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RESEARCH ARTICLE

The Sustainable Development of Chinese Vocational Undergraduate Teachers' Professional Competencies: A Social Cognitive Theory and Career Motivation Theory Perspective

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ABSTRACT

The United Nations' 2030 Agenda for Sustainable Development underscores the significance of high-quality education and equitable learning opportunities. As a critical component of educational practice, teachers' professional competency development profoundly influences educational quality. Grounded in Social Cognitive Theory and Career Motivation Theory, this study explores the sustainable development of Chinese vocational undergraduate faculty's professional competencies, focusing on the interactive effects of socio-psychological factors (e.g., motivation, cognition, group dynamics) and environmental factors (e.g., organizational support, resource availability) on career development. Employing a mixed-methods approach, a questionnaire survey was conducted with 267 vocational undergraduate teachers, supplemented by in-depth interviews with 21 faculty members. The findings revealed an average professional competency score of 3.81, indicating a moderately high level, with development influenced by both organizational environmental factors (perceived resource accessibility, institutional trust) and socio-psychological factors (self-efficacy, career identity, achievement motivation, group dynamics, research engagement, and experiential learning). Recommendations include enhancing achievement motivation, fostering organizational equity, and strengthening institutional trust to promote the sustainable development of teachers' professional competencies.

Keywords: Influencing factors; organizational environment; professional competence; socio-psychological factors; sustainable development; teachers competencies; vocational undergraduate

1. Introduction

In 2015, the United Nations released the 2030 Agenda for Sustainable Development, outlining 17

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Sustainable Development Goals (SDGs). Among these, Goal 4 emphasizes providing inclusive and equitable quality education and lifelong learning opportunities for all, while Goal 9 focuses on sustainable industrialization, innovation, and infrastructure development. These goals underscore the fundamental principles of global educational quality and equity [1][2]. Within the realm of vocational undergraduate education, skilled technical talent plays a pivotal role in driving industrialization and innovation [3][4]. As the primary pathway for talent cultivation, high-quality education serves as the cornerstone for enhancing individual well-being, advancing national development, fostering social progress, and achieving sustainable development [5]. Education for Sustainable Development (ESD) constitutes a critical component of quality education [6][7]. Against this backdrop, teachers—as central agents in educational practice—exert profound influences on educational quality [8]. Consequently, conducting research on the sustainable development of vocational undergraduate faculty's professional competencies has become particularly imperative.

Bandura's Social Cognitive Theory posits that individual behavior, environment, and cognition interact dynamically [9]. In the context of sustainable professional competence development among vocational undergraduate faculty, teachers' instructional practices (behavior) are shaped by institutional industry-education integration environments (environment) and their occupational cognition (cognition). This triadic interaction drives teachers to proactively adapt to industrial demands, continuously update their skills, and achieve long-term professional growth.

Teachers' personal cognition profoundly influences their professional behaviors. Professional competence is not innate but can be cultivated through learning [10][11]. Teachers' professional cognition, encompassing understanding of subject knowledge, pedagogical skills, attitudes, and values, shapes their instructional planning, classroom performance, and reflective practices [12][13][14][15]. For instance, educators with strong passion, confidence, and positive career motivation typically demonstrate greater occupational adaptability and higher teaching proficiency [16], reflecting the guiding role of cognition in professional behavior.

Environmental factors also play a pivotal role in teachers' professional development. Both personal and organizational contexts shape career trajectories [17]. Personal environmental factors include family dynamics, critical life events, crises, personality traits, intentions, interests, leisure pursuits, and life stages, while organizational factors comprise institutional policies, management styles, public trust, social expectations, professional associations, and faculty organizations [18][19]. Additionally, Glatthorn identified personal cognition, career development, motivational orientation, social context, school systems, teaching teams, departmental policies, classroom conditions, and special programs as influential factors [20]. For example, institutional support measures can reduce workload while enhancing teachers' autonomy, belonging, and competence, demonstrating environmental impacts on cognition and behavior [21][22].

Teachers' professional behaviors also reciprocally influence their environment and cognition. Through practice, teachers accumulate experience and enhance competence, thereby refining their perceptions of teaching and career. Simultaneously, their behaviors shape institutional environments in that positive instructional performance may prompt schools to improve policies and foster better teaching climates. For instance, enhancing working conditions in higher education institutions encourages faculty to prioritize educational quality and fulfill public responsibilities toward students and communities, while quality teaching behaviors incentivize institutions to further improve teacher support [23].

London's Career Motivation Theory highlights three dimensions: career identity motivates vocational undergraduate teachers to view teaching as a mission, fostering intrinsic professional development drives; career insight enables precise alignment with industrial demands and skill enhancement directions; and

career resilience equips teachers to navigate technological disruptions. These dimensions synergistically provide sustained motivation for long-term professional growth in dynamic contexts [24].

Achievement motivation drives continuous professional development. Teachers with strong achievement orientation are more inclined to embrace innovations, evaluate peers, share experiences, and engage in creative thinking [25]. Empirical studies indicate that age, tenure, institutional socioeconomic status, and organizational factors significantly influence professional growth, with highly motivated teachers demonstrating greater advancement [26].

Career identity serves as a critical internal motivator. Teachers with strong professional identity exhibit greater instructional commitment and competence. For example, passionate and confident educators demonstrate higher occupational adaptability and teaching effectiveness [16].Li et al.'s research revealed that female teachers' professional competence is primarily determined by human capital, social capital, environmental conditions, and psychological factors, with the latter closely linked to career identity [27].

Career motivation and identity also affect work engagement. Three types of work engagement positively influence novice teachers' self-preparation and occupational adaptability, with self-preparation further enhancing adaptability. Work engagement emerges as a key factor in early-career development [28], suggesting that motivation and identity promote professional growth through enhanced engagement.

China's economic expansion has intensified demand for high-skilled technical talent, necessitating continuous vocational education development [7][29]. Cultivating innovative students in vocational institutions places new demands on faculty competence, which determines student outcomes and reflects their teaching quality [30]. Teachers' professional development is shaped by multifaceted factors. From an educational psychology perspective, enhancing faculty competence is crucial not only for improving instructional quality but also for influencing students' academic achievement, psychological development, and career motivation. This study aimed to explore the current state and influencing factors of professional competence among Chinese vocational undergraduate teachers from social cognitive and career motivation perspectives, providing theoretical and practical guidance for enhancing vocational education quality and promoting holistic student development.

2. Methods

2.1. Research participants

The present study recruited teachers from the first batch of 15 pilot vocational colleges approved by the Ministry of Education of China in 2019 as the research participants. The above 15 colleges had experienced 4 years of exploration and development of vocational education at the undergraduate level, with the achievement of faculty construction. Higher authorities, enterprises, and the wider society have scrutinized the quality of teaching and student performance of the above 15 colleges. Through the 4 years of adaptation and development, teachers from the above 15 colleges also gained valuable insights and particular experience in vocational education at the undergraduate level. Therefore, they were able to assess their professional competence and reflect on the various factors that influence their development. The participants in the present study were indicative of the population.

2.2. Research methodology

This empirical study adopted a mixed-methods approach, integrating quantitative and qualitative data analyses to comprehensively investigate the current status and influencing factors of professional competence among vocational undergraduate faculty. Grounded in Social Cognitive Theory and Career Motivation Theory, the study reconstructed an analytical framework that conceptualizes teachers'

professional competence development as the outcome of dynamic interactions between individual cognition, environmental factors, and career motivation.

In the initial phase, questionnaire surveys were distributed to determine the current state of vocational undergraduate teachers' professional competence. Descriptive statistical analyses of the collected data were conducted using SPSS software. A questionnaire survey is a simple, fast, and effective method of data collection that can provide researchers with rich information and data support [31][33]. This study used a questionnaire survey to broadly and efficiently collect respondents' evaluations of the current state of vocational undergraduate teachers' professional competencies, which then underwent descriptive statistical analysis.

Simple statistics and a percentage analysis of the respondents' background information, including their region, gender, title, education, and length of teaching, were included in the questionnaire. Furthermore, we presented the mean and standard deviation of the questionnaire outcomes across 10 categories, including professional development, teaching, and practical operation ability. During the second phase, we used semi-structured interviews as a data collection tool. The flexibility and depth of this approach make it an ideal choice for gathering relevant data, helping to uncover respondents' insights and experiences regarding the factors influencing the professional competencies of vocational undergraduate teachers [34][35]. Furthermore, grounded theory was selected as the data analysis method because it provides an effective approach to explanation. By systematically collecting and analyzing data with a focus on theory generation, grounded theory helps uncover underlying issues and explain interactions within social processes. This method allows for an in-depth understanding of the challenges and issues faced by respondents in the field of education, providing profound insights and theoretical support for the research. It aids in advancing the study and theoretical development of factors influencing teachers' professional competencies [36]. In summary, the fundamental framework of our research plan was a combination of research approaches to analyze both quantitative and qualitative data, enabling us to thoroughly grasp the present state of vocational college teachers' professional competence, and investigate the elements that influence their growth.

According to the research content of the above two stages, the research flow chart is shown in Figure 1.

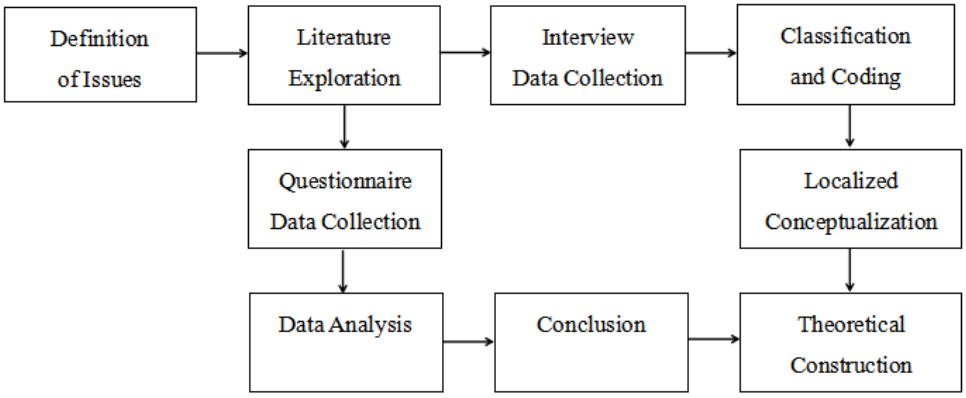

Figure 1. The research flow chart

2.3. Research instrument

In the first phase of this study, namely the quantitative research component, we measured various dimensions of teachers' professional competence using the Self-Assessment Questionnaire for Professional Competence of Undergraduate Vocational Education Teachers, developed by Fang et al. and adapted for the

Chinese context [30]. The original questionnaire was designed to assess undergraduate vocational education teachers in China and was based on the Chinese cultural context. We translated it into English for reporting purposes. This questionnaire measured teachers' professional competence from 11 dimensions: discipline development capacity, teaching capacity, practical operation capacity, curriculum design capacity, industry-academia collaboration capacity, training facility, development capacity, administration capacity, teamwork capacity, research capacity, and lifelong learning capacity. The questionnaire comprised a total of 43 items. Examples of the items in this questionnaire are "How proficient are you in analyzing the industrial chain?", "How good are your teaching design skills?", and "What is the proximity of your organization to leading companies?". Likert's 5-point scoring method was adopted, with 1 representing "*not qualified at all*" and 5 representing "*completely qualified*." The scale's χ^2/df was 1.287, and the GFI was 0.891. Additionally, the IFI, TLI, and CFI exceeded the threshold of 0.9. The standardized factor loadings for each dimension were greater than 0.6, and the composite reliability (CR) values were above 0.7. The aforementioned indicators demonstrated that the questionnaire exhibited satisfactory levels of reliability and validity.

During the second phase, through semi-structured interviews with vocational undergraduate faculty, we gained in-depth insights into the factors influencing their professional competence development. The interview protocol was designed with reference to Bandura's Social Cognitive Theory and Career Motivation Theory, ensuring comprehensive capture of teachers' socio-psychological characteristics and environmental influences [31]. The first draft of the semi-structured interview outline was designed with reference to the literature on teachers' professional competence [17][27][37], and was combined with the Self-Assessment Questionnaire for Professional Competence of Vocational Undergraduate Education Teachers [30]. One Ph.D. in education management with abundant experience in qualitative research, and two senior experts in teaching management evaluated the draft. The final interview outline is shown in Table 1.

Table 1. Interview outline regarding factors influencing vocational college teachers' professional competence

Items	Semi-structured interview outline
1	A person's career can be classified into "Competence formation stage", "Enthusiasm and growth stage", "Stabilized stage", and "End-of-career stage". At which stage are you currently?
2	Have you participated in discipline development and curriculum design activities? In your opinion, what are the determinants of these processes?
3	What strategies or concepts will you implement to enhance your pedagogical skills? In your opinion, what are the determinants contributing to the development of teaching proficiency?
4	Have you engaged in the establishment of practical training facilities both on-campus and off-campus? In your opinion, what are the determinants of the capacity to establish practical training facilities both on-campus and off-campus?
5	Have you ever built or participated in a teaching team? Or have you had any experience of managing a team of students? In your opinion, what are the determinants of the ability to manage a team effectively?
6	Have you ever engaged in scientific research as a host or a participant? What are the determinants of one's research proficiency, in your opinion? Have you consistently engaged in the pursuit of knowledge and do you believe in lifelong study?
7	In which areas do you perceive your skills to be more proficient? In which areas do you perceive your skills to be less proficient?
8	What strategies can teachers employ to enhance their professional competence following the transformation or foundation of their educational institution into a vocational college? What actions can the college undertake?

2.4. Research process

During the initial phase, the questionnaires were administered online via Wenjuanxing (Questionnaire Star in English, a popular questionnaire distribution platform in China) to participants from various disciplines in the 15 pilot Chinese vocational colleges between August and September 2022.

During the second phase, teachers who had previously participated in the questionnaire survey and expressed their willingness to be interviewed were recruited for semi-structured interviews. A total of 21 participants were selected from a variety of academic disciplines, professional titles, age cohorts, and career stages to maximize diversity and provide a comprehensive representation of vocational college teachers. This approach was taken to facilitate the identification of factors that influence vocational teacher development. Table 2 displays the statistical demography data of the interview samples. The semi-structured interviews were conducted in August of 2022 through online calls via WeChat (a widely used social media app in China), accompanied by an interview. The interview duration was estimated to be 30 to 60 minutes, and the interview process was recorded with the participants' permission. Following the completion of the interviews, the transcripts were organized based on serial numbers ranging from 01 to 21, which served as the primary source of data for the interviews. Among the 21 interview transcripts, 17 were chosen randomly for the coding analysis based on the grounded theory study. The remaining four transcripts were set aside to test theoretical saturation. The transcribed raw interview data were compiled into a verbatim script for repeated reading. This script was thoroughly reviewed and analyzed using the MAXQDA software for open, axial, and selective coding procedures. The resulting codes were then mapped to their corresponding analysis dimensions, and the analysis continued until no new data or insights emerged. Relevant sentences were tagged and classified throughout this process.

Table 2. Descriptive statistics of interview samples ($N = 21$)

Variables	Counts	Ratio	Variables	Counts	Ratio
Professional Title			Working years as a teacher		
Associate Professor	11	52%	Less than 5 years	2	10%
Lecturer	8	38%	5-10 years	5	24%
Teaching Assistant	2	10%	11-15 years	11	52%
Age			15-20 years	3	14%
30-40 years old	17	81%			
40-50 years old	2	10%	Career Stage		
More than 50 years old	2	10%	Competence formation stage	3	14%
Gender			Enthusiasm and growth stage	15	71%
Male	9	43%	Stabilized stage	2	10%
Female	12	57%	End-of-career stage	1	5%

2.5. Coding rules

The initial code represents gender, with “F” indicating female and “M” indicating male. The second code denotes distinct respondents, indicated by the numbers 01 to 21. The third code represents the categories, indicated by the order of A1 to A13. Lastly, the fourth code denotes the order of the excerpts, indicated by the numerical order of 1. For instance, M4-A1-1 denotes the initial extract for the fourth male in the A1 category of resource matching.

2.6. Reliability, validity, and research ethics

The present study employed triangulation validation to enhance the credibility and validity of the interview data analysis [38]. In order to ensure credibility, the researcher employed three distinct data collection methods to ensure the stability and reproducibility of the data, namely full audio recording, verbatim script transcription, and points recording in the field. Furthermore, during data interpretation for the present study, the researcher engaged in discussions with two specialists regarding the rationality of the

coding and categorization. Upon arriving at mutual agreement, the coding framework and categories were initially established, followed by the coding of all respondents' data.

The interview outline was provided to participants a day before the scheduled interview session, allowing them ample time to contemplate the questions and their viewpoints. Throughout the interview process, the researchers meticulously regulated the balance between listening, speaking, and questioning to thoroughly comprehend the respondent's response and to explicate any uncertainties through appropriate rhetorical inquiries, thereby ensuring the validity of the qualitative research [39]. During the data coding process, the researchers endeavored to maintain objectivity by repeating comparisons and analyses of the interview information to minimize any potential influence on the research findings. The present study was conducted following research ethics by upholding the principle of confidentiality, safeguarding the privacy of the interviewee data, and refraining from disclosing any information that could potentially disclose the identity of the interviewees.

3. Results

3.1. Current status of Chinese vocational college teachers' professional competence

The participants involved in the questionnaire survey were from various regions across China, including Hainan, Jiangxi, Guangdong, Guangxi, Shaanxi, Shandong, Henan, Fujian, and Chongqing. The study yielded a total of 333 questionnaires, with 267 valid after the exclusion of any invalid responses. It was revealed that the gender distribution of the participants was 39.0% male and 61% female. Moreover, 68.9% were course teachers, 31.1% were administrative staff with teaching duties, and 45.3% were double-professionally-titled teachers (who work in industry and teach students in school simultaneously). Regarding professional title ranks, the ratio of teaching assistants, lecturers, associate professors, and professors was 24.7%, 34.5%, 18.7%, and 3%, respectively. Regarding educational attainment, it can be observed that 30.3%, 61.0%, and 2.2% held bachelor, master's, and doctoral degrees, respectively, while 44.9% of the samples had teaching experience of less than 5 years, 19.1% between 5-10 years, another 19.1% between 10-15 years, 9.4% between 15-20 years, and 7.5% more than 20 years.

Table 3 presents the results of the descriptive statistics analysis conducted on the questionnaire data. Table 3 indicates that vocational undergraduate teachers scored above average across all dimensions of professional competence, demonstrating a relatively high level of professional capability. From a social-psychological perspective, the outstanding performance in teaching competence and lifelong learning ability can be interpreted as socialized manifestations of teachers' high achievement motivation and strong professional identity.

Table 3. Descriptive statistical results of the questionnaire survey ($N = 267$)

Dimensions	*M*	*SD*	Dimensions	*M*	*SD*
Discipline Development Capacity	3.692	0.693	Training Facility Development Capacity	3.535	0.839
Teaching Capacity	4.169	0.598	Administration Capacity	3.979	0.667
Practical Operation Capacity	3.713	0.813	Teamwork Capacity	3.928	0.630
Curriculum Design Capacity	3.636	0.772	Research Capacity	3.704	0.712
Industry-Academia Collaboration Capacity	3.496	0.813	Lifelong Learning Capacity	4.230	0.593
Total Score of Professional competence	3.808	0.571			

Note: *M = mean; SD = standard deviation*

3.2. Affecting factors of Chinese vocational college teachers' professional competence

3.2.1. Open coding: extracting concepts and setting categories

The open coding of the present study centered on the research goal to identify the influencing factors of professional competence among vocational college teachers. Of the 21 interview transcripts, 17 were randomly selected for effectively classifying, labeling, summarizing, coding, and conceptualizing. The open coding involved in the present study went through the following processes: (1) the selected interview transcripts were imported into MAXQDA for repeated reading and comprehension, with statements or paragraphs extracted, summarized, sorted, numbered, and named; (2) similar content was analyzed and categorized into 56 initial encoding concepts; and (3) the 56 initial encoding concepts were abstracted based on their connotations and extensions, resulting in the formation of 13 categories as elaborated in Appendix 1.

3.2.2. Axis coding: extraction of sub-categories and main categories

The axial coding process involves iterative analysis, comparison, and summarization of generalized categories to identify commonalities among concepts, ensure mutual exclusivity and rigor of categories, and establish typologies, thereby extracting sub-categories and main categories. Through continuous exploration of "factors affecting teachers' professional competence" via axial coding, eight sub-categories emerged: perceived resource availability, institutional trust, organizational support perception, self-efficacy, professional identity, achievement motivation, group dynamics, and research experience. Additionally, two main categories were formed: organizational environmental factors and socio-psychological factors. Table 4 presents the axial coding analysis.

Table 4. Axial coding analysis

Main Category (C)	Sub-Category (B)	Open Codes (A)
Organizational Environmental Factors	Perceived Resource Availability	A1 Resource Matching A3 Opportunity Availability
	Institutional Trust	A2 Institutional Guarantees & Funding Support
	Perceived Organizational Support	A4 Strengthened Organizational Leadership
Socio-Psychological Factors	Self-Efficacy	A5 Professional Knowledge & Skill Reserves
	Professional Identity	A6 Experience A7 Networking Resources
	Achievement Motivation	A8 Career Development A9 Time & Energy Investment A10 Teaching Attitude
	Group Dynamics	A11 Team Collaboration
	Research & Experience	A12 Research Capacity A13 Value Experience

3.2.3. Selective Coding: Model Construction

Selective coding resulted in the "Influencing Factors of Professional Competence for Vocational Undergraduate Faculty" model. This model emphasizes the interactive effects of socio-psychological factors (e.g., achievement motivation, professional identity, self-efficacy) and environmental factors (e.g., institutional trust, perceived resource availability) on the development of teachers' professional competence. The model, closely tied to the research theme, is illustrated in Figure 2.

Based on the model in Figure 2, the professional competence of vocational undergraduate faculty is primarily shaped by the combined influence of organizational environmental factors and socio-psychological factors.

Dual-Factor Interaction Framework

- Organizational Environmental Factors (External): Directly affect objective conditions for career development through resource provision, institutional guarantees, etc.
- Socio-Psychological Factors (Internal): Modulate individuals' efficiency in utilizing environmental resources via cognition, motivation, and group influence.

Examples of Interactive Effects

- Institutional Trust (Organizational Environment) enhances job security, thereby strengthening achievement motivation (Socio-Psychological) and prompting greater time/energy investment (A9).

Key Pathways

- Pathway 1: Perceived Resource Availability → Self-Efficacy → Professional Competence Development
- Example: Institutional guarantees (A2) provide funding support → individuals perceive abundant resources → teaching confidence improves → professional performance optimizes.
- Pathway 2: Institutional Trust → Professional Identity → Achievement Motivation
- Example: Strengthened organizational leadership (A4) enhances fairness → teachers' professional identity deepens → motivation to pursue excellence is activated.

Theoretical Integration

- Bandura's Theory highlights bidirectional interactions among "environment- individual- behavior."
- Occupational Motivation Theory complements this by emphasizing intrinsic drivers.
- "Group Dynamics" and "Research & Experience" in the model reflect dynamic processes of social learning and practical feedback.

This table and model provide a structured analytical tool for researching vocational education teachers' competence development, clarifying intervention directions (e.g., optimizing resource allocation, enhancing institutional trust).

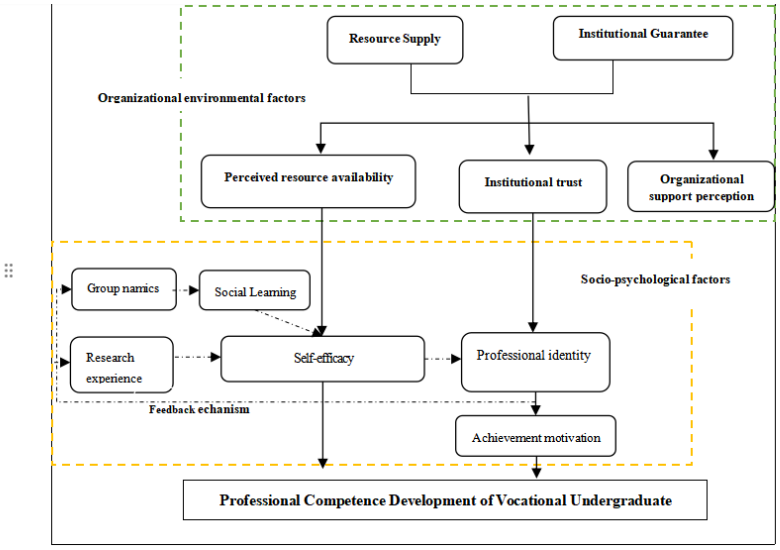

Figure 2. Model of Influencing Factors on Professional Competence for Vocational Undergraduate Teacher

3.2.4. Theoretical saturation test

In order to evaluate the theoretical saturation of the preceding model, the other four interview transcripts were imported into MAXQDA, and the coding procedures were conducted. A meticulous examination and deduction determined that no new primary categories, subcategories, or main categories were identified, and no additional connections were discovered. Furthermore, the coding results and model were subjected to expert evaluation by two individuals possessing extensive experience in teaching management and front-line teaching. The feedback received from these experts was affirmative, signifying that the model depicted in Figure 2 successfully passed the theoretical saturation assessment.

4. Discussion

4.1. Research findings

The study findings revealed that environmental factors, such as perceived resource availability, institutional trust, and organizational support, alongside socio-psychological factors, including self-efficacy, professional identity, and achievement motivation, collectively influence the development of professional competence among vocational undergraduate faculty. A deeper analysis through the lenses of Social Cognitive Theory and Occupational Motivation Theory clarifies their underlying mechanisms.

Environmental Factors: Resources, Institutions, and Organizational Support

Social Cognitive Theory emphasizes the shaping role of the environment on individual behavior. Regarding perceived resource availability, Romlah et al. noted that access to high-quality resources meets teachers' needs for instructional and research activities, thereby enhancing professional competence [39]. When teachers perceive resources as adequate and aligned with student needs, it creates a supportive learning environment, providing material foundations for professional growth and boosting confidence to experiment with innovative teaching methods and engage in research.

Institutional trust and organizational support are equally indispensable. Kibrit et al. highlighted that robust institutional guarantees and funding are critical for vocational education development [41]. A stable institutional framework fosters a predictable career environment, reassuring teachers that the organization will support their development.

This trust reduces concerns about occupational risks, encouraging proactive engagement in professional development activities. For instance, incentive policies motivate teachers to invest sustained effort for rewards and recognition. However, resource instability in private institutions may undermine teachers' perceived resource availability and institutional trust, hindering professional growth [42][43].

Socio-Psychological Factors: Self-Efficacy, Identity, and Motivation

Bandura defined self-efficacy as individuals' judgments of their capability to accomplish tasks. Vocational undergraduate teachers with high self-efficacy are more confident in addressing instructional and professional challenges, actively experimenting with new approaches, and continually upgrading their expertise. For example, teachers proficient in information-based teaching strengthen their self-efficacy through successful problem solving, creating a virtuous cycle [20].

Professional identity—a deep emotional and value-based connection to one's occupation—serves as a core intrinsic motivator for professional development [24]. Teachers with strong professional identity view teaching as a mission for self-actualization, voluntarily dedicating time and effort to enhance competence and pursue excellence. In competence-oriented instructional contexts, research confirms that teachers' instructional attitudes and willingness significantly positively influence their teaching identity. Teaching

identity, as a mediator, further promotes three types of instructional reform behaviors: teaching preparation, practice, and sustained professional development [44].

Achievement motivation drives teachers to pursue success. Vocational undergraduate faculty strive to elevate their professional competence to gain organizational recognition and achieve personal goals. Skoryk and Grytsyk found that teachers' awareness of career decision-making correlates closely with professional growth and success, indicating that achievement motivation shapes career choices and behaviors [45].

Interaction Between Environmental and Socio-Psychological Factors

Environmental and socio-psychological factors interact dynamically. A favorable environment of resources, institutions, and organizational support strengthens teachers' self-efficacy, professional identity, and achievement motivation. For instance, abundant training opportunities enhance professional expertise, fostering perceived organizational support and, in turn, reinforcing professional identity and self-efficacy. Conversely, positive socio-psychological factors encourage teachers to proactively leverage environmental resources, driving professional development.

In summary, environmental factors such as perceived resource availability and socio-psychological factors such as self-efficacy jointly influence the professional competence of vocational undergraduate faculty through mechanisms outlined in Social Cognitive Theory and Occupational Motivation Theory. A nuanced understanding of these factors and their interactions provides actionable strategies for enhancing teacher professional competence.

4.2. Research contributions

This study makes significant contributions. First, it validates the applicability of Fang et al.'s self-assessment questionnaire, expands the conceptual scope of professional competence among vocational undergraduate faculty, and provides a straightforward reference for advancing vocational education and psychology [30]. Second, by focusing on 15 pilot institutions in their inaugural 4-year development phase, and employing mixed-methods research, it enriches the literature on China's vocational undergraduate education. Third, through in-depth interviews grounded in theory, it explores professional competence and its influencing factors in vocational undergraduate colleges, offering insights to enhance capabilities and ensure instructional quality. Notably, by integrating Social Cognitive Theory and Occupational Motivation Theory, it broadens the theoretical lens for studying professional competence among vocational undergraduate teachers, providing a novel reference for advancing vocational education psychology.

4.3. Research recommendations

Based on analytical findings and interviewee suggestions, this study proposes the following recommendations from individual and organizational perspectives to support sustainable professional development for vocational undergraduate faculty.

4.3.1. Strategies for individual teachers

Set Clear Goals and Challenges: Teachers should establish specific objectives to stimulate intrinsic motivation for professional growth.

Reflect and Reshape Perspectives: Deepen understanding of vocational undergraduate education's requirements, significance, and implications. Break cognitive limitations and actively engage in institutional professional development initiatives.

Engage in Academic Exchanges: Participate in professional or academic conferences to foster peer learning, adopt best practices, and achieve collective progress.

Enhance Qualifications and Skills: Pursue advanced degrees, expand knowledge reserves, strengthen research capabilities, and broaden research directions to solidify foundational expertise.

Vocational undergraduate colleges aim to cultivate highly skilled talent aligned with market demands. Teachers must stay abreast of technological trends, understand industry needs, diversify their knowledge, and strengthen their professional mission and responsibility. Emphasizing skill development, teachers should prioritize practical experience to fulfill their roles effectively. Lifelong learning is essential for teachers to proactively expand knowledge, accumulate skills, sustain professional growth, and reinforce professional identity.

4.3.2. Institutional support for teacher development

Strengthen Value-Driven Motivation: Institutions should systematically guide teachers to recognize the interconnectedness of professional development with personal career value, student growth, and institutional success. Sustained (professional achievement) and social recognition foster a virtuous cycle of "development – identification – redevelopment," enhancing institutional trust [46].

Establish Resource Support Systems: Allocate dedicated funding for teacher development, prioritizing teaching resource libraries, digital tool development, and practice-based maintenance. Dual material and institutional support signals "organizational empowerment," alleviating concerns about sustainable development resources and fostering long-term trust.

Establish a resource guarantee system and lay a solid foundation for professional development. Set up a special fund for teacher professional development, focusing on supporting the construction of teaching resource libraries, the development of digital teaching tools, and the operation and maintenance of practice bases. Through the dual guarantee of material resources and institutional resources, convey a clear signal of "organizational empowerment" to teachers, eliminate their concerns about the sustainability of development support, and thereby establish long-term trust in the professional development system.

Deepen Industry-Education Integration: Implement institutionalized enterprise practice programs, enabling teachers to gain industry exposure through internships and collaborative projects. This "dual-qualified" model enhances practical teaching capabilities and clarifies career development pathways.

Foster Collaborative Growth Ecosystems: Create a three-dimensional development framework combining competition-driven teamwork (e.g., skills competitions), individualized plans (e.g., overseas training, industry certifications), and research communities for action research. This holistic approach addresses differentiated needs, promotes knowledge sharing, and drives sustainable professional growth [47].

4.4. Research limitations and future directions

This study has three limitations and corresponding optimization paths, described as follows.

Sample Representativeness: It was limited to 15 pilot vocational undergraduate colleges, excluding central/western regions and industry-specific institutions. Future research should expand to diverse regions and industrial sectors, examining policy impacts on practical competencies.

Methodological Rigidity: Reliance on qualitative analysis lacks quantitative validation. Future studies could develop assessment tools aligned with Vocational Education Teacher Competency Standards, using structural equation modeling to test relationships between policy environments, enterprise practice, and digital literacy, while exploring socio-psychological mechanisms with broader samples.

Interactional Depth: Semi-structured interviews inadequately capture group dynamics. Incorporating focus group discussions and analyzing the mediating role of social capital accumulation under the "1+X"

certification system (via mixed methods) would provide empirical support for optimizing teacher development policies.

5. Conclusion

This study employed mixed methods to comprehensively investigate the sustainable development of professional competence among Chinese vocational undergraduate teachers through Social Cognitive Theory and Occupational Motivation Theory. Findings revealed that socio-psychological and environmental factors jointly shape teacher competence. Vocational undergraduate colleges should foster achievement motivation, strengthen professional identity, enhance organizational fairness, and build institutional trust to sustainably elevate teacher capabilities.

Data availability

Data are available on request from the corresponding author.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Hainan Vocational University of Science and Technology (HKD-2022-15).

Consent for publication

All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

The authors declare no conflict of interest

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Appendix 1. Open Coding and Category Extraction

Category (A)	Concepts (a)	Source extract from the interview transcripts	Counts
A1 Resource Matching	a1 Course resource	The matching of teaching resources and personnel (M10-A1-2)	3
	a2 Human resources	One is the students' cultivation aspect, which may be related to the internal construction of the college, but the construction cannot continue without proficient teachers (F05-A1-7)	7
	a3 Industry-academia cooperation resources	I know very little about industry-academia cooperation. I think the promotion of the construction of our discipline, curriculum construction, and training base is not enough (F05-A1-12)	3
	a4 Overall planning of equipment procurement	There has yet to be an overall plan for the purchase of equipment. From a professional point of view, this is good professional planning, but this process may require a lot of meetings. If the college can purchase proper equipment step by step, there will be no mess (F05-A1-15)	4
	a5 Site facilities and equipment supporting	Secondly, our conditions are not mature. As I told you, we do not have much experimental equipment, so we cannot make it (M04-A1-20).	9
	a6 Scientific research platform is complete and advanced	Integrity and advancement of scientific research platform (M18-A1-27)	2
A2 System Guarantee and Financial Support	a7 System guarantee	Mandatory requirements of the school, imperfect system, and unsatisfactory salary (M01-A2-29)	10
	a8 Incentive policy	The school requires every teacher to complete the course construction task with a corresponding payment reward (F02-A2-39)	5
	a9 Performance appraisal	Reward policy for conducting scientific research, and so on (M17-A2-42)	8
	a10 Expenditure budget and input	In addition, the investment from the school is much better in these two years; it is still relatively good (F05-A2-52)	7
	a11 Timely release of funds	I still hope that the school funds will be in place as early as possible (F05-A2-61)	8
A3 Prevalence of Opportunities	a12 Training opportunities	I think training opportunities affect the improvement of my teaching ability (F08-A3-67)	2
	a13 Competition opportunity	There are various teaching teams and student teams and many opportunities in my school (F02-A3-69)	2
	a14 Research opportunities	There are more channels and resources to apply for the research project... so if you have the energy to conduct research... the school can offer many opportunities (F03-A3-71)	2
A4 Organizational Leadership Reinforcement	a15 Organizational leading	Whether there is organizational leading and inspection (F08-A4-74)	4
	a16 Organizational Deployment	I hope that the functional departments of the school can provide very clear guidelines for how to implement work and lead us teachers to do it together so that this work can be done in time (F02-A4-80)	11
	a17 Organizational training	I hope that the organization can provide some highly targeted training to invite teachers who have competed and won in provincial or national competitions in recent years to instruct us so that we can learn from their experience, find out our shortcomings and improve the team's ability (F02-A4-88)	4
	a18 Organizational emphasis	It may be related to the school; for example, the faculty is small, the professional development is slow, or the school does not pay enough attention to it (F05-A4-93)	7

Category (A)	Concepts (a)	Source extract from the interview transcripts	Counts
	a19 Organizational support	Of course, the first thing is the strong support from the leader who is in charge of teaching (M04-A4-100)	3
	a20 Team building	I am now disadvantaged since I do not have a teaching team (F05-A4-104)	7
A5 Professional Knowledge and Skill Reserve	a21 Professional knowledge reserve	Professionalism is a key factor. I do not have sufficient professional competence (F05-A5-112)	20
	a22 Mastery of information-based teaching	Mastery of modern teaching tools and means (M17-A5-129)	2
	a23 Mastery of new technologies and processes	Familiarity with new training equipment (M14-A5-131)	2
	a24 Awareness of the market demand and the cutting-edge professional knowledge	Constantly understanding the nation, society, industry, and international maritime organization out of professional requirements, mastering new technology, equipment, and changes, and applying them to teaching. Teaching is at the forefront of the industry (M10-A5-137)	9
	a25 Lack of enterprise experience	I think one of the hindrances to the improvement of teaching ability is that teachers still lack experience in the industry...so the way of thinking or the teaching content is sometimes not quite in line with the needs of today's enterprises (F06-A5-146)	6
	a26 Weak practical ability	However, my practical teaching ability is still weak, and it is difficult to integrate mathematics into different majors (F02-A5-148)	6
	a27 Lack of extensive knowledge	Personal time, energy, and knowledge influence the improvement of personal teaching ability (F16-A5-156)	4
A6 Prior Experience	a28 Experience accumulation	The personal factor that affects my ability of scientific research is that I have not done it before and do not know where to start (F11-A6-161)	8
	a29 Study and work experience	I think the professional level, work experience, and other factors affect the construction of on/off-campus training bases (M17-A6-173)	10
	a30 Translation of experience into knowledge and research	I can present some ideas, experiences, and thoughts from my 13 years of teaching through the way of research (F02-A6-178)	3
A7 Interpersonal Network Resource	a31 Relationship cost	However, undertaking these projects also requires teachers to communicate with various departments and other enterprises, resulting in costs of time, human capital, and interpersonal relationships (F02-A7-181)	3
	a32 Social resources	An individual's great social resources should also be a positive factor (F07-A7-184)	5
A8 Career Development	a33 Professional title evaluation requirements	First of all, I need to complete some course construction tasks for the requirements of professional title evaluation (F02-A8-189)	6
	a34 Individual professional development direction	In addition, the food production major has a long-term future, so that I can develop in this direction. In order to better integrate into this major, I have also passed some tests for some relevant vocational certificates, such as a baking certificate (F05-A8-195)	3
A9 Input of Time and Effort	a35 Uninterrupted period for research	I may have a gap year now, and I will also apply for a project again soon (F05-A9-198)	5
	a36 Dealing with cumbersome administrative matters	I think the concurrent administrative duties for the teachers in my school are overloaded (F03-A9-203)	4

Category (A)	Concepts (a)	Source extract from the interview transcripts	Counts
	a37 Overload of teaching tasks	The required amount of teaching duties also affects my scientific research (F06-A9-210)	8
	a38 Limited time	Due to the specialty of my major, I need to attend the preparation for certificate tests frequently, and my time is limited (M01-A9-215)	11
	a39 Limited energy input	I have to spend a lot of time on the preparation of the fine-course PPT speech and some other teaching materials, longer than usual course preparation. Because I need to refine it, which costs me much effort (F06-A9-228)	12
	a40 Family	Family support or attachment can affect the development of a teacher's professional competence (F08-A9-238)	2
A10 Teaching Work Attitude	a41 Personality characteristics	From the aspect of personal characteristics, I am enthusiastic (F07-A10-242)	4
	a42 Concerned about student employment prospect	I think this off-campus training base is beneficial for students' employment, so I think it is worth doing (F02-A10-244)	7
	a43 Commitment and dedication	Let me start with the student team. To tell you the truth, the students have weekly group meetings at my school. It is all volunteer work. Every teacher has been doing it entirely with a spirit of dedication and a heart of sacrifice (F05-A10-252)	6
	a44 Love for teaching	After having a confident grasp and understanding of my major, I developed a systematic course, which was applied to practical teaching with good results. This persistence comes from love and the responsibility of being a teacher (M10-A10-261)	5
	a45 Active participation	I am also willing to do some course development to improve my professional competence (F02-A10-262)	5
	a46 Learning eagerness	However, I will continue to learn and participate in scientific research work with my team (F16-A10-271)	5
	a47 Working hard	I dare not claim that I am committed to teaching with all my heart. Just let me give you an example. I did not adjust the curriculum schedule for personal reasons in this school for 12 years. You can think for yourself what that means (M04-A10-27204)	5
A11 Team Cooperation	a48 Contribution to the team	The integrality and advancement of the scientific research platform, as well as the contribution of the scientific research team members, will affect the development of teachers' professional competence (M18-A11-278)	2
	a49 Division of labor and cooperation	Teamwork, reasonable division of labor, the chance to show personal strengths, organization, communication, and brainstorming will lead to many unexpected outcomes (F13-A11-280)	3
	a50 Collaborative communication	Only with the cooperation and active participation of the teachers of one course can things be done well (M04-A11-282)	9
	a51 Whether there is a team or not	The lack of teams is also a significant factor (F11-A11-295)	5
A12 Capacity for Research	a52 Whether agreeing with scientific research or not	Because my major is navigation technology, mainly navigation, I do not dabble in or agree with scientific research (M01-A12-304)	3
	a53 Research basis	Whether there is a research basis (F08-A12-301)	4

Category (A)	Concepts (a)	Source extract from the interview transcripts	Counts
	a54 Research direction	As a matter of fact, our teachers all have different majors and research directions, so it is difficult to find a common research direction (F06-A12-305)	6
A13 Experiential Value	a55 Perception of a sense of accomplishment	Students' positive responses to the class and good spirits in class will affect my teaching state. In terms of depth of knowledge and more details, students' good response also gives me a great sense of achievement (M01-A13-309)	4
	a56 Growth and accomplishment	Then, it is about feeling growth and accomplishment (F05-A13-314)	3

(*Continued*)