STUDY ON THE INFLUENCE OF THE "JOB COURSE COMPETITION CERTIFICATE INTEGRATION" ON STUDENT LEARNING OUTCOMES — TAKING SHANDONG ENGINEERING VOCATIONAL UNIVERSITY AS AN EXAMPLE

ZHENG JIAN
6317195906

AN INDEPENDENT STUDY SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER'S DEGREE IN BUSINESS ADMINISTRATION GRADUATE SCHOOL OF BUSINESS
SIAM UNIVERSITY
2023

STUDY ON THE INFLUENCE OF THE "JOB COURSE COMPETITION CERTIFICATE INTEGRATION" ON STUDENT LEARNING OUTCOMES — TAKING SHANDONG ENGINEERING VOCATIONAL UNIVERSITY AS AN EXAMPLE

ZHENG JIAN

This Independent Study has been Approved as a Partial Fulfillment of the Requirement of International Master of Business Administration in Education Management

Advisor: .....

(Dr. ZHANG LI)

Date: ...13.../...11...../.....2023...

.....

(Associate Professor Dr. Jomphong Mongkhonvanit)
Dean, Graduate School of Business Administration

Date ..... 1 / 02 / 2024
Siam University, Bangkok, Thailand

Title: Study on the Influence of the "Job Course Competition Certificate Integration" on Student Learning Outcomes — Taking Shandong Engineering Vocational University as an Example

By: Zheng Jian

Degree: Master of Business Administration

Major: Education Management

Advisor: .....

(Dr. ZHANG LI)

13 / 11 / 2023

ABSTRACT

This paper aimed to study the "Job Course Competition Certificate Integration" on student learning outcomes — Taking Shandong Engineering Vocational University as an Example. The research objectives were: 1) To verify that the "Job Course Questionnaire Certificate" comprehensive education model has a positive impact on improving students' self-directed learning abilities; 2) To verify that the "Job Course Competition Certificate" comprehensive education model has a positive impact on students' professional competence; 3) To verify that the "Job Course Competition Certificate" comprehensive education model has a positive impact on students' comprehensive practical abilities.

This paper adopted quantitative research methods. The study was conducted with students majoring in Intelligent Manufacturing at Shandong University of Engineering and Technology. A questionnaire survey was employed, with 120 questionnaires distributed and 120 returned, resulting in a 100% response rate and 100% valid response rate. The study was theoretically supported by Action-Oriented Education Theory, the Theory of the Iceberg of Competence, and the Theory of Comprehensive Human Development.

This paper found that: 1) The "Job Course Competition Certificate" comprehensive education model has a positive impact on enhancing students' self-directed learning abilities; 2) The "Job Course Competition Certificate" comprehensive education model has a positive impact on students' professional competence; 3) The "Job Course Competition Certificate"comprehensive education model has a positive impact on improving students' comprehensive practical skills."

Keywords: Job Course Competition Certificate Integration, comprehensive education model, theoretical foundation

ACKNOWLEDGEMENT

I want to express my deepest gratitude to my advisor for his invaluable guidance, support, and encouragement throughout my independent study. His insightful comments and constructive criticism have significantly improved the quality of my work.

Additionally, I am grateful to Associate Professor Dr.Jomphong Mongkhonvanit, Dean of the Graduate School of Business, for his continuous support and encouragement throughout my studies. His dedication to the graduate program and commitment to excellence have inspired me to strive for academic excellence.

Finally, I would like to extend my appreciation to all the faculty members and staff of Siam University who have contributed to my growth and development as a student. Their unwavering support and encouragement have been a source of inspiration and motivation for me.

Declaration

I, ZHENG JIAN as a result of this, certify that the work embodied in this, independent study entitled **"Study on the Influence of the "Job Course Competition Certificate Integration" on student learning outcomes — Taking Shandong Engineering Vocational University as an Example"** *is a result of original research and has not been submitted for a higher degree to any other university or institution.*

(ZHENG JIAN)

Oct 28, 2023

CONTENTS

TABLE CONTENTS

FIGURE CONTENTS

Chapter 1 Introduction

1.1 Research Background

China's economy has entered a stage of high-quality development, with continuous updates and upgrades in economic development methods, economic structures, and industrial structures, which have raised higher demands for technical and skilled personnel (Dong & Yang, 2012). Vocational education, as one of the main types of education for talent development, plays a crucial role in achieving high-quality vocational education and further deepening the training of high-quality professionals (Zhou, 2019).

During the 2021 Vocational Education Week, the Chinese Ministry of Education emphasized the promotion of the integration of "Job Course Competition Certificate" to enhance the influence of vocational education. In the same year, the Central Committee of the Communist Party of China and the State Council issued "Opinions on Promoting High-Quality Development of Modern Vocational Education," which further underlined the need to improve the mechanism of "Job Course Competition Certificate" integration for comprehensive education. These requirements have provided scholars with clear research directions, making the "Job Course Competition Certificate" integration model a new focus of research in the field of vocational education (Jing & Zhou, 2022).

The "Job Course Competition Certificate" integration model is seen as a key solution to bridging the gap between vocational education and industry enterprises, ensuring that talent development effectively meets the high-quality technical and skilled personnel needs of industry enterprises. Promoting the integration of the "Job Course Competition Certificate" is beneficial for nurturing more highly skilled technical and skilled professionals who are aligned with the needs of industrial development, contributing to the nation's skilled workforce (Ling, 2021).

The design of this comprehensive education model starts from the perspective of the industry's job position requirements, using vocational standards as the logical starting point for the educational model. It emphasizes the integration of ethics and skills and combines education and training. It also coordinates reforms in various practical aspects such as professional curriculum development, talent development plans, course materials, classroom teaching, and internships to effectively enhance the quality of talent development. Vocational colleges are vigorously exploring and promoting the "Job Course Competition Certificate" integration model. This not only helps in achieving effective alignment between vocational colleges and industry enterprises in talent development but also serves as an essential measure for deepening the cooperation between educational institutions and the industry, contributing significantly to the advancement of high-quality modern vocational education in China (Jing & Zhou, 2022).

In April 2021, the Chinese government explicitly emphasized the role of the "Job Course Competition Certificate" in leading the "Three-Education" reform and the development of high-level vocational schools that integrate industry, specialization,

and employment (Zhang & Wang, 2017). The promotion of the "Job Course Competition Certificate" as a comprehensive education model represents both an innovative approach to fulfilling the historical mission of vocational education and a new choice for vocational colleges to enhance the quality of talent development within the framework of the "Three-Education" reform. Over a long history of exploring talent development models, vocational colleges across different regions in China have introduced varying degrees of innovative models that integrate the "job," "course," "competition," and "certificate." These models have led to deeper educational objectives, enriched curriculum content, improved teaching quality, and gained broad recognition from society (Ling, 2021).

The advancement of the "Job Course Competition Certificate" plays a pivotal role in improving the quality of professional program development within vocational colleges. The key strategy is to organically integrate job standards, competition content, and the '1+X' certificate standards into the professional curriculum, creating a dynamic system for managing the professional curriculum that can be adjusted as needed (Chen, Chen, Xie, & Gao, 2021). This approach allows vocational colleges to tailor their educational programs to the practical needs of industries. By optimizing and upgrading a set of high-quality programs that align closely with strategic emerging industries, advanced manufacturing, modern service sectors, modern agriculture, and other areas, they can better prepare their students for future employment.

The "Job Course Competition Certificate" comprehensive education model is a concept with Chinese characteristics and has not been widely studied in other countries. While the term "cultivation model" or "training model" is commonly used for similar concepts, searching for foreign literature using these terms often leads to translations of Chinese papers. There is limited research from other scholars on talent development models in this specific context.

Nonetheless, a brief overview of the international landscape reveals that Germany, for example, follows a "dual system" of vocational education, where students receive both theoretical knowledge from school courses and practical training from companies. This dual system emphasizes a strong focus on vocational aspects (Jiang, 2013).

In the context of the "Job Course Competition Certificate" comprehensive education model, the emphasis is on the close alignment with real work situations and the requirements of job readiness (Xu & Qiang, 2014). In terms of educational reform, researchers such as Harmen Sharpe have highlighted the importance of students' professional development, learning methods, integration of knowledge, knowledge processing, learning motivation, and professional identity in the context of vocational education and workplace learning (He, 2014).

Generally, international research on talent development models in vocational education focuses on learner-centric, competency-based approaches, emphasizing the development of learners' comprehensive professional abilities (Xu & Qiang, 2014).

At present, the overall status and future research trends regarding the "Job Course Competition Certificate" comprehensive education model remain unclear (Zhang, Wang & Qiang, 2021). Consequently, practical explorations of this model are necessary to better serve the evolving needs of the "Job Course Competition Certificate" and provide a foundation for further research in this area.

1.2 Research questions

"Technological changes and industrial transformation and upgrading have led to an elevation in the level and competence requirements of technical and skilled talent in China (Ling, 2017). However, the current curriculum and teaching of the Intelligent Manufacturing program at Shandong Vocational College of Engineering lack close alignment with the needs of the industry. The modes of integrating education involving participation from various sectors remain superficial, with low student interest and an indifferent attitude towards learning. Students lack initiative, and their self-motivation is weak. They also lack professional competence. These issues are leading to an increasingly prominent mismatch between technical and skilled talent in frontline production in China and the demands of the job. The problem of low comprehensive vocational competence is becoming more apparent (Yang, 2019). Research into the application of the "Job Course Competition Certificate" integrated education model in school curriculum aims to study the specific aspects of the teaching and cultivation process. The main research questions include:

1. Does the adoption of the "Job Course Competition Certificate" comprehensive education model have a positive impact on students' self-directed learning abilities?

2. Does the adoption of the "Job Course Competition Certificate" comprehensive education model have a positive impact on students' professional competence?

3. Does the adoption of the "Job Course Competition Certificate" comprehensive education model have a positive impact on improving students' comprehensive practical abilities?

1.3 Objectives of the Study

"Frontline technical professionals are an important part of our country's talent pool and a crucial force supporting 'Made in China' and innovation in China. In the modern society of industrial transformation and digital development, traditional teaching methods that involve a switch between theoretical and practical learning, on-the-job training, and customized training programs in cooperation with companies need to recognize change, adapt, seek improvement, and optimize. It is necessary to establish a high-level skilled talent development system that is based on vocational colleges, led by enterprises, closely connected with educational institutions and business training, and jointly promoted by the government and supported by society. This system should highlight the training of highly skilled talents in areas of urgent need. It should also emphasize the characteristics of type-based education and implement an integrated 'Position Course Competition Certificate' training model.

This model encompasses a four-in-one approach, combining internal and external factors, typical leadership, high-end guidance, and external incentives to encourage more young people to embark on the path of skill development and contribute to their country. This approach promotes the optimization and upgrading of the industrial structure, enhances the competitiveness of businesses, drives technological innovation and the transformation of scientific achievements. Ultimately, it plays a vital role in ensuring higher-quality employment for students and promoting high-quality economic development.

The ultimate goal of this research is to:

1. To verify that the "Job Course Questionnaire Certificate" comprehensive education model has a positive impact on improving students' self-directed learning abilities.
2. To verify that the "Job Course Competition Certificate" comprehensive education model has a positive impact on students' professional competence.
3. To verify that the "Job Course Competition Certificate" comprehensive education model has a positive impact on students' comprehensive practical abilities.

1.4 Scope of the Study

This research was conducted with third-year students majoring in Intelligent Manufacturing at Shandong Engineering Vocational and Technical University. The experiment took place in the first half of 2023, covering one semester, with data collection occurring from March 2023 to July 2023. A total of 120 questionnaires were distributed, and all 120 were successfully collected, resulting in a 100% response rate.

The results of this study will serve as a theoretical basis and contribute to researching the current implementation status of the "Job Course Competition Certificate" comprehensive education model. Regarding the demographics of the respondents in the valid questionnaires, 82 were male, and 38 were female. In terms of the distribution by grade, approximately 67.88% were third-year students, and 2.12% were graduating seniors. The survey respondents closely align with the overall student population relevant to the "Job Course Competition Certificate" comprehensive education model, exhibiting no extreme deviations.

Through conducting this research on the implementation status of the "Job Course Competition Certificate" integrated education model, the study aimed to summarize the achievements and experiences of this model in the major, and analyze the educational effectiveness of the "Job Course Competition Certificate" integrated education model during its implementation.

1.5 Research Significant

Through the research and practical implementation of this project, we can further understand the patterns of vocational education for higher vocational professionals, gradually develop a curriculum system that aligns with the actual needs of the

industry and businesses, promote the development of high-level professional groups in intelligent manufacturing, advance the reform and innovation of vocational education in technology and skills, and ultimately enhance the quality of talent development.

Firstly, this helps enhance students' motivation and proactiveness, improving their self-directed learning abilities.

By conducting theoretical research on the "Job Course Competition Certificate" comprehensive education model, we aim to provide new theoretical perspectives, clarify the relevant concepts and current status of this model, and lay the theoretical foundations for the study of the "Job Course Competition Certificate" comprehensive education model. We will explore the underlying mechanisms and operational mechanisms of this model at the theoretical level, enhancing our understanding of the implementation of the "Job Course Competition Certificate" comprehensive education model in higher vocational colleges. Simultaneously, we will focus on a specific higher vocational institution's intelligent manufacturing program to investigate the implementation process and current status of the "Job Course Competition Certificate" comprehensive education model, enriching the relevant theoretical research and providing exemplary cases.

Secondly, it helps enhance students' professional competence.

This approach benefits students in their job-seeking and employment efforts, participation in competitions, and obtaining relevant skill certificates. The integrated teaching of the "Job Course Competition Certificate" model is oriented towards students' employment and career development, with the goal of nurturing job-related competencies. In the process of optimizing teaching, typical job tasks from enterprises, competition projects, and the knowledge and skills required for skill certificate examinations are extracted and integrated into the theoretical and practical training content of the curriculum. This ensures that the teaching process aligns closely with the requirements of "Position Course Competition Certificate," making it job-oriented, certificate-driven, and competition-enhanced (Gao, 2022). Through the integrated teaching of the "Position Course Competition Certificate," students can effectively strengthen their knowledge foundation, enhance their comprehensive practical abilities, and facilitate their sustainable development in the future.

Thirdly, it contributes to improving students' comprehensive practical abilities, promoting the precise alignment of knowledge in the field of intelligent manufacturing with the demands of industry positions.

By investigating the current state of the "Job Course Competition Certificate" comprehensive education model in the intelligent manufacturing program and analyzing the fundamental characteristics of this model, it aims to clarify the challenges and issues faced in advancing this model in higher vocational institutions. In response to these issues, it proposes rational suggestions (Wang,Tong & Sun, 2022). On one hand, these recommendations offer guidance for the top-level design of deepening the "Job Course Competition Certificate" comprehensive education model

in the program. On the other hand, specific measures are suggested to optimize the "Job Course Competition Certificate" comprehensive education mechanism, enhance the quality of vocational education, increase its attractiveness, and cultivate highly skilled technical talent that meets societal needs. This will effectively improve the efficiency of higher vocational institutions, promote high-quality development in modern vocational education, and enhance the overall effectiveness of vocational education.(Zhang, Wang & Liu, 2021)

Chapter 2 Literatures Review

2.1 Comprehensive education model of "Job Course Competition Certificate"

Based on the clarification and analysis of the concepts mentioned above, this research defines the "Job Course Competition Certificate" integrated education model as follows: Under the guidance of modern vocational education theory, this model formulates corresponding educational objectives and talent specifications based on the demands of job positions (occupational groups). It is implemented through a relatively stable curriculum system and teaching content, with vocational and technical skills competitions as the core component of collaborative education. The evaluation of the quality of education is based on the acquisition of educational certificates and vocational skill level certificates. This model encompasses the comprehensive training process for multi-skilled technical professionals (see Figure 2.1).

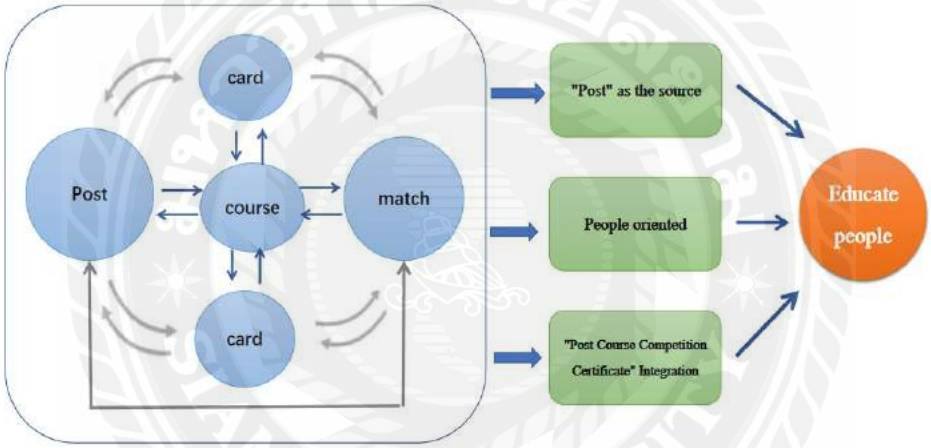

Figure 2.1 "Job Course Competition Certificate" Interrelationships.

"Job Course Competition Certificate" form an organic, integrated key element in the training of technical and skilled personnel in vocational colleges. These components have been the primary focus of scholars' research and discussions, although a unified terminology had not been established before. "Occupation" refers to the identification of occupational groups in a particular industry by collaborating with experts, determining the corresponding competency objectives that students need to achieve. "Curriculum" refers to the construction of a curriculum system based on the requirements of national occupational standards for knowledge, skills, and qualities. "Certificate" involves aligning the vocational level certificate examination outline with the teaching outline, achieving integration between the curriculum and the work process, and the vocational level certificate. "Competition" refers to the use of vocational skills competitions to evaluate professional competence, assess teaching quality, and promote effective interaction among various vocational colleges.

In April 2021, Vice Premier Sun Chunlan clearly stated at the National Conference on Vocational Education that it is necessary to implement "Position Course Competition Certificates" to enhance education quality. Since then, the terminology has gradually become standardized, and the definition of the concept of "Position Course Competition Certificates" has become clearer. "Occupation" refers to job positions, "Curriculum" refers to the curriculum system, "Competition" refers to vocational skills competitions, and "Certificate" refers to various vocational skill level certificates (Cheng, 2021).

In summary, "Position Course Competition Certificates" use "occupation" as the logical starting point, precisely aligning talent development objectives and standards with job positions, making occupation requirements the entry point for vocational education. Simultaneously, they use "certificate" as the logical endpoint, evaluating based on competencies as the exit point for vocational education, effectively supplying high-quality technical and skilled personnel to society. In the description of "Position Course Competition Certificates," "curriculum" and "competition" are placed in the middle, acting as the central link. This terminology is more systematic and aligns better with the principles of vocational education and the laws of technical and skilled personnel training, compared to previous terminology.

2.2 Integrated Parenting Model

2.2.1 Integrated

From the perspective of word origin, "comprehensive" refers to "connecting existing understandings of various parts, aspects, factors, and levels of the research object to form a unified and holistic understanding of the research object." In this research, "comprehensive" is used as a prefix for the educational model, primarily expressing traits and characteristics (Xu, 2019). It entails grasping the inherent mechanism of the "Post Course Competition Certificate" (Certificate for Competency in Post-Related Courses and Competitions) educational model from a holistic perspective, reflecting the comprehensiveness and organic nature of the educational model (Fu, 1992).

2.2.2 Parenting Model

In the context of modern Chinese, "educate people (esp. undergraduates)" refers to education and cultivation. It involves providing education and cultivation in various aspects such as ethics, intelligence, physical fitness, and aesthetics to the learners. The goal of "educate people (esp. undergraduates)" is to facilitate the all-around development of the educated individuals, making them physically and mentally healthy individuals who meet the needs of society (Xi, 2012). "Model" is explained in "Cí Hăi" as the standard pattern of things. According to Xu Liman, "'Educational model' is a concise summary of the organizational methods of certain educational processes, which are guided by certain educational theories and are aimed at serving the growth and development of educational subjects in accordance with educational laws, providing education practices for reference" (Xu, 2019).

Therefore, "comprehensive Parenting model" can be understood as a holistic approach that connects various aspects of education under the guidance of educational theories to serve the growth and development of learners in accordance with educational principles. It reflects the integrated nature of this educational model .

The "talent development model" possesses significant comprehensiveness and paradigmatic features (Liu,2019). It is a standardized pattern and implementation method adopted to achieve educational objectives, based on specific educational principles and ideals, and it has developed a certain style or characteristics through long-term practice (Xi, 2012). It inherently includes three core factors closely related to educational objectives: professional structure layout, curriculum design, and teaching management systems (Pan, 2003). Some scholars argue that a talent development model should encompass elements such as development goals, content, methods, and conditions (Zhong, 2013). These elements represent the main features of a talent development model.

In conceptual terms, there is both a connection and a distinction between the "educational model" and the "talent development model." Based on the above definitions, the "educational model" emphasizes education and reflects a process-oriented nature, focusing on the process of student development, whereas the "talent development model" emphasizes talent and is outcome-oriented, emphasizing the results of student development (Zhong, 2013).

Based on this, the "comprehensive educational model" can be defined as a process of designing and constructing educational activities (Yang & Li, 2022). It is a standardized pattern formed by the organic integration of various elements required for talent development, based on specific educational principles, to achieve educational objectives. In general, an "educational model" needs to have a solid theoretical foundation, clear educational purposes, a stable operating mechanism, and strong practicality (Tian, 2016). Building on the explanations provided above, this research breaks down the elements of the comprehensive educational model, primarily including three educational stages: educational objectives, the educational process, and educational assessment.

2.3 Cultivation Theory

2.3.1 Action-Oriented Education Theory

"Action-Oriented Teaching," known as "Handiungsorientierung" in German, is an advanced pedagogical concept that gradually developed in the field of German vocational education during the 1980s. When first introduced into the field of vocational education in China, it was initially translated as "Behavior-Oriented Teaching." However, Professor Jiang Dayuan later revised the translation to "Action-Oriented Teaching" in 2003 (Jiang, 2003). The essence of Action-Oriented Teaching lies in creating a social and interactive learning environment throughout the entire teaching process, where teachers and students engage in mutual interaction. Through students' autonomous learning activities, this approach aims to build a comprehensive

knowledge system and develop integrated abilities. It enables students to not only meet the requirements of their corresponding job positions but also apply their knowledge and skills to other professions, thus achieving practical application (Xiao, 2012). Action-Oriented Teaching emphasizes that the center of the learning process is the student, not the teacher. Teachers play the roles of organizers and coordinators during the learning process, following a sequence of "information, planning, decision-making, implementation, checking, and evaluation" in their teaching.The theoretical foundation of Action-Oriented Teaching includes constructivist teaching perspectives, the theory of multiple intelligences, the concept of lifelong learning, and humanistic educational perspectives (Song, 2015).

Constructivist teaching theory represents a further development of the cognitive perspective in learning theory (Feng, 2010). It emphasizes that the teaching process should be student-centered, involving the design of well-structured learning environments to stimulate students' interest and initiative. The approach aims to guide students to engage in practical, hands-on learning experiences, allowing them to acquire professional knowledge, master skills, and autonomously construct their own individual knowledge and experiential framework.

The Multiple Intelligence Theory emphasizes the importance of individual development in the educational process and aims to uncover one's potential. It adheres to the idea that "everyone is talented, and everyone can develop their talents," and it promotes the concept of teaching according to students' individual abilities. The theory of multiple intelligences suggests that teachers should adopt suitable teaching models to stimulate students' developmental potential and prioritize personalized development based on individual characteristics during the teaching process.

The theory of lifelong education emphasizes the active and continuous role of individuals in their learning and education. It promotes the development of an individual's capacity for self-directed learning and advocates the integration of learning and education throughout a person's entire life to achieve sustainable career development. The concept of lifelong education is a response to the rapidly evolving technological and industrial landscape, highlighting the importance of nurturing students' self-directed learning abilities throughout the teaching process.

Humanistic education theory emphasizes the status and dignity of students and advocates that education should be student-centered, focusing on the holistic and harmonious development of students' personality, physical and emotional well-being, and potential (Cui, 2015). It recognizes students as the central figures in the teaching and learning process, emphasizing the importance of respecting their role as active participants. Teachers are seen as facilitators and participants in the learning process, with their primary role being to guide and encourage students in their active learning and critical thinking.

2.3.2 Theory of the Iceberg of Qualities

The "Iceberg of Qualities Theory" is proposed by the renowned American social psychologist David McClelland. He suggests that in the workplace, determining

whether a person excels involves not only the knowledge and skills required by the job but also includes hidden factors within an individual's inner self, such as personality traits, motivation, attitudes, and values. These hidden factors often carry greater weight. He refers to the knowledge and skills required for a job as the "above-water part of the iceberg," which can be achieved through short-term training. The factors hidden deep within a person, which are difficult to measure, are defined as the "below-water part of the iceberg" and require long-term training and internalization.The study of the Iceberg of Qualities Theory emphasizes the development of vocational competency, which is a comprehensive quality demonstrated in the work process. It focuses not only on the cultivation of explicit vocational competencies such as knowledge and skills during work but also on the development of implicit vocational competencies related to an individual's character, attitude, consciousness, and capabilities. This theory underscores the importance of both explicit and implicit vocational competency development in the context of career growth and continuous development (Zhang, 2005).

The research and implementation of the "Integration of Position Course Competition Certificates" emphasize a student-centered approach. It is based on the requirements of occupational competencies, competition project standards, and the skill criteria for Certificate X. This approach involves the restructuring of teaching content with a strong focus on practical application, aiming to integrate teaching and practice throughout the curriculum development and teaching process. This allows students to learn by doing, gradually mastering the required occupational competencies, competition project contents, and skills specified in Certificate X. As a result, students build a comprehensive knowledge and experiential framework, enhancing their overall practical abilities and potential for career development. This approach reflects the practical nature of vocational education.

2.3.3 Theory of Comprehensive Human Development

"Comprehensive human development" is a concept envisioned by Karl Marx, which specifically refers to the harmonious and full development of all aspects of a person's labor capacity. Marx believed that the phenomenon of "alienated labor" in reality is the primary cause of one-sided and restricted human development. He argued that the practice of having laborers repetitively engage in low-value work like machines is a manifestation of "alienated labor" and, in essence, represents the exploitation of laborers by capitalists. However, Marx also acknowledged that "alienated labor," while detrimental to comprehensive human development, is an inevitable step towards the liberation of human value. He pointed out that only when labor machinery develops to a certain extent can the qualitative alienation of humanity be eliminated. This transformation is initially driven by economic interests, as people, in pursuit of higher economic value, begin inventing and innovating extensively, thus initiating technological revolutions. When the socially necessary labor time is reduced to a certain limit, people start to have surplus time for activities beyond production and invest in their well-rounded self-cultivation. Today, with the development of

intelligent technology to a certain extent, the subject of labor has been silently undergoing changes. The low-value labor that once "alienated" people can largely be performed by machines, and humans have more free time at their disposal, gradually providing them with the opportunity to pursue comprehensive development. For students in vocational education who are growing up in the technological era, the challenge is how to break free from low-value labor constraints and achieve their own comprehensive development.

The ultimate goal of the research on the impact of integrating "Position Course Competition Certificates" is to enhance students' comprehensive vocational abilities and achieve high-quality employment. Therefore, it should be guided by positions suitable for secondary vocational school students, incorporating the ability requirements of typical job tasks in those positions, the competition standards that reflect industry talent requirements, and the skill requirements of the "X certificate" into curriculum development and the teaching process. This approach involves simulating real work scenarios and processes, promoting the use of "competition certificates" as teaching aids, achieving alignment between courses and job requirements, and enhancing students' comprehensive vocational abilities to meet the demands of employers.

2.3.4 Students' self-directed learning abilities

In the process of societal development, self-directed learning ability can influence whether students can efficiently achieve a particular learning goal or task, playing a crucial role in facilitating self-education. Regarding the definition of self-directed learning ability, scholars from both domestic and international perspectives have explored the concept, resulting in its continuous enrichment and extension.Littlewood suggests in his research that self-directed learning ability is the combination of both the willingness and the capacity to learn, defining it as the learners' conscious choice of learning objectives and their willingness and ability to implement them (Arnold Jane, 1999). Jane Arnold posits that self-directed learning ability consists of psychological-social support and technical support, both encompassing various elements. Psychological-social support can be understood as learning motivation and other influencing factors, while technical support can be seen as the learner's ability to set goals, choose methods and tasks, as well as self-monitor and evaluate (W. Littlewood, 1999).Domestic scholar Zhu Zude and others propose that self-directed learning ability refers to the student's capacity to independently stimulate learning motivation, engage in planned learning behaviors, and ultimately achieve favorable learning outcomes (Zhu, 2005). He Jisheng suggests that self-directed learning ability is a comprehensive competence that helps learners adapt and develop continuously. It includes the ability for self-guidance, application of learning strategies, self-monitoring, and self-evaluation (He, 2009).

Therefore, based on the explanations provided by the scholars from different perspectives and various theoretical foundations mentioned above, the author of this study defines self-directed learning ability as follows: It is the learner's capacity to

consciously set their learning objectives, independently select learning content and methods, autonomously monitor and adjust their plans in response to changes in the external environment, and self-assess their learning outcomes. Importantly, this ability is dynamic and malleable, capable of being cultivated and enhanced through various learning practices and activities.

2.3.5 Regarding students' professional competence

By conducting searches in Chinese and foreign literature using the keyword "professional competence", the author has found that most of the research on professional competence in China consists of theoretical studies in the field of subject-based education. After reviewing numerous articles, the following understanding of professional competence has been synthesized. The concept of competence was initially explored by the Organization for Economic Cooperation and Development (OECD), which defined competence as follows: "Competence refers not only to knowledge and skills but also emphasizes the ability to use and apply a variety of psycho-social resources (such as knowledge, skills, attitudes, and emotions) in different contexts to meet various needs."

In the professional domain, what we refer to as professional competence is termed "professional competence" in Chinese. The germination of professional competence dates back to the 1940s when John Fray Negen introduced the concept of focusing on the inherent qualities within one's profession (Huang, 2010). After several years of theoretical development, the dual-track education system in Germany, known for its "learning by doing and doing by learning" approach, eventually integrated professional competence education into vocational education (Lou, Wang, & Du, 2018). Since then, the concept of professional competence has gradually become clearer, and the goals of professional competence education have become more well-defined and specific.

Research on the concept of professional competence during the vocational education phase has gradually expanded. In China, in 1998, the national key project "National Skill Revitalization Strategy" provided an interpretation of the system of professional competence. Subsequently, Deng Ruochao (2013) pointed out that professional competence is a comprehensive quality that should be possessed in the workplace and in practice, contributing to task completion and self-development (Deng, 2014). From the perspective of career development, Liu Chunguang and Xie Jianhong (2023) believe that professional competence is a set of qualities needed for current employment and lifelong development. It possesses characteristics of professionalism, stability, and intrinsic qualities. Research on the essence of professional competence, both domestically and internationally, continues to emerge.

In academic research on professional competence, it is recognized that professional competence is not only a combination of qualities and skills but also a comprehensive set of attributes for sustainable career development. This article defines professional competence as the comprehensive qualities exhibited by individuals in the course of their work, which are necessary for employment and

lifelong development. These qualities encompass three aspects: knowledge, awareness, and abilities.

2.3.6 Students' comprehensive practical abilities

From a philological perspective, some scholars argue that practical competence is, in essence, the ability to engage in and consciously transform objects with a purpose during one's existence. Liu Dongyan (2005) categorizes practical competence into two aspects: basic practical competence and comprehensive practical competence. He believes that basic practical competence pertains to single-skill levels and involves the ability of the agent to perform specific activities or tasks, while comprehensive practical competence is a higher-level ability for solving complex problems, encompassing independent thinking, analysis, and problem-solving.To date, one of the most in-depth studies on practical competence comes from the American psychologist Sternberg, who defines practical competence as the ability to translate theory into practice and abstract thinking into tangible outcomes. It involves an individual's capacity to acquire background information and implicit knowledge, define problems, and solve them in practical activities. Additionally, Zhou Aiguo (2007), from the perspective of modern cognitive psychology, suggests that practical competence is essentially procedural knowledge. It serves as a rule system governing individuals' completion of various social tasks and job requirements, and its development is closely linked to the mastery of corresponding declarative knowledge.

Based on the references and summaries of numerous documents above, this article deduces a definition for "practice," which refers to the process in which an individual forms a concept of practice and consciously puts that concept into practice. The definition for "competence" involves the sum of psychological and physiological characteristics necessary to ensure that an individual can smoothly complete the corresponding activities.Therefore, the "practical competence" studied in this paper refers to the sum of an individual's psychological and physiological characteristics that, combined with their relevant knowledge, enable them to form a concept of practice and implement it. The definition and understanding of comprehensive practical competence can be analyzed from the following three aspects:

(1) Comprehensive practical competence is a complex cognitive activity that relies on the support and development of intellectual factors and general abilities. Therefore, the development of comprehensive practical competence is closely linked to the support and development of intellectual factors and general abilities.

(2) Comprehensive practical competence is a manifestation of comprehensive abilities. It differs from typical cognitive abilities, as cognitive abilities represent cognitive aspects, while comprehensive practical competence is a synthesis of various abilities. It requires students to not only possess basic cognitive abilities but also problem-solving skills.

(3) Comprehensive practical competence is also a concentrated manifestation of creative abilities. It is a concentrated manifestation of the creative capacity of the individual in practice, as they adapt to and modify their living environment. It

represents the sum of various practical abilities needed to complete complex tasks and solve real-world problems. It is characterized by the comprehensive application of knowledge from multiple disciplines, practicality, and creative problem-solving for high-complexity real-world problems.

2.4 Theoretical framework

This study employs a literature review approach to comprehensively analyze existing relevant research. It summarizes and examines the research background, literature review, relevant concepts, and theoretical foundations. The research is supported by the theories of Action-Oriented Education, the Iceberg Theory of Quality, and the Theory of Comprehensive Human Development.

It utilizes a combination of questionnaire surveys and experimental control methods to investigate the current status of teaching in intelligent manufacturing technology courses. The study aims to draw conclusions based on empirical evidence and explore the necessity and feasibility of integrating "Position Course Competition Certificates" into the curriculum. The goal is to enhance students' self-directed learning abilities, vocational competence, and overall practical skills, ultimately achieving positive learning outcomes.

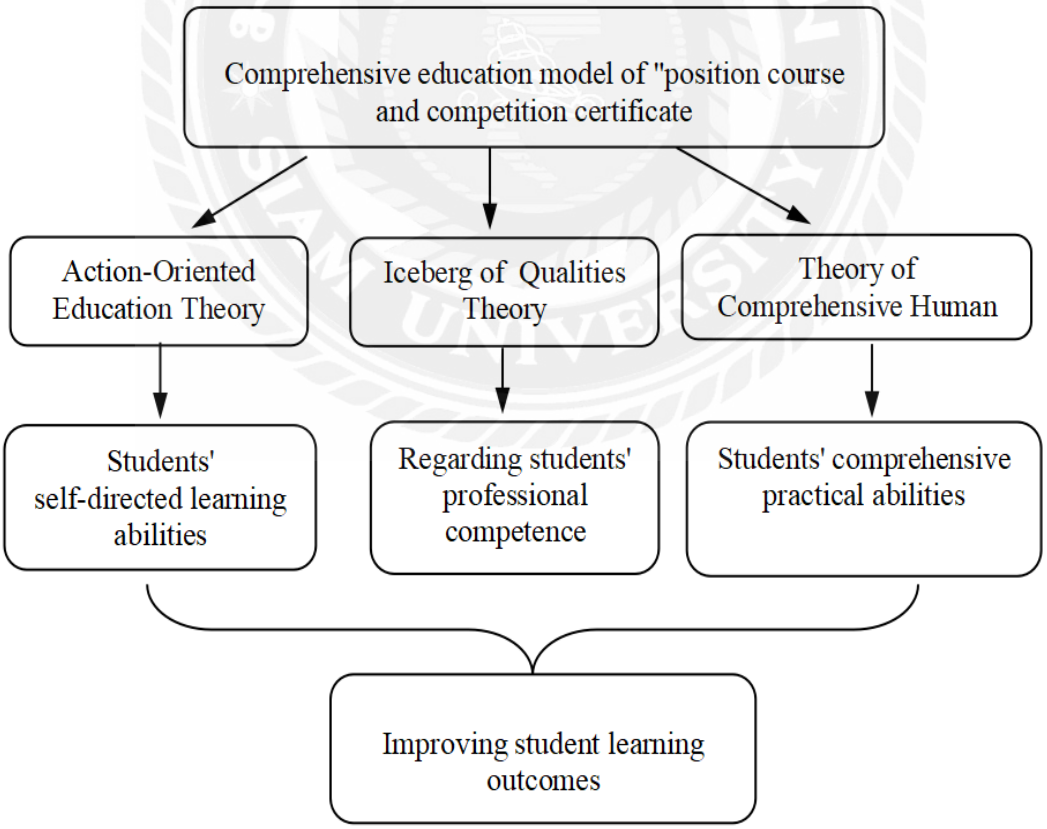

Figure 2.2 Diagram of the theoretical framework of the Study

2.5 Hypotheses

Based on the analysis of the "Job Course Competition Certificate" in the Intelligent Manufacturing major, the following three hypotheses are proposed:

H1. The "Job Course Competition Certificate" comprehensive education model has a positive impact on students' independent learning abilities.

H2. The "Job Course Competition Certificate" comprehensive education model has a positive impact on students' professional qualities.

H3. The "Position-specific Course Competition Certificate" comprehensive educational model has a positive impact on students' comprehensive practical abilities.

Chapter 3 Research Methodology

This paper adoptes a quantitative research method for data collection. It focuses on students majoring in Intelligent Manufacturing at Shandong Engineering and Vocational College to investigate the application of the "Job Course Competition Certificate" comprehensive education model in higher vocational institutions.

3.1 Questionnaire Design and Implementation

The purpose of conducting this research is to clarify the current implementation status, issues, and reasons of the "Job Course Competition Certificate" integrated education model. It aims to understand the requirements of industry enterprises for highly skilled technical personnel in the field of intelligent manufacturing from higher vocational colleges. Therefore, a research survey was designed in the form of a student questionnaire titled "Survey on the Implementation Status of the 'Position Course Competition Certificate' Integrated Education Model in Higher Vocational Programs in Intelligent Manufacturing."

The "Job Course Competition Certificate" integrated education model inherently possesses a student-centric characteristic. Therefore, the research focuses on studying the implementation status of the "Job Course Competition Certificate" integrated education model from the perspective of students. Preliminary visits and surveys have revealed that first and second-year students have not yet participated in internships, vocational qualification examinations, or professional skills competitions within their field of study. This lack of participation has some impact on their overall understanding of the implementation status of the "Job Course Competition Certificate" integrated education model. Consequently, the research has defined the survey's target population as two classes of third-year students to ensure representative subjects and the comprehensiveness of the research content.

3.2 Sample size and sampling

The subjects of this experiment consisted of 120 students majoring in Mechatronics in the Intelligent Manufacturing School of Shandong Engineering Vocational College, a three-year vocational program. These students were divided into two classes, each with the same number of students and an equal male-to-female ratio. One class was designated as the experimental group, while the other served as the control group. The experimental group received instruction using the "Position Curriculum Competition Certificate" comprehensive education model, while the control group was taught using traditional lecture-based methods. To assess the impact of the teaching methods, questionnaires were distributed to students (Anticipating the Questionnaire, See Appendix). Data related to student performance, class participation rates, and questionnaire responses were collected and subjected to independent sample tests using SPSS software for further analysis.

During the teaching process, data were collected on students' self-directed learning abilities, professional qualities, and comprehensive practical skills. Subsequently, the experiment data was collected, analyzed, and compared. Through statistical analysis of data related to students' self-directed learning abilities, professional qualities, and comprehensive practical skills, differences between the experimental and control groups were identified. Quantitative analysis was performed using statistical methods to validate the application effectiveness of the "Position Curriculum Competition Certificate" comprehensive education model in the Mechatronics major at Shandong Engineering Vocational College.

3.3 Research design

This article is based on a literature review, and the questionnaire design is centered around the integration of the "Job Course Competition Certificate." Through classroom observations and multiple revisions based on research questions, the final questionnaire comprises four parts. It includes a section on basic information and an investigation into the current implementation status of the "Job Course Competition Certificate" comprehensive education model. The questionnaire was created using the Questionnaire Star platform and consists of 34 questions. The part concerning the implementation status of the "Job Course Competition Certificate" encompasses questions related to the dependent variables, such as students' self-directed learning abilities, their professional competence, and their comprehensive practical skills.

Extensive literature reading and analysis revealed that the integration of the "Job Course Competition Certificate" in vocational education should primarily aim to enhance students' academic performance. Consequently, the questionnaire items are structured around three dimensions: students' self-directed learning abilities, their professional competence, and their comprehensive practical skills. Specifically, the questionnaire includes four items related to students' self-directed learning abilities, nine items concerning students' professional competence, and four items related to comprehensive practical skills.

The fourth part of the questionnaire consists of open-ended questions, mainly focused on soliciting suggestions related to the improvement of students' expertise and critical skills, as well as reforms in the "Job Course Competition Certificate" comprehensive education model. (For a detailed questionnaire, please refer to the appendix.)

The survey questionnaire used in this study was developed with reference to relevant literature from other scholars, and some questions were modified accordingly. We conducted reliability and validity analyses of the pilot results to ensure the scientific rigor and effectiveness of the questionnaire. This process ultimately resulted in the questionnaire used in our research（see Table 3.1）.

Table 3.1 Independent Variables

variable	Measuring item	NO.
students' self-directed learning abilities	1. Having the ability to interpret, recognize, and demonstrate creativity based on self-directed learning	Q1
	2. Having the ability to work with blueprints, mechanical design, and basic interface design	Q2
	3. Possessing digital technology and digital animation production skills	Q3
	4. Having the ability to adapt to job changes and update technical theories and knowledge	Q4
students' professional competence	5. Developing the ability to express design concepts and ideas clearly	Q1
	6. Cultivating team communication and coordination, as well as strong interpersonal skills	Q2
	7. Developing the ability to learn and acquire new knowledge, methods, and technologies in one's field	Q3
	8. Cultivating sharp insight and flexible, adaptable thinking	Q4
	9. Developing management and coordination skills as well as team collaboration abilities	Q5
	10. Cultivating innovation awareness and innovation skills	Q6
	11. Developing a diligent and industrious attitude towards diligent research and continuous improvement of professional skills	Q7
	12. Cultivating a sense of responsibility, proactivity, and a dedicated attitude to willingly contribute and work hard	Q8
	13. Cultivating a joyful attitude towards work by finding happiness in doing one's job well	Q9
students' comprehensive practical abilities	14. The ability to understand engineering drawings and interpret blueprints	Q1
	15. The ability to master and apply zero-point processing software and mechanical product design operations	Q2
	16. Mastering professional skills such as creating 2D drawings and utilizing 3D digital technology	Q3
	17. Mastering and applying professional knowledge in manufacturing and processing techniques, assembly, and debugging	Q4

3.4 Data analysis

3.4.1 Reliability analysis

Reliability refers to the consistency of a measurement tool in producing similar results when assessing the same variable. It reflects the degree to which scores obtained from the measurement can be trusted. Higher reliability indicates that scores from different items within the same scale are less influenced by errors, allowing the scores to be consistent across different respondents and accurately reflect the true state. The higher the consistency, the greater the reliability, and vice versa.

In this study, Cronbach's Alpha was used as the basis for assessing the reliability of the survey questionnaire. The survey data indicated good reliability. The questionnaire consisted of a total of 17 items. The acceptability of a questionnaire is generally assessed based on the reliability and validity of the questionnaire data. Using SPSS software, reliability and validity tests were performed on the sample data. Reliability, in this context, measures the consistency of the data. The questionnaire used a Likert five-point scale for rating each item, with each item having five response levels. Cronbach's Alpha (α) was employed to measure internal consistency (Brown, 2002). The overall reliability of the entire questionnaire was assessed using SPSS. Based on the calculated Cronbach's Alpha value, an α value above 0.9 is considered excellent reliability, while a value between 0.8 and 0.9 is considered within an acceptable range, as shown in Table 3.2.

In this study, during the initial design phase, 120 questionnaires were used for the reliability analysis using SPSS software. The results indicated that the reliability coefficient for the items was 0.918, which is greater than 0.9, signifying very high internal consistency for this section of the questionnaire.

Table 3.2 Reliability Statistics

sample size	Cronbach's Alpha	project count
120	0.918	17

3.4.2 Validity analysis

"Efficiency" is the evaluation of the effectiveness of various variables in questionnaire surveys. The common method for testing the questionnaire's efficiency is factor analysis. The questionnaire's efficiency is determined through factor analysis. Prior to principal component factor analysis, the questionnaire needs to be tested using the KMO test and Bartlett's sphericity test. Factor analysis can only be conducted when the KMO value is greater than 0.7. Survey data shows an overall KMO value of 0.868 with a significance level of 0.000, which is less than 0.05, reaching a significant level, indicating that the overall questionnaire validity is relatively good (see Table 3.3).

Table 3.3 KMO and Bartlett's Test

A sampling of sufficient degrees of Kaiser-Meyer-Olkin	Metrics	0.868
Bartlett, the sphericity test	Approximate cardinality	1504.748
	df	231
	Sig.	0.000

Table 3.4 Validity Analysis Table

KMO Value	Measuring Sampling Adequacy	0.875
Bartlett's Sphericity Value	Approximate Chi-Square	1156.569
	df	91.000

3.5 The design of teaching experimental methods

This study selected third-year students at Shandong University of Engineering and Technology for the experiment, which took place in the first half of 2023, spanning one semester. Two classes were chosen, comprising a total of 120 students. Class 1 served as the experimental group with 60 students, while Class 2 was the control group with 60 students. Both classes were taught by the same instructors for their major courses. The experimental group primarily used the "Job Course Competition Certificate" comprehensive education teaching method. The key variables revolved around the effect of the "Job Course Competition Certificate" comprehensive education teaching method versus traditional teaching on students' practical skills development.

To ensure the validity of the data, the test results were analyzed, resulting in the formation of the experimental data used in this research. As shown in Table 3.5, there were 82 male students, accounting for 68.3% of the total, and 38 female students, making up 31.7% of the total. Among the students, 54% were 23 years old, 35% were 22 years old, and 11% were 21 years old or older.

Table 3.5 Sample Data - Basic Information Survey

sample data	project	percentage share
gender	male students	68.3
	female students	31.7
age	23	54%
	22	35%
	21	11%

At the beginning of the experiment, this study selected the final comprehensive exam scores of the students from two classes majoring in Intelligent Manufacturing at Shandong University of Engineering and Technology in the previous semester as a reference. The experiment class's average score before the implementation of the "Job Course Competition Certificate" comprehensive education teaching method was 79.323, while the control class's average score was 80.452. The experiment class's average score was slightly lower than that of the control class, but there was no significant difference in the averages.

Assuming that the students' grade data results were normally distributed, a statistical test using SPSS was conducted on the two groups of experiment and control class students. As shown in Table 3.6, the test results (T=-0.595, P=0.554>0.05) indicated that there was no significant difference in the students' scores between the experiment class and the control class. The students in both the experiment class and the control class had similar baseline levels, suggesting that the grouping for this experiment was effective.

Table 3.6 Independent Sample T-Test

The pre-test scores of two classes in the Intelligent Manufacturing program						
	mean	standard deviation	mean standard error	standard deviation	T	significance
experimental class	79.323	8.146	1.4631	1.8981	-0.595	0.554
control class	80.452	6.732	1.2091			

Chapter 4 Finding

4.1 Introduction

This research employed a quantitative research approach, focusing on students majoring in Intelligent Manufacturing at Shandong University of Engineering and Vocational Technology. A questionnaire survey was conducted, with 120 questionnaires distributed and 120 returned, resulting in a 100% response rate. All 120 returned questionnaires were considered valid, yielding a 100% validity rate.

The following are the research findings and conclusions. Data analysis was conducted using SPSS software, examining students' professional learning through the dimensions of self-directed learning abilities, vocational competence, and overall practical skills. These dimensions were used to assess the students' proficiency in their field of study and further analyze the current implementation of the "Position Curriculum Competition Certificate" comprehensive education model.

4.2 Students' Self-Directed Learning Abilities

In statistical analysis, the mean provides a comprehensive reflection of the general level of observed values under certain conditions, while the standard deviation is the most commonly used quantitative measure to indicate the degree of dispersion within a dataset. A smaller standard deviation indicates that the observed values in the sample are distributed closer to the mean, with smaller differences among individuals. Conversely, a larger standard deviation suggests greater dispersion.

In terms of the mastery of professional knowledge, students rated their self-perceived level of mastery quite high, with a minimum mean value of 3.68 and a corresponding standard deviation of 0.77. This indicates that the 'Position Curriculum Competition Certificate' comprehensive education model is conducive to students' mastery of professional knowledge (as shown in Table 4.1). Furthermore, after three years of study, students have expressed a high level of satisfaction with their learning of professional knowledge, which lays a solid foundation for their future employment prospects."

Table 4.1 Students' Mastery Levels of Professional Knowledge Objectives

Effectiveness Dimensions	Specific Indicators	Minimum Value	Maximum Value	Mean Value	Standard Deviation
Self-Directed Learning Abilities	1. Having the ability to interpret, recognize, and demonstrate creativity based on self-directed learning	3	5	4.01	0.57
	2. Having the ability to work with blueprints, mechanical design, and basic interface design	3	5	3.93	0.68
	3. Possessing digital technology and digital animation production skills	2	5	3.78	0.85
	4. Having the ability to adapt to job changes and update technical theories and knowledge	2	5	3.68	0.77

4.3 Students' Vocational Competence

In terms of vocational competence, students rated themselves highly on various quality objectives. This indicates that the “Position Course Competition Certificate”’ comprehensive education model is effective in cultivating students' vocational competence. However, there was a relatively lower score and a larger standard deviation in the dimension of 'the ability to cultivate learning and acquire new knowledge, methods, and technologies in their field.' This suggests that to some extent, the development of this vocational competence is influenced by individual qualities, and it also indicates that students' self-directed learning and self-updating abilities may need further improvement and development."(as shown in Table 4.2)

Table 4.2 Students' Mastery Levels of Vocational Competence

Effectiveness Dimensions	Specific Indicators	Minimum Value	Maximum Value	Mean Value	Standard Deviation
Vocational Competence	1. Developing the ability to express design concepts and ideas clearly	2	5	3.70	0.90
	2. Cultivating team communication and coordination, as well as strong interpersonal skills	3	5	3.89	0.75
	3. Developing the ability to learn and acquire new knowledge, methods, and technologies in one's field	2	5	3.41	1.03
	4. Cultivating sharp insight and flexible, adaptable thinking	2	5	3.83	0.81
	5. Developing management and coordination skills as well as team collaboration abilities	2	5	3.94	0.84
	6. Cultivating innovation awareness and innovation skills	2	5	3.88	0.89
	7. Developing a diligent and industrious attitude towards diligent research and continuous improvement of professional skills	3	5	4.08	0.67
	8. Cultivating a sense of responsibility, proactivity, and a dedicated attitude to willingly contribute and work hard	3	5	3.99	0.73
	9. Cultivating a joyful attitude towards work by finding happiness in doing one's job well	3	5	4.04	0.72

4.4 Situational Overview of Comprehensive Abilities

In terms of comprehensive abilities, students have generally mastered the key capabilities required in the field of Intelligent Manufacturing Technology. Among these, the skill related to 'Understanding engineering drawings and design, as well as creative thinking abilities' had the highest average value, at 4.10, with a corresponding standard deviation of 0.58. This indicates that there is little variation in scores among students, and overall, they excel in this skill.

Conversely, the ability indicator 'Mastering and applying professional knowledge in manufacturing and processing techniques, assembly, and debugging' had the lowest average score, at 3.40, and a standard deviation of 1.01, indicating a greater level of variation. This suggests that, compared to other critical abilities, there is a more significant variation in the overall mastery of this key skill among students, and there is room for improvement (as shown in Table 4.3).

Table 4.3 Students' Mastery Levels of Comprehensive Abilities

Effectiveness Dimensions	Specific Indicators	Minimum Value	Maximum Value	Mean Value	Standard Deviation
Comprehensive Practical Skills	1. The ability to understand engineering drawings and interpret blueprints	3	5	4.10	0.58
	2. 2.The ability to master and apply zero-point processing software and mechanical product design operations	3	5	3.94	0.74
	3. Mastering professional skills such as creating 2D drawings and utilizing 3D digital technology	2	5	3.95	0.76
	4. Mastering and applying professional knowledge in manufacturing and processing techniques, assembly, and debugging	2	5	3.40	1.01

4.5 Correlation Analysis

Correlation analysis primarily illustrates the relationships between each variable. Pearson correlation analysis is used to describe the linear relationships between variables. The Pearson correlation coefficient ranges from -1 to 1. By using Pearson correlation coefficients, the relationships between the factors influencing the integration of "Position Curriculum Competition Certificate" at Shandong Engineering Vocational and Technical University are analyzed. Based on Table 4, we can draw the following conclusions. The Pearson correlation coefficients for students' autonomous learning ability, students' vocational literacy, and students' comprehensive practical ability are all greater than 0.5, less than 0.9, and $P<0.01$, indicating that there is a positive correlation between these variables (as shown in Table 4.4).

Table 4.4 Correlation between variables (Pearson correlation matrix)

Variables	Students' Self-Directed Learning Abilities	Students' Vocational Competence	Students' Comprehensive Practical Abilities
Students' Self-Directed Learning Abilities	1		
Students' Vocational Competence	.591**	1	
Students' Comprehensive Practical Abilities	.551**	.665**	1

NOTE：*P<0.05, **P<0.01, ***P<0.001

4.6 Multiple Regression Analysis

Multiple regression analysis was conducted to determine the relationships between the dependent variables: students' autonomous learning ability, students' vocational literacy, students' comprehensive practical ability, and the independent variable "Position Curriculum Competition Certificate." The regression equation was significant, with an F-value of 142.172 and P<0.001. The Durbin-Watson test value was 1.944, within the range of 1.8 to 2.2, indicating data independence and meeting the requirements for linear regression.

In the collinearity diagnostic results, the Variance Inflation Factor (VIF) for students' autonomous learning ability was 1.118, for students' vocational literacy was 1.091, and for students' comprehensive ability was 1.195. Since VIF values are close to 1, it suggests there is no multicollinearity in the data.

Students' autonomous learning ability (β=0.145, P<0.05), students' vocational literacy (β=0.218, P<0.05), and students' comprehensive ability (β=0.112, P<0.05) all significantly positively influence the integration of the "Position Curriculum Competition Certificate." The variables collectively explain 57.5% of the variation in classroom participation, meeting the requirements (as shown in Table 4.5).

Table 4.5 Multiple Regression Analysis

Item	Unstd. B	Std. Beta	t	Sig.	VIF	F	Durbin-Watson
C	3.209	-	7.506	0.000			
Students' Self-Directed Learning Abilities	0.145	0.175	4.176	0.000	1.118		
Students' Vocational Competence	0.218	0.262	5.327	0.000	1.091	142.172 ***	1.944
Students' Comprehensive Practical Abilities	0.112	0.130	2.753	0.006	1.195		
R Square				0.579			
Adjusted R Square				0.575			

According to the multiple regression analysis, the impact relationships between each variable can be expressed as follows:

Position Curriculum Competition Certificate Integration = 3.209 + 0.145 * Students' Self-Directed Learning Abilities + 0.218 * Students' Vocational Competence + 0.112 * Students' Comprehensive Practical Abilities.

Based on the data analysis results, in the research on the "Job Course Competition Certificate" comprehensive education model for the Intelligent Manufacturing major at Shandong University of Engineering and Vocational Technology, the model has a positive impact on students' self-directed learning abilities, which supports Hypothesis H1.

The"Job Course Competition Certificate" comprehensive education model has a positive impact on students' vocational competence, supporting Hypothesis H2."

The "Job Course Competition Certificate" comprehensive education model has a positive impact on enhancing students' comprehensive practical abilities, supporting Hypothesis H3.

Chapter 5 Conclusion and Recommendation

5.1 Conclusion

This study focused on two classes of third-year students at Shandong University of Engineering and Technology. After conducting an in-depth research into the current state and effectiveness of the "Job Course Competition Certificate" comprehensive education model in the Intelligent Manufacturing program, the research findings revealed substantial progress in the implementation of the model. By aligning educational objectives, the educational process, and assessment, a comprehensive "Job Course Competition Certificate" model was established, characterized by the integration of job-related courses, competition activities, and certification processes.

Therefore, based on the findings from the current state investigation and the analysis of implementation effectiveness, the following conclusions are drawn in this paper.

5.1.1 "Job Course Competition Certificate" comprehensive education model has a positive impact on enhancing students' self-directed learning abilities.

The "Job Course Competition Certificate" integrated curriculum primarily utilizes an action-oriented teaching model in its implementation. This approach is conducive to promoting self-directed learning. It combines various student-centered teaching methods, such as a blended approach that combines online and offline elements, task-driven teaching, project-based teaching, and mind-mapping teaching. These methods fully respect the central role of the students, and the teaching process is structured around the completion of specific learning tasks, effectively engaging students in self-directed learning.During the teaching implementation process, the emphasis extends beyond nurturing students' self-directed learning and innovation skills. It also includes methods like group collaboration and discussions to develop students' communication skills and a spirit of teamwork, which are advantageous for their future career development. Using mind-mapping teaching methods, students are guided to promptly organize and summarize their acquired knowledge, which aids in helping students construct a knowledge and experience system.Furthermore, the use of developed physical and digital teaching resources, including loose-leaf textbooks, micro-lecture videos, case libraries, and question banks, assists in the implementation of teaching. This approach helps bridge the gap between the teaching process and the working process, broadens students' knowledge horizons, and solidifies their knowledge foundation.

5.1.2 "Job Course Competition Certificate" comprehensive education model has a positive impact on students' professional competence.

Designing curriculum objectives for the "Job Course Competition Certificate" integrated curriculum from three dimensions: knowledge objectives, skill objectives, and quality objectives, is indeed quite reasonable. The overall objective of the curriculum, which is to cultivate skilled professionals who meet the competency requirements of industry positions, aligns perfectly with the fundamental principles of vocational education.The curriculum objectives that require students to master

knowledge and skills in four areas, including mechanical system and intelligent manufacturing system installation and adjustment, basic operation of intelligent manufacturing equipment, programming for typical intelligent manufacturing applications, and maintenance of intelligent manufacturing machine tools, along with the development of a strong sense of professional ethics, are essential for equipping students with the necessary knowledge, skills, and qualities to meet the demands of industry positions.In the actual teaching process, the entire instructional approach is designed and conducted with a focus on the curriculum objectives. This approach effectively enhances students' knowledge and skills and cultivates their professional competence. Consequently, students can generally achieve the intended curriculum objectives, demonstrating the practicality and success of the teaching process.

Professional ethics and qualities are indispensable components for skilled professionals and have a significant impact on an individual's career development. During the development and teaching process of the "Job Course Competition Certificate" integrated curriculum, there has been a strong focus on cultivating students' professional ethics and qualities.

For instance, in the design of the teaching environment, the practical training areas are set up and decorated to replicate actual industrial production environments, enabling students to adapt to workplace conditions in advance. Additionally, the implementation of the 7S methodology is strictly integrated into every training session, fostering good professional behavioral habits among students.

Furthermore, systematic learning tasks within the curriculum are designed to simulate work processes, and students engage in practical exercises in groups. This approach helps develop students' communication skills and teamwork spirit. Through practical exercises such as robot disassembly and assembly, typical application programming, and maintenance and upkeep tasks, students progressively adapt to job-related responsibilities and gradually develop a professional spirit characterized by resilience, determination, and a commitment to excellence.

In summary, through their learning experience in the "Job Course Competition Certificate" integrated curriculum, students have acquired the essential professional ethics and qualities, making them, for the most part, genuine skilled professionals.

5.1.3 "Job Course Competition Certificate" comprehensive education model has a positive impact on enhancing students' comprehensive practical abilities.

The "Job Course Competition Certificate" integrated curriculum, in terms of its teaching content, starts with the aim of enhancing students' vocational abilities. It analyzes the job tasks in enterprises, competition projects, X-certificate skill requirements, and the curriculum's teaching content to identify commonalities among them. This process allows for the extraction of specific learning tasks, the design of learning scenarios, and the restructuring of the curriculum's content and structure. By closely aligning the teaching process with the demands of employment in companies, competition projects, and X-certificate skill requirements, the curriculum successfully integrates the "Position Course Competition Certificate." This integration harnesses

the comprehensive education potential of the "Position Course Competition Certificate."

In terms of the organization of teaching content, considering students' cognitive characteristics and their current learning status, the curriculum is structured in a progressive and in-depth manner. This approach makes it easier for students to understand and master knowledge and develop their skills gradually.

Shandong Engineering Vocational College aims to train skillful professionals that meet the demands of society, ultimately facilitating high-quality employment for students. Given the continuous evolution of new technologies, processes, and standards in the manufacturing industry in China, it is essential to keep up with the times in the process of talent development. The "Job Course Competition Certificate" integrated curriculum is tailored to industrial robot system installation and adjustment, intelligent manufacturing machine tool operation and programming, and intelligent manufacturing machine tool maintenance positions.

During the teaching process, there is a strong focus on nurturing students' abilities in system installation and adjustment, operation programming, and maintenance. Based on students' learning feedback, behavioral performance during practical training, and the quality of their completion of training tasks, students, on the whole, have effectively acquired practical operational skills related to the installation and adjustment of intelligent manufacturing machine tools, programming, and maintenance. They have developed these skills to a level that can largely meet the competency demands of the relevant positions.

5.2 Recommendation

The above text discusses the autonomous learning ability of students, their vocational literacy, and their comprehensive practical ability in the context of the "Position Curriculum Competition Certificate" integrated education model at Shandong Engineering Vocational and Technical University's Intelligent Manufacturing major. It analyzes the current implementation status and the challenges faced. The analysis reveals that issues such as the untimely development of new teaching materials, the inadequacy of competition mechanisms, and the lack of relevant institutional support are the main factors contributing to the deviation from the intended objectives of the "Position Curriculum Competition Certificate" integrated education model.

In light of these findings, the following countermeasures and recommendations are proposed to address these issues and their underlying causes.

5.2.1 Continuously refining educational objectives and nurturing students' self-directed learning abilities

The "Position Curriculum Competition Certificate" integrated education model in the Intelligent Manufacturing major at Shandong Engineering Vocational and Technical University is implemented with the push of policies, but its fundamental basis lies in the demand of the intelligent manufacturing technology industry. At the

national level, providing guidance is essential to the implementation of the "Position Curriculum Competition Certificate" integrated education model. Currently, the primary focus should be on clarifying the industry orientation of the "Position Curriculum Competition Certificate" integrated education model, as this determines its development direction.

Different vocational levels and job positions have varying skill standards required by job seekers. To address this, it can be led by the government, guided by experts, and facilitated by cooperation between educational institutions and enterprises. Conducting large-scale COMET occupational skill assessments for the intelligent manufacturing technology industry to analyze occupational skills will help form comprehensive content and provide guidance for overall education goals (Zhao, 2022). At the school level, aligning the curriculum with national vocational skill standards can help design progressively increasing levels of occupational skill mastery to differentiate educational objectives for students at different levels. This approach guides teachers to adopt various teaching goals for students at different grade levels and adapt their teaching methods accordingly, ensuring the true implementation of the integrated education concept in teaching.

By clearly defining the hierarchical positioning of educational objectives, students can develop a better understanding of their career choices and industry awareness. This approach not only helps students clarify their career goals but also contributes to the sustainable development of the "Position Curriculum Competition Certificate" integrated education model.

Students exhibit weak self-directed learning abilities, and their awareness of career development is often unclear. Subjective factors play a significant role in these issues. Relying solely on government and corporate support for cultivating their essential competencies is not a viable approach. The school's one-sided approach to talent development reform is insufficient. Students must also develop a proper understanding of the pressures and contradictions inherent in their professional learning and career development. Recognizing the positive and negative implications of the stress associated with academic studies and career pursuits is essential. They should transform this stress into motivation and continually enhance their professional competence. Furthermore, students should transition their perspective on learning. They need to understand that the benefits gained from acquiring knowledge and skills in their field are time-bound and do not provide a "one-size-fits-all" solution. Embracing a lifelong learning mindset is crucial, requiring continuous improvement of their knowledge and practical abilities.

In addition, throughout their careers, students should engage in continuous self-reflection and intellectual growth. They should actively adapt to and learn new knowledge and technologies in the field of intelligent manufacturing, preparing themselves for lifelong career development.

5.2.2 Continuously innovating the "Position Curriculum Competition Certificate" integrated education approach to foster the development of students' vocational competence

In the implementation of the "Position Curriculum Competition Certificate" integrated education, there is a need to change the teaching philosophy and innovate educational approaches. Firstly, it is essential to strengthen the teaching staff by recruiting external expert resources such as skilled craftsmen, industry experts, expert judges, vocational education specialists, etc., to form teacher teams like "Master Teachers Studios" and "Skilled Craftsman Studios." This optimization of the teaching staff enhances their qualifications, and the implementation of the "dual-tutor" model combines in-house and external instructors for course teaching. Secondly, there should be an improvement in teaching materials. By integrating the knowledge points of "Occupational, Competition, Certificate" based on professional positions and collaborating between the school and industry, new project-based and case-based teaching materials should be developed to emphasize new processes, new technologies, and new standards. Finally, scenario-based teaching should be established. Students should be provided with scenario-based teaching that simulates the skill requirements of "Occupational, Competition, Certificate," leveraging resources from various sources, to enhance students' learning enthusiasm and vocational competence.

Enhancing the "Position Curriculum Competition Certificate" integrated education mechanism, designing and developing courses based on actual production and job demands, and creating a modular and systematic training course system are all essential for improving students' practical skills. For the design of high-quality courses in the field of intelligent manufacturing, it is necessary to start with the job requirements of the intelligent manufacturing technology industry, using vocational standards as the logical starting point for the education model. It should emphasize the integration of ethics and skills, education and training, and coordinate the reform of various aspects such as program offerings, talent development plans, course materials, classroom teaching, and internships. This will effectively promote the deep integration of the "Position Curriculum Competition Certificate" and enhance the quality of teaching.

Vigorously exploring and promoting the development of high-quality courses is a crucial step in advancing the integration of the "Position Curriculum Competition Certificate" at Shandong Engineering Vocational College. This approach not only helps in aligning the professional program with the needs of industry enterprises, but it also benefits student skill development, improving their professional abilities and vocational competence.

5.2.3 Reconstructing the curriculum system based on job competency demands to enhance students' comprehensive practical abilities

"In the implementation of the 'job-course-competition-certificate' integration, 'course' is the basic unit of talent cultivation in higher vocational colleges. It is

essential to combine the major direction, carefully analyze the common characteristics and intrinsic connections of the four elements, 'job,' 'course,' 'competition,' and 'certificate.' Using specialized courses as the carrier, the skills standards, professional norms, business literacy, evaluation criteria, nurturing and training modes of 'job,' 'competition,' and 'certificate' are transformed into the entire educational process of learners, forming an organic network of knowledge and skills.

Firstly, in the process of constructing the curriculum system, emphasis should be placed on the complexity of skills. Given the current shift in society's demand for highly skilled talents from single-skilled to multi-skilled, in the actual process of formulating talent development plans, it should not be simplistically understood as the integration of a single course in the 'job-course-competition-certificate.' Instead, it should be based on the demands of the work tasks in the professional job cluster. This involves constructing blocks of specialized courses. The academic institution and the enterprise should jointly analyze the comprehensive skill requirements, vocational qualification standards, skill competition standards from the perspective of unified formulation of professional talent development plans. They should align these with vocational standards and work processes, transform them into the objectives, requirements, and skill knowledge points of talent development implementation plans, and integrate them into the specialized curriculum system. This approach can not only prevent the duplication and wastage of resources both inside and outside the institution but also effectively coordinate resource utilization, thereby enhancing the quality of talent cultivation.

Secondly, it is necessary to reconstruct the curriculum system based on the growth laws of vocational abilities. One should clarify the demands for job skills and the requirements of professional certificate levels, carefully analyze the typical positions and duties corresponding to different skill level stages, and distill the requirements for professional knowledge and skills, abilities and methods, professional literacy, etc. Combine this with the content of skill competition projects, incorporate it into the curriculum system, and follow a progressive path from easy to difficult and from shallow to deep, in conjunction with the cognitive patterns of students and future development needs."

References

Arnold, J. (1999). *African in language learning*. Cambridge University Press.

Brown, J. D. (2002). The Cronbach Alpha reliability estimate. *JALT Testing & Evaluation SIG Newsletter, 6*(1).

Cai, Q. (2010). Exploration of the teaching model "competition and teaching combination, learning in competition, and promoting improvement through competition." *Vocational and Technical Education,* (26), 40-43.

Chen, S., Chen, L., Xie, G., & Gao, J. (2021). Research and practice of the "Integration and Innovation of Position Courses, Competitions, and Certificates" Teaching model: A case study of the "Landscape Engineering Construction Technology" course. *Chinese Forestry Education, 41*(3), 53-59.

Cheng, Z., Li, H., & Zhang, J. (2021). Value inquiry, theoretical basis, and practical innovation of the "Job Course Certificate" integrated training mode. *Vocational Education Forum, 1*(11), 68-74.

Deng, R.Q. (2014). *Research on vocational competence of secondary vocational school students*. Hubei University of Technology.

Dong, G., & Yang, L. (2012). A study on the quality of high-quality technical and skill-oriented talent training in higher vocational education. *Chinese Higher Education Research*, 9, 91-94.

Dou, F. (2022). The logic and path of developing new forms of vocational education textbooks through the integration of "Job Course Certificate." *China's Vocational and Technical Education, 2*(26), 65-71.

Fu, Y. (2019). Research on the three-level pyramid system of skills competitions in Chinese vocational colleges. *Vocational Education Forum, 9*(01), 6-12

Fu, Y., & Jin, Z. (2016). Issues and countermeasures of integrating course and certificate in higher vocational education. *Heilongjiang Higher Education Research, 16*(11), 174-176.

Gao, R. (2022). Implementation path of "Job Course Certificate" integrated education in preschool education majors in higher vocational colleges. *China Higher Education, 2*(09), 59-61.

Gong, Y. (2020). Research on the ecosystem and evolution mechanism of professional group in higher vocational education. *Research on Higher Engineering Education,* (06), 141-147.

Huang, L. (2015). Exploration of the innovative talent training mode of "Job Course Certificate." *China's University Science and Technology, 15*(07), 80-81.

Huang, Q.M. (2010). *Research on the quality assurance system of higher vocational courses: From teaching to curriculum*. Shanghai Jiao Tong University Press.

He, J.S. (2009). The connotation, composition, and dynamic analysis of students' self-directed learning abilities. *Educational Review*, (02), 81-83.

He, K. (1997). Constructivist teaching models, teaching methods, and instructional design. *Journal of Beijing Normal University: Social Sciences Edition, 5*, 74-81.

Jing, A. L., & Zhou, H. T. (2022). Foundations, issues, and trends in promoting high-quality development of higher vocational education. *Journal of Beijing Normal University (Social Sciences Edition)*, (6), 50-58.

Li, H. (1995). Discussion on educational ecology. *Teaching and Management, 5*(01), 14-16.

Li, Y. (2018). Construction of the new era vocational education industry-education integration ecosystem. *Education and Vocation*, *8*(20), 19-25.

Lin, H. (2021). Comprehensive initiation of Fujian's new journey in building a high-quality education system. *China Education Daily, 33*(12), 98-101.

Liu, H. (2017). Research on the comprehensive optimization of teaching quality factors from the perspective of integrating courses, certificates, competitions, and groups. *Chinese Vocational and Technical Education*, *7*(29), 78-80.

Liu, S. (1992). Preliminary exploration of the transfer of job-related skills learning for employees. *Adult Education, 2*(06), 25-27.

Lou, F.Y., Wang, M., & Du, X.W. (2018) Exploring the core competencies of German vocational education and their implications. *Heilongjiang Higher Education Research, 285*(01), 55-58.

Qi, R., & Zhang, X. (2022). Optimization of the incentive mechanism for teachers in higher vocational colleges from the perspective of "Job Course Certificate" integration. *China's Vocational and Technical Education, 2*(24), 67-71.

Qu, L. (2020). Research on the integration of job-related courses in vocational colleges based on modern apprenticeship. *Liaoning Higher Vocational College Journal, 20*(05), 57-65.

Ren, J., Yang, X., Tai, K., et al. (2021). Integration of competition and teaching: The path and considerations of transforming national vocational college skills competition resources – Taking the early childhood education professional skills competition as an example. *China's Vocational and Technical Education, 1*(09), 91.

Shao, Y., & Liu, Y. (2021). Research on the compound talent training mode of EPUI based on the theory of collaboration. *China's University Science and Technology, 1*(10), 71-75.

Song, Y. (2020). Research on the ecosystem and evolution mechanism of professional group in higher vocational education. *Research on Higher Engineering Education,* (06), 141-147.

Sun, M., & Kang, C. (2006). A new interpretation of educational mechanism theory. *Educational Research, 6*(12), 22-28.

W- Littlewood. (1999). Defining and developing autonomy in East Asian contexts. *Applied Linguistics*, *20*(1), 2-3.

Wang, C., Ye, H., & Sun, H. (2019). Research on curriculum reform based on the cultivation of craftsmanship spirit from the perspective of course-competition integration. *Education and Vocation, 9*(14), 109-112.

Wang, F., & Mi, J. (2021). Professional group ecology and governance path in the "Double High Plan" of vocational education. *Education and Vocation, 1*(03), 13-20.

Wang, H. (2015). Research on the talent training mode of "course-competition integration" in higher vocational accounting majors. *Financial and Accounting Communication, 5*(31), 63-65.

Wang, L., & Li, Y. (2021). The connotation and path exploration of the comprehensive education of "Job Course Certificate" in higher vocational colleges. *China's Vocational and Technical Education, 1*(26), 5-11.

Wang, X., & Jin, H. (2022). The theoretical basis, intrinsic requirements, and implementation path of vocational education "Job Course Certificate" integration based on the perspective of the "Big Vocational Education" concept. *Education and Vocation, 2*(02), 21-28.

Wang, Y. (2017). Internal quality assurance system construction in higher vocational colleges in the action plan for the quality of higher vocational education. *Vocational and Technical Education, 7*(25), 39-43.

Wang, Y., Tong, H., & Sun, Z. (2021). Application of the 1+X certificate integration method in the construction of professional groups and the development of new teaching materials. *China's Vocational and Technical Education, 1*(29), 91-96.

Wu, D. (1989). Preliminary exploration of the basic laws of educational ecology. *Journal of Nanjing Normal University (Social Science Edition), 9*(03), 95-99.

Xu, X., & Qian, D. (2014). Design and scenario research on the application of smart learning environment in vocational education. *Journal of East China Normal University (Natural Sciences), 4*(2), 60.

Xu, Y. (2021). Intelligent ecosystem of higher vocational education: Connotation, structure, and practical path. *China Distance Education, 1*(07), 18-24.

Yang, R., & Li, C. (2022). Connotation, structure, and practical path of school-enterprise dual-element education from the perspective of educational ecology theory. *China's Vocational and Technical Education, 2*(24), 38-45.

Yang, S. (2019). Curriculum reform and exploration of financial majors based on the integration of courses, certificates, competitions, and groups. *China's Vocational and Technical Education, 9*(05), 77-80.

Yang, S., & Yu, Z. (2018). Integration of job-related courses: Implications and promotion pathways for modern apprenticeship. *Vocational Education Forum, 8*(01), 63-67.

Zeng, T. (2021). Practical exploration of "Job Course Certificate" in cultivating high-skilled talents. *China's Vocational and Technical Education, 1*(08), 5-10.

Zhang, E., Zhang, Z., & Shi, L. (2020). Promoting the professional competence development of higher vocational college teachers from the perspective of "production, competition, and teaching" integration: Mechanism and path. *Vocational Education Forum,* (11), 52-57.

Zhang, H., Wang, H., & Liu, X. (2020). The practical issues and implementation paths of the "Job Course Certificate" integrated education model in higher vocational colleges. *Education and Vocation, 1*(21), 27-34.

Zhang, H., Wang, H., & Liu, X. (2021). Practical issues and implementation paths of the "Work-Integrated Competitions Certificate" integrated education model in higher vocational colleges. *Education and Vocations,* (11), 27-34.

Zhang, H., Wang, H., & Liu, X. (2021). Realistic issues and practical pathways of the "Job Courses and Competition Certificates" integrated education model in higher vocational colleges. *Education and Occupation*, *2*(11), 27-34.

Zhang, X., & Geng, X. (2020). Research on the integration of courses and certificates under the 1+X certificate system: Reflections based on BTEC in the UK. *Vocational Education Forum, 20*(10), 47-51.

Zhang, Y., He, T., & Liu, S. (2023). Research and practice on the pathway to enhancing the adaptability of vocational education majors in the context of data intelligence. *Education and Vocation, 3*(05), 63-68.

Zhong, B. (2013). The reform of talent training mode in higher education is the core of connotation construction. *Research on Higher Education, 3*(11), 71-76.

Zhu, D., & Yang, Y. (2020). Integration of "production, competition, and teaching" in vocational education: Mechanism, problems, and governance. *Vocational Education Forum,* (11), 31-38.

Zhu, Q. (2015). Construction of the "Job Course Certificate" integrated curriculum system in vocational college character design majors. *Education and Vocation, 15*(19), 96-98.

Zhao, X., & Zhong, S. (2022). Rural education revitalization through "three classrooms" in the ecological perspective: Value, operation mechanism, and development path. *E-Education Research, 2*(07), 48-55.

Zhu, W., & Yan, C. (2017). Exploring a new path for cultivating e-commerce talents with the integration of course and competition. *Vocational Education Forum*, (09), 75-79.

Zhu, Z.D., Wang, J.Q. Zhang, W., & Ye, Q.Q. (2005). Development of the self-directed learning scale for college students. *Psychological Development and Education*, (03), 60-65.

Appendix

Questionnaire Survey on the Impact of Integrating “Position Course Competition Certificates” on Student Learning Outcomes

Dear students.

shalom! I am a graduate student at Siam University. This survey aims to investigate the basic information regarding the impact of integrating "Position Course Competition Certificates" in the Intelligent Manufacturing Engineering program at higher vocational colleges on students' learning outcomes. It does not involve the collection of personal or private information. This survey is conducted anonymously, and the information provided is solely for academic research purposes and will not be used for any other purposes. Please feel free to complete the questionnaire with care, and thank you for your cooperation!

Questionnaire, thank you for your cooperation!

一. Basic information (please type "√") on the actual option

1. Your gender ( )
   A.man
   B.woman
2. Your grade ( )
   A.first grade
   B.second grade
   C.junior class
   D.graduate
3. Your hukou ( )
   A.city
   B.rural area
   C.other
4. Why did you choose the major of reading books? ( )
   A. Apply for the examination according to the result of
   B. Have a skill and get a good employment
   C. More relaxed, no pressure
   D. Personal interests
5. Do you hope to pursue further your study in the future?( )
   A. hope
   B. Not want
   C. It doesn't matter
6. The reason why you want to go to school is ( )
   A. Like major, want to continue to study
   B. good employment
   C. parents want me to continue to study
   D. No personal idea, see the students around you choose to go to school
7. You want to get an ( ) through your major

A. Professional knowledge
B. skills and literacy required by the position
C. Related recruitment channels and employment information
D. career selection and planning ability

二. Investigation on the implementation status of the comprehensive education mode of "Post class competition certificate"

8. Are you clear about the training objectives of your major? ( )
A.as clear as a bell
B.clear
C. Probably know that
D. Not quite clear about the
E. Don't know

9. Do you think the current training objectives of this major reflect the characteristics of its major? ( )
A. Fully reflect the
B. The basic embodiment of the
C. Most of them reflect
D. A few parts reflect
E. Not at all. Yes

10. Does your school's comprehensive education model of "Certificate of Job Competition" meet the requirements for the training of composite talents in digital media technology? ( )
A. Very consistent with the
B. More in line with the
C.same as
D. Not quite consistent with the
E. It doesn't fit

11. Do you know the employment direction and career position of your major? ( )
A.as clear as a bell
B.clear
C. Probably know that
D. Not quite clear about the
E. Don't know

12. You think the school's professional curriculum is set up in ( )
A. Very reasonable.
B. More reasonable.
C.same as
D. Unreasonable
E. Very unreasonable

13. You think of the current course structure of this major (multiple choice) ( )
A. Sufficient amount of practical courses

B. The course are offered in reasonable time and order
C. The courses are closely connected
D. The course content is old and more repeated parts
E. The course teaching form is single

14. Do you think ( ) is more important in classroom teaching?(Limited to 3 items)
A. Teachers have rich theoretical knowledge and strong professional character
B. The classroom atmosphere is active to stimulate students' interest
C. Inspire students to think and guide their independent learning
D. Rich in content, and close connection with the practical work
E. Contact with life, learn the knowledge with high application

15. Do you think the teachers will closely combine their professional knowledge with the relevant cutting-edge trends for teaching? ( )
A.be completely in conformity with
B.accord with
C.same as
D. Not quite consistent with the
E. It doesn't fit

16. Do you think the teachers closely link their courses with the practice of their major? ( )
A. Very tight to the other
B. More tight, and the
C.same as
D.clearance leakage
E. Completely disjointed

17. Do you think the major reflects the concept of school-enterprise cooperation in the practice process? ( )
A. Fully reflect the
B. The basic embodiment of the
C. Most of them reflect
D. A few parts reflect
E. Not at all. Yes

18. Do you think the internship time is sufficient? ( )
A.Very adequate, and the
B.adequate
C.sufficiency
D.a fat lot E.hardly any

19. Do you have a variety of professional vocational skills competitions organized or activities you have participated in? ( )
A.Very adequate vs.
B.adequate
C.sufficiency

D.a fat lot E.hardly any

20. Have you ever participated in the professional skills competition of your major?( )

A. Yes, if you have the opportunity to actively participate in

B. No, willing to try (jump to question 23)

C. Not concerned, not interested (just jump directly to question 23)

21. Do you think the theoretical knowledge learned in class is useful in the vocational skills competition related to your major? ( )

A.quite useful

B. More useful

C.same as

D. Not very useful

E. It's almost useless

22. Do you think that participating in the vocational skills competition will play a great role in promoting your professional knowledge and skills?( )

A.very large

B. Comparison of large

C.same as

D.less E.wee

23. What is your attitude towards introducing the content and requirements of skills competitions into practical learning? ( )

A. Very supportive of the

B. Compare the support of the

C. General

D. comparison does not support

E. No support at all

24. Do you think the current vocational skills competition will help you to obtain the vocational skills qualification certificate? ( )

A.very large

B. Comparison of large

C. same as

D. less E.wee

25. What is your major ( ) (multiple choice)

A. professional knowledge

B. Key Capabilities

C. attitude to learning

D.professional quality

E. Internship practice

26. In what way is your major assessed ( ) (multiple choice)

A. written examination

B. Practice operation

C. Examination + Practice

D. practice

27. Do you think the current assessment plays a great role in promoting your professional knowledge and skills? ( )

A. very large

B. Comparison of large

C.same as

D. less E.hardly any

28. In your opinion, do the current assessment and evaluation match the educational goals of your major? ( )

A. Very match

B. Comparison and match of

C. same as

D. Not quite match the

E. Completely mismatches

29. Through the study of your major, do you think to improve the learning and application of your professional knowledge? ( )

A. There is a big improvement in

B. There is a large improvement in

C.same as

D. Not much improvement in the

E. There was no improvement at all

30. Through the study of your major, do you think your professional ability required by your position has been improved? ( )

A. There is a big improvement in

B. There is a large improvement in

C.same as

D. Not much improvement in the

E. There was no improvement at all

31. Through the study of this major, do you think you meet the professional quality requirements of the job requirements? ( )

A. Very consistent with the

B. More in line with the

C.same as

D. Not quite consistent with the

E. It doesn't fit

32. Do you think it is helpful to obtain the professional qualification certificate or vocational skill certificate for employment? ( )

A. Very helpful to the use of

B. There is a certain amount of help for the use of

C.same as

D. Nothing to help the

E. Not at all. It helps

三. Study of student learning effect

Warm tip: This research part mainly wants to understand your learning effect in the process of studying this major, so as to improve and optimize the education mode of "post course competition certificate" later. Please read each sentence carefully, and then choose according to your own actual situation, and delimit "" on the corresponding number.

The specific situation is as follows: 1-very disapproval (1 point) 2-more disapproval (2 points) 3-more identification (3 points) 4-identification (4 points) 5-very identification (5 points).

dimension	Specific indicators	1. Very much disagree	2. disagree	3. More recognition	4. To agree with it	5. Very much agree
students' self-directed learning abilities	1. Having the ability to interpret, recognize, and demonstrate creativity based on self-directed learning					
	2. Having the ability to work with blueprints, mechanical design, and basic interface design					
	3. Possessing digital technology and digital animation production skills					
	4. Having the ability to adapt to job changes and update technical theories and knowledge					
students' professional competence	5. Developing the ability to express design concepts and ideas clearly					
	6. Cultivating team communication and coordination, as well as strong interpersonal skills					
	7. Developing the ability to learn and acquire new knowledge, methods, and technologies in one's field					
	8. Cultivating sharp insight and flexible, adaptable thinking					
	9. Developing management and coordination skills as well as team collaboration abilities					
	10. Cultivating innovation awareness and innovation skills					
	11. Developing a diligent and industrious attitude towards diligent					

	research and continuous improvement of professional skills					
	12. Cultivating a sense of responsibility, proactivity, and a dedicated attitude to willingly contribute and work hard					
	13. Cultivating a joyful attitude towards work by finding happiness in doing one's job well					
students' comprehensive practical abilities	14. The ability to understand engineering drawings and interpret blueprints					
	15. The ability to master and apply zero-point processing software and mechanical product design operations					
	16. Mastering professional skills such as creating 2D drawings and utilizing 3D digital technology					
	17. Mastering and applying professional knowledge in manufacturing and processing techniques, assembly, and debugging					

四. Your suggestions on the reform of the comprehensive education mode of "post class competition certificate".

33. What knowledge and skills do you think of the graduates need to be strengthened, and what other courses or knowledge and skills should be added?

_____

_____

34. Your valuable opinions and suggestions on the reform of the comprehensive education mode of "Post Course Competition Certificate" in Higher Vocational Colleges:

_____

_____

Thank you again for your cooperation, I wish you a smooth work and a happy life!