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The Impact and Countermeasures of Generative Artificial Intelligence on Vocational Education Teaching in China：A Systematic Review

Yifan Zhao[1], Shiliang Zheng[2]
[1](*College of Vocational and Technical Education, Shanghai Polytechnic University, China; Entrance Examination Department, Weifang Engineering Technician College, China;)*
[2](*College of Vocational and Technical Education, Shanghai Polytechnic University, China)*

ABSTRACT: *In the intelligent era, Generative Artificial Intelligence (Generative AI) injects vitality into vocational education development but faces challenges due to technical limitations and the particularity of vocational education. This paper is a systematic literature review. Through analysis and summary of selected literature, it finds that Chinese scholars and educators hold an acceptance and approval attitude towards making integration of generative artificial intelligence into vocational education teaching but have concerns about specific implementation. Studies in 2024-2025 are more comprehensive, mostly covering its positive and negative impacts and coping strategies. However, there are few studies on secondary vocational education, and countermeasure research mainly focuses on teachers, students, schools and policies, ignoring parents, industries and other subjects, which are feasible directions for future research.*

KEYWORDS - *Generative Artificial Intelligence, vocational education teaching, positive impacts, coping strategies, countermeasure, other subjects*

I. Introduction

1.1 Research Background

With the rapid development of information technology, Artificial Intelligence has rapidly penetrated into various fields of people's work and life. Generative AI（The following text will abbreviate Generative AI as GenAI.）with its powerful ability to automatically generate multi-model content, which has a profound impact on various industries, especially in the field of education. (Shen&Cao, 2023) As an important component of education in China, vocational education has also had an undeniable impact on its educational philosophy and teaching mode through GenAI. Taking the launch of the Generative Pre trained Transformer (ChatCPT) by OPENAI in the United States in 2022 as an example, GenAI has attracted widespread discussion and attention and many researchers have gradually realized its high value in vocational education applications. (Wang&Zhang, 2023)

1.2 Rationality of the Study

The United Nations Educational Scientific and Cultural Organization (UNESCO) warns in its *Artificial Intelligence and Education: Policy Guidelines* that the misuse of Generative AI may lead to some issues such as students' excessive reliance on technology, academic integrity, and privacy disclosure. (Artificial Intelligence and Education, 2022) GenAI has the potential to bring development opportunities to vocational education. However, it also brings certain challenges. This study aims to summarize the relationship between GenAI and vocational education, reveal the challenges in their integration, and explore relevant strategies.

II. Definition of Core Concepts

2.1 Vocational Education

In China, vocational education is referred to Vocational Education (VE) or Technical and Vocational Education and Training (TVET). VE includes both secondary and higher education levels. The main focus is on preparing students for specific careers through a combination of theoretical and practical training. The term "vocational education" was first defined in the Manifesto of the Chinese Vocational Education Society in 1917, emphasizing the development of individuals' aptitudes, preparation for livelihood, service to society, and improvement of productivity (Chen, 2007). It seeks to develop well-rounded socialist builders and successors proficient in both morality and technology.

Vocational education has characteristics that are fundamentally different from general education and it is rich in the essential attributes. (Jiang, 2007) So the application of generative artificial intelligence in vocational education teaching is difficult to be compared with other types of education, and targeted research is needed.

2.2 Generative Artificial Intelligence

It is an artificial intelligence technology that automatically generates new content based on prompts written in natural language provided by users. The prompts are mainly written in words, supplemented by various files such as graphics, images, audio, and videos. The output content, according to the prompts' requirements, is presented in various symbolic forms of human thinking, including text, images (including photos, digital paintings, and comics), videos, music, and software code. (Guidance for Generative AI, 2023)

What makes GenAI the global focus is the ChatGPT released by the American AI research experiment OpenAI on November 30, 2022. Because of its powerful functions, it caused a worldwide sensation less than a week after its debut (Zhang, 2024). It has generated rich teaching materials and cases for VE, and created scenarios for students' skill acquisition. Personalized learning plans can also be formulated based on each student's individual differences, which is in line with the educational goal of VE to cultivate well-rounded talents.

III. Research Methods

3.1 Literature Sources and Literature Search Process

The literature studied in this article mainly comes from literature search websites such as China National Knowledge Infrastructure (CNKI), Wanfang, and VIP. By searching for the term “The Impact and Strategies of Generative Artificial Intelligence on Vocational Education Teaching”, some keywords can be replaced. For example, “Generative Artificial Intelligence” can be replaced with “GenAI”, “Artificial Intelligent Generated Content”, “AIGC”... “Vocational Education” can be replaced with “VET”, “TVET”, “Secondary/Higher Vocational Education", etc.

3.2 Literature Screening Process

From 4910 articles obtained via keyword search, 2529 full texts were accessible, while others cannot. The study selected 1549 articles from 2021–2025, excluding other fields, resulting in 1129 education-related articles. After filtering by keywords on GenAI and VE, 390 articles remained and they met the needs of the two. Further review the identified 63 highly relevant articles, of which 34 with clear research themes were selected for in-depth analysis.

3.3 Use PRISMA Flowchart to Visually Present the Literature Screening Process

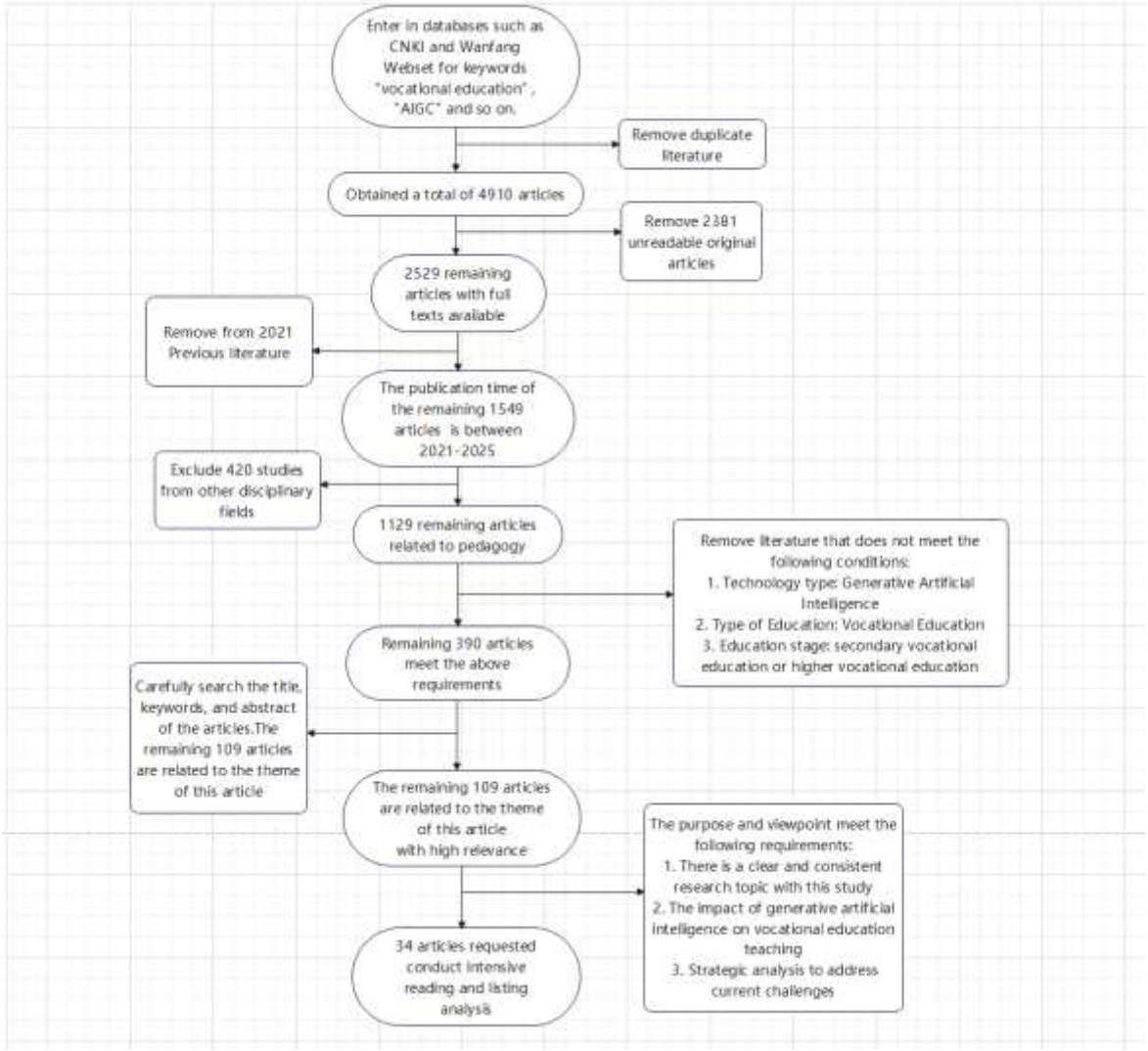

Figure 1 PRISMA Flowchart of the Literature Screening Process

3.4 Inclusion and Exclusion Criteria for Literature

Based on the research topic and object of this paper, the inclusion and exclusion criteria for literature are formulated.

Table 1 Inclusion and Exclusion Criteria for Literature

Number	Inclusion criteria	Exclusion criteria
1	Chinese literature	Non Chinese literature
2	Can obtain the full text	Can not obtain the full text
3	Journal articles	Manuscripts, reports, etc

Number	Inclusion criteria	Exclusion criteria
4	Literature produced from 2023 to 2025	Literature produced before 2023
5	Filtered duplicate literature	Literature with repeated occurrences
6	Domestic authors or research subjects	Foreign authors or research subjects
7	Types of education are vocational education	Regular primary and secondary schools, or other non vocational higher education
8	Research subjects are GenAI	Other artificial intelligence
9	Obvious research questions and methods	No clearly research questions and methods

3.5 Analyze the Selected Intensive Reading Literature

After gradual screening, this review is based on 34 articles. Figure 2 shows that research on this topic has been conducted since 2023, and it is expected to peak in 2025 with more comprehensive dimensions and a surge in similar literature.

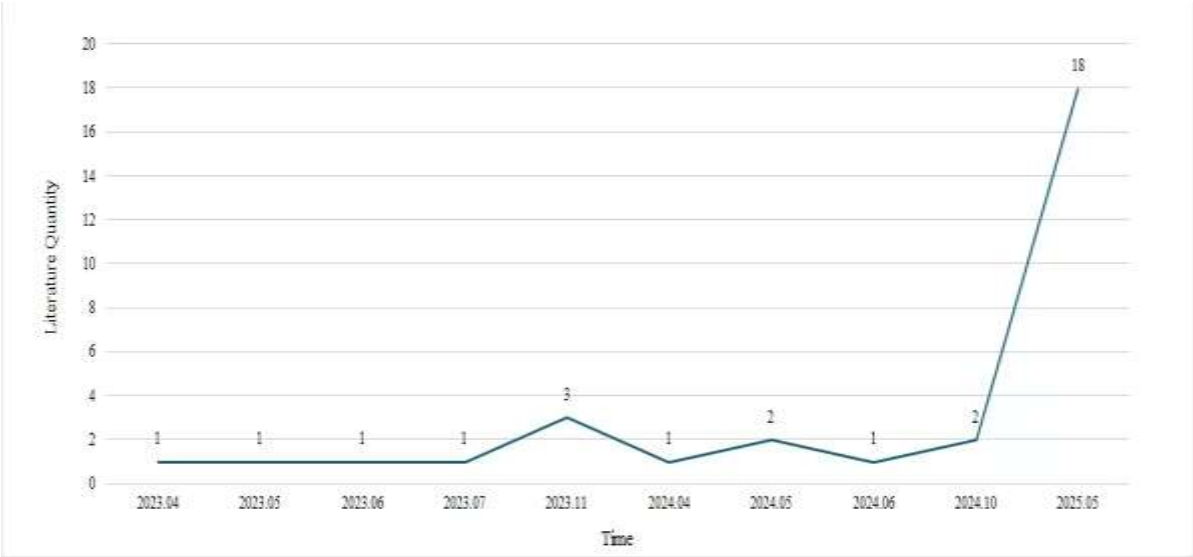

Figure 2 Temporal Trend of Publication Frequency

IV. Research Results and Discussion

4.1 The Relationship Between Generative AI and Vocational Education Teaching

The study reveals that Generative AI and vocational education teaching are complementary. This article will explore their relationship at three levels: macroscopic, intermediate, and microscopic.

4.1.1 Macroscopic Level

From the macroscopic level, this paper focuses on social policies and social development needs.*The Vocational Education Law of the People's Republic of China*, passed on April 20, 2022, clarifies that vocational education is a type of education with equal importance to general education. At the same time, the state encourages social forces to participate in vocational education construction and supports professional colleges. It requires enterprises and other social forces to establish institutions. In addition, policy documents such as the *New Generation Artificial Intelligence Development Plan* in 2017 issued by the State Council, the Education Informatization Action Plan issued by the country in 2018, and the *Artificial Intelligence Innovation Action Plan for Higher Education Institutions*(2024-2025) issued by the Ministry of Education all reflect the general trend of digital education development in China. (Liu, 2024)

In January 2025, the Central Committee of the Communist Party of China and the State Council issued the "Outline of the Plan for Building an Education Strong Country (2024-2035)", which proposed to accelerate the construction of a modern vocational education system and promote AI to assist in educational reform. (The Central Committee, 2025) GenAI, as an important support for educational digitization, is an indispensable application in vocational education teaching.

4.1.2 Intermediate Level

From the intermediate level, there is a tendency towards updating the teaching mode of vocational education.The development of digital technology has given rise to the smart education model, and digital transformation has become a necessary path for the high-quality development of vocational education. (Wang, 2025) For instance, Generative AI can integrate and enrich teaching resources, transforming traditional materials into digital and intelligent resources like digital textbooks and smart lab equipment. This enhances teaching efficiency and effectiveness while better meeting students' learning and training needs. GenAI can also transform some educational content into popular forms such as interesting reading materials, games, projects, etc. These forms are easy to stimulate students' interest in participation. In this way, teaching resources will become more abundant and diversified, thereby strengthening students' curiosity, thirst for knowledge, and focus.(Liu, 2024;The Central Committee, 2025) Secondly, Bai Tingguo (Bai, 2023) and Zeng Jin (Zeng, 2023) believe that Generative AI can enhance the intelligent evaluation system in vocational education by analyzing student engagement and teaching efficiency. It uses big data models to automatically grade and provide feedback on students' homework, enabling teachers to offer targeted guidance.

4.1.3 Microscopic Level

From the micro level, It emphasizes personalized teaching and digital literacy development.The students in vocational education almost lack learning initiative and self-control and have a relatively weak knowledge foundation. But it cannot be denied that this type of student has active and agile thinking, well-developed concrete thinking, and strong hands-on ability. Based on the particularity of vocational education students, generative artificial intelligence can capture and analyze their learning situation, deeply understand their learning habits, knowledge reserves and other personalized characteristics through interaction with students. On the basis of the above information, Generative AI can set personal goals, develop exclusive learning plans and daily practice tasks for each student, meeting the individual learning needs.

For vocational education teachers, GenAI can analyze students' data to tailor teaching designs to current learning levels. This allows teachers to more focus on students' feedback and experiences, providing targeted instruction. In this way, teachers can increase humanistic care, and consolidate their role as guides and friends for students. Bai Tingguo (Bai, 2023) also stated that tools like ChatGPT, ERNIE Bot, and Doubao offer comprehensive teaching support, enabling teachers to focus on optimizing curriculum design, addressing personalized student needs, and fostering higher-order thinking skills. They also facilitate scenario-based teaching by providing rich resources and creating simulation scenarios, enhancing vocational students' ability to master and apply professional skills.

Vocational school students also have the characteristics of daring to ask and question. This characteristic is presented in the real teaching interaction and thinking collision with teachers and humanoid technology. In this situation, students' questioning to some extent drives technological progress, pointing out the direction for the application and optimization of generative artificial intelligence in vocational education teaching.

Generally speaking, GenAI offers new momentum and opportunities for vocational education, guiding its development, integrating teaching resources, transforming teaching modes, and enhancing teacher efficiency and student development. However, its application also reveals issues needing upgrades. Thus, they are complementary and mutually reinforcing.

4.2 The Application of GenAI in Vocational Education Teaching is Both an Opportunity and a Challenge

This study analyzes 34 relevant literature via intensive reading. Based on Figure 3, this paper explore the application of GenAI in vocational education from three aspects: opportunities, challenges, and countermeasures, aiming to offer theoretical references and practical guidance for digital transformation.

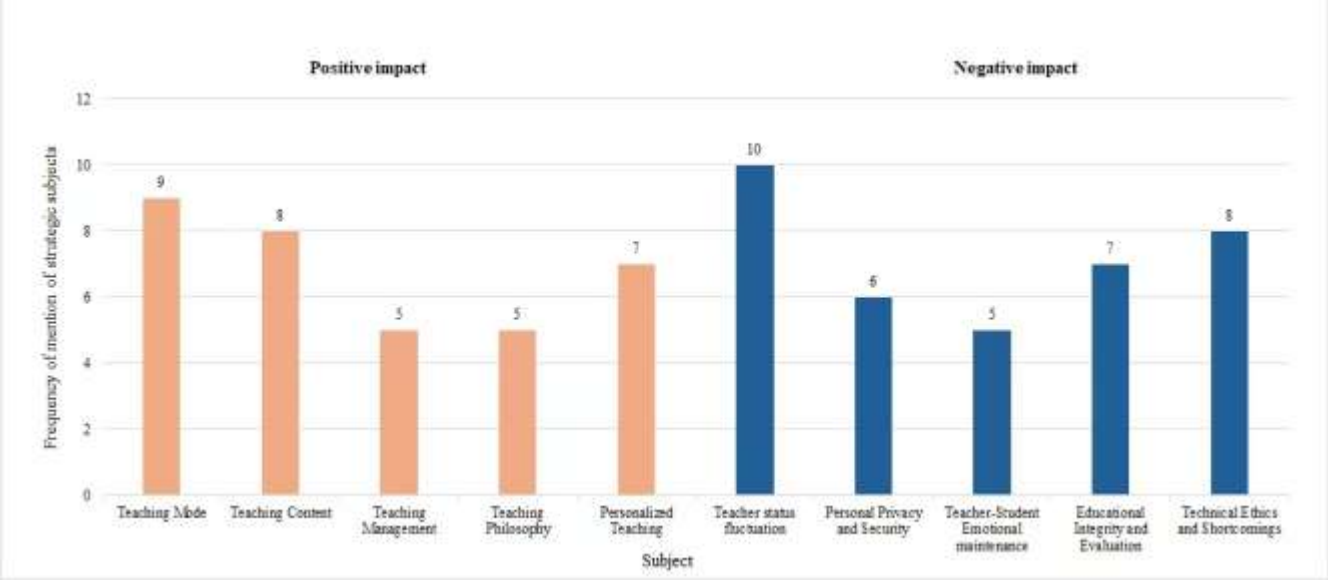

Figure 3 Positive and Negative Impacts of Specific Aspects

4.2.1 Positive Impacts of GenAI on Vocational Education and Teaching

Positive impacts of GenAI are mainly reflected in the following five aspects:

- Updated Education Models and Teaching Methods

Generative AI transforms vocational education by enabling collaboration among machines, students, and teachers. It promotes engaging and flipped classrooms, diversifying teaching methods. Project - based and scenario - driven learning are increasingly adopted to enhance interactivity and practicality.

- Enriches Teaching Resources and Scenarios

Generative AI leverages its capabilities to provide teachers with extensive reference materials and students with diverse resources for thinking and exploration. It enhances vocational skills training through simulated scenarios and integrates with the metaverse, virtual spaces, blockchain, digital twins, and immersive interactions to create embodied learning channels.(Wu&Ji, 2025) The integration of GenAI, metaverse, and big data into vocational education has made teaching content and processes intelligent, featuring human-machine collaboration and blended reality.

- Optimizes Teaching Management

This technology reduces subjective biases in data collection, accurately identifying student strengths, interests, and difficulties. It creates comprehensive digital profiles and personalized e-portfolios ("one file per student"). (Wu&Zhu, 2025) This enhances the credibility of educational management.

- Technological Innovation Drives Teaching Concepts

Zhang Xiaolei et al. introduced the TPACK framework, which integrates three knowledge domains: TPK (Technology-Pedagogy Knowledge), TCK (Technology-Content Knowledge), and PCK (Pedagogy-Content Knowledge). TPACK integrates technology, teaching, and subject knowledge harmoniously. For vocational education teachers, TPACK development should align with digital strategies and new technologies, supported by training to enhance technical skills. (Zhang, Qing, &Du, 2024) In addition, as tools like ChatGPT can automate routine tasks, cultivating students' digital literacy and collaborative innovation abilities becomes urgent. The AI era offers broader perspectives on fundamental educational questions such as "what kind of talent should cultivate" and "how to cultivate them," refreshing traditional pedagogical concepts.

- Facilitates Personalized Development

Generative AI analyzes individual student data to create customized learning goals, practice plans, performance evaluations, and career plans. These adaptive strategies evolve with students' progress, providing a "tailor - made" learning experience.

In summary, the positive integration of GenAI and vocational education will drive holistic development, leading to qualitative breakthroughs through widespread adoption, practice, and improvement.

4.2.2 Negative Impacts of GenAI on Vocational Education and Teaching

Similarly, based on Figure3 the challenges brought by this technology to vocational education teaching can also be summarized in the following five aspects:

- Changing Role of Teachers

Generative AI is increasingly used as a teaching assistant, both in and out of the classroom. This shift challenges the traditional roles of teachers as knowledge imparters and problem solvers. Teachers are now becoming guides, inspirators, and collaborators. The pressure of public opinion and the need for enhanced digital literacy during this transition are significant issues. The classroom model has also evolved from traditional "cramming" to more interactive forms like "flipped classrooms" and "blended learning."

- Dilution of Teacher-Student Emotions

The extensive interaction between humans and machines can reduce the emotional connection between teachers and students. Adaptive learning systems, driven by AI, provide customized content based on big data analysis. As students receive more AI - generated advice, their reliance on teachers' guidance decreases. This can lead to a sense of role loss among teachers and reduced communication, affecting educational innovation and teacher - student relationships.

- Privacy and Security Risks

Generative AI involves collecting personal information from students and teachers, raising privacy concerns. The more detailed the personalized learning, the greater the exposure of personal data. Data breaches can have severe and far - reaching consequences for individuals' privacy and security.

- Controversy Over Educational Integrity and Evaluation

As AI - generated outputs become more human - like, distinguishing between human and AI - generated work in evaluations becomes challenging. This raises questions about the fairness and integrity of academic assessments.

- Technological and Ethical Shortcomings

Generative AI in vocational education faces limitations such as inadequate platform construction and online misinformation. These issues can exacerbate academic disparities and harm students' well - being. While Generative AI has brought significant momentum to vocational education, the idealized model is not yet fully realized, and much remains to be done to promote deeper integration.

4.3 Relevant strategies to face the above challenges

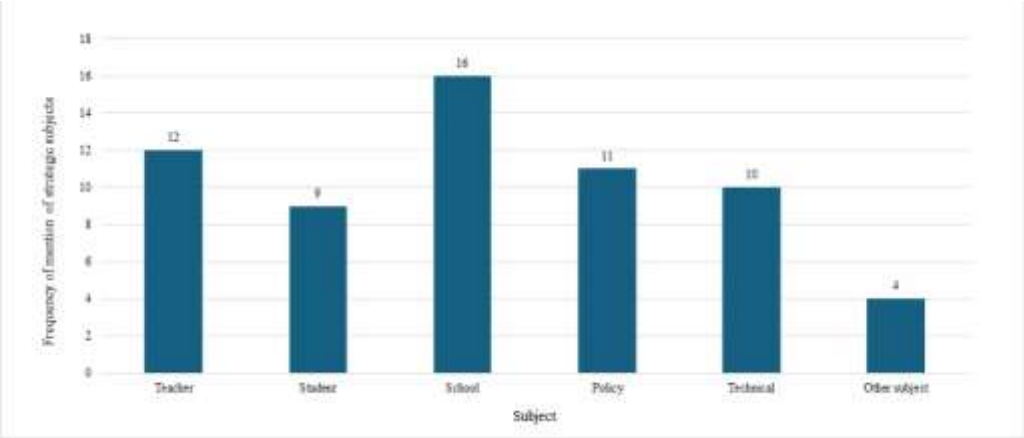

Figure 4 Distribution of Strategies Among Different Subjects

4.3.1 Clear Requirements for Vocational Education Teachers

Figure4 shows that 12 of 34 articles highlight the need for vocational education teachers to adapt to Generative AI. Teachers, as classroom leaders, should proficiently use this technology for teaching. This paper examines teachers' recognition and acceptance, emphasizing their self-improvement and the impact of their behavior on students. Luo Xiaofen also showed in her research that the use of digital intelligence technology by higher vocational teachers in teaching will also drive students to learn and use digital intelligence technology in the learning process, which subtly promotes the improvement of students' digital intelligence literacy.(Luo, 2025)

4.3.2 Requirements and Training Objectives for Vocational School Students

Nine articles highlight vocational students' use of GenAI. Students to be the center in the application of technology. The cultivation of students' self-management ability is particularly important. This technology enables students to choose teaching content based on individual needs. Under teacher guidance, they can create and adjust learning plans. To prevent plagiarism and over - reliance, self - restraint is crucial. The emphasis is on cultivating compound talents with digital intelligence, craftsman spirit, practical innovation ability, digital competitiveness. (Xu, Cai & Jiang, 2023)

4.3.3 The Role of Vocational Education Schools

Approximately half of the literature highlights vocational schools' role in promoting GenAI. As primary teaching venues and digital literacy hubs, these schools need systematic planning and special supervision for intelligent education platform construction, technology platform use, and digital classroom quality control. Their importance in the interaction between new technologies and vocational education is evident.

4.3.4 The Leading Role of Policy

Policy formulation and revision should be put in place first. Through the study of the collected literature, 10 articles of literature related to the actions, requirements, guidance and planning at the macro level. Correct policy guidance is the guarantee for GenAI to exert a positive impact on vocational education and teaching. Therefore, the perspective can be considered as a direction for subsequent supplementary research in the future.

4.3.5 The Improvement Requirements of Generative Artificial Intelligence Technology Itself

The development and application of Generative AI in vocational education highlight its inherent advantages, even though it was not specifically designed for this field. Regional disparities in application are inevitable, necessitating a focus on improving weaknesses and leveraging strengths. In the Guangdong-Hong Kong-Macao Greater Bay Area, there are significant differences in the usage of Generative AI in vocational education among the 11 cities in the Pearl River Delta, Hong Kong, and Macao. The teaching development level of higher vocational teachers and the vocational education ecosystem reflect that digital intelligence is still imperfect. Given the large differences in teaching development, strategies must be targeted and regional. For example, cities with more mature AI technology, such as Guangzhou and Shenzhen, should utilize their technological advantages to promote smart classrooms, virtual reality, and develop AI - based teaching software and simulation systems (Tang, 2024). However, false information and incompatibilities in educational applications can hinder integration. Therefore, timely maintenance and updates of technology platforms, stricter information screening, and enhanced protection of personal information are essential.

In summary, Figure 4 shows that among strategic subjects, teachers, students , schools, policies, and technology are frequently discussed, while other subjects like parents and enterprises are rarely mentioned (only 4 times). This indicates almost current research focus on the five main subjects, with insufficient attention to others. Future research should strengthen exploration of these under - studied subjects to achieve a more balanced and comprehensive academic discourse.

V. Summary and Reflection

5.1 Limitations of the Study

5.1.1 Literature Sources

This study focuses on the impact of GenAI on China's vocational education, relying mainly on Chinese literature due to research limitations. It references databases like VIP Knowledge Network and CNKI, with limited English literature, restricting insights into global research trends. Future work should expand data sources for broader insights.

5.1.2 Literature Quality

Journal articles were the main literature included in this study, but the large quantity and diverse sources led to uneven quality. Additionally, to maintain the academic rigor of the paper, some types like book reviews and reports were excluded during screening, which may had research value. Future work can expand the types of literature sources.

Researchers independently completed the selection, evaluation, and inclusion process, which inevitably risking subjective bias. Future work should improve literature quality to enhance the study's reliability and comprehensiveness.

5.2 Research Innovations

5.2.1 The Reason why GenAI is Rarely Used in Secondary Vocational Education

Currently, there is a lack of specific research on the application of Generative AI in secondary vocational education in the academic field. After research, the main reasons are as follows.

Firstly, students have a weak foundation in learning. Secondary vocational school students have relatively weak cultural foundations and may have certain problems in understanding and accepting new technologies,

making it difficult for them to grasp the principles of Generative AI technology and its application in complex scenarios.

Secondly, the adaptability of Generative AI to teaching objectives and content.This learning stage focuses on cultivating students' primary skilled talents and emphasizes the mastery of simple practical operations. How to use this technology to develop teaching resources and curriculum systems that are suitable for the level of vocational school students is a challenge. Compared to it, higher vocational schools is easier to find suitable points for the application of AI technology.

Thirdly, the issue of equipment and resource investment. The application of generative artificial intelligence requires certain hardware and software resources support, such as advanced computers, stable network environments, and related software platforms. However, the financial allocation for secondary vocational schools is relatively limited, and the channels for obtaining resources are narrow, which limits the widespread application of Generative AI in this learning stage.

Fourthly, the issue of student employment adaptation. After graduation, most vocational school students enter the labor market and work in basic jobs. The job position requires less direct application of generative artificial intelligence technology, so vocational schools also fully consider the input-output ratio of the technology introduction and teaching.

5.2.2 The Insufficient Research on the Role of Parents of Secondary Vocational School Students

Most current research on strategies overlooks the role of parents in vocational education teaching based on AI. Adolescents often lack self - management skills. Parents can help set boundaries for AI use and collaborate with schools. Some may provide infrastructure if financially able. However, some parents may have limited education and low acceptance of GenAI, hindering students' digital literacy development. Despite these challenges, active engagement from multiple social stakeholders can create a synergistic effect to empower vocational education and AI usage, resulting in a 1+1+1>3 effect.

5.2.3 The Synergistic Effect of Social Subjects Such as Parents, Communities, Businesses, and Industry Associations Should not be Underestimated.

First of all, schools can take the initiative to build a "parent-technology" bridge, organize parent-child practice, invite parents entering the campus and other activities. These efforts allow children and parents to use GenAI to complete simple tasks together, and make parents aware that generative artificial intelligence is a practical tool rather than a toy or complex problem. For students with low levels of family support, schools can also provide targeted tutoring.

Besides, community service centers, public welfare organizations, etc. can carry out "digital literacy" activities, or donate relevant equipment and introduce teachers in areas where digital literacy improvement is difficult.

Finally, companies can design "GenAI+Vocational Skills" internship programs or competitions, such as giving priority to e-commerce students to use GenAI to optimize live streaming scripts, product detail page introductions, and other tasks, so that students can understand how to use this technology in the workplace to solve specific problems before entering society. Industry associations can also use channels such as short videos and bulletin boards to present positive cases of vocational education students using this technology, using role models to enhance students' learning motivation.

Schools can build a "parent - technology" bridge through parent - child campus activities, helping parents see GenAI as a practical tool. For students with limited family support, targeted tutoring can be provided. Community centers can run "digital literacy" programs or donate equipment. Companies can create "GenAI + Vocational Skills" internships or competitions, like giving priority to e-commerce students, optimizing e -

commerce scripts and producing detail page introductions. Industry associations can share positive cases via social media to boost student motivation.

VI. Prospects for Future Research

Future research will explore the integration path of GenAI and secondary vocational education, focusing on why secondary students face more challenges with tools like ChatGPT compared to higher vocational students, and proposing solutions based on real teaching. The study will also consider key factors such as parental education and support, social policies, educational platform operations, and joint course development by enterprises. Quantitative methods will be used to analyze correlations, providing theoretical and practical insights.

Additionally, the research will expand literature searches and strengthen English database studies to clarify development gaps, broaden perspectives, and optimize problem analysis through international comparisons, enhancing the comprehensiveness and depth of the research.

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