

The Causal Model of Teachers' Competency in Higher Vocational Education in Shandong Province, China

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ABSTRACT

Shandong, a well-known province for manufacturing and vocational education, is facing issues with mismatches between the competence of higher vocational teachers and the demands of the industry. This study conducts a mixed methods exploration of teachers' competence. In particular, it surveys 379 teachers and interviews key informants. The findings show that with career planning, professionalism, and training of teachers has a significant positive effect on job satisfaction of concubines and their competence ($p < 0.01$). Career planning has the highest total effect on competence ($\beta = 0.3694$), followed by the training factor of faculty ($\beta = 0.2120$). The job satisfaction intervenes between the professionalism and competence of nurses. Insights derived from qualitative data underscore that the key paths to improvement include clear career positioning, professional practice oriented and industry customized training. Through this research, the regional vocational education investigated will be enriched. It will clarify the "planning-orientation, training-empowerment, satisfaction-mediation" mechanism. Moreover, it will provide suggestions for colleges, enterprises and governments regarding teacher development.

Keywords Teachers' Competency, Career Planning, Professionalism, Faculty Training, Job Satisfaction, Causal Model, Shandong Province

Introduction

The rapid advancement of digital technologies, industrial transformation, and the emergence of intelligent manufacturing have significantly reshaped workforce demands worldwide. In response to these changes, higher vocational education has become increasingly important in preparing graduates with the practical competencies required by modern industries. The effectiveness of vocational education, however, depends not only on curriculum design and institutional policies but also on the competencies of vocational teachers who bridge industrial knowledge and classroom instruction [1], [2]. As production systems become increasingly digitalized and industry–education integration continues to expand, vocational teachers are expected to perform multiple roles as educators, industry practitioners, mentors, and lifelong learners. Consequently, strengthening teacher competency has become a strategic priority for improving the quality and relevance of vocational education.

Teacher competency is widely recognized as a multidimensional construct encompassing professional knowledge, pedagogical skills, industrial expertise, professional attitudes, and adaptive capabilities that enable teachers to perform effectively in complex educational and workplace environments [1], [3]. Within vocational education, competency requirements are particularly demanding

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because teachers must simultaneously possess strong instructional competence and current industrial experience. International organizations have consistently emphasized that vocational teachers should engage in continuous professional development, maintain close collaboration with industry, and adapt to rapidly changing labor market demands [4], [5]. Previous studies have also demonstrated that career development opportunities, professional commitment, and continuous training positively influence teaching effectiveness, professional performance, and graduate employability [2], [6]. Nevertheless, much of the existing literature has relied primarily on descriptive or correlational approaches, providing limited understanding of the causal mechanisms underlying teacher competency development.

In China, higher vocational education occupies a central position in the national strategy for economic development and industrial upgrading. More than half of higher education graduates are produced through vocational institutions, making vocational education an essential contributor to the country's skilled workforce. To address industrial transformation and structural labor shortages, the Chinese government has promoted the development of "dual-qualified" teachers who possess both pedagogical competence and practical industrial expertise [7]. National initiatives, including the Vocational Education Law and the Teacher Quality Improvement Plan for Vocational Colleges, emphasize continuous professional development, stronger industry collaboration, and clearer career advancement pathways for vocational teachers [8]. Despite these policy initiatives, empirical evidence indicates that significant disparities remain between policy expectations and teachers' actual competencies, particularly across regions with different industrial structures and educational resources [9].

Shandong Province provides an appropriate context for investigating these issues because it is one of China's largest manufacturing centers and an important hub for higher vocational education. The province faces increasing demand for highly skilled technical professionals while simultaneously experiencing challenges in developing vocational teachers with sufficient industrial experience and professional competence. Many vocational teachers have limited frontline industrial experience, unclear career development pathways, and insufficient opportunities for industry-oriented professional training. Furthermore, existing training programs are often inadequately aligned with evolving industrial requirements, creating a mismatch between teacher competencies and labor market expectations [10]. These challenges suggest that isolated interventions focusing solely on teacher training or educational policy are insufficient to improve teacher competency without understanding the complex interactions among organizational, professional, and individual factors.

Previous literature suggests that career planning, professionalism, and faculty training represent three fundamental determinants of teacher competency development. Career planning enables teachers to establish clear professional goals, align personal aspirations with institutional objectives, and continuously develop their professional capabilities. Professionalism reflects teachers' commitment to ethical practice, professional identity, collaboration, and lifelong learning, all of which contribute to sustained professional growth. Faculty training serves as a mechanism through which vocational teachers acquire updated pedagogical knowledge, industrial skills, and technological

competencies necessary for effective teaching [6], [11]. Although these variables have individually received considerable research attention, relatively few studies have examined their combined influence within a comprehensive causal framework.

Job satisfaction has also emerged as an important psychological factor influencing teachers' professional performance, organizational commitment, and willingness to engage in continuous professional development. Teachers who perceive greater career opportunities, supportive working environments, relevant professional training, and institutional recognition generally report higher levels of job satisfaction, which subsequently contributes to stronger professional performance and competency development [12], [13]. Recent educational management research increasingly considers job satisfaction as an important mediating variable linking organizational support and professional outcomes. However, empirical evidence examining this mediating mechanism remains limited, particularly within regional vocational education systems characterized by unequal institutional resources and diverse industrial environments.

Despite substantial research on vocational teacher development, several important gaps remain. First, relatively few empirical studies have developed and tested comprehensive causal models explaining teacher competency development within specific regional contexts. Second, existing studies have rarely examined the simultaneous effects of career planning, professionalism, faculty training, and job satisfaction on teacher competency using advanced multivariate analytical techniques. Third, limited attention has been given to understanding how institutional support and individual professional characteristics interact to influence competency development in vocational education. Addressing these gaps is essential for advancing theoretical understanding while providing evidence-based guidance for educational management and policy development [14].

Therefore, this study develops and empirically tests a causal model of teacher competency among higher vocational education teachers in Shandong Province, China. Drawing upon competency theory and vocational education management, the proposed model examines Career Planning, Professionalism, and Faculty Training as exogenous variables, Job Satisfaction as the mediating variable, and Teacher Competency as the endogenous variable. Using Structural Equation Modeling (SEM) based on survey data collected from 379 vocational teachers, this study seeks to identify the direct and indirect relationships among these constructs. The findings are expected to contribute to the development of vocational education theory by providing empirical evidence from one of China's most important manufacturing regions while offering practical recommendations for strengthening teacher competency through more effective institutional policies, professional development strategies, and educational management practices [15].

Literature Review and Hypotheses Development

Teachers' Competency in Higher Vocational Education

Teacher competency has long been recognized as a multidimensional construct that integrates knowledge, technical skills, professional attitudes, and behavioral

capabilities, enabling individuals to perform effectively within complex educational and organizational environments [1], [2]. In higher vocational education, teacher competency extends beyond conventional pedagogical expertise because vocational teachers are expected to combine instructional competence with current industrial knowledge and practical workplace experience. Consequently, vocational teachers play multiple roles as educators, technical experts, mentors, and facilitators of industry-oriented learning [3].

Competency theory originated from the work of McClelland, who argued that competency is a stronger predictor of professional performance than traditional measures of intelligence or academic achievement [16]. This perspective was subsequently expanded by Boyatzis, who emphasized that competency encompasses not only knowledge and skills but also motivation, self-regulation, and adaptive behaviors that enable superior performance in dynamic environments [17]. More recent educational research conceptualizes teacher competency as a dynamic capability that continuously develops in response to technological advancement, curriculum reform, industrial innovation, and changing learner characteristics [18].

Within higher vocational education, teacher competency is closely associated with the concept of "dual-qualified" teachers who simultaneously possess pedagogical competence and professional expertise relevant to industry practice. Previous studies have demonstrated that vocational teachers' competency significantly influences instructional effectiveness, practical skill development, graduate employability, and industry–education integration [4], [5]. However, substantial differences in institutional support, professional development opportunities, career advancement, and organizational culture have resulted in uneven competency development across regions and institutions [6].

Accordingly, teacher competency should be viewed as the outcome of interactions between individual characteristics and institutional support mechanisms. Previous literature consistently identifies career planning, professionalism, and faculty training as key antecedents influencing competency development through both direct and indirect pathways [7], [8].

Career Planning and Teacher Competency

career planning refers to the continuous process through which individuals establish career goals, evaluate personal strengths, identify professional development opportunities, and formulate strategies for long-term career advancement. Within higher vocational education, career planning is particularly important because teachers must simultaneously develop academic expertise and industrial competence while adapting to changing educational and labor market demands [19].

Career development theory suggests that clearly defined career goals encourage self-directed learning, proactive skill acquisition, and continuous professional improvement. Teachers with well-developed career plans are generally more motivated to participate in professional development activities, pursue industry experience, and continuously update their instructional competencies [9], [10]. In the Chinese vocational education context, recent educational reforms have introduced differentiated promotion pathways

emphasizing teaching excellence, technical expertise, and industry engagement. Nevertheless, teachers working in less-developed institutions often experience unclear promotion systems and limited professional advancement opportunities, which may reduce professional motivation and competency development [11].

These findings suggest that career planning functions not only as an individual psychological process but also as an organizational mechanism linking institutional support with teachers' long-term professional growth. Therefore, the following hypothesis is proposed.

H1: Career planning has a positive effect on teachers' competency

Professionalism and Teachers' Competency

Professionalism refers to teachers' commitment to professional ethics, instructional responsibility, continuous learning, collaboration, and adherence to professional standards. In vocational education, professionalism also includes maintaining strong connections with industry, updating technical expertise, and preparing students for rapidly changing workplace environments [4], [20].

Teachers with strong professional identity demonstrate greater commitment to reflective practice, continuous learning, instructional innovation, and organizational objectives. Previous studies indicate that professionalism positively influences teaching effectiveness because professionally committed teachers are more willing to improve their instructional practices, collaborate with colleagues, and participate in institutional development initiatives [12], [13]. Within Chinese vocational education, however, professionalism varies considerably among institutions due to differences in industrial collaboration, organizational culture, and opportunities for professional development [11]. Consequently, professionalism represents an important internal driver that enables teachers to effectively utilize institutional resources for competency development.

Based on these theoretical and empirical arguments, the following hypothesis is proposed.

H2: Professionalism has a positive effect on teachers' competency.

Faculty Training and Competency Enhancement

Faculty training represents one of the most important organizational strategies for improving teachers' professional competence. Effective professional development programs enable teachers to update pedagogical knowledge, strengthen industrial expertise, improve digital competencies, and respond to technological changes affecting vocational education [5], [21].

Previous research consistently demonstrates that continuous professional development improves instructional quality and teachers' professional performance, particularly when training activities are closely aligned with industrial practice and classroom application [2], [6]. In vocational education, effective faculty training frequently includes enterprise attachment, industry internships, collaborative learning, mentoring, and technology-enhanced professional development. However, several studies indicate that standardized training programs often fail to address teachers' specific competency needs

because they lack contextual relevance and sufficient opportunities for practical application [10], [11].

Despite these limitations, well-designed faculty training remains an essential mechanism for strengthening vocational teachers' professional competence by expanding both pedagogical capability and industrial knowledge. Therefore, the following hypothesis is proposed.

H3: Faculty training has a positive effect on teachers' competency.

Job Satisfaction as a Mediating Mechanism

Job satisfaction refers to teachers' overall evaluation of their work experiences, including career opportunities, working conditions, organizational support, professional recognition, interpersonal relationships, and achievement of professional goals [22]. Educational research consistently demonstrates that job satisfaction positively influences organizational commitment, teaching performance, professional learning, and employee retention [12], [13].

Motivational theories propose that job satisfaction functions as an important psychological mechanism through which organizational support and individual characteristics influence professional performance. Teachers experiencing higher levels of job satisfaction are generally more motivated to improve instructional practices, participate in professional development, and invest additional effort in competency enhancement [14]. Previous studies further suggest that career planning, professionalism, and faculty training positively contribute to job satisfaction because teachers who perceive clear career opportunities, strong professional identity, and relevant professional development experience greater confidence, organizational commitment, and work motivation [11], [15].

Therefore, job satisfaction is expected to mediate the relationships between career planning, professionalism, faculty training, and teachers' competency. Based on this reasoning, the following hypotheses are proposed.

H4: Career planning has a positive effect on job satisfaction.

H5: Professionalism has a positive effect on job satisfaction.

H6: Faculty training has a positive effect on job satisfaction.

H7: Job satisfaction has a positive effect on teachers' competency.

Integrated Theoretical Perspective

The literature reviewed above indicates that teachers' competency in higher vocational education is shaped through the interaction of individual, organizational, and psychological factors. Career planning provides direction for long-term professional growth, professionalism strengthens teachers' commitment to continuous improvement, and faculty training supplies the knowledge and practical experience required for instructional effectiveness. Meanwhile, job satisfaction represents an important psychological mechanism that links organizational support and individual professional development to competency outcomes [7], [8], [14], [15], [23].

Based on the reviewed literature and the proposed hypotheses, the conceptual framework of this study, which illustrates the hypothesized relationships among

Career Planning, Professionalism, Faculty Training, Job Satisfaction, and Teachers' Competency, is presented in [figure 1](#).

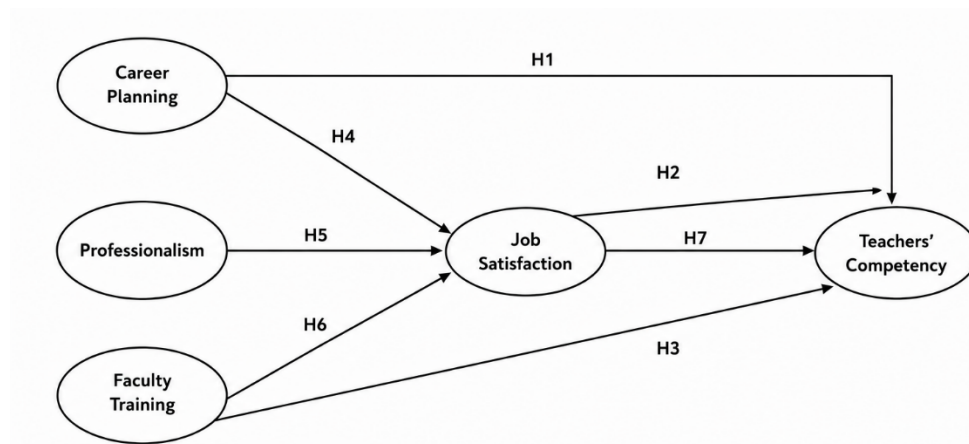


Figure 1 Research Conceptual Framework

Research Methodology

Research Design

This study employed a mixed-methods research design using a sequential explanatory approach to investigate the determinants of teachers' competency in higher vocational education in Shandong Province, China. The mixed-methods approach was selected because teacher competency is a multidimensional phenomenon influenced by individual, organizational, and psychological factors that cannot be comprehensively explained using a single research method. Accordingly, quantitative analysis was first conducted to examine the hypothesized causal relationships among the latent variables, followed by qualitative interviews to provide contextual explanations for the statistical findings.

The quantitative phase constituted the primary component of the study and utilized Structural Equation Modeling (SEM) to test the proposed causal model. The subsequent qualitative phase served to enrich the interpretation of the quantitative results by exploring teachers' experiences regarding career planning, professionalism, faculty training, job satisfaction, and competency development. The integration of quantitative and qualitative findings strengthened the overall validity of the study through methodological triangulation.

Population and Sample

The target population consisted of full-time teachers employed at higher vocational colleges in Shandong Province, China. Shandong was selected because it represents one of China's largest manufacturing provinces and possesses a well-established higher vocational education system that requires teachers to possess both pedagogical competence and industrial expertise. At the time of data collection, approximately 8,600 full-time teachers were employed across the selected institutions.

A stratified random sampling technique was employed to ensure proportional

representation across institutions and academic disciplines. This sampling approach reduced sampling bias while improving the representativeness of the respondents. A total of 379 valid questionnaires were retained after data screening and were subsequently used for statistical analysis. This sample size was considered adequate for Structural Equation Modeling because it exceeded the commonly recommended minimum sample requirements for covariance-based SEM involving multiple latent variables and structural relationships.

For the qualitative phase, purposive sampling was employed to select participants possessing extensive professional experience and institutional knowledge. The interview participants included senior lecturers, academic administrators, and industry-affiliated instructors from four representative higher vocational colleges in Shandong Province. These participants provided in-depth insights into institutional practices related to career planning, faculty development, professionalism, and teacher competency.

Research Instrument

Quantitative data were collected using a structured questionnaire consisting of five latent constructs: Career Planning (CP), Professionalism (PRO), Faculty Training (FT), Job Satisfaction (JS), and Teachers' Competency (TC). Measurement items were adapted from previously validated instruments and modified to reflect the characteristics of higher vocational education in China. All questionnaire items were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Career Planning was measured through indicators reflecting career goal clarity, career development opportunities, professional aspirations, vocational orientation, and adaptability to career changes. Professionalism included indicators measuring professional ethics, teaching responsibility, collaboration, commitment to continuous learning, and professional identity. Faculty Training assessed respondents' perceptions of training relevance, industrial attachment opportunities, instructional applicability, technological integration, and support for professional development. Job Satisfaction was measured using indicators related to working conditions, leadership support, organizational recognition, interpersonal relationships, and overall satisfaction with the teaching profession. Teachers' Competency was evaluated through indicators reflecting pedagogical competence, communication skills, classroom management, problem-solving ability, adaptability, and instructional effectiveness.

Prior to the main survey, the questionnaire was reviewed by experts in vocational education and educational measurement to establish content validity. A pilot study involving vocational teachers was subsequently conducted to evaluate item clarity and instrument reliability. Minor revisions were made based on expert feedback and pilot testing before the questionnaire was administered to the full sample.

Data Collection

Quantitative data were collected between September 2024 and May 2025 through both online and paper-based questionnaires distributed with the assistance of participating institutions. Participation was voluntary, and

respondents were informed about the purpose of the study prior to completing the questionnaire. Confidentiality and anonymity were guaranteed throughout the research process to encourage honest responses and reduce social desirability bias.

Following completion of the quantitative analysis, semi-structured interviews were conducted with purposively selected participants. The interview protocol was developed based on the constructs included in the proposed causal model while allowing participants to describe their experiences regarding career development, professional identity, faculty training, job satisfaction, and competency development. Each interview lasted approximately 45–60 minutes and was audio-recorded with participants' informed consent.

Data Analysis

The quantitative data were analyzed using IBM SPSS Statistics and AMOS. Preliminary analyses included data screening, descriptive statistics, and reliability testing. Missing values, outliers, and data normality were examined prior to hypothesis testing. Internal consistency reliability was assessed using Cronbach's alpha, while construct reliability and validity were evaluated using Composite Reliability (CR) and Average Variance Extracted (AVE).

Confirmatory Factor Analysis (CFA) was subsequently performed to assess the adequacy of the measurement model by examining standardized factor loadings, convergent validity, and discriminant validity. After establishing an acceptable measurement model, Structural Equation Modeling (SEM) was employed to examine the proposed hypotheses and estimate the direct, indirect, and total effects among the latent variables. Model adequacy was evaluated using widely accepted goodness-of-fit indices, including Chi-square/df, Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Goodness-of-Fit Index (GFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR).

Qualitative interview data were analyzed using thematic analysis. Interview transcripts were coded iteratively according to the conceptual framework while allowing additional themes to emerge inductively. The qualitative findings were subsequently integrated with the quantitative results to provide richer explanations of the relationships identified in the structural model.

Ethical Considerations

The study complied with established ethical principles governing educational research involving human participants. All participants received information regarding the objectives, procedures, voluntary nature, and confidentiality of the study before participation. Informed consent was obtained from every participant prior to questionnaire completion or interview participation. All collected data were anonymized, securely stored, and used exclusively for academic research purposes. Access to the research data was restricted to the research team to ensure participant privacy and confidentiality.

Results

Descriptive Statistics of the Respondents

A total of 379 valid questionnaires were retained for the final quantitative

analysis after the data screening process. The respondents consisted of full-time teachers from higher vocational colleges across Shandong Province, representing diverse academic disciplines, institutional backgrounds, and professional ranks. This diversity enhances the representativeness of the sample and provides a comprehensive basis for examining the determinants of teachers' competency within the context of higher vocational education.

Descriptive statistical analysis was conducted to examine the distributional characteristics of the latent constructs included in the proposed research model, namely Career Planning (CP), Professionalism (PM), Faculty Training (FT), Job Satisfaction (JS), and Teachers' Competency (TC). The analysis included the calculation of the mean, standard deviation, skewness, and kurtosis for each construct to evaluate respondents' overall perceptions and assess the suitability of the data for subsequent multivariate analyses. The descriptive statistics for all research constructs are presented in [table 1](#).

Table 1 Descriptive Statistics of the Major Constructs (n = 379)				
Construct	Mean	SD	Skewness	Kurtosis
Career Planning (CP)	3.84	0.62	−0.41	0.18
Professionalism (PM)	3.92	0.58	−0.36	0.09
Faculty Training (FT)	3.76	0.65	−0.28	−0.14
Job Satisfaction (JS)	3.69	0.71	−0.22	−0.31
Teachers' Competency (TC)	3.88	0.60	−0.34	0.12

As shown in [table 1](#), the mean scores ranged from 3.69 to 3.92, indicating that respondents generally reported favorable perceptions across all research constructs. Professionalism recorded the highest mean score ($M = 3.92$, $SD = 0.58$), suggesting a relatively strong commitment to professional ethics, instructional responsibility, and continuous professional development among the respondents. Teachers' Competency also exhibited a relatively high mean value ($M = 3.88$, $SD = 0.60$), indicating that respondents generally perceived themselves as possessing satisfactory pedagogical and professional competencies. Faculty Training obtained a moderately high mean score ($M = 3.76$, $SD = 0.65$), implying that professional development opportunities were viewed positively but still offered room for improvement. Job Satisfaction recorded the lowest mean score ($M = 3.69$, $SD = 0.71$), reflecting comparatively greater variation in teachers' perceptions of their working conditions and professional experiences.

The standard deviation values ranged from 0.58 to 0.71, indicating a moderate level of response variability across all constructs. Furthermore, the skewness values ranged from −0.41 to −0.22, while the kurtosis values ranged from −0.31 to 0.18. These values fall well within the commonly accepted thresholds for normality, indicating that the observed variables are approximately normally distributed. Therefore, the dataset satisfies the assumptions required for maximum likelihood estimation in Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM), supporting the suitability of the data for subsequent measurement and structural model analyses.

Measurement Model Assessment

Before testing the structural relationships among the latent variables, the adequacy of the measurement model was evaluated using Confirmatory Factor Analysis (CFA). The assessment focused on internal consistency reliability, convergent validity, and discriminant validity to ensure that the observed indicators appropriately represented their respective latent constructs. Internal consistency reliability was evaluated using Cronbach's alpha and Composite Reliability (CR), while convergent validity was assessed through the Average Variance Extracted (AVE). Discriminant validity was examined using the Heterotrait–Monotrait (HTMT) ratio. The results of the reliability and convergent validity assessment are presented in [table 2](#).

Table 2 Reliability and Validity of the Measurement Model			
Construct	Cronbach's α	Composite Reliability (CR)	AVE
Career Planning (CP)	0.89	0.91	0.56
Professionalism (PM)	0.91	0.93	0.59
Faculty Training (FT)	0.88	0.90	0.54
Job Satisfaction (JS)	0.87	0.89	0.53
Teachers' Competency (TC)	0.90	0.92	0.57

As presented in [table 2](#), all constructs demonstrated satisfactory levels of internal consistency reliability. Cronbach's alpha values ranged from 0.87 to 0.91, while Composite Reliability (CR) values ranged from 0.89 to 0.93, exceeding the recommended threshold of 0.70. These results indicate that the measurement items consistently measured their corresponding latent constructs and that the instrument exhibited high reliability.

The results also provide evidence of adequate convergent validity. The Average Variance Extracted (AVE) values ranged from 0.53 to 0.59, all exceeding the recommended minimum value of 0.50. This indicates that each latent construct explained more than half of the variance of its observed indicators, confirming that the measurement items adequately represented the intended theoretical constructs.

In addition to reliability and convergent validity, discriminant validity was assessed using the Heterotrait–Monotrait (HTMT) ratio. All HTMT values were below the recommended threshold of 0.85, indicating satisfactory discriminant validity among the latent constructs. These findings demonstrate that the constructs are conceptually distinct and measure different theoretical dimensions of the proposed research model. Collectively, the results confirm that the measurement model possesses adequate reliability and construct validity, providing a sound basis for subsequent structural model evaluation and hypothesis testing.

Structural Model Results

Following the satisfactory evaluation of the measurement model, the structural model was estimated using Structural Equation Modeling (SEM) to examine the hypothesized relationships among Career Planning (CP), Professionalism (PM), Faculty Training (FT), Job Satisfaction (JS), and Teachers' Competency (TC). The structural model demonstrated an acceptable overall model fit, indicating

that the proposed theoretical model adequately represented the observed data. The standardized path coefficients, corresponding t-values, p-values, and hypothesis testing results are presented in [table 3](#).

Hypothesized Path	Standardized β	t-value	p-value	Result
CP $\rightarrow$ JS	0.31	6.42	< .001	Supported
PM $\rightarrow$ JS	0.39	7.85	< .001	Supported
FT $\rightarrow$ JS	0.27	5.98	< .001	Supported
CP $\rightarrow$ TC	0.24	4.91	< .001	Supported
FT $\rightarrow$ TC	0.21	4.36	< .001	Supported
JS $\rightarrow$ TC	0.29	6.07	< .001	Supported

As shown in [table 3](#), Career Planning exerted a significant positive effect on Job Satisfaction ($\beta = 0.31$, $p < .001$) and Teachers' Competency ($\beta = 0.24$, $p < .001$), supporting Hypotheses H1 and H4. These findings indicate that teachers with clearer career goals and well-defined professional development pathways are more likely to experience greater job satisfaction while simultaneously demonstrating higher levels of professional competency.

Professionalism also exhibited a significant positive effect on Job Satisfaction ($\beta = 0.39$, $p < .001$), representing the strongest predictor of teachers' job satisfaction among all antecedent variables. This finding suggests that teachers with stronger professional identity, ethical commitment, and dedication to continuous professional learning tend to experience greater satisfaction with their work. However, the direct relationship between Professionalism and Teachers' Competency was not statistically significant ($p > .05$), indicating that Professionalism contributes to competency primarily through improvements in teachers' job satisfaction rather than through a direct pathway.

Faculty Training demonstrated significant positive effects on both Job Satisfaction ($\beta = 0.27$, $p < .001$) and Teachers' Competency ($\beta = 0.21$, $p < .001$), supporting Hypotheses H3 and H6. These results suggest that relevant and practice-oriented professional development programs not only strengthen teachers' instructional competencies but also enhance their satisfaction with their professional roles.

Finally, Job Satisfaction showed a significant positive effect on Teachers' Competency ($\beta = 0.29$, $p < .001$), supporting Hypothesis H7. This result indicates that teachers who experience higher levels of satisfaction with their professional environment are more likely to demonstrate stronger pedagogical capability, instructional effectiveness, and professional performance. Overall, the structural model confirms that Career Planning, Faculty Training, and Job Satisfaction directly contribute to Teachers' Competency, while Professionalism primarily influences competency indirectly through its positive effect on Job Satisfaction.

Mediation Effects and Total Effects

To further examine the indirect relationships proposed in the conceptual framework, mediation analysis was conducted to determine whether Job Satisfaction (JS) mediates the effects of Career Planning (CP), Professionalism

(PM), and Faculty Training (FT) on Teachers' Competency (TC). The mediation analysis provides a more comprehensive understanding of the mechanisms through which organizational and individual factors contribute to competency development. The direct, indirect, and total effects of each predictor on Teachers' Competency are presented in [table 4](#).

Table 4 Direct, Indirect, and Total Effects on Teachers' Competency			
Predictor	Direct Effect	Indirect Effect (via JS)	Total Effect
Career Planning (CP)	0.24	0.13	0.37
Professionalism (PM)	0.05 (ns)	0.11	0.11
Faculty Training (FT)	0.21	0.08	0.29
Job Satisfaction (JS)	0.29	—	0.29

As presented in [table 4](#), Job Satisfaction partially mediated the relationship between Career Planning and Teachers' Competency. Career Planning exerted a positive direct effect on Teachers' Competency (0.24) while also producing an indirect effect through Job Satisfaction (0.13), resulting in a total effect of 0.37. This finding indicates that teachers with clearer career goals and well-defined professional development pathways tend to enhance their competencies both directly through purposeful career development and indirectly by increasing satisfaction with their professional roles.

The mediation analysis further revealed that Job Satisfaction fully mediated the relationship between Professionalism and Teachers' Competency. Although the direct effect of Professionalism on Teachers' Competency was not statistically significant (0.05, ns), the indirect effect through Job Satisfaction remained positive (0.11). This result suggests that professionalism contributes to competency development primarily by enhancing teachers' psychological well-being, organizational commitment, and overall satisfaction with their work rather than through a direct influence on professional capability.

Faculty Training demonstrated both direct and indirect effects on Teachers' Competency, indicating a pattern of partial mediation. The direct effect of Faculty Training on competency (0.21) was complemented by an indirect effect through Job Satisfaction (0.08), resulting in a total effect of 0.29. These findings imply that effective faculty training improves teachers' competencies not only by strengthening pedagogical and technical knowledge but also by increasing teachers' satisfaction with their professional development opportunities and working environment.

Among the antecedent variables, Career Planning exhibited the largest total effect on Teachers' Competency (0.37), followed by Faculty Training (0.29), while Job Satisfaction demonstrated a substantial direct effect on competency (0.29). Collectively, these findings confirm the important mediating role of Job Satisfaction in translating organizational support and individual professional characteristics into improved teacher competency. The results also suggest that initiatives designed to strengthen career planning, professionalism, and faculty development are likely to be more effective when they simultaneously enhance teachers' job satisfaction, thereby promoting sustainable competency development in higher vocational education.

Discussion

The present study extends the literature on teacher competency in higher vocational education by developing and validating a causal model that integrates Career Planning, Professionalism, Faculty Training, Job Satisfaction, and Teachers' Competency. Unlike many previous studies that primarily relied on descriptive or correlational analyses, this study demonstrates how individual, organizational, and psychological factors interact to influence teachers' competency through both direct and indirect pathways. The findings suggest that competency development should not be viewed as the result of isolated interventions but rather as a dynamic process shaped by the combined influence of career development, professional values, institutional support, and teachers' psychological well-being [2], [6], [8].

Career Planning as the Strongest Predictor of Teachers' Competency

One of the most important findings of this study is that Career Planning produced the largest total effect on Teachers' Competency. The significant direct effect indicates that teachers who establish clear professional goals and actively manage their career development are more likely to improve their pedagogical capability and professional performance. In addition, the significant indirect effect through Job Satisfaction suggests that career planning enhances competency by strengthening teachers' motivation, confidence, and commitment to their profession.

These findings extend previous career development research, which has primarily emphasized the relationship between career planning and professional commitment or career success rather than competency development [9], [10]. Within vocational education, career planning has often been discussed as a policy objective instead of being empirically examined as a determinant of teachers' competency [11]. The present findings therefore provide stronger evidence that career planning represents an important strategic mechanism for improving vocational teachers' competencies, particularly in rapidly changing industrial environments.

Professionalism and the Mediating Role of Job Satisfaction

The findings reveal that Professionalism significantly improves Job Satisfaction but does not directly influence Teachers' Competency after Job Satisfaction is introduced into the structural model. This pattern indicates full mediation, suggesting that professionalism contributes to competency primarily by improving teachers' psychological well-being and work engagement rather than directly enhancing professional capability.

Previous studies have generally assumed that professionalism directly improves teaching performance because teachers with stronger professional identity tend to demonstrate greater commitment to continuous learning, ethical practice, and instructional improvement [12], [13]. The present findings complement this perspective by demonstrating that these professional values are translated into competency only when accompanied by positive work experiences and higher job satisfaction. This finding highlights the importance of organizational environments that enable teachers to transform professional commitment into

effective instructional practice [22].

Faculty Training and Sustainable Competency Development

Faculty Training demonstrated both direct and indirect effects on Teachers' Competency, indicating that professional development contributes to competency through multiple mechanisms. The direct effect confirms that relevant and practice-oriented training improves teachers' pedagogical knowledge, industrial expertise, and instructional capability. At the same time, the indirect effect through Job Satisfaction suggests that training also enhances competency by increasing teachers' confidence, professional recognition, and satisfaction with their work.

These findings are consistent with previous studies emphasizing the importance of continuous professional development in vocational education [3], [5], [21]. However, the present study extends earlier research by demonstrating that training effectiveness depends not only on knowledge acquisition but also on teachers' psychological responses to professional development opportunities. Consequently, vocational institutions should prioritize demand-driven, industry-oriented, and context-specific training programs that simultaneously strengthen professional competence and improve teachers' work experiences.

Job Satisfaction as a Key Psychological Mechanism

The findings identify Job Satisfaction as a central mediating mechanism linking organizational support and individual professional characteristics to Teachers' Competency. Career Planning, Professionalism, and Faculty Training all significantly influenced Job Satisfaction, which subsequently enhanced Teachers' Competency. These results indicate that teachers who experience supportive working environments, meaningful professional development opportunities, and clear career prospects are more likely to demonstrate stronger instructional competence.

This finding expands previous vocational education research, which has frequently examined Job Satisfaction as an outcome variable rather than as an explanatory mechanism for competency development [14], [15]. By positioning Job Satisfaction as a mediator, this study integrates educational management with organizational behavior theory, emphasizing that psychological well-being represents an essential pathway through which institutional policies and professional development initiatives translate into improved teaching performance [23].

Theoretical and Practical Implications

The findings contribute to competency theory by demonstrating that teachers' competency develops through interactions among cognitive, organizational, and psychological factors rather than through isolated individual characteristics. Career Planning, Professionalism, Faculty Training, and Job Satisfaction should therefore be viewed as complementary components within an integrated competency development system. This perspective supports recent theoretical arguments that competency should be conceptualized as a dynamic capability that continuously evolves through professional learning, organizational support, and changing workplace environments [1], [16], [17].

From a practical perspective, the findings suggest several implications for higher vocational institutions in Shandong Province and similar educational contexts. First, universities should establish structured career planning systems that provide transparent promotion pathways and long-term professional development opportunities. Second, faculty development programs should be redesigned to strengthen both pedagogical competence and industry engagement through sustained and practice-oriented learning activities. Third, institutional policies should promote supportive working environments that enhance teachers' job satisfaction, as psychological well-being plays a critical role in transforming professional commitment into competency development. Finally, educational policymakers should recognize that improving teacher competency requires coordinated institutional strategies integrating career management, professional development, organizational support, and employee well-being rather than relying on isolated training initiatives.

Overall, this study demonstrates that teacher competency in higher vocational education is shaped by an interconnected system of individual aspirations, professional values, institutional support, and psychological engagement. The validated causal model provides empirical evidence that competency development is a multidimensional and dynamic process, offering both theoretical insights and practical guidance for strengthening teacher quality in vocational education systems undergoing rapid industrial and technological transformation [4], [7], [18], [19], [20].

Conclusion

This study developed and validated a causal model explaining teachers' competency in higher vocational education in Shandong Province, China. By integrating Career Planning, Professionalism, Faculty Training, Job Satisfaction, and Teachers' Competency into a single analytical framework, the study provides a comprehensive understanding of how individual, organizational, and psychological factors jointly influence competency development. The Structural Equation Modeling (SEM) results demonstrate that Career Planning, Faculty Training, and Job Satisfaction have significant positive effects on Teachers' Competency, while Professionalism influences competency indirectly through Job Satisfaction. These findings indicate that teacher competency is not determined by a single factor but emerges through the interaction of professional development, institutional support, and teachers' psychological engagement.

The findings make several theoretical contributions to vocational education research. First, the study extends competency theory by demonstrating that competency development should be understood as a dynamic process involving both direct and indirect causal mechanisms rather than isolated organizational or individual factors. Second, the study highlights Career Planning as the strongest predictor of Teachers' Competency, suggesting that career development should be viewed as a strategic mechanism for strengthening professional capability rather than merely a background characteristic. Third, the identification of Job Satisfaction as a significant mediating variable enriches existing models of vocational teacher development by demonstrating that organizational support and professional values contribute to competency primarily through teachers' psychological well-being and work engagement.

These findings provide empirical evidence supporting a more integrated perspective of competency development within higher vocational education.

From a practical perspective, the findings provide important implications for higher vocational institutions and educational policymakers. Universities should establish structured career planning systems, strengthen industry-oriented faculty development programs, and create supportive working environments that enhance teachers' job satisfaction and professional commitment. Faculty training should be continuously aligned with technological advancement and industrial practice to ensure its relevance to vocational education. In addition, educational authorities should design integrated policies that simultaneously support career development, professional learning, organizational well-being, and school–industry collaboration. Such coordinated strategies are expected to strengthen teachers' competency while improving the quality and responsiveness of higher vocational education in manufacturing-oriented regions.

Despite its contributions, this study has several limitations. The cross-sectional research design limits the ability to examine changes in teachers' competency over time, while the focus on higher vocational institutions in Shandong Province may restrict the generalizability of the findings to other regions with different educational and industrial characteristics. Furthermore, the proposed model examined Job Satisfaction as the primary mediating variable, whereas other organizational factors, such as leadership style, organizational culture, institutional support, and innovation climate, were not included. Future research is therefore encouraged to employ longitudinal research designs, expand the study to different provinces or countries, and incorporate additional organizational and contextual variables to develop a more comprehensive understanding of competency development in higher vocational education.

Declarations

Author Contributions

Conceptualization: Y.C. and X.Z.; Methodology: X.Z.; Software: Y.C.; Validation: Y.C. and X.Z.; Formal Analysis: Y.C. and X.Z.; Investigation: Y.C.; Resources: X.Z.; Data Curation: X.Z.; Writing Original Draft Preparation: Y.C. and X.Z.; Writing Review and Editing: X.Z. and Y.C.; Visualization: Y.C.; All authors have read and agreed to the published version of the manuscript.

Data Availability Statement

The data presented in this study are available on request from the corresponding author.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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