

The Influence of Positive Growth Experience of Craftsmen on Vocational Education of Automotive Inspection and Maintenance Technology and Mental Health

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Abstract. Since 2014, in China, there has been a principle to divert the graduating junior high school students to regular high schools and secondary vocational schools in an orderly manner, with a ratio of 50%. Vocational education serves as an important foundation for cultivating technical and skilled talents, as well as craftsman talents. However, vocational education, as a distinct type of education, has not yet gained widespread recognition in society. And it is a very meaningful thing to explore how their teachers' positive growth experience influence these students to become successful and feel pleasure. Using a qualitative methodology, we interviewed ten Zhejiang craftsmen specializing in the automotive field, who work as full-time or part-time teachers in technical colleges and vocational schools, to explore the relationship between their growth experiences and the impact of teacher education on the cultivation and development of craftsmen. The study not only focused on their professional development but also delved into the psychological aspects of their journey. By examining the interplay between professional growth, educational impact, and psychological factors, this results provide valuable insights into the holistic development of skilled craftsmen. The findings reveal that the growth characteristics of Zhejiang craftsmen can be categorized into four stages: aspiration, enjoyment, dedication, and innovation. These stages are reflected in various aspects such as career aspirations, professional identity, and collaborative innovation, which are further subdivided into 29 factors. Moreover, the analysis demonstrates how these self-growth experiences can be effectively transferred to the student training process, thereby stimulating students' enthusiasm for learning vehicle inspection, testing, and repairs. The development of vocational education can draw insights from the growth process of Zhejiang craftsmen, with a specific focus on fostering workplace learning, integrating theoretical instruction with practical skill development, and nurturing both technical expertise and personal qualities. And the comprehensive strategy focuses on the areas, such as fostering workplace learning, integrating theoretical instruction with practical skill development, nurturing both technical expertise and personal qualities, promoting psychological health and so on. By implementing these strategies, vocational education institutions can help students grow into healthy, skilled, and psychologically robust professionals.

Keywords: Zhejiang craftsmen, vocational education, interviews, qualitative analysis.

1. Introduction

The increasing globalization and rising knowledge-based economy have created a higher-than-ever demand for skilled workers[1]. In China, according to the analysis and forecast of the National Development and Reform Commission, the demand for senior technical and skilled talents will continue to grow from 2019 to 2035, with an average annual shortfall of over 7 million people[2]. In addition, the McKinsey Global Institute estimates that if China fails to fill the gap in high-skilled talent by 2020, it may suffer a loss of up to 250 billion US dollars. Craftsmen typically refer to professionals with profound knowledge and skills in a specific craft or technical field[3]. Therefore, it is important to cultivate technical and skilled talents especially craftsmen nowadays.

Vocational education, as a distinct type of education, has not yet gained widespread recognition in society. The Vocational Education Law of the People's Republic of China emphasizes the importance

of employing skilled masters, model workers, skilled craftsmen, and inheritors of intangible cultural heritage in vocational schools[4]. This approach aims to enhance the quality of vocational education and meet society's urgent demand for highly skilled professionals. Globally, the use of professional and technical personnel with practical experience as part-time teachers is recognized as a vital component in constructing vocational education systems[5,6]. It not only helps reduce educational costs but also enables students to master technical skills and ensures the overall quality of vocational education. "The State Council on Accelerating the Development of Modern Vocational Education Decision" has proposed improving relevant policies to encourage highly skilled professionals to serve as full-time and part-time teachers in vocational colleges. Consequently, outstanding craftsmen from various industries have joined the vocational education faculty.

Moreover, the "Administrative Measures for the Selection of Zhejiang Craftsmen in the New Era" has established a training support project by the provincial government for highly skilled talents in Zhejiang[7]. Candidates for the title of Zhejiang craftsman are primarily selected from leading industries, key sectors, and front-line industrial workers who possess exceptional technical skills, contributing to the province's economic development. The recognition and selection of Zhejiang craftsmen in the new-era have garnered strong responses from high-skilled professionals, boosting their motivation and confidence. Over the past three years, around 1,800 new era Zhejiang craftsmen have been selected. And nearly 50 craftsmen, including Wenbin Hong from Zhejiang Auto Repair Co., Ltd., are working in the area of automotive inspection and maintenance technology.

The development of craftsmen is also important, therefore the interdisciplinary relationship between industrial designers, industrial manufacturers, and craftsmen was also explored[8]. Moreover, the relationship of Crafts and Craftsmen has great importance on Technology and Culture[9]. In manufacturing enterprises, many operations need craftsman skills even when the production is industrial. A "craftsmanship index" has been defined to assign a concrete value to the artisanal competencies. This index can be useful in understanding how to hone and develop these kinds of skills, which can be of significant competitive advantage to manufacturing enterprises[10]. Craftsman skills are often necessary in several industrial productions to realize complex processes. The pilot projects have been developed between designers of the Design course of the University of Madeira and students of the Craft course in wicker, specialized in furniture, promoted and taught by Wine Embroidery and Crafts Institute to recover and strengthen artisan knowledge and processes[11].

In recent years, many new-era Zhejiang craftsmen have become teachers in technical schools and vocational institutions. As "craftsmen + teachers," they impart their accumulated knowledge and skills to students while embodying an infectious personality. As we all know a person's upbringing influences their traits as an adult. Recent research has shown that the teacher is the single most important factor for students' learning in school[12]. Therefore, this study explores the relationship between the growth factors of Zhejiang craftsmen and their approach to vocational education, aiming to provide valuable inspiration and clear directions for improving vocational education and nurturing more skilled talents in the future. It is strategic for enterprises to be aware of which competencies are required for each process and of how it is possible to educate and train workers to acquire them, especially to cultivate the craftsman spirit[13]. Few articles mention the cultivation of students with the growth elements of craftsmen in schools. WANG et.al[14] makes model link, evaluate model achievement links, speak key points of the model and the links of the craftsman story, and guide students to watch related videos and expand related knowledge.

This article, through an in-depth analysis of the growth characteristics of all of the 10 "Zhejiang craftsmen teachers" in the field of automotive inspection and maintenance, explores the appropriate practices for vocational colleges and technical schools to cultivate craftsman-type talents and looks forward to extending the process of cultivating craftsman-type talents to other fields.

2. Materials and Methods

2.1. The research participants

The selection of research subjects for this study was based on two key principles. Firstly, the subjects were chosen to have a dual identity as Zhejiang craftsmen and full-time/part-time teachers involved in vocational education. Additionally, the subjects were selected to represent varying levels of education. Based on these principles, a total of 10 Zhejiang craftsmen specializing in auto repair were chosen from Zhejiang province (refer to Table 1 for specific details).

These craftsmen have been recognized with prestigious titles such as “Technical expert in Zhejiang province,” “Chief technician in Zhejiang province,” “Zhejiang craftsman,” and “National technical expert.” Currently, they are actively engaged in full-time or part-time Teachers at Hangzhou Technical College and vocational colleges, as indicated in Table 1. All ten Research subjects are men and their technician position is Senior Technician.

2.2. Research methodology

For data collection, the researchers employed an open and flexible format through face-to-face and telephone interviews conducted from October 2022 to November 2023. This method allowed for a deeper exploration of the growth trajectories of the subjects and facilitated the gathering of detailed information. Before conducting the interviews, the researchers provided a clear explanation of the study's purpose and adhered to ethical research principles. All participants gave their consent to participate in the research after receiving the promised anonymity in any publication of the findings.

The interviews primarily focused on the personal growth experiences of Zhejiang craftsmen and their approaches to training vocational college students. The interviews began with open questions asking: “Can you tell me why you chose the profession of automotive inspection and repair?” “Can you share with me your pathway to the Zhejiang Craftsman...?” This was followed by clarifying questions, such as “Can you give me a story about it...?” These interviews provided valuable firsthand data for the study.

2.3. Data analysis

In this study, the process of coding played a crucial role in grounding theory[15]. To conduct a systematic analysis of the interview data, NVivo 10.0 qualitative analysis software was utilized. The researchers engaged in a step-by-step coding analysis, involving a careful examination of each sentence, repeated comprehension, and continuous dialogue with the experiential data. Key information related to the growth of the 10 Zhejiang craftsmen was thoroughly annotated.

Following the standard requirements of data coding, a three-level coding approach was employed. The first step involved open coding, which aimed to identify relevant concepts and determine their corresponding categories. To facilitate data understanding and comparison, the researchers identified a total of 217 concept tags. These tags were subsequently refined, combined, and organized into 29 subcategories. As an example, a selection of data showcasing conceptual and generic categories is presented in Table 2.

In the second step of the coding process, spindle coding was conducted to identify core concepts and establish relationships between them. This involved further organizing the open codes and re-analyzing them, resulting in the formation of 29 subcategories. The logical relationships between these subcategories were examined, leading to their further classification. Eventually, 10 categories were identified, namely: interest cultivation, professional identity, external support, diligent and eager to learn, refining skills, pragmatic and rigorous, focused and persistent, responsibility, pioneering and innovative, and collaborative innovation.

Table 1. The basic situation of the researched subjects

Research subjects	Age	Education	The main honor	Enterprise work experience	Vocational education situation
<i>A</i>	39	senior middle school	National technical expert, highly skilled talent mentor, and chief technician of Hangzhou,, Zhejiang technical expert, Zhejiang gold blue collar, Zhejiang provincial “skilled craftsman” of enterprises and enterprises, Zhejiang youth post expert national Vocational Skills Competition referee.	STO era	Middle and higher vocational colleges specially part-time teachers, guided students to participate in domestic and foreign skills competitions and won many awards
<i>B</i>	48	senior middle school	National May Day Labor Medal, National Transportation Technology Expert, Hangzhou automobile maintenance industry leader, member of the automotive technology project coaching group of the World Skills Competition	Zhejiang Mijia Automobile Sales and Service Co., Ltd	Part-time teacher in higher vocational collegesTeacher, establish the model workers Studio,and guide students to participate in skills competitions.
<i>C</i>	32	senior middle school	The 9th place in the automotive technology project of the 42nd World Skills Competition, national technical expert, Hangzhou C talent, Zhejiang Provincial People's Government, young craftsman of Zhejiang Province	/	Talents are introduced to technical colleges as professional teachers to guide students to participate and win professional skills ompetition
<i>D</i>	42	undergraduate degree	Zhejiang technical expert, Hangzhou technical expert, provincial deployment of enterprise teachers and students	Zhejiang Zhixin Automobile Co., Ltd	Higher vocational colleges as professional teachers, to solve many technical problems in enterprises
<i>E</i>	41	Undergraduate degree	The 13th Hyundai Motor World Maintenance Technician skills Competition gold medal and Zhejiang gold blue collar, Zhejiang technical expert, national transportation technology expert	Zhejiang Hantong Automobile Co., Ltd	As a professional teacher in higher vocational colleges, I applied for sevral patents, guided students to participate in the skills competition, and won many awards
<i>F</i>	26	undergraduate degree	Hangzhou C talent, national technical expert, Hangzhou technical expert, young craftsman of Zhejiang Province, a member of the 45th World Skills Competition national team, provincial deployment of enterprise famous teachers and outstanding students.	/	After graduation, he became a professional teacher of technical colleges and guided students to participate and won the World Skills Competition
<i>F</i>	40	senior middle school	National technical expert, national transportation technical expert, national transportation industry motor vehicle inspection and maintenance personnel professional skills competition national final automobile air conditioning maintenance project first place	Zhejiang Shenzhe	Part-time teacher of Technician College,guide students to participate and win professional skills competition
<i>G</i>	42	Undergraduate degree	Chief technician of Zhejiang Province, city model worker, served as the 43rd and 44th session of the World Skills Competition China team technical expert and coaching team leader, the 45th session of the car painting project coaching team leader	/	Talents are introduced to vocational colleges as professional teachers to guide students to participate and win professional skills competition
<i>H</i>	43	undergraduate degree	Zhejiang Province technical expert, the city May 1 labor medal, the city master studio leader	Zhejiang Yuantong Futong Automobile Co., LTD	Part-time teachers in vocational colleges; Guide students to participate and win professional skills competition
<i>I</i>	44	undergraduate degree	Hangzhou D talents, Hangzhou May 1 Labor Medal, Hangzhou technical expert, Hangzhou chief technician	Yuan tong star	Talents are introduced to vocational colleges as professional teachers to guide students to participate in vocational skills competitions, school practical training and teaching, and the practical teaching base construction.

Table 2. The examples of the open coding

Category	Initial concept	Original Conversation Materials
Parental influence	The influence of his family helped him establish his career goals	When the people around me were only riding bicycles, Uncle and Dad drove tractors. After my dad drove the tractor, he repaired and maintained the car by himself, which made me feel very proud, after graduating from junior high school, I entered a technical college to study automobile inspection and maintenance technology and later became an automobile doctor. (C)
Personal hobbies	Love cars	I've always loved cars since I was a child, and when I saw one in the village, I would stare at it for a long time until it disappeared at the end of the road. I am interested in cars, I have a strong hands-on ability, and I often make gadgets at home. (A)
Recognition of industry prospects	Be optimistic about the auto repair industry, so as to establish the profession	There are more and more private cars in the community, and some families have a car per person. With the popularization of automobile use, the market demand for automobile repair and maintenance will be good. (E)
Amateur self-study	While working, adults take self-exams and insist on long-term learning	At that time, I took classes during the day and took continuing education courses in the evenings, from vocational high school to adult college entrance examination to self-examination undergraduate. It took 9 years to complete the study of automation, which laid a theoretical foundation for engaging in mechanical work and automation work. (C)
Ponder	Good at delving into technology, gaining practical experience from solving problems, and improving skills	I like to delve into technology. Dealing with incurable diseases has become a joy in my work, so my maintenance experience has been greatly improved. If the other 4S stores of the group can't solve the problem, they will recommend it to our store to discuss the solution with me. (E)
Innovative approaches	Carry out innovation in the inspection and maintenance methods of auto parts, and greatly shorten the maintenance time	Sometimes, by sound or with eye observation, you can know whether the emulsion pump is leaking, so you don't need to change the big shell of the emulsion pump, you only need to remove the core part of the middle, put half of it in, and go back to repair the other half. The original maintenance amount of one day can be reduced to 2-3 hours to complete. (H)
Bear hardships and stand hard work	Working hard in a challenging work environment	To learn technology, you need to do practical operations on the equipment to deeply understand the theoretical knowledge. When the machines are busy at work, I use the noon production interval or off-duty time to enter the station for research, operation, and testing to verify the theoretical knowledge. (I)
Patiently focused	Patiently focusing on long-term detection and maintenance of a component malfunction	I think the craftsman spirit is a word-sinking, settling, and accumulating, and it must be able to withstand loneliness. (J)
Diligent performance of responsibilities	Diligently fulfill responsibilities and fulfill one's job responsibilities	As a monitor, my main responsibility was to reduce the rate of station stoppage. Starting the equipment means effective production, even if the equipment stops for a few minutes, it must be reported to the workshop, and the factory director will personally ask questions. Therefore, stopping the station is the natural enemy of our maintenance personnel and must be eliminated as much as possible. Combined with the production site, I sorted out the electrical components of the equipment and summarized the maintenance technology for electrical faults. After a long period of study and accumulation, I can clarify the connection between electrical components through drawings and solve problems quickly. After listening to some fault descriptions, I can roughly lock the cause of the fault. (B)
cooperation	Cooperate to solve problems	We can't fight alone, we'll get together. We discussed it word by word and finally found the crux. The pneumatic motor has a crankshaft angle, and we misunderstood the size of the angle, which led to the failure to find the correct position during assembly. With the concerted efforts of working together, the reassembled pneumatic motor finally turned. (A)

Moving on to the third step, selective coding was employed to form core categories and construct a theoretical framework. Through this process, the 10 categories were condensed into four core categories, which encompass the growth factors of Zhejiang craftsmen. These four dimensions are “Ambition”, “Study”, “Dedication”, and “Innovation”. The specific results of the tertiary coding can be found in Table 3.

Table 3. The three-level coding of growth factors of Zhejiang craftsmen

Selective coding	Principal axis coding	Open coding
Ambition	Interest cultivation	Parental influence, personal hobbies, idol influence
	Professional identity	Recognize the industry, establish beliefs, affirm value
	External support	Social environment, educational environment, external opportunities
Study	Diligent and eager to learn	Amateur self-study, research and training for improvement, learning from others
	Refining skills	Diligent practice, deep thinking, accumulation of experience
Dedication	Pragmatic and rigorous	Start small, work hard, rigorous and serious
	Focus and persist	Patiently focused, persistence
	Responsibility	Sense of responsibility, due diligence, imparting skills
Innovation	Pioneering and innovating	Innovative methods, optimized processes, technological breakthroughs
	Collaborative innovation	Remote collaboration, group collaboration, problem-solving

2.4. Theoretical Saturation Test and Validity Test

In grounded theory methodology, it is crucial to test for theoretical saturation once the theoretical construction is complete. The determination of theoretical saturation relies on the continuous comparison process and is typically made in the later stages of data collection and analysis. In the current study, the coding of interview data was conducted in the order of *A-I*. During this process, it was observed that the coding categories *A*, *E*, and *H* could all be subsumed under previously identified categories, and no new categories or related topics emerged. This finding suggests that the existing classification of categories sufficiently explains all the original data and provides a substantial depth and breadth of information for understanding the growth of Zhejiang craftsmen. As a result, the theoretical saturation in this study is considered to be high. By conducting this assessment, the researchers have ensured that their theory has reached a point of saturation, indicating that further data collection is not required and that the theory adequately accounts for the observed data.

The examination of accuracy or credibility in interpreting research results is an essential aspect of validity testing in qualitative research. One strategy commonly used for this purpose is triangulation, as proposed by John W. Creswell[16]. Triangulation involves gathering evidence from multiple information sources to support and validate the findings. In this study, the researchers employed triangulation by selecting video materials from the “Great Country Artisans of the Year” broadcasted by CCTV on March 2, 2022, as well as using the book “To Fine to Good” published by China Workers' Press in 2021. Additionally, the interview data of three craftsmen was randomly selected, transcribed, and subjected to tertiary coding. After analysis and verification, it was found that the findings align with the core categories of voluntary industry, learning, dedication, and innovation. This alignment provides evidence that the constructed theory has good explanatory power and adds to the validity of the research findings.

3. Results and Discussion

This study aims to investigate and construct the growth factors of Zhejiang artisans, with a particular focus on analyzing their vocational education methods in depth. A theoretical model of core competence growth for Zhejiang craftsmen is shown in Figure 1.

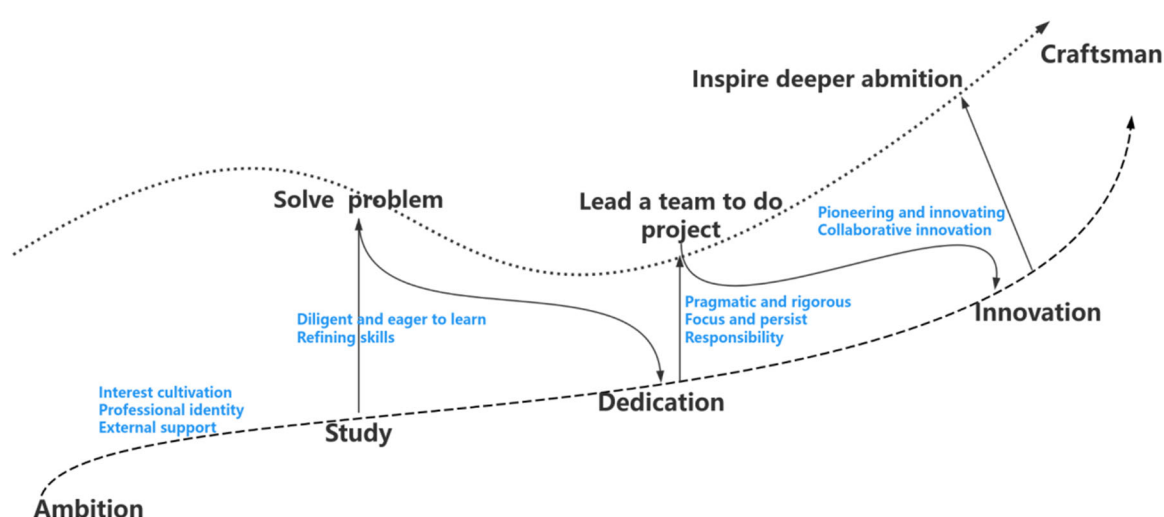


Figure 1. Theoretical model of core competence growth for Zhejiang craftsmen

3.1. The basic connotation and performance of the growth factors of Zhejiang artisans

3.1.1. Ambition - interest development, professional identity, external support

The term “*Ambition*” was coined by German sociologist Max Weber to mean “*feeling that something is one's destiny*”. Outstanding artisans not only regard work as a career based on society but also have a belief in working. From the perspective of data coding, the study reveals that the reasons why the ten artisans became Zhejiang craftsmen can be attributed to several factors. Firstly, their interest in the profession and occupation plays a significant role. This interest may stem from personal hobbies or a deep influence on their parents' careers. Some artisans develop an interest in technical careers based on workplace learning methods. Moreover, the choice of major and career for some artisans, such as *C*, *F*, and *I*, is influenced by their parents' occupations. For instance, *I*'s fascination with machinery is largely derived from his father's work, indicating that parents' occupations can have an “anchoring” effect and shape their children's interests in technical careers. Secondly, personal preference is also an important factor in career choices[17]. Artisans like *A*, *D*, and *E* mentioned that they are hands-on individuals who actively engage in relevant work because they enjoy it. While not everyone may have a strong interest in a particular profession before entering it, hands-on practice and skill development under the guidance of a master can gradually foster professional interest. *D*'s experience exemplifies this process.

It is noteworthy that the work of Zhejiang artisans often involves challenging and demanding conditions, and professional identity is crucial for their growth. Professional identity formation is influenced by the recognition of industry prospects and the affirmation of job value. For example, *E* believes that the future development of the auto repair industry is promising, leading them to choose related majors. Additionally, the affirmation of the importance of their job contributes to the development of professional identity. For instance, *B*, who has worked as a welder for nearly 30 years, recognizes the significance of automotive inspection and maintenance technology and its impact on safety. Research suggests that occupational identification positively impacts job engagement, as workers who identify with their occupation are more willing to invest time and energy into their work[18,19]. By analyzing these factors, the study provides insights into the motivations and experiences of Zhejiang artisans, highlighting the significance of personal interest, parental influence, workplace learning, and the development of professional identity in their career paths.

The typical characteristics of the growth of Zhejiang artisans are not only reflected in the internal driving factors characterized by interest formation and professional identity but also rely on the external support provided by the social environment, educational environment and external opportunities. China's automobile industry had a relatively late start, resulting in a predominantly young pool of talented individuals in the automotive field. Table 1 demonstrates that Zhejiang craftsmen specializing in automotive inspection and maintenance technology are all under the age of 50. The “post-70” youth era represented by *B* was in the early stage of China's reform and opening up, and the national industrialization process was promoted, it was a very ideal choice to enter the factory to become an apprentice and eventually become a worker. As the “post-90” *C* and *F* coincided with the transition period from a planned economy to market economy, the recovery and development of secondary vocational education, the favorable conditions of secondary technical package distribution, household registration, and low tuition are more attractive. With the national social and economic development, the historical mission and training goals undertaken by vocational education have changed, and people's attitudes and demands for vocational education have also changed. *A*, *D*, *E*, *F*, *G*, *H* and *I* show the rise of pursuing personal aspirations and grasping development opportunities in the new era.

3.1.2. Study - studious, temper skills

The term “study” in China originates from “Lu Chunqiu Bozhi,” which refers to the process of learning, acquiring knowledge, and growing from ordinary employees to highly skilled talents. In the context of the 10 Zhejiang craftsmen, diligence and eagerness are common characteristics when it comes to the process of learning.

These craftsmen devote their spare time to eagerly studying professional theories, improving their abilities through research and training, and exchanging experiences with their peers. Continuous learning is driven by several factors. Firstly, the progress of the times necessitates keeping up with technological advancements and updating existing knowledge. Secondly, technological advancements bring about changes in work processes, requiring the mastery of new tools and techniques to solve problems and guide production. Lastly, the overall improvement of the education level in society makes learning a necessity.

Starting from junior high school education, *E* and *H* went on to work in factories and underwent a learning process that included vocational high school education and self-study for undergraduate studies. For instance, *E* shared his experience gained from observing the operation specifications of foreign players. He noticed that the tools on their operating table were well-organized, and he applied this observation to improve his workspace layout, resulting in smoother operations and increased efficiency. It is their diligence in theoretical and practical studies that allow them to reach higher professional levels and realms.

Having exceptional skills is a significant characteristic of Zhejiang artisans. They practice diligently day after day, constantly honing their skills, and paying attention to every movement and detail. *A* mentioned that while automobile detection technology may be easy to learn, achieving finesse requires skill and precision, which can only be attained through daily practice. *H* even underwent specific training to overcome the difficulties of certain tasks, such as squatting. The improvement of technical expertise also relies on their willingness to study and accumulate practical experience. It is through long-term honing of industry-specific skills that they stand out from their peers and become leaders among modern industrial workers.

3.1.3. Dedication - pragmatic and rigorous, focused and committed, and responsible

Dedication is a fundamental quality exhibited by Zhejiang artisans, characterized by their pragmatic, rigorous, dedicated, and responsible attitude towards their work. It is a moral category that reflects their sense of responsibility and respect for the work they are engaged in. Over decades of hard work, Zhejiang artisans have consistently demonstrated excellent dedication.

Firstly, they exhibit a pragmatic and rigorous work style by starting with small tasks and gradually expanding their knowledge and skills. For example, *H* emphasizes the importance of beginning with a small part of a function in electrical repair, such as lighting or a small component of air conditioning. Through continuous learning and practice, they develop a network thinking approach to understand complex systems like engine and transmission control. This approach requires logical reasoning and the ability to connect different components, demonstrating their dedication to mastering their craft.

Secondly, Zhejiang artisans demonstrate patience and focus in their work, investing significant time and energy into what they do. *D*, for instance, has been producing auto parts for ten years, creating tens of thousands of products with a consistently high pass rate. This level of achievement is a result of long-term focus and perseverance. As Schmidt Kamp points out, craftsmen must continually improve their skill levels through trial and error, even in mundane tasks[20]. They overcome difficulties and setbacks by making persistent efforts to enhance their abilities.

Thirdly, Zhejiang artisans possess a strong sense of responsibility and fulfill their practical duties, particularly in the transmission of technology and artistry. Quality responsibility is always at the forefront of their minds. *H* highlights the critical role of molds in ensuring the quality of stamping parts in automobile manufacturing. As an excellent mold maintenance professional, they treat car molds as works of art, recognizing their high precision and investment value. By adhering to their duties and striving for excellence from the very beginning, they willingly pass on their skills to others through guidance and staff training. This commitment to knowledge transmission aims to foster the growth of more artisans in their field.

Through their dedication, Zhejiang artisans demonstrate their commitment to their work, their continuous pursuit of excellence, and their willingness to contribute to the development and transmission of their craft. Their pragmatic approach, perseverance, and sense of responsibility play a crucial role in their professional success and the advancement of their field.

3.1.4. Innovation-Pioneering innovation and collaborative innovation

Innovation, philosophically speaking, represents human creative activity, aimed at increasing the total amount of benefits, and requires the utilization and reinvention of discoveries, especially the exploitation and re-invention of contradictions in the material world. According to John Christopher Jones, inventor of the Craft Evolution theory, design innovation in general was first developed by craftsmen activities to produce local products used to meet life demands[21]. After mastering the technical essentials of their respective fields, Zhejiang craftsmen often push forward with determination, pioneering, and innovating to enhance work efficiency.

Firstly, to enhance product quality, address technical challenges, and propel industry development, they dedicate substantial time, energy, and effort, pouring their heart and soul into their work. Utilizing their rich experience and ingenuity, they continually push boundaries and overcome challenges in the realm of production services. For instance, when addressing the welding challenge of a locomotive brake cylinder body, *A* employed a unique method to ensure high quality and zero defects. After refining the process, the yield rate rose from 30% to 99.9%. When a new car worth over 1000000 yuan malfunctioned and required precise repairs, he took the initiative to successfully resolve the issue. Zhejiang craftsmen innovate operational methods, refine product processes, and tackle technical challenges to optimize product performance and aesthetic appeal. This process not only generates significant economic benefits and goodwill for enterprises but also fulfills their moral cultivation and enhances their life fulfillment, driven by the value pursuit of "*extending to the vast yet meticulous*".

Secondly, in this era of Internet and the rapid technological development, it is necessary to form a collaborative goal management system through a group of interconnected professionals from multiple fields to achieve a common goal, and to exchange ideas, information, and work conditions through the internet[22]. Taking *I* as an example, in 2021, the Mercedes Benz GLE350e experienced abnormal problems such as limited AC charging power and high temperature during the PDI process. During the testing process, the diagnostic instrument provided a fault that did not specify the specific components, but instead pointed to the cooling circulation system. However, there was no problem after checking the cooling system. Through collaboration with engineering and technical personnel at the Beijing headquarters, it took one day and a half to discover that two water pumps with similar appearances were installed in the wrong position at the factory and the fault was eliminated. Zhejiang Craftsman, in response to the actual problems of vehicles, adopted remote collaboration to quickly solve the problems in vehicle fault diagnosis, greatly restoring the reputation of Mercedes Benz's new model.

The growth process of Zhejiang craftsmen is characterized by four interconnected elements: ambition, study, dedication, and innovation. The logical relationship between ambition, study, dedication, and innovation creates a synergistic effect in the growth process of Zhejiang craftsmen. Their ambition provides the driving force, while the experience of study fuels their enthusiasm for learning and skill development. Dedication ensures the quality and significance of their work, and innovation propels them towards continuous improvement and new achievements. Together, these elements foster the holistic growth and development of Zhejiang craftsmen.

3.2. Exploration of the Education Methods for Zhejiang Craftsmen

Zhejiang craftsmen, who teach in vocational colleges, play a crucial role in guiding young students to develop their skills and practical expertise. Through research interviews, it was observed that they effectively share their self-reflection experiences and incorporate them into student development. This approach establishes a meaningful connection with the four-dimensional growth elements of ambition, learning, dedication, and innovation, as depicted in Figure 2.

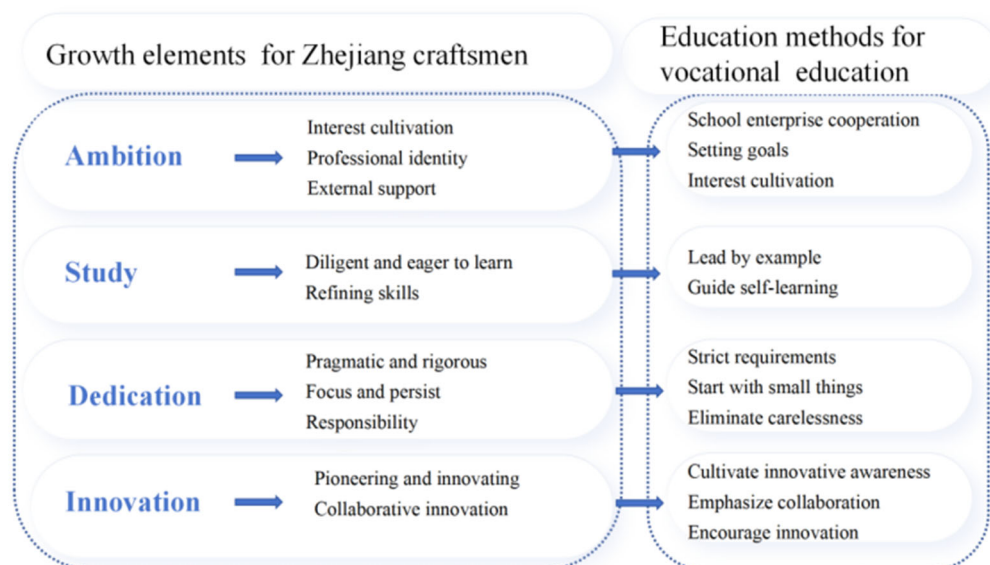


Figure 2. The correlation between the growth factors of Zhejiang craftsmen and the ways of vocational education personnel

3.2.1 Emphasize interest cultivation, set goals, and cooperate with schools and enterprises

Based on their growth experience, they believe that the first step is to make students enjoy and love what they have learned, which is the foundation of professional learning and an important aspect of the formation of craftsmanship spirit.

“As soon as students enter the school, I always ask them why they are studying this major and if it is something they want to learn. Then they invest their energy in it, and later it becomes love. After love, the spirit of craftsmanship comes out. He will study diligently, forget about sleep and food, endure loneliness, and be not afraid of setbacks.”(G)

They conducted an analysis and highlighted the importance of students' pre-existing knowledge about various professions and the gradual guidance they receive during vocational education in determining their enjoyment and interest in their chosen majors. The pathway to cultivating professional interests involves guiding students toward their desired career trajectory through informative lectures upon entering the school. Additionally, it emphasizes the significance of not only acquiring theoretical knowledge through extensive reading but also exploring diverse avenues to broaden their horizons. Furthermore, students must be able to recognize their progress and receive encouragement along the way. When students develop a genuine interest in their chosen field, they become more motivated to invest their efforts and take proactive action, thus harnessing their innate drive.

“The best way to teach students now is to be interest-oriented, rather than teachers teaching. Students should listen with their ears raised, and if they don't listen, their grades will be fine. With this interest-oriented approach, we constantly give students a small sense of achievement and encourage them to look back at their own changes. We will encourage them to do better and better.”(B)

To foster a stronger connection between students and their future careers, educators employ a guiding approach that encourages students to begin by setting career goals. This approach recognizes that although students may study the same major, each field offers various positions and diverse paths for post-graduation development. Consequently, it becomes crucial for students to establish individualized goals and engage in effective career planning. Setting career goals not only provides a solid foundation for developing a professional identity but also ensures that students align their aspirations with their chosen field.

“After students gradually understand what this major can do, they must find their own goals, develop it, and learn more about it, so as not to be blind to future work.” (G)

Zhejiang craftsmen recognize that the technological knowledge taught in schools may sometimes fall behind and deviate from industry practices. To address this discrepancy, it is imperative to foster stronger collaboration between educational institutions and enterprises. By establishing closer ties with actual production processes, students can gain a deeper understanding of industry operations. One key strategy employed in educational practice is providing students with opportunities to immerse themselves in real workplace environments.

H, for instance, organizes regular practical teaching sessions in partnership with enterprises. This enables students to directly observe and experience the day-to-day operations within these organizations, gaining valuable insights into the work performed by industry professionals. Such firsthand exposure greatly benefits students in developing a more comprehensive understanding of their future professional roles.

3.2.2. Emphasis on guiding self-learning, leading by example, and encouraging innovation

The ten Zhejiang craftsmen, who have experienced significant personal growth through continuous learning, prioritize guiding students toward self-study as a crucial teaching method. According to *B*, *"I encourage students to engage in self-learning. I provide them with methods, and they explore. My role is to evaluate their progress and guide them in the right direction."* Similarly, *A* guides students through professional projects by initially encouraging independent research and understanding. They then assist students in conceptualizing the overall framework of their work, supplementing materials accordingly, and identifying individual strengths. After receiving this guidance, students meticulously polish and revise their projects, presenting them to teachers and classmates for feedback. By identifying areas for improvement and gradually refining their work, this process mirrors the development cycle of real-world enterprise projects. These craftsmen firmly believe that students who possess strong self-learning abilities will experience a sense of achievement, leading to a heightened sense of pleasure and a greater ability to find innovative solutions. This approach significantly benefits students' personal growth and progress. The relationship between theory and practice in vocational education has been extensively discussed[23,24].

To help students master their skills, Zhejiang craftsmen take a different approach compared to theoretical teachers. They prioritize on-site guidance and demonstration, offering continuous feedback and guidance for improvement. As *D* explains, *"I primarily teach through example, providing gradual explanations on-site rather than a systematic approach. It's about experiencing it in everyday life."* These craftsmen emphasize that there is no one-size-fits-all "fixed method" for skill operation. Instead, students need to rely on theory as a foundation while combining it with practice to discover suitable methods. *E* elaborates, *"Each individual's experience is unique, and students cannot always follow my exact methods. I adjust my approach accordingly, integrating their ideas as much as possible."*

3.2.3. Emphasis on strict requirements, starting with small things and abandoning the concept of "similar"

Adhering to standards and emphasizing quality are key objectives in vocational education. Zhejiang craftsmen recognize the importance of referencing enterprise standards and develop practical training project standards that impose strict requirements on students. *G* agrees with the notion that *"famous teachers may be few, but strict teachers produce excellent apprentices."* He believes that becoming a renowned teacher is no easy feat, but strict teachers can instill valuable qualities in their students. To illustrate this, he uses the example of two pieces of equipment in the studio.

"The right hose binding is slanted, which does not meet the standard since it should be horizontal and vertical from a product perspective. This is simply completing the process without adhering to the standard. On the other hand, the left side follows clear rules and ensures comfort. Students can easily tie the hose in 10 minutes, but according to the standard, it may take 20 or 30 minutes. In this case, they prefer to work slowly and meticulously."

Craftsmen pay attention to every detail, teaching students to perform tasks correctly, adhere to size standards, and exhibit meticulousness, avoiding carelessness and negligence. Cultivating students' ability to focus primarily stems from accumulating proficiency in small tasks. *E* emphasizes that practicing the spirit of craftsmanship as a student does not necessarily involve constructing a bus or manufacturing a car. Instead, it starts with small, accessible tasks. By completing these smaller tasks and gradually tackling larger projects, students naturally develop a focused mindset and pursue excellence. However, relying solely on student self-awareness can often be challenging.

To facilitate this development, teachers need to take proactive measures and create a conducive learning environment. *G*'s team, for instance, prohibits students from using their phones or listening to music in the studio to minimize external distractions. This approach mirrors the management of the work environment for employees in a professional setting.

While students may not bear actual quality responsibility or economic losses for their work, the cultivation of a sense of responsibility should not be overlooked. One crucial aspect highlighted by ten Zhejiang craftsmen in response to the common issue of students neglecting details is the abandonment of the “close enough” mentality. *E* draws from teaching experience to elaborate on this point.

“When I asked the students how they were doing, they would respond with a vague answer like 'it's okay' or 'it's close enough.' However, we need to use precise data to assess their work. Even a difference of just a millimeter can have serious consequences. In a factory setting, only workpieces that meet the required specifications are considered qualified, and anything outside those specifications is deemed unfit for use.”

The term “close enough” often permeates daily conversations as a habitual expression. However, if individuals adopt a “close enough” approach in their actions, it indirectly reflects a lack of personal responsibility. By addressing and correcting students' tendency towards a “close enough” attitude and behavior, and by setting clear standards for areas that do not meet requirements, educators can effectively guide students toward developing a stronger sense of responsibility and accountability.

3.2.4. Emphasis on cultivating innovation awareness, prioritizing collaboration and fostering a culture of innovation

Promoting collaborative work and encouraging individuals to work together to find solutions and address challenges is a key objective of vocational education. Zhejiang craftsmen strongly support the significance of collaborative work in this context.

“By bringing together experts from various fields, a sustainable car maintenance plan can be designed. For instance, professionals in the energy sector can contribute by installing solar photovoltaic panels and wind power generation equipment, ensuring workshops have access to clean energy sources. Meanwhile, individuals specializing in spare parts can repair or refurbish discarded components, reducing environmental impact and enhancing resource utilization efficiency during the maintenance process (I).”

Zhejiang craftsmen excel at forming problem-solving teams, collaborating effectively, and efficiently addressing practical issues. To enhance students' problem-solving abilities, it is crucial to cultivate their innovation awareness and foster a culture of innovation.

“Leveraging cutting-edge technologies such as virtual simulation, we can develop an innovative automotive maintenance training system that allows new students to engage in hands-on practice within a virtual environment. This approach not only cultivates their innovation awareness, but also equips them with practical skills for future endeavors (D).”

Furthermore, skill learning is not limited to a step-by-step process. These craftsmen actively encourage students to cultivate an innovative mindset. Once students have a solid foundation in skills, they are urged to think creatively and explore how to accomplish tasks in unique ways, while maintaining efficiency and ensuring quality. According to Yeon Minsoo[25], craftsmen undergo a process of “guarding, breaking, and leaving” on their journey toward becoming exceptional artisans. Initially, they faithfully adhere to the teachings of their masters. Then, they “break” away from those established patterns and apply their interpretations. Ultimately, they “leave” behind the traditional

forms to create their innovative realm. True education and teaching should strive for this balance between “guarding” and “breaking,” guiding students to transform acquired skills into their own abilities, fostering innovation, and practical application.

4. Summary

Through the narrative analysis of ten Zhejiang craftsmen experienced in vocational education, it is evident that their own growth experiences significantly influence the way they receive vocational education. This research conclusion provides valuable insights for vocational colleges, emphasizing the need to follow the growth patterns of skilled talents, learn from the growth processes of Zhejiang craftsmen, and focus on the following four aspects:

Firstly, there should be an emphasis on enhancing the interaction between stimulating interest and promoting workplace learning. Taking into account the influence of family, school, environment, and personal factors on individual growth, vocational education should effectively stimulate students' interest and passion for their chosen careers. This can be achieved through methods such as family surveys and parent discussions to understand parents' professions and expectations for their children's development, guiding students to make career plans based on their unique characteristics. Additionally, respecting individual development intentions is crucial, as students may enroll in majors that do not align with their personal preferences. Establishing a flexible credit system allows students to choose courses or minors in other majors within a certain range. Creating learning opportunities in the workplace further enhances the effectiveness of learning. The workplace serves as a platform for experiential learning, promoting individual growth through the synergy between the work environment and personal initiative. Vocational colleges, equipped with professional training bases, have made progress in integrating industry and education and facilitating school-enterprise cooperation. To optimize this model, educators should prioritize “*participatory practice*,” enabling students to engage in learning activities according to their abilities, needs, goals, and identity requirements. This ensures that students truly improve their skills through workplace teaching.

Secondly, there should be an exploration of the mutual promotion between professional theoretical teaching and practical ability guidance. The approach of prioritizing theory over practice or vice versa has its limitations. Emphasizing the combination of operational skills and solid theory, vocational colleges should coordinate the relationship between professional theoretical teaching and practical ability guidance. A well-designed talent cultivation plan accurately positions the functions of professional theoretical courses, enabling students to acquire theoretical knowledge while deepening their understanding through systematic practical training. When students encounter practical problems, teachers can guide them to review and strengthen relevant knowledge, encourage self-study, and provide timely recognition and feedback on their progress. By repeatedly engaging in this process, the integration of learning and doing can be achieved, leading to better teaching outcomes.

Thirdly, there should be a focus on integrating technical skills and impartation with the cultivation of personal qualities. As early as 1919, researchers emphasized the importance of not solely teaching professions without paying attention to spiritual cultivation. It is essential to balance instrumental rationality and value rationality goals in vocational education. The four-dimensional growth elements observed in Zhejiang Craftsmen highlight the pursuit of professional skills as well as the attitude and qualities necessary for being a person and doing things. This dual emphasis on morality and technical competence is the key purpose of vocational education. In the current social environment where ideologies are evolving, educators must recognize that practical knowledge and skills alone do not encompass the entire content of education and teaching. A comprehensive vocational education should prioritize the cultivation of good professional qualities in students, integrating moral improvement and the exploration of meaning throughout the entire educational process. By promoting the spirit of craftsmanship, combining morality with technology, and guiding the development of complete human nature, a solid foundation is established for cultivating a new generation of artisans who are ambitious, fulfilled, dedicated, and innovative.

Finally, they should enhance the cultivation of innovation ability and synchronize it with career development planning. In the field of education, the emphasis on and cultivation of innovation ability is an evolving process. The implementation of innovative talent training programs has been approved. This includes incorporating case studies from competitions such as competitions of smart cars and electronic design, introducing innovative theories and methods, and exploring the significance of cultivating innovative awareness. Students are encouraged to actively participate in various skill competitions and university subject competitions to receive practical training in cultivating their innovative abilities. The cultivation of innovation ability is a crucial component of personal career development. In the rapidly evolving social and economic environment, possessing innovation ability has become a key element for personal competitiveness. The career development plan for craftsmen provides goals and directions for cultivating innovative abilities. Schools should provide innovative education, practical opportunities, and research training to help students develop innovative thinking. Additionally, career guidance and planning services can assist students in formulating career development plans that align with industry needs. This will lay a solid foundation for future-oriented craftsmanship training.

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