide immediate feedback to improve calligraphy skills

In the teaching of calligraphy in colleges and universities, real-time feedback is an important part of improving students' calligraphy skills. GAI, combined with image recognition technology, can instantly analyze students' calligraphy works, provide specific feedback, and help students identify and correct problems in writing.

Students can upload their calligraphy works via cell phones or computers, and GAI analyzes the works using image recognition technology. The system identifies each character in the calligraphy work and analyzes the order of the strokes, structural integrity, and overall aesthetics. This process is not only fast and efficient, but also provides students with timely feedback. It is possible to evaluate each stroke of each character individually. For example, when writing the character “书”, GAI will check whether the starting, moving and finishing strokes are standardized, and whether there is any incorrect order of strokes or improper connection of strokes. For structure, GAI will analyze the overall layout of the character to determine if the shape is well-proportioned and conforms to the aesthetic standards of calligraphy. During the analysis process, GAI will automatically identify common problems in students' writing, such as strokes that are too thick or too thin, distorted character shapes, and unreasonable structures. In response to these problems, GAI will provide specific suggestions for correction, for

example, “Please pay attention to the angle between the apostrophe and the downstroke in the ‘Shu’ part of the character ‘書’, it is recommended that the angle be adjusted to 45 degrees.” “When writing the character ‘书’, pay attention to the consistency of the strokes and avoid broken strokes.” Based on the student's problems in writing, GAI can recommend personalized exercises. For example, if a student has a problem with the incoherent strokes in the character “草”, GAI can recommend a video to help the student strengthen his or her understanding and mastery of the stroke. GAI can record the student's learning progress and feedback history to help the student understand his or her own progress. For example, students can view their calligraphy work over time, comparing the changes before and after corrections to enhance their sense of achievement in learning. At the same time, GAI can also adjust the subsequent learning program based on the students' feedback history to ensure that the learning content always meets the students' needs. GAI can interact with students through real-time feedback to encourage students to actively participate in calligraphy learning. For example, students can get immediate feedback after completing an exercise and build on it to take the next step, forming a good learning cycle.

Through the application of these real-time feedbacks, GAI can effectively help students identify and correct problems in writing, enhance the learning effect, and improve the skills of calligraphy, so that students can make continuous progress in the learning of the art of calligraphy.

2.4 Generate Calligraphy Works and Increase Practice Opportunities

In the teaching of calligraphy in colleges and universities, the generation of calligraphic works is a highly valuable application, which can provide students with abundant copying and practicing materials, increase practice opportunities, and help them explore and improve their calligraphic skills in different styles.

GAI can generate high-quality calligraphy works based on different styles of calligraphy (e.g., Regular, Running, Cursive, Clerical, etc.). Students can choose a specific style to study, and GAI will generate corresponding character posters showing the typical character shapes and strokes of that style. For example, if a student chooses a running script style, GAI can generate running script versions of the characters “spring”, “autumn”, “winter”, etc. for the student to copy. GAI can provide real-time practice guidance when students are copying the GAI-generated calligraphy works. For example, when students write the character “spring”, GAI can prompt them to pay attention to the start and end of the strokes, emphasizing the smoothness and consistency of the running script. In this way,

students can not only imitate the shape of the character, but also understand the techniques and aesthetics of calligraphy. GAI can generate different calligraphic styles of the same character for students to compare and analyze. For example, students can see how the character “愛” (love) is represented in regular, running and cursive scripts, and understand the characteristics and writing techniques of each style. This kind of comparative analysis helps students form their own stylistic perceptions in the learning process. In addition to copying, GAI can also encourage students to engage in creative writing exercises. Students can input what they want to write, and GAI will generate calligraphic works of the corresponding styles for students' reference and imitation. In this way, students can explore different styles of calligraphy in practice and enhance their creative abilities.

Through these applications of calligraphy work generation, GAI can provide students with rich practice opportunities, help them explore and improve their calligraphy skills in different styles, and enhance the fun and effectiveness of learning.

2.5 Creative Aid, Expanding Horizons

In the teaching of calligraphy in colleges and universities, GAI can provide students with creative inspirations and suggestions, encourage them to carry out innovation and personalized expression, stimulate students' creativity and expand their artistic vision.

For example, in the school calligraphy course, the teacher organizes a calligraphy creation competition with the theme of “spring”. In order to stimulate students' creativity, the teacher introduced GAI as a creative aid. The students first used GAI to obtain poems and idioms related to “spring”, and GAI recommended “spring wind and rain” and “spring is in full bloom” to help the students determine the theme of creation. Students could choose from a wide range of calligraphic styles. Students could choose different styles of calligraphy for their creations. GAI recommended a combination of regular, running and cursive scripts according to each student's level of calligraphy and style preference, encouraging them to experiment with different strokes and layouts in their works. During the creative process, students uploaded their works to GAI, where the system analyzed and provided feedback in real time. For example, GAI pointed out that a student's brushstrokes were not connected smoothly enough when writing the character for “spring” and suggested that he or she adjust the starting and ending positions of the brushstrokes to enhance the overall coherence, and also displayed spring-themed works by famous calligraphers from history to inspire the students to create their own works. Eventually, students completed their individual pieces and presented them at the competition. GAI provided personalized critiques of

each student's work to help them understand the strengths and weaknesses of their creations.

Through the application of this creative assistance, students not only improved their calligraphy skills, but also gained inspiration and self-confidence in their creations, expanded their artistic horizons, and enhanced their understanding and love of the art of calligraphy.

3. Summary

In the context of new liberal arts, GAI can provide a new direction and possibility for teaching calligraphy in higher education. Through the generation of rich teaching resources, personalized learning plans, real-time feedback and assessment, promotion of innovation and creativity, and in-depth cultural understanding, GAI can effectively solve the many dilemmas facing the teaching of traditional calligraphy. In practical teaching, GAI's innovative model makes calligraphy learning more flexible and efficient, thus better cultivating composite talents that meet the requirements of the new era.

However, the application of GAI in art education also faces some challenges. First, the dependence on technology may lead to the limitation of students' creativity. Over-reliance on GAI-generated content may cause students to lack the ability to think independently and innovate in the creative process. Second, the role of teachers faces a shift. Teachers not only need to master GAI technology, but also need to redefine their teaching methods to adapt to the new teaching environment.

In the future, the effective combination of GAI and traditional education needs to be further studied and explored, so as to inject new vitality into the inheritance and development of calligraphy culture, in order to realize the innovation and development of education. Meanwhile, teachers should actively embrace this emerging technology and improve their technical literacy and teaching ability to adapt to the changing educational environment and needs.

Conflict of Interest

The author declares that she has no conflicts of interest to this work.

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