

The Practical Difficulties and Countermeasures of Vocational Teachers Use of GAI Technology

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Abstract Generative artificial intelligence (GAI) injects new impetus into the digital transformation of vocational education. As the key implementers of technology application, vocational teachers face multi-dimensional and deep-seated practical challenges in embracing this cutting-edge technology, which constitutes a core bottleneck on the path of technology-enabled education. This paper systematically analyzes the multi-dimensional difficulties encountered by teachers in practice and explores their internal causes. To this end, this paper proposes a three-in-one collaborative framework of "technology empowerment - teaching innovation - institutional guarantee", and suggests that through measures such as hierarchical and classified teacher ability improvement plans, the development of teaching case libraries deeply integrated with specialties, and the improvement of a system that emphasizes both incentives and regulations, GAI can truly be implemented from a "conceptual hot spot" to a "classroom norm". Help improve the quality of vocational education and promote the professional development of teachers.

Keywords Vocational education teachers; Application of generative artificial intelligence technology; Practical dilemmas; Teaching integration; Technology integration

I. Introduction

Generative artificial intelligence (GAI) is profoundly reshaping the way global industries and societies operate, and is also driving the education system to explore how GAI can be transformed into a core driving force for promoting educational equity and enhancing teaching quality. Vocational education, as an educational type directly facing industrial demands, has particularly prominent strategic significance in its digital transformation. To address the dual challenges of the global industrial chain reconstruction and the rapid iteration of skill demands, vocational education must proactively integrate intelligent technologies such as GAI to more precisely and efficiently cultivate high-quality workers who can adapt to future work patterns.

In recent years, China has issued a series of guiding documents, such as the "Opinions on Promoting High-Quality

Development of Modern Vocational Education" issued by the General Office of the Central Committee of the Communist Party of China (2021) and the "Digital Strategy Action Plan for Vocational Education (2023-2025)" issued by the Ministry of Education (2023), clearly designating digitalization and intelligence as the new engines for the high-quality development of vocational education. And it particularly emphasized the need to "promote the application of new-generation information technologies such as artificial intelligence, big data and blockchain in teaching, management, practical training and other links". The effective application of GAI technology by vocational teachers has risen from an optional skill to an urgent requirement and mission of The Times under the national education strategy. Looking across Asia and even the world, countries with well-developed vocational education systems such as Japan, Singapore, and Germany have also successively formulated national artificial intelligence strategies and focused on the application of intelligent technologies in the education field. A competition for the modernization of vocational education based on GAI has quietly begun globally. Despite high attention at the policy level, there is still a clear contrast between "hot policy" and "cold practice" in the application of GAI teaching among front-line teachers in China's vocational education.

Based on this, this study is dedicated to systematically exploring three core issues: First, what specific practical difficulties do vocational education teachers in China face when applying GAI technology? The second question is what are the deep-seated cognitive, institutional and cultural constraints behind these difficulties? The third is how to build a systematic countermeasure system that is rooted in the local context and oriented towards the international community, so as to promote GAI technology to truly become an effective enabler for the high-quality development of vocational education.

In terms of theoretical basis and research framework, Koehler et al. (2009) proposed the Technology-teaching-subject Content Knowledge (TPACK) framework. Mishra et al. (2021) further proposed the "empowerment and restraint" framework, emphasizing that teachers need to understand the duality of AI technology, which not only empowers teaching innovation but also brings ethical and cognitive risks. In domestic research, Xu, G (2022), based on the theory of work process systematization, constructed an evaluation index system for digital literacy of vocational education teachers, providing an important reference for assessing teachers' application ability of GAI. In terms of the progress of applied practice research, international studies have shown that the application of GAI in education and teaching mainly manifests in three aspects: the development of teaching resources, the optimization of teaching processes, and the innovation of teaching evaluation. Researchers explore the use of GAI to generate personalized learning materials. Kasneci et al. (2023) studied the effectiveness of ChatGPT in creating adaptive practice questions. Hu, J and Zhu, Z (2021) based on the intelligent development of teacher education, proposed several universal principles for the implementation of micro-innovations for teachers. In the hope of providing some ideas and references for the practice and fission evolution of minimally invasive innovation in the

field of education. In terms of existing challenges and limitations, the current research has obvious limitations: First, the research scenarios are relatively single, with most studies focusing on higher education and general education, and insufficient attention paid to the particularity of vocational education; Second, the depth of research needs to be enhanced. The existing literature mostly focuses on the surface level of technology application, and there are relatively few studies on the deep integration of GAI with project-based teaching, contextualized practical training and other characteristic models of vocational education. Thirdly, research on teachers' professional development is insufficient, and there is a lack of systematic training systems and support strategies for teachers' GAI application capabilities. Although Asian vocational education research has focused on digital transformation, it mostly starts from the macro level of infrastructure or policies, and does not adequately analyze the specific challenges that teachers, as key actors, face in the application process of GAI. This research aims to fill this gap, focusing on the intersection of vocational education and GAI technology in China, and conducting an in-depth analysis of the micro-predicaments in teaching practice. Although the research conclusion is based on the Chinese context, it has significant reference and comparative value for Asian countries and regions such as Southeast Asia and South Asia that are facing similar transformation challenges.

II. Practical Challenges

Amid the global wave of accelerated digital transformation in vocational education, the educational application of generative artificial intelligence (GAI) technology is regarded as a key path to enhance teaching efficiency and innovate talent cultivation models. The practice of vocational education in China shows that teachers face multi-dimensional challenges in the application of GAI technology. These challenges run through the entire process from teaching preparation, classroom implementation, after-class tutoring to professional development, and tend to be more complex due to the unique attributes of vocational education that emphasize the integration of industry and education as well as the cultivation of practical skills.

2.1 Technical Operation Layer

At the level of technology access and application, Wang et al. (2023) mentioned that vocational education teachers inevitably face the challenges of "advanced" functional application and insufficient digital literacy when using ChatGPT and related artificial intelligence tools to empower the acquisition of professional skills. Teachers generally lack the ability to effectively "communicate" with machines through prompt engineering and other means, making it difficult for them to write instructions that precisely align with teaching objectives. As a result, the teaching plans, exercises, and other content generated by GAI often remain superficial and fail to meet the teaching requirements of specific majors such as numerical control technology and elderly care services and management, nor can they adapt to the learning needs of students with different foundations. The instability of output quality significantly reduces its teaching assistance value. At the level of tool selection and integration, in the face of various GAI tools such as text-to-text, text-to-image, and code generation that have emerged both at

home and abroad, teachers find it difficult to effectively distinguish their advantages and disadvantages in terms of reliability, cost structure, data compliance, and compatibility with local teaching platforms like Smart Vocational Education in an information-overloaded environment. In terms of technical stability and accessibility, some advanced international GAI tools have access restrictions or instability, while high-quality domestic tools may face paywall constraints. Even if they are accessible, they are often affected by slow response speeds and service disruptions. Technical bottlenecks have severely impacted the continuity and expected effectiveness of classroom teaching processes. This further weakens the intrinsic motivation of teachers to continuously adopt GAI technology.

2.2 Instructional Design Layer

The teaching integration challenges that vocational teachers face when applying generative artificial intelligence have gone beyond the basic operational level. The core issue lies in how to deeply integrate the technology into the key links of teaching design. The current practice shows a superficial feature, mostly applying GAI to auxiliary tasks such as making PPTS and writing administrative documents, and failing to effectively empower core areas of vocational education such as project-based learning, work process-oriented teaching and contextualized practical training. This phenomenon stems from the fact that teachers are constrained by traditional teaching models and lack the intrinsic motivation and methodical support to carry out teaching innovation through GAI. Particularly, there are obvious application gaps in key links that enhance students' practical abilities, such as simulating equipment failures and generating virtual working scenarios. The wide application of GAI has raised teachers' anxiety about their professional identity, worrying that the replacement of traditional teaching functions by technology will lead to the marginalization of their roles, and being concerned that excessive reliance will weaken their teaching judgment and creativity.

2.3 Academic Integrity and Teaching Assessment Layer

The wide application of generative artificial intelligence (GAI) poses a profound challenge to the original academic integrity standards and teaching evaluation system in vocational education. The primary issue lies in the fact that it is difficult to clearly define the boundaries of students' use of GAI, especially when completing tasks such as project reports, design plans, and programming assignments. Teachers lack a clear basis to distinguish between the reasonable use of GAI for information retrieval and thought inspiration and the direct appropriation of generated content that constitutes academic misconduct. Most vocational colleges' current student management norms have not yet provided operational discrimination standards. The evaluation system urgently needs to transform towards process-oriented assessment, work defense and comprehensive task evaluation based on real working scenarios. However, the design and implementation of these assessment models not only put forward higher requirements for teachers' professional capabilities, but also significantly increase

their workload. When teachers themselves apply GAI for literature review, data simulation or paper drafting in scientific research activities, they also face new challenges of how to strictly abide by academic norms and ensure the originality of research results. Hou and Wang (2025) pointed out that no matter how deeply artificial intelligence is involved in teachers' teaching and how the degree of intelligent support for teaching practice is enhanced, the essence of education will not change.

2.4 Time and Energy Layer

For Chinese vocational education teachers who already bear heavy tasks such as teaching, student management, school-enterprise cooperation and social services, the adoption of GAI technology also faces an extremely realistic contradiction - the short-term imbalance between input and output, that is, the "efficiency paradox". Mastering GAI technology is not something that can be achieved overnight. It requires teachers to invest a considerable amount of their spare time in learning, exploring and practicing, especially in prompt engineering, tool selection and teaching integration design, where the learning curve is relatively steep. In the early stage of application, due to unfamiliarity with skills and improper methods, teachers often have to go through a long "trial and error" period. During this period, investing a lot of time may not immediately lead to a significant improvement in teaching effectiveness, and may even add additional workload due to technical instability. The experience of "high investment and low return" in the short term is very likely to dampen teachers' enthusiasm.

III. Underlying Causes

3.1 Cognitive Constraints

The core obstacle for vocational teachers to apply generative artificial intelligence (GAI) stems from insufficient understanding of the essence of the technology and the disconnection in its integration with educational theories. Long et al. (2024) pointed out that at the level of knowledge imparting and reception, teachers will face a huge professional survival crisis. The sources and channels for students to acquire knowledge have become extensive. Teachers are no longer the spokespeople of authoritative knowledge, and students' dependence on teachers has greatly decreased. The role of teachers as knowledge disseminators has been further marginalized. Most teachers lack an understanding of the fundamental principles such as the Transformer architecture and pre-training mechanisms, making it difficult for them to rationally predict the output boundaries and "illusion" risks of GAI. As a result, they experience a sense of loss of control and distrust anxiety during use. There is a lag in adaptation between the current teaching theories and the characteristics of GAI. There is a lack of an operational framework to guide the integration of techniques into vocational education scenarios such as systematic courses in the work process. As a result, although teachers master basic operations, they are unable to design teaching activities that leverage the advantages of GAI's personalized generation and scenario simulation based on teaching theories, leading to a "technical idling" predicament. Li and Zheng (2024) pointed out that the "black box" output of

generative artificial intelligence can easily weaken teachers' control over classroom discourse power and cause the drift of teaching goals. This requires teacher training to shift from a paradigm that emphasizes both "tool operation" and "generative mechanism" as well as "teaching reconstruction".

3.2 Institutional Deficiencies

The current vocational education system lags systematically in supporting teachers in addressing the challenges of generative artificial intelligence (GAI). The key issue is the incomplete professional development system for teachers. The information technology training content in most vocational colleges lags behind technological development and still focuses on the operation of conventional office software. There is a lack of stratified and classified precise training programs that are deeply integrated with professional teaching needs and tailored to the digital literacy foundation of different teachers. The deeper institutional obstacles are reflected in the absence of incentive and evaluation mechanisms. Generally, institutions of higher learning have not incorporated teachers' innovative practices in GAI teaching exploration into core evaluation systems such as the calculation of teaching workload, performance distribution, and professional title evaluation and appointment. This institutional environment has severely suppressed teachers' intrinsic motivation to carry out teaching reforms. The necessary infrastructure and resource support are generally insufficient. At the school level, stable and compliant GAI tool access, school-based teaching case libraries, and data security guidelines and other systematic guarantees are often not provided. Teachers have to bear the tool screening and data risks themselves, significantly increasing the threshold for technology application and hindering the large-scale and regular development of GAI in teaching.

3.3 Ethical and Cultural Tensions

The practical predicament of Chinese vocational teachers in applying generative artificial intelligence (GAI) stems from the deep tension between the inertia of traditional education and the characteristics of emerging technologies. Akgun and Greenhow (2022) mentioned that due to the ethical risks in the educational application of new technologies such as AI, teachers should also pay attention to ethical considerations in the use of technology, including ethical issues such as data privacy and algorithmic bias. At present, vocational colleges generally lack ethical norms for GAI applications. There are institutional gaps in key areas such as data privacy protection, algorithm fairness, intellectual property rights ownership, and the boundaries of academic integrity. This leads teachers to tend to avoid risks during the exploration process due to concerns about crossing unknown ethical red lines. On the other hand, the traditional education model centered on teachers and based on teaching materials forms a path dependence. Its emphasis on control and presupposition is in essential conflict with the openness, generativity and personalization requirements of GAI technology itself. When GAI undertakes the functions of knowledge production, homework correction and even student situation diagnosis, the identity of teachers is at risk of "de-professionalization". Zhou and Yu (2025) proposed that to move towards the era of general artificial

intelligence, it is necessary to establish a "dual-teacher" ethical framework of "human-teacher - machine-teacher" collaboration and clarify the role of teachers as the ultimate gatekeepers of the generated content. Practical countermeasures should be embedded in the school-based teaching and research system. For instance, GAI output can be incorporated into the "collective secondary lesson preparation" process to avoid ethical deviations through group review.

IV. Proposed Pathways for Resolution

This study proposes that a three-in-one collaborative framework of "technology empowerment - teaching innovation - institutional guarantee" should be constructed to systematically promote the deep integration and application of GAI in vocational colleges. This framework emphasizes taking the actual teaching needs as the driving force and the construction of the institutional environment as the support to achieve the leap from the introduction of technology to the effectiveness of classroom teaching. Li and Qu (2025) suggest that teachers' understanding of GAI should be deepened, innovative practices of technology integration in educational teaching scenarios should be promoted, teachers' awareness and ability of technology application ethics should be strengthened, and teachers should be helped to better adapt to the digital transformation of education and ultimately achieve professional development.

At the level of technological empowerment, a stratified and categorized, continuous and in-depth plan for enhancing teachers' GAI application capabilities should be carried out. The training content should go beyond basic operations and delve into prompt engineering optimization, critical evaluation of output content, and application strategies combined with specific professional scenarios. Zheng et al. (2024) proposed a training mechanism based on the individualized portrait of each teacher to stimulate teachers' questioning of their original beliefs and methodological systems, promote the endogenous motivation and demand for participating in training and continuing exploration, and then determine the specific training content and generate personal paths. In training, stratified and categorized training should be adopted for teachers of different levels, clearly defining the training goals, frameworks, contents and difficulties for teachers of different levels, and promoting their development in a targeted manner.

At the level of teaching innovation, there is an urgent need to develop a GAI application case library and teaching resource platform that are highly consistent with vocational education professional courses. These resources should be derived from real teaching practices, covering key links such as project-based learning, contextualized training, and personalized tutoring. GAI should be utilized to generate virtual troubleshooting scenarios, simulate customer service conversations, or automatically generate personalized skills training plans, thereby providing teachers with referential and transferable teaching design templates and reducing the difficulty and risk of independent exploration.

At the institutional guarantee level, institutions of higher learning need to establish a supportive environment that encourages innovation and tolerates trial and error. This includes incorporating the effective application of GAI into the teaching performance assessment and professional title evaluation system, establishing "GAI+ Teaching" innovation experimental projects and providing special funds and resource support. Gao and Meng (2025) also pointed out that schools should incorporate teachers' "AIGC cognitive level, technical application ability, instructional design ability and human-computer collaborative teaching ability" into teachers' professional assessment indicators, encourage teachers to independently enhance their artificial intelligence literacy, and set up special funds to help teachers uniformly purchase generative artificial intelligence training services. At the same time, Formulate school-based GAI application guidelines, clarify data security and academic norms, and provide clear policy boundaries and institutional support for teachers to carry out practical work.

V. Conclusion

This study analyzed the multiple practical predicaments encountered by front-line teachers in China's vocational education field when applying generative artificial intelligence (GAI), and revealed their underlying causes, including factors such as technical cognition, institutional design, and work habits. Research has found that the effective application of generative artificial intelligence by teachers not only involves technical operations but also requires multi-dimensional and systematic efforts such as conceptual innovation, ability improvement, institutional support, and environmental construction. A single solution is hard to be truly effective, so this article advocates that a systematic thinking mode must be established: Advocate a new paradigm of "human-machine collaboration and digital capability priority", establish a teacher training framework of "gradual progress, precise positioning and sustainable development", build a protection mechanism integrating "incentive mechanism, standardized management and support system", and cultivate an institutional culture of "open innovation, integration and symbiosis". Only through multi-dimensional collaborative efforts can educators truly overcome the challenges of introducing general artificial intelligence, transform knowledge into action, and ultimately achieve a shift from passively adapting to technology to actively mastering it - and even leverage technology to drive teaching innovation.

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