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Research on AIGC-Enabled Mentorship Project System and Innovative Talent Cultivation in Higher Vocational Colleges

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Abstract

Against the backdrop of rapid development of artificial intelligence, generative artificial intelligence has become an important force driving change in the field of education. This study explores the application and effectiveness of AIGC-empowered mentorship project system in the cultivation of innovative talents in vocational colleges. Through empirical research and case analysis, it has been found that the mentorship project system empowered by AIGC can significantly enhance students' innovation and problem-solving abilities, optimize project output and achievement transformation, enhance learning engagement and team collaboration. The study also constructed a "six-in-one" innovation path model, providing a systematic framework for the deep integration of AIGC and mentorship project system. However, research also suggests that the long-term effects, ethical standards, and institutional safeguards of AIGC in education still need further exploration. This study provides theoretical support and practical reference for vocational colleges to achieve high-quality development in the context of digital transformation.

Keywords

AIGC-Enabled Mentorship; Higher Vocational Colleges; Innovative Talent Cultivation; Project-Based Learning

1. Presentation of the Problem

In recent years, the scale of vocational education has continued to expand, but the uneven quality of student sources and insufficient learning motivation remain prominent issues. The Annual Report on the Quality of Higher Vocational Education in China (2023) shows that over 40% of new students in vocational colleges have scores below the undergraduate admission line by more than 50 points in the college entrance examination, and their learning foundation and self-motivation are generally insufficient[1]. Many students choose their majors based on employment

considerations rather than academic interests, and lack initiative in learning. Even if mentors introduce project-based learning, students find it difficult to enter the state of deep learning[2].

The insufficient teaching staff and lack of integration between industry and education in vocational colleges directly restrict the implementation of the mentorship project system. As of the end of 2022, the proportion of "double-qualified" teachers nationwide is only 42.6%, which is lower than the national recommendation of over 60%[3]. At the same time, school-enterprise cooperation often remains at the level of short-term internships or order classes, lacking in-depth joint research and practical projects, resulting in a lack of industrial scenario support for the projects[4].

The problem of outdated curriculum system and teaching mode is also pronounced. In art and design vocational colleges, over 65% of courses are still mainly taught in the classroom, and the proportion of interdisciplinary and project-driven courses is less than 20%[5]. The evaluation system still focuses on knowledge mastery and lacks assessment of innovation ability.

The insufficient technological empowerment and digital divide have further exacerbated this problem. The investment in educational informatization in the eastern region is 2.3 times that of the western region, and there is a significant gap in AI literacy between teachers and students. Many teachers still adhere to the traditional "PPT+multimedia" teaching mode[6].

In addition, the deficiencies of policies and evaluation mechanisms also limit the innovative development of higher vocational education. Research funding and innovation projects tend to favor undergraduate and research-oriented universities, while vocational colleges are at a disadvantage in terms of resources. The current system places excessive emphasis on graduation and employment rates, while neglecting the focus on innovation achievements and conversion rates[7].

In summary, vocational education is facing multiple challenges such as low quality of student sources, limited teaching staff, lagging curriculum, technological gaps, and unreasonable policy guidance, which provide a realistic background for exploring the "AIGC+Mentorship Project System".

2. Theoretical Basis and Literature Review

The effective operation of the mentorship project system requires the cross-integration of interdisciplinary theories such as education, psychology, and AI-enabled education. Constructivist learning theory emphasizes learners' autonomous exploration and collaborative interaction in real situations, believing that knowledge construction depends on context, cooperation, and practice[8], which is highly consistent with the core concept of project-based learning in mentorship. The Output-Oriented Approach emphasizes learning outcomes as the guide, promoting learners' ability improvement through goal setting, path design,

and outcome evaluation[9], providing an evaluation framework for the implementation of mentorship projects. The theory of Competency-Based Education further emphasizes the cultivation of students' core competencies, vocational abilities, and innovative spirit[10], which is highly consistent with the goal of cultivating "applied and technical" talents in higher vocational education.

The development of artificial intelligence has also provided new theoretical support for education. The theory of empowering artificial intelligence education points out that AI technology is not only an educational tool, but also a restructuring force in the educational process. It reshapes the logic of "teaching and learning" through mechanisms such as intelligent recommendation, knowledge tracking, and learning analysis[11]. Especially, generative artificial intelligence has demonstrated unprecedented capabilities in knowledge expression, resource generation, and learning interaction, providing solid support for the intelligent transformation of mentorship projects[12].

From an international perspective, countries such as Europe and America have been exploring the "mentorship+project-driven" model earlier. MIT, Stanford University, and other universities in the United States have effectively improved students' research and engineering practice levels[13] through the combination of the "Research Apprenticeship Program" and the "Capstone Project". The University of Helsinki in Finland has introduced AI learning analytics tools into its mentorship system, establishing a "personalized learning profile" to help mentors track students' progress in real time [14]. These practices have shown that the mentorship project system, empowered by artificial intelligence, can effectively solve the problems of uneven distribution of educational resources and insufficient personalized guidance[15].

In China, research has mostly focused on undergraduate and graduate levels, believing that mentorship project system can promote the cultivation of research and innovation abilities. However, exploration at the vocational level is relatively weak. In recent years, with the advancement of the digital education strategy, some vocational colleges have attempted to integrate AIGC tools into project-based teaching. For example, art and design majors use the AIGC platform for visual creativity generation, significantly improving students' creative efficiency and diversity of works[16]. However, overall, domestic research still lacks a systematic theoretical framework and empirical data support.

In summary, existing research has revealed the value of mentorship project system and AI-enabled education, but there is still a lack of theoretical explanation and limited data support on how AIGC can be deeply embedded into the mentorship project system in higher vocational education. This article intends to propose an innovative path of "AIGC+Mentorship Project System" that is suitable for vocational colleges through case studies, in order to make up for the shortcomings.

3. Data Investigation and Research Design

This study selected five secondary colleges (Intelligent Engineering, Automotive Engineering, Computer Engineering, Management Engineering, Mechanical Engineering) of vocational colleges in a certain region as samples for the pilot classes of mentorship project system. The student sample size is N=1000 (AIGC group, n=200; control group, n=800). The sample sizes for teachers and corporate mentors are 80 and 20, respectively. This study used stratified cluster sampling and completed equivalence testing before participation.

This study proposes three hypotheses: firstly, the mentorship project system empowered by AIGC can significantly enhance students' innovation and problem-solving abilities, as evidenced by significantly higher post-test scores in the AIGC group compared to the pre-test and control groups; Secondly, the AIGC group significantly outperformed the control group in terms of project output (number of works, number of entries, patents/competitions), achievement conversion rate, and employment quality; Thirdly, learning engagement and teamwork play a partial mediating role in the path from AIGC to innovation capability, where AIGC not only directly promotes innovation capability but also indirectly generates positive effects through learning engagement and teamwork.

A mixed method of questionnaire survey (pre-test and post-test), semi-structured interview, and project file quantification was adopted, as shown in Tables 1 and 2. The questionnaire covers dimensions such as learning engagement, teamwork, innovation ability, project output, and employment expectations; The interviewees include students, on-campus mentors, and corporate mentors; The archive data comes from the course platform and the school-enterprise cooperation system.

Table 1. Research variables and measurement indicators

Primary indicator	Secondary indicator	Measurement method	Scale/Unit
learning engagement	learning motivation and duration	Likert/learning platform log	1-5 minutes/hours
team collaboration	role division and collaboration frequency	Likert/platform records	1-5 points/time
innovation capability	Innovative thinking and problem-solving	pre- and post-test Likert	1-5 points
project output	number of works, number of entries, patents/competitions	quantitative statistics of archives	piece/item
outcome conversion	enterprise adoption and conversion rate	enterprise feedback + supporting materials	%
employment quality	employment rate and job matching degree	graduation tracking/enterprise feedback	%

Table 2. Questionnaire dimensions, item examples, and reliability and validity

Dimension	Example of question items	Reliability coefficient	Validity indicators
learning motivation	I have a sustained interest in the project theme.	0.86	0.82

team collaboration	Clear division of labor and timely communication exist within the team.	0.84	0.80
innovation capability	Capable of proposing multiple feasible solutions and iteratively optimizing them.	0.88	0.85
problem solving	Capable of independently identifying problems and selecting appropriate tools to solve them.	0.83	0.79
self-directed learning	Being able to search for information and utilize resources to enhance learning outcomes.	0.85	0.81
technology application	Proficient in using AIGC tools to assist in completing project tasks.	0.87	0.83
communication expression	Ability to express ideas clearly and communicate effectively with others.	0.82	0.78
critical thinking	I analyze the problem from multiple perspectives and question existing solutions.	0.84	0.80

4. Innovative Path Design of Mentorship Project System Empowered by AIGC

In the context of the digital transformation of vocational education, higher vocational colleges promote the mentorship project system empowered by AIGC. Higher vocational colleges first need to make overall plans from the top-level design and strategic orientation levels. The "Strategic Action for the Digitalization of Vocational Education" clearly stated that by 2025, more than 80% of vocational colleges should have built intelligent teaching environments[17]. This provides policy and institutional guarantee for higher vocational colleges to build a mentorship project system based on AIGC. Colleges and universities should combine national strategies and local policies, formulate systematic plans, clarify training objectives, implement teacher training and funding support, integrate resources from a strategic perspective, and ensure the feasibility of project system reform.

In terms of teaching model, AIGC promotes the evolution of the mentorship project system from "single guidance" to "compound mentorship + intelligent assistant". Teachers, industry experts and corporate mentors form an interdisciplinary team to provide students with multidimensional guidance; At the same time, tools such as ChatGPT and Stable Diffusion can assist in solution generation and creative visualization, forming a new type of learning environment called "human-machine collaboration". Studies have shown that by introducing AIGC into project-based learning, the efficiency of students in completing scheme design and experimental verification has increased by about 27% on average[18].

In terms of curriculum system, a progressive structure of "basic ability-cross-border

ability-innovation ability" should be constructed. In the basic stage, courses on the use of AI tools and digital ethics are offered; In the cross-border stage, promote integrated courses such as "AI+ industry"; In the innovation stage, the graduation design and entrepreneurial practice links are fully integrated into AIGC. For example, students majoring in mechatronics in a higher vocational college in Zhejiang completed the optimized design of circuit boards with the support of corporate tutors and AIGC, which reduced the design error rate by 21% and shortened the project cycle by 18%.

In terms of school-enterprise collaboration, the mentorship project system empowered by AIGC not only emphasizes "integration of production and education", but also emphasizes the transformation of achievements and industrial implementation. Colleges and universities should jointly build AI joint laboratories with enterprises, and use real data to promote the integration of industry, education and research; Enterprise tutors should deeply participate in the design of the project, so that students' achievements can directly enter the enterprise's research and development process. For example, in a new energy project class jointly organized by an automotive vocational college in Shanghai and BYD, students proposed optimization plans for the battery management system using AIGC, and two of these plans were adopted and entered the production verification stage.

In terms of quality assurance, higher vocational colleges need to build a data-driven multi-dimensional evaluation system. In addition to process evaluation, achievement and value evaluation should also be introduced, with achievement conversion rate, patent application rate and enterprise adoption rate as core indicators[19]. Empirical research shows that the proportion of students who adopt the "AI project system" whose innovative achievements are adopted by enterprises is 1.8 times that of the traditional model[16].

To sum up, the innovation path of the mentorship project system empowered by AIGC can be summarized as a six-in-one of "policy guidance-strategic design-reconstruction-curriculum progression-integration of production and education-quality assurance". This not only responds to reality, but also provides a practical paradigm that can be promoted in the future.

5. Experimental Results

The application of the AIGC-empowered mentorship project system has led to improvements in teaching, curriculum, school-enterprise collaboration, and quality assurance, yielding positive data outcomes. As shown in Figure 1, Figure 2, and Figure 3:

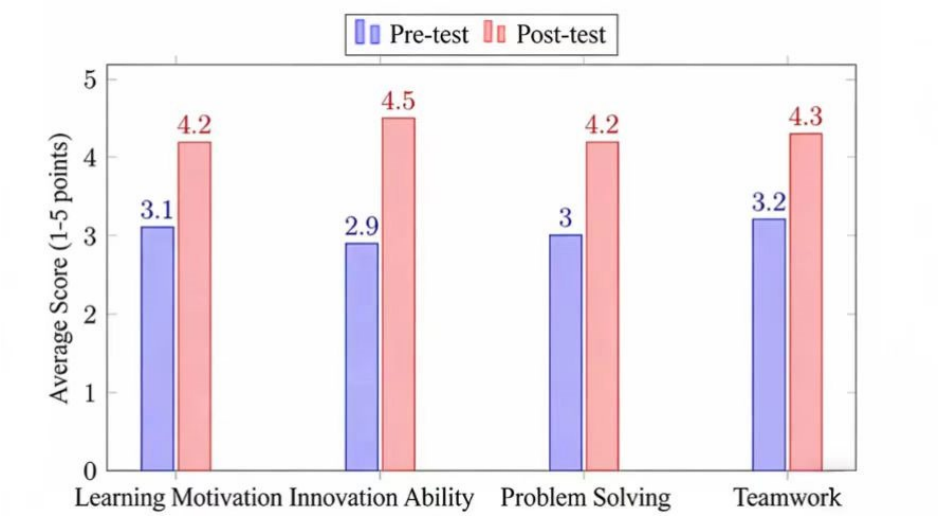


Figure 1. Comparison of Key Abilities of the AIGC Group Before and After the Intervention

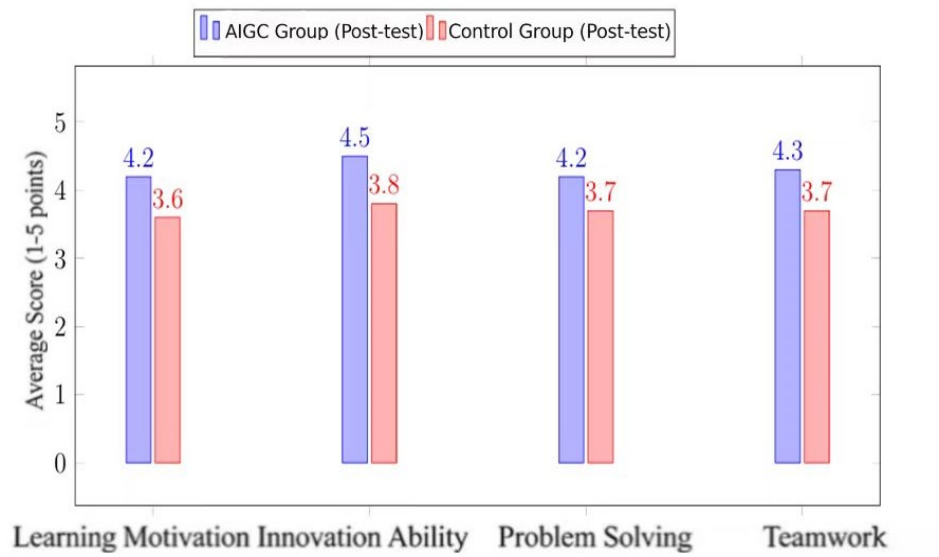


Figure 2. Comparison between the AIGC group and the control group after testing

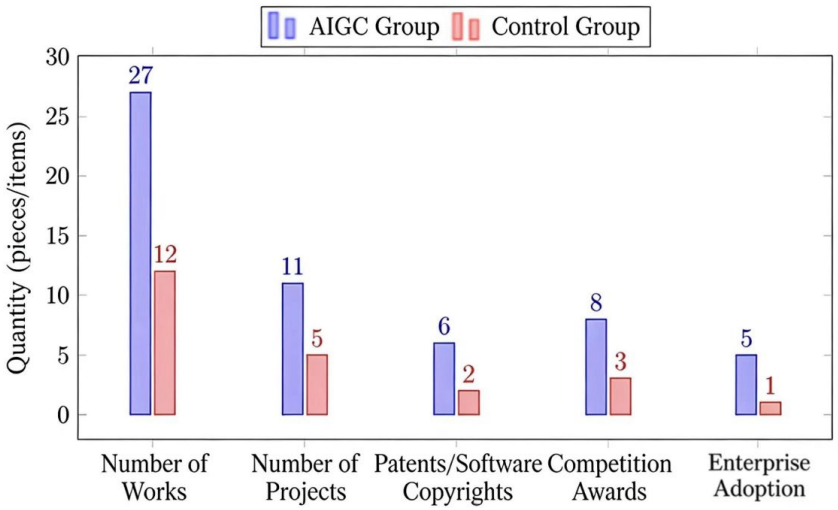


Figure 3. Comparison of the transformation of project outcomes between the two groups

To sum up, the mentorship project system empowered by AIGC breaks through the limitations of education, strengthens personalized training and interdisciplinary cooperation, promotes the deep integration of production and education, and effectively improves students' innovation ability and self-efficacy[20]. This is not only an innovation in the form of education, but also an important strategic path for higher vocational colleges to realize "elite training" and "innovative talent supply".

6. Case Study: Comparison of Typical Practices between Undergraduate and Vocational Colleges

In recent years, with the wide application of AIGC, the mentorship project system has gradually shown unique advantages at different levels of education.

The undergraduate model represented by the "Qian Xuesen Class" of Tsinghua University highlights the cultivation of top innovative talents, emphasizing interdisciplinary integration and cutting-edge scientific research training. Through the establishment of a "scientific research group-mentor team-enterprise joint guidance" mechanism, the class introduces AIGC into data modeling, scientific research writing and interdisciplinary research. For example, students use AIGC to simulate aerodynamic parameters in propulsion system research, the model accuracy is improved by 27%, the experimental cycle is shortened by nearly one-third, the proportion of students in the class participating in national scientific research projects reaches 85%, and at least 1.7 high-level papers are published per capita [21].

In higher vocational education, engineering and art majors present differentiated application paths. Taking the "New Energy Project Class" jointly organized by Shanghai Automotive Vocational College and BYD as an example, the school has established a process of "introduction of real projects in enterprises-dual-track

guidance by tutors-student group research". Under the joint guidance of enterprise tutors and school teachers, students use AIGC to design battery management systems. The results are directly applied to BYD experimental factories. Some design parameters have entered the industrial test stage, and both student employment rate and enterprise satisfaction have been greatly improved [15].

Art and design higher vocational colleges pay more attention to the advantages of AIGC in creative generation and visualization. Beijing Institute of Fashion Technology introduced Stable Diffusion and other tools into the "AI Fashion Design" course. Students completed a series of fashion design works under the guidance of their tutors. Some works were selected by China International University Fashion Week to display and cooperate with enterprises for negotiation. The project incubation rate increased by more than 30% [16]. In the "Intelligent Design and Manufacturing Workshop" of a higher vocational college in Zhejiang, students used AIGC to analyze product modeling and market trends, and the conversion rate of results increased from 15% to 32% [15].

A comparison between undergraduate and vocational institutions reveals that undergraduate programs emphasize research frontiers and international standards, whereas vocational colleges prioritize industrial application and outcome transformation. The common trend of the two under the empowerment of AIGC is: on the one hand, the depth and breadth of project-driven learning have been significantly enhanced, and students' learning autonomy and achievements have been improved; On the other hand, interdisciplinary collaboration and school-enterprise cooperation have gradually become the core path.

This comparison shows that AIGC not only improves the efficiency and quality of the mentorship project system, but also promotes the hierarchical positioning of different educational levels in terms of talent training goals. In the future, higher vocational colleges can learn from the scientific research elements of undergraduate programs, and undergraduate colleges can also absorb the industry orientation of higher vocational colleges to jointly promote the talent training pattern driven by "academic-industry" two wheels.

7. Comparison and Inspiration of Domestic and Foreign Cases

In international practice, some developed countries in Europe, America and Asia have made relatively mature explorations in the mentorship project system empowered by AIGC. The d.school of Stanford University in the United States introduced ChatGPT and Midjourney in the design thinking course. Students use these tools to complete user research and creative visualization, thereby shortening the solution iteration cycle. The data shows that after the application of AIGC, the output of student projects has increased from an average of 2.1/semester to 3.8/semester, and the pass rate of innovative solutions in the market has increased by 35% [18]. The University of Applied Sciences in Munich, Germany, cooperated

with BMW to set up the "Intelligent Manufacturing Project Class". Students use AIGC to carry out process simulation and process optimization. The proposed plan is directly adopted by the company and implemented in the pilot factory, and the production efficiency has increased by about 18% [22]. The "Future Automotive Engineer Program" jointly promoted by Tokyo Institute of Technology and Toyota Corporation, through the engineering simulation function of AIGC, realizes the whole process of training of "virtual trial production-iterative optimization-physical verification" for students during school [23].

In China, the educational application of AIGC is still in the stage of rapid exploration, but some pilot projects have shown positive results. For example, a higher vocational college in Zhejiang set up an "Intelligent Design and Manufacturing Workshop". Under the guidance of a tutor, students use AIGC to generate product appearance, material parameter simulation and market research. The results show that the adoption rate of students' graduation design has increased from 15% to 32% [15]. Beijing Institute of Fashion Technology offers courses in the direction of "AI Fashion Design". Students use generative models such as Stable Diffusion to design clothing styles, and carry out project-based practice in combination with the tutorial system. Some student works will be exhibited at the 2023 China International University Fashion Week, and the proportion of enterprises engaging in cooperation negotiations increased by 40% [16].

Comparing domestic and foreign practices, it can be found that the common feature of foreign cases is that they emphasize interdisciplinary cutting-edge experiments and industrial implementation, and institutional and ethical norms are relatively complete; The domestic advantages mainly lie in the rapid promotion of policies and the strong ability to integrate regional resources, but the shortcomings lie in the lack of depth of teacher training, the lack of depth of student application, and the lack of a standardized system[24].

The following enlightenments can be obtained from these practices: First, a stable school-enterprise cooperation mechanism should be established to promote the students' project achievements to directly enter the industrial chain; The second is to highlight interdisciplinary integration, learn from the practices of Stanford and other universities, and use AIGC as a "bridge" between different disciplines; Third, it is necessary to improve the system and ethical norms of AIGC application to ensure academic integrity and intellectual property protection; Fourthly, we should construct a comprehensive achievement evaluation system with output, transformation and value as the core, so as to promote the quantitative assessment of innovation ability of higher vocational education.

8. Research Conclusion and Prospect

Through systematic analysis and case studies, it can be concluded that the mentorship project system empowered by AIGC can effectively address the

predicaments faced by higher vocational education, such as the uneven quality of student intake, limited teaching resources, outdated curriculum systems, and insufficient integration of industry and education. Its value is mainly reflected in four aspects: first, it enhances project efficiency and outcome quality through intelligent tools; second, it strengthens personalized guidance and differentiated cultivation; third, it promotes cross-disciplinary integration and the combination of industry and education; fourth, it boosts students' innovation capabilities and self-efficacy [20].

The theoretical contribution of this paper lies in proposing a "six-in-one" innovation path model, which provides a systematic framework for the deep integration of AIGC and the mentorship project system. The practical contribution is that through the comparison of domestic and foreign cases, it summarizes the experiences and deficiencies that can be promoted. However, this paper still has certain limitations: first, the empirical data mainly come from some vocational college and undergraduate cases, with limited representativeness; second, the long-term effects of AIGC application still need larger-scale tracking research; third, the research on ethics and institutional norms still needs to be deepened.

Future research can be carried out in three directions: First, strengthen large-scale empirical research and build comparative data across regions and disciplines; second, deeply explore the issues of teaching evaluation, intellectual property rights and academic integrity of AIGC in the mentorship project system; third, promote international comparison and policy research to provide experience and reference for the internationalization and high-quality development of higher vocational education in China[8].

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