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Research on the cultivation of vocational ability of students in higher vocational institutions

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ABSTRACT

This study examines the impact of teacher competency and industry-academic collaboration on vocational ability, focusing on technical, problem-solving, and soft skills. It also explores the mediating role of career self-efficacy and the moderating role of social support in these relationships. A quantitative and cross-sectional survey was conducted among Chinese students in higher vocational institutions. Stratified random sampling resulted in 350 distributed questionnaires with 270 completed responses. Data were analyzed using SmartPLS 4. Teacher competency and industry-academic collaboration both positively impacted vocational ability. Career self-efficacy mediated the relationships between these factors and vocational ability. Social support moderated these relationships highlighting its importance in enhancing vocational outcomes. This study integrates key factors— teacher competency, industry-academic collaboration, career self-efficacy, and social support providing a comprehensive understanding of vocational outcomes in higher vocational education. The findings offer insights to improve vocational education practices and policies, particularly in rapidly developing economies like China. Enhancing teacher competency, fostering industry-academic collaboration, and supporting career self-efficacy and social networks are crucial for improving vocational outcomes.

Contribution/Originality: The present study stands out by integrating teacher competency, industry-academic collaboration, career self-efficacy, and social support providing a holistic perspective on vocational outcomes. These findings overcome the gaps in previous literature as it emphasizes the mediating and moderating roles of career self-efficacy and social support, offering new insights into the factors influencing vocational ability in higher education.

1. INTRODUCTION

Many global economies depend on vocational education to fill skill gaps. Technology and business expansion are changing the job market, increasing demand for technical and emotional skills. However, many educational systems, especially vocational ones, struggle to prepare students for modern employment. The skills gap between vocational school graduates and employers has persisted for years resulting in underemployment and unemployment (Wang, Ma, Liu, & Feng, 2022). Thus, vocational education goes beyond teaching technical skills. The process includes learning flexibility, communication, problem-solving and other soft skills needed in today's business world (Wang, Peng, & Li, 2022). This issue requires an elaborate approach that incorporates effective pedagogical methodologies, industry-education partnerships, and awareness of psychological factors affecting student learning outcomes (Attard & Holmes, 2022). Teacher proficiency and industry-academia collaboration can

bridge the gap between educational outputs and labor market needs (Maheshwari, Kha, & Arokiasamy, 2023). Teacher expertise is crucial to vocational education student success. Effective teachers know their subject well and create an environment that fosters critical thinking, problem-solving, student engagement, and practical learning. Li, Li, Zhu, and Guo (2020) state that teachers' ability to establish a positive classroom environment, use active learning tactics, and provide timely feedback affects student learning. Teacher competency also includes teaching transferable skills like communication, cooperation, and decision-making, which are crucial in the modern workplace. Since vocational education teachers' roles change, institutions that want to improve vocational training results must improve teacher competency.

Industry-academic collaboration also improves vocational education. Technological advancement has made it harder for vocational programs to meet industry requirements, creating a gap between students' abilities and employers' needs (Ma & Ding, 2022). Industry-academia partnership, including educational institutions and companies is essential for vocational programs to stay updated. Joint curriculum development, internships, apprenticeships, and student-industry projects are possible (Siti, Rasul, Mohammad Yasin, & Hashim, 2023). Collaborations assist students by teaching them practical skills that boost job market competitiveness and workplace understanding. These partnerships also help educational institutions keep up with industry trends and adapt their curricula to labor market demands (Kuralová, Zychová, Kvasničková Stanislavská, Pilařová, & Pilař, 2024). Despite these benefits, industry-academic collaboration's impact on occupational skills and competencies, especially in vocational training programs is rarely studied. Career self-efficacy, social support, instructor competency, and industry participation all affect occupational success. According to Gazit, Zaidman, and Van Dijk (2021) career self-efficacy or confidence in one's ability to do work-related activities predicts academic and occupational success. Career self-efficacy leads to better transitions from college to job overcoming difficulties, and establishing ambitious objectives (Jemini-Gashi, Duraku, & Kelmendi, 2021). Career self-efficacy improves students' belief that they can learn and employ vocational skills which affects their achievement (Amaral, Krägeloh, Henning, & Moir, 2023). Knowing this mediation process is important for establishing successful techniques to improve students' vocational abilities as it implies that self-confidence may increase teacher collaborations. Family, coworkers, and mentors' emotional, informational, and instrumental support affects vocational education results (Siti et al., 2023). Social support during suffering boosts youngsters' resilience, academic drive, and mental health (Munir, Sinambela, Halizah, Khayru, & Mendrika, 2022). It helps vocational students overcome obstacles, boosts self-confidence, and improves career self-efficacy (Abou Hashish & Bajbeir, 2022). Socially supported students have a better educational environment which affects their occupational skill development and career transfer (Berthet, 2022). Social support is crucial in modulating the relationship between professional self-efficacy, instructional methodologies, vocational competence, and industry-academic cooperation. However, the processes by which social support affects these correlations are unclear and further study is needed to understand how it moderates vocational education (Li, 2021).

In vocational education, teacher competency, industry-academic collaboration, professional self-efficacy, and social support have been investigated but their effects on vocational proficiency are unknown. Teacher competency, industry-academic collaboration and social support's impacts on professional self-efficacy and vocational skills are unclear. Complex links require a more sophisticated method to correctly characterize occupational skill development dynamics. Bandura (1986) and other theoretical frameworks with these factors may explain how they impact occupational competence (Chui, Li, & Ngo, 2022). This study explores the direct and indirect effects of teacher competency, industry-academic collaboration, career self-efficacy, and social support on vocational outcomes to address these concerns.

This study examines how teacher competency and industry-academic collaboration affect vocational ability, concentrating on technical, problem-solving, and soft skills. The study examines how career self-efficacy mediates and social support moderates these associations. This study integrates various variables to better understand those

affecting vocational training results in higher vocational institutions. Teacher competency and industry collaboration will be examined as well as the psychological mechanisms and environmental elements that affect vocational skill development.

- How does teacher competency influence vocational ability, including technical skills, problem-solving skills, and soft skills among students in higher vocational institutions?
- How does industry-academic collaboration impact vocational ability, specifically technical skills, problem-solving skills, and soft skills among students in higher vocational institutions?
- What role does career self-efficacy play in mediating the relationship between teacher competency and vocational ability?
- How does social support moderate the relationship between industry-academic collaboration and career self-efficacy among students in higher vocational institutions?

The significance of this study lies in its potential to address critical gaps in vocational education research, particularly concerning the interplay between teacher quality, industry partnerships, and psychological factors. Given the increasing emphasis on the need for a skilled workforce, understanding the factors that contribute to vocational ability is crucial for improving educational outcomes and aligning them with labor market demands. This study contributes to the literature by exploring the role of career self-efficacy and social support as a moderator in the development of vocational skills, both of which are underexplored in the context of vocational education. Additionally, the study provides insights that can inform both policy and practice in similar educational settings by focusing on the Chinese context where vocational education plays a central role in the national development strategy. Ultimately, the findings of this study aim to guide the design of more effective vocational training programs that better equip students with the skills needed to succeed in the modern workforce.

2. LITERATURE REVIEW

2.1. Teacher Competency and Vocational Ability

Teacher proficiency greatly impacts vocational skills like technical, problem-solving, and interpersonal development. Professors with vast professional experience and excellent pedagogical methods create a learning atmosphere. Professors who explain complex topics and demonstrate best practices affect students' abilities to participate in industry-relevant activities (Mo, 2021). Practical applications and experience learning boost students' technical skills preparing them for industry changes. Technical abilities that are often business-specific require accurate education and ongoing technology updates from skilled instructors (Wang, Peng, & Feng, 2023). Their ability to adapt and assess each student's learning demands ensures that every student reaches their technical potential. Teacher competency encompasses technical expertise, problem-solving capabilities, and interpersonal skills, all important for professional success. Effective teachers encourage critical thinking to help students solve problems creatively and analytically (Odeh & Patanakul, 2024). They use case studies, simulations, and project-based learning to foster teamwork and adaptation, which are vital to problem-solving. Teachers' interpersonal skills and professional conduct often promote soft skills including emotional intelligence, teamwork, and communication (Boudouaia, AL-Qadri, Houichi, & Diafi, 2024). These criteria show how important teachers are in developing technical skills, critical thinking, and interpersonal skills needed to navigate complex job contexts. Proficient teachers integrate these aspects to prepare students for immediate employment and career advancement.

H_1: Teacher competency has a significant and positive impact on vocational ability.

2.2. Industry-Academic Collaboration and Vocational Ability

Industry-academia collaboration improves vocational skills, especially technical, interpersonal, and problem-solving. Collaborations between educational institutions and industry allow students to apply theoretical knowledge in practice. Internships, industry-sponsored programs and mentorship programs help students learn

new technologies and methods (Cui, 2022). Academic programs that meet industry standards ensure students learn relevant skills, improving their employability and work readiness (Zhang & Sun, 2021). Incorporating industry insights into educational practices helps students understand sector-specific issues and develop technical skills that meet market demands (Stephen & Festus, 2022). Students gain technical skills and confidence in professional situations from this experience. The industry-academic interaction improves students' technical, interpersonal, and problem-solving skills. Students are encouraged to cooperate in diverse teams to solve complicated business problems (Gowrie, Harikirishanan, & Ling, 2020). Students learn to solve problems creatively and analytically while working with industry specialists. Collaborative programmed emphasize communication, adaptability, and teamwork essential soft skills for success in dynamic workplaces (Ali, Triyono, & Koehler, 2020). Industry leaders often model professional behavior and workplace ethics for students. The academic framework's incorporation of these aspects shows how these collaborations strengthen students' technical and problem-solving skills and provide them the interpersonal skills needed for long-term professional success.

H_2: Industry-academic collaboration has a significant and positive impact on vocational ability.

2.3. Career Self-Efficacy and Vocational Ability

Technical, interpersonal, and problem-solving abilities impact occupational competency. It indicates a person's confidence in their professional abilities, which impacts their desire to study. High career self-efficacy is linked to faster technical skill acquisition (Liu, Li, Ding, Liu, & Zhang, 2022). This confidence motivates students and specialists to explore new tools, practice, and accomplish difficult technical jobs. Career self-efficacy promotes proactive skill development to adapt to industry and technology changes (Jemini-Gashi et al., 2021). Technical abilities improve professional progress and adaptability in changing work situations by confidence. Soft skills development for professional success and problem-solving is affected by career self-efficacy. Self-efficacy helps people solve complicated challenges analytically and creatively (Ramadhan, Purwaningrum, & Bith, 2023). Self-confidence minimizes anxiety and indecision, helping people handle uncertainty and obstacles (Amaral et al., 2023). Career self-efficacy greatly impacts soft skills including communication, teamwork, and leadership. Confident people collaborate better and express their ideas. Career self-efficacy enhances technical and problem-solving skills and facilitates interpersonal skills, preparing individuals for varied professional settings.

H_3: Career self-efficacy has a significant and positive impact on vocational ability.

2.4. Career Self-Efficacy as a Mediator

Career self-efficacy, which mediates the relationship between teacher competency and professional ability, enhances experienced teachers' impact on students' technical, problem-solving, and interpersonal abilities. Effective teachers create a supportive and exciting learning environment that boosts students' career confidence (Wang, Peng, et al., 2022). Students' self-efficacy motivates them to participate in the program, ask questions, and apply their knowledge to real-world issues. Studies show that students with stronger self-efficacy are more motivated to overcome technical problems and display instructor-taught skills (Mei, Lee, & Xiang, 2020). Career self-efficacy empowers students to take ownership of their learning and skill acquisition, magnifying the influence of teacher proficiency on career outcomes. It improves teacher and technical problem-solving. Effective teachers give theoretical frameworks, encourage critical thinking, apply material to real-world situations and foster problem-solving (Hersh, 2024). Students with high career self-efficacy see challenges as opportunities to demonstrate their skills rather than obstacles. This approach, reinforced by teachers, helps students solve difficult challenges creatively and enhance job preparation. Teachers' efforts will improve students' analytical and creative skills and prepare them for dynamic professional contexts through career self-efficacy. Career self-efficacy strongly influences occupational aptitude and industry-academic collaboration. Joint programs introduce students to industry practices and practical experiences, which can be intimidating. It helps students confidently pursue these opportunities,

improving their happiness (Pitcher, Ravid, Mancarella, & Behrend, 2022). Self-efficacy encourages internships, industrial projects, and mentorship programs, which improve technical skills. Self-confidence boosts industry-academic involvement and student career success. Career self-efficacy improves interpersonal and problem-solving skills by integrating theoretical knowledge with practical application. Li, Pan, and Nie (2022) noted that collaborative programs allow students to work with professionals, participate in interdisciplinary projects, and manage complex organizational dynamics. These actions need substantial adaptation and confidence. High self-efficacy students collaborate to enhance their critical thinking, communication, and cooperation abilities making them better at overcoming challenges (Luo, So, Wan, & Li, 2021). Career self-efficacy functions as a psychological stimulant, extending industry-academic relationship benefits beyond technical skill acquisition to a variety of occupational qualities. This mediation stresses the value of teamwork in enhancing employability and self-confidence in turning opportunities into professional growth.

H_4: Career self-efficacy mediates the relationship between instructor competency and vocational ability.

H_5: Career self-efficacy mediates the relationship between industry-academic collaboration and vocational ability.

2.5. Social Support as a Moderator

Social support moderates the relationship between teacher competence and vocational aptitude in technical, problem-solving, and interpersonal skills. Mentors, family, and peers help students learn better and boost the impact of teacher ability on vocational outcomes. It reduces stress and helps people handle problems, improving learning outcomes (Giri, Aylott, Giri, Ferguson-Wormley, & Evans, 2022). Students are more resilient and more likely to seek help when they feel supported by their social networks, making them more likely to work with and benefit from skilled vocational teachers. It can help youngsters develop problem-solving skills by developing a growth mindset that views failures as learning opportunities (Zhao & Van de Walle, 2024). It also creates an enjoyable learning environment that enables students to speak, connect, and develop interpersonal skills, which are essential for professional success. Therefore, it affects the relationship between teacher proficiency and vocational skills by giving students the emotional resources they need to maximize their education. It moderates the relationship between occupational aptitude and industry-academic collaboration, improving soft, problem-solving, and technical skills. Industry-academic interactions require communication, teamwork, adaptation, and technical skills to overcome practical challenges. It can give children the resources and motivation they need to succeed. Abdallah, Hatamleh, Nemer Abu Eid, and Mahroum (2024) discovered that students with family, mentor, or peer support cooperate and take chances more, improving their learning. It helps students overcome academic uncertainty and problems by raising their confidence and empowering them. Students may overcome workplace stress and focus on technical skills and complicated challenges with strong support networks (Liu, Zhang, Dang, & Gao, 2023). The idea harnesses social support to improve industry-academic collaboration and teach practical skills. Soft skills in industry-academic relations improve with social aid. Socially supported students are more likely to learn soft skills like adaptability, cooperation, and communication, which are crucial in collaborative workplaces. Supportive relationships help students coordinate and communicate professionally, boosting collaboration and interpersonal growth. Students cooperate more confidently when social support minimizes fear in new or high-pressure situations. Social support enhances conflict resolution, communication, and adaptation which are crucial to professional success (Oludayo & Omonijo, 2020). Strong social networks help students lead, cooperate, and think creatively in flexible industry-academic linkages (Fraune et al., 2023).

Social support affects students' perception of their work success owing to industry-academic partnerships. Industry-academia collaboration gives students real-world experience and lets them use their academic knowledge. Strong social support networks may boost students' career self-efficacy. Studies show that those who identify significant social support are more likely to feel capable of navigating real-world jobs (Jemini-Gashi et al., 2021). Students in industry-academic cooperation can overcome self-doubt and uncertainty with social support and

empowering them to solve issues. Students who have mentors, classmates, or family support are more confident in their professional accomplishment, especially while facing adversities. Social support increases students' career self-efficacy and provides the psychological resources needed for success in challenging situations, enhancing industry-academic collaboration. It strengthens industry-academic collaboration skills and experiences, especially soft skills, boosting career self-efficacy. Industry-academic collaborations boost students' technical and problem-solving skills but soft skills like adaptation, communication, and teamwork are often essential for professional success. It boosts these skills by making students feel comfortable taking risks, connecting with others, and communicating (Almulla & Al-Rahmi, 2023). Supportive networks can help students gain confidence in their social and collaborative job skills. Support network validation boosts students' career self-efficacy, boosting their capacity to handle professional interpersonal dynamics. This process shows how social support moderates the relationship between industry-academic collaboration and career self-efficacy, helping students develop the social and emotional confidence needed to succeed in dynamic work environments and the technical skills needed for their careers.

H_6: Social support moderates the relationship between teacher competency and vocational ability.

H_7: Social support moderates the relationship between industry-academic collaboration and vocational ability.

H_8: Social support moderates the relationship between teacher competency and career self-efficacy.

H_9: Social support moderates the relationship between industry-academic collaboration and self-efficacy.

Hence, we developed the following conceptual framework as shown in Figure 1 based on the above discussion and literature:

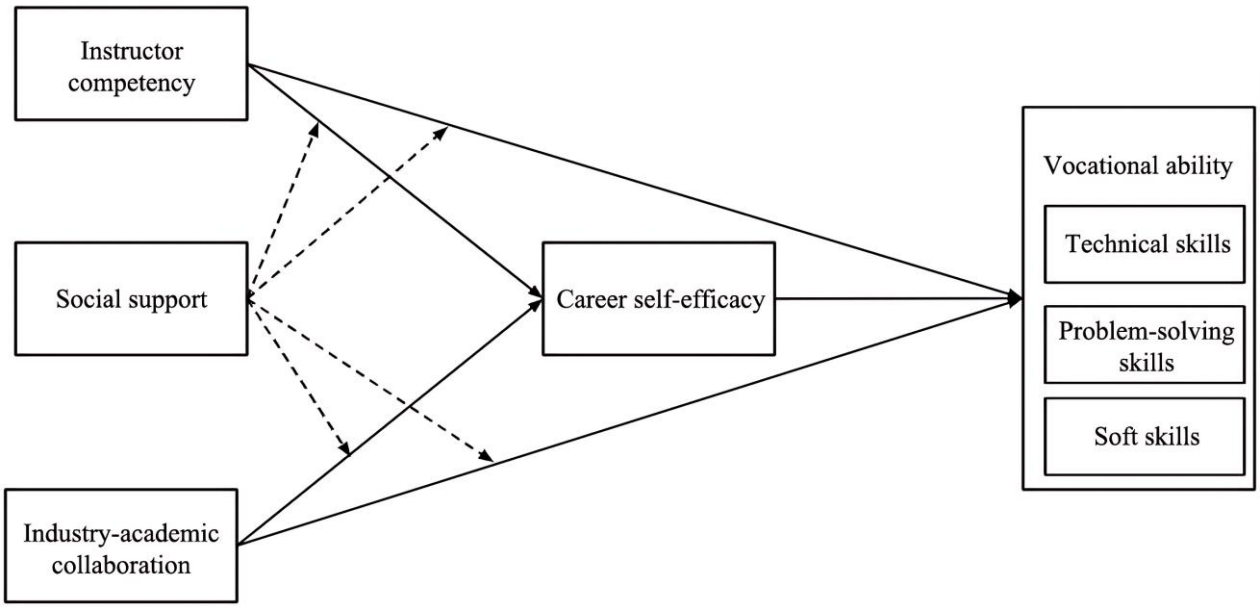

Figure 1. Conceptual framework.

3. METHODOLOGY

3.1. Research Design

This survey was quantitative and cross-sectional. Quantitative methods help evaluate hypotheses and analyze correlations. Standardized measurement methods can provide objective data for statistical analysis. The suggested approach may measure direct, indirect, and moderating influences. Data was collected at a specific time to provide a snapshot of the variables. Thus, cross-sectional research was used. Teacher competency, industry-academic collaboration, professional self-efficacy, vocational ability, and social support are correlated and causally linked by this design. It speeds up data collection from many participants who are essential for examining student attitudes and views of vocational education. Pre-structured surveys measure construct relationships directly to test the study's hypotheses. Researchers can study how teacher proficiency and industry-academic collaboration affect

professional self-efficacy, vocational skills, and social support in vocational education students. This method also helps identify causal correlations between variables and improves our understanding of occupational skill development aspects.

3.2. Population and Sample

Chinese students enrolled in technical colleges and vocational training programs were examined. This population was chosen because vocational education prepares students for employment, especially in technical professions where technical, problem-solving, and interpersonal skills are valued. This group is competent at analyzing expected relationships because higher vocational institutions host instructor-led learning and industry-academic partnerships. Representative samples were obtained using stratified random sampling. Strategic sampling allowed the target population to be divided into strata based on academic performance, educational attainment, and discipline (e.g., engineering, business, and healthcare). It ensured that the sample included students from diverse backgrounds and fields. This strategy reduced sample bias and made the findings applicable to all Chinese vocational students. Power analysis showed that 150 respondents would provide enough statistical power to assess expected relationships. The required sample size was computed. Four hundred surveys were sent to institutions to handle partial responses and unreturned questionnaires. This strategy improved dataset acquisition and reduced non-response bias. We completed 270 questionnaires with a 67.5% response rate. This sample size exceeds the structural equation modeling minimum. Structural equation modeling requires large sample sizes for accurate parameter estimates and hypothesis testing. Demographic data of respondents (age, gender, program type, and year of study) was collected to contextualize the research and identify biases.

3.3. Data Collection Instrument

This study collects data through a standardized survey form. It specifically asks students about the research's main variables such as teacher proficiency, industry-academic collaboration, professional self-efficacy, occupational aptitude, and social support. Participants were asked to rate each subject on a five-point Likert scale from one (strongly agree) to five (strongly disagree). Social science researchers prefer this scale type because of its simplicity and clarity. According to Daradkeh (2023) the instructor competency scale measures vocational school instruction efficacy. Their measure emphasizes student interaction, instructor expertise, and instructional methods, key indicators of teaching proficiency. This study assessed career self-efficacy using Liu et al.'s (2022) Career Decision Self-Efficacy Scale (CDSE). This scale is often used to assess professional confidence and job resilience. This study measures students' confidence in their career-related success, a key concept in professional self-efficacy. Technical, problem-solving, and social skills are modified. Almulla and Al-Rahmi (2023) and Abdallah et al. (2024) comprise the vocational ability scale. In vocational education, vocational aptitude which combines both technical skills for specific vocations and interpersonal skills for effective workplace interactions is extremely important. Thus, this scale matters. The social support scale developed by Liu et al. (2023) is a commonly used tool for assessing social support quality and accessibility. Their evaluation covers instrumental, informational, and emotional support crucial to student performance and job success. This study proposes that social support mediates the relationship between professional self-efficacy, teacher competency, and industry-academic collaboration. Each scale is culturally suited to Chinese vocational education. Each item's language and diction are assessed and modified to fit Chinese vocational students' cultural differences. Expert reviews and pilot testing affirm the modified scales' reliability and usefulness for the study.

3.4. Data Collection Procedure

The selected higher vocational institutes' classrooms hosted in-person surveys to collect data. This data collection strategy aimed to increase response rates and reduce the risks of incomplete or incorrect responses. The

researcher also answered respondents' survey questions face-to-face, assuring accuracy and reliability. Participants were told the study's goal, their voluntary participation, and their anonymity before taking the survey. Participants were told their responses would be kept confidential and used only for academic research. Each participant gave informed consent before the survey and was told they could leave the study without penalty. Faculty coordinated responders and ensured questionnaires were completed in class. Surveys were distributed in classrooms with their help. Researchers oversaw and assisted the operation. Participants have a certain time to complete the questionnaire. Fast surveys were taken to ensure secrecy. The response rate was good with 270 completed questionnaires out of 400 delivered. This data collection approach confirmed that the sample accurately reflected the intended demographic and allowed for speedy replies from many students.

3.5. Data Analysis Techniques

The responses from data collection were imported into SmartPLS 4, a statistical software tool for PLS-SEM. PLS-SEM was used to explore complicated interactions between variables, including direct, mediating, and moderating effects. Partial Least Squares-Structural Equation Modeling (PLS-SEM) can handle small to intermediate sample sizes making it ideal for this investigation with 270 complete responses. Evaluation of the measurement model and construct reliability and validity were the initial steps in data analysis. Average variance extracted (AVE) and component loadings assessed convergent validity whereas composite reliability and Cronbach's alpha assessed internal consistency. The Fornell-Larcker criterion and Heterotrait-Monotrait ratio of correlations (HTMT) confirmed each construct's uniqueness and precise measurement. After establishing the measurement model's validity and reliability, the structural model was assessed by assessing direct variable connections and mediation and moderation effects. Path coefficient importance was measured using bootstrapping with 5,000 resamples and analyzed using p-values and t-values. Mediation effects were assessed through indirect routes between variables while moderation effects were assessed through moderator-predictor interaction terms. SmartPLS 4 also included fit indicators to evaluate model quality. The analysis reveals the study's variables' direct, indirect, and interacting links allowing the researcher to test hypotheses and determine what factors affect Chinese vocational students' vocational competence and career self-efficacy. This study's data analysis methods answered the research questions and revealed insights into vocational ability, career self-efficacy, and social support's moderating role in teacher competency and industry-academic collaboration.

4. RESULTS

4.1. Measurement Model Assessment

The construct reliability and validity results in Table 1 and Figure 2 reflect the soundness of this study's measuring model. Some things, like cse10 and pss1 have lower loadings but their outside loadings for each construct are usually above 0.70 indicating strong item reliability. Despite these exclusions, all structures have excellent Cronbach's alpha and composite reliability (CR). Teacher competency has a Cronbach's alpha of 0.906 and a composite reliability (CR) of 0.928 showing strong internal consistency. Through the industry-academic partnership, the scale's Cronbach's alpha of 0.875 and CR of 0.903 demonstrate its trustworthiness in capturing this construct's intricacies. Despite low cse10 loading, career self-efficacy is reliable with a Cronbach's alpha of 0.823 and a CR of 0.861. For model improvement, it may be excluded in future iterations. The average variance extracted (AVE) values for all constructs exceed the minimum of 0.50, confirming convergent validity. The technical, interpersonal, and problem-solving sub-dimensions of vocational aptitude must be assessed for reliability and validity. Cronbach's alpha of 0.929 for problem-solving skills and composite reliability (CR) of 0.916 show that overall reliability measures are within acceptable standards, even if pss4 and pss1 have lower peripheral loadings. The social support scale's Cronbach's alpha of 0.920 and composite reliability (CR) of 0.932 indicate its reliability in assessing this moderating component. The AVE values for all constructs exceed 0.50 indicating that they explain

more variance than measurement error. These data suggest measurement model is reliable and valid, with enough consistency and discrimination to allow structural model testing.

Table 1. Construct reliability and validity.

Parameters	Items	Outer loading	Cronbach's alpha	CR	AVE
Academic industry- collaboration	AIC1	0.671	0.875	0.903	0.572
	AIC2	0.720			
	AIC3	0.837			
	AIC4	0.768			
	AIC5	0.745			
	AIC6	0.727			
	AIC7	0.813			
Career self-efficacy	CSE1	0.706	0.823	0.861	0.528
	CSE10	0.163			
	CSE2	0.801			
	CSE3	0.810			
	CSE4	0.793			
	CSE5	0.751			
	CSE6	0.770			
	CSE7	0.775			
	CSE8	0.897			
	CSE9	0.876			
Teacher competency	IC1	0.804	0.906	0.928	0.682
	IC2	0.859			
	IC3	0.832			
	IC4	0.855			
	IC5	0.775			
	IC6	0.825			
Vocational ability					
Problem-solving skills	PSS1	0.530	0.929	0.916	0.547
	PSS2	0.793			
	PSS3	0.799			
	PSS4	0.653			
	PSS5	0.693			
Soft skills	SS1	0.727			
	SS2	0.778			
	SS3	0.770			
	SS4	0.805			
Technical skills	TS1	0.775			
	TS2	0.692			
	TS3	0.737			
Social support	SoS1	0.704	0.920	0.932	0.538
	SoS2	0.740			
	SoS3	0.780			
	SoS4	0.758			
	SoS5	0.751			
	SoS6	0.711			
	SoS7	0.767			
	SoS8	0.749			
	SoS9	0.693			

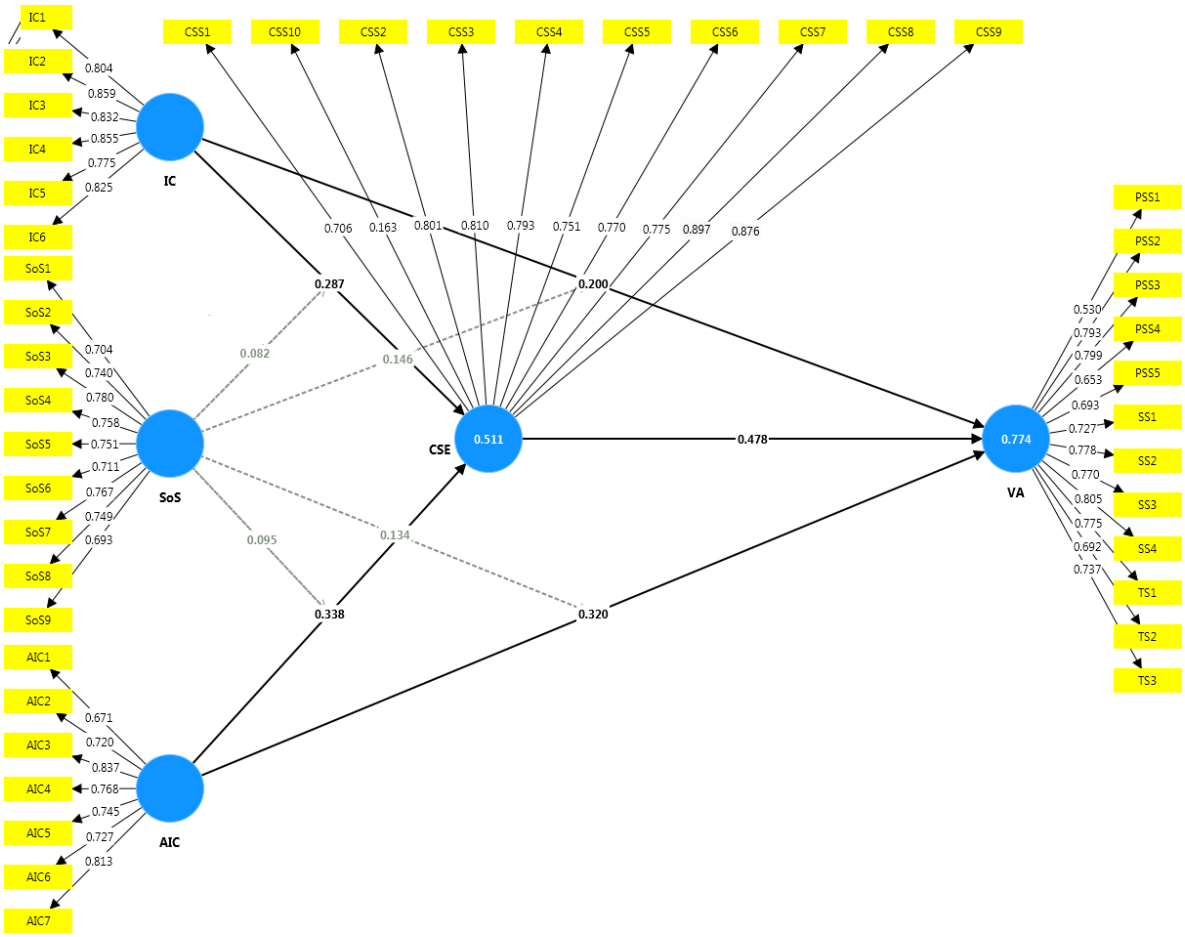

Figure 2. Measurement model.

4.2. Discriminant Validity

Table 2's Heterotrait-Monotrait (HTMT) ratio discriminant validity results show that the model's constructs are distinct. The constructs are not highly associated and have sufficient discriminant validity because the HTMT values are below 0.85. Academic-industry collaboration and professional self-efficacy have an HTMT ratio of 0.695, indicating that they are empirically distinct but connected. The association between occupational ability and teacher competency is 0.806 which is moderately high yet acceptable. Social support results confirm the model's discriminant validity as its HTMT values are much lower than academic-industry collaboration and vocational competence, which have values of 0.200 and 0.173, respectively. This shows that social support is important in the framework. These findings support theoretical component differentiation, enhancing the model's structural research and hypothesis testing.

Table 2. Discriminant validity (HTMT).

Parameters	AIC	CSE	IC	SoS	VA
Academic- industry collaboration	0.121				
Career self-efficacy	0.695				
Instructor competency	0.784	0.687			
Social support	0.200	0.550	0.212		
Vocational ability	0.836	0.835	0.806	0.173	0.236

4.3. Coefficient of Determination and Q2

According to Table 3, the model's coefficient of determination (R2) and predictive relevance (Q2) values explain and forecast. The R2R^2R2 score for career self-efficacy is 0.511 with teacher proficiency and industry-academic

collaboration accounting for 51.1% of variance. The moderate explanatory power of these qualities shows that they considerably influence students' work competency assessments. In occupational aptitude, career self-efficacy, teacher competency, and industry-academic collaboration explain 77.4% of the variance (R2 = 0.774). These constructs, including interpersonal, technical, and problem-solving skills significantly impact professional success. Blindfolded Q2 values for both constructs show the model's predictive significance. Career self-efficacy is 0.354 and vocational ability is 0.515. The model predicts results reliably and accurately as shown by values above zero. The model clarifies and predicts crucial constructs as shown by the results.

Table 3. Coefficient of determination and Q2.

Constructs	R2	Q2
Career self-efficacy	0.511	0.354
Vocational ability	0.774	0.515

4.4. Structural Equation Model

Direct path analysis results in Table 4 and Figure 3 show substantial correlations between constructs, verifying the assumptions. The path coefficient of 0.200 suggests that teacher competency improves occupational ability (H1). T = 3.922 and p = 0.000. This shows that teachers' ability, knowledge, and pedagogical approaches greatly impact students' occupational skills, including technical competency, problem-solving, and interpersonal skills. Instructor training is needed to improve vocational education outcomes despite the moderate coefficient. Other studies underline educators' crucial role in influencing students' cognitive and practical skills. A robust and statistically significant positive effect is shown by the path coefficient for academic-industry collaboration and vocational competence (H2), 0.320 with a t-value of 6.399 and a p-value of 0.000. Strong industry-education relationships can improve students' professional skills by providing practical training and real-world experience. The path coefficient of 0.478, t-value of 10.521, and p-value of 0.000 (H3) showed that professional self-efficacy directly affected vocational ability the greatest. This study shows that students' confidence in their career-related skills is vital to their vocational growth. These findings show that teacher competency, academic-industry collaboration, and career self-efficacy directly improve vocational abilities, suggesting a complete approach to vocational education outcomes.

Table 4. Direct path analysis.

Hypotheses	Relation	Path coefficient	t value	P value
H1	IC -> VA	0.200	3.922	0.000
H2	AIC -> VA	0.320	6.399	0.000
H3	CSE -> VA	0.478	10.521	0.000

4.5. Mediation Assessment

The mediation analysis shows that career self-efficacy mediates the relationship between teacher competency and academic-industry cooperation and vocational ability (see Table 5). Teacher competency indirectly affects occupational ability through professional self-efficacy (H4) as shown by a path coefficient of 0.137, a t-value of 3.693, and a p-value of 0.000.

This study shows that teacher competency directly influences occupational ability and boosts students' career self-efficacy. Competent teachers improve students' vocational achievements by enhancing their technical, cognitive and career confidence.

This mediation emphasizes teachers' roles as skill developers and self-efficacy builders, supporting social cognitive theory that self-beliefs improve performance. A t-value of 3.964, a p-value of 0.000, and a path coefficient

of 0.161 support professional self-efficacy as a mediator between academic-industry collaboration and vocational ability (H5).

This result shows that academic-industry relationship benefits go beyond quick professional development. Industry partnerships provide hands-on learning and confidence in students' ability to overcome career hurdles and flourish in professional settings. These contacts boost career self-efficacy, a crucial psychological mechanism. As career self-efficacy mediates the linkages between necessary traits and vocational competence and improves skill development programs, it is crucial to vocational education.

Table 5. Mediation analysis.

Hypotheses	Relation	Path coefficient	t value	P value
H4	IC -> CSE -> VA	0.137	3.693	0.000
H5	AIC -> CSE -> VA	0.161	3.964	0.000

4.6. Moderation Assessment

Table 6 shows that social support strongly moderates vocational competence and professional self-efficacy interactions. Path coefficient (0.146), t-value (2.339), and p-value (0.010) indicate statistically significant positive moderation in teacher competency and social support for occupational ability (H6). Social support from peers, family, or institutional networks amplifies the positive benefits of teacher competency in occupational skills, including technical, problem-solving, and interpersonal skills. Social ties enhance the benefits of education, allowing students to better use their teachers' help.

Academic-industry collaboration and social support interact to affect vocational competence (H7) with a path coefficient of 0.134, a t-value of 2.336, and a p-value of 0.010. Strong social networks are needed to turn industry-academic interactions into skill development. Social support helps students collaborate and maximize their industry experience by encouraging and providing tools. It strongly influences the link between professional self-efficacy and independent factors and moderates the relationship with vocational skill. A path coefficient of 0.082, a t-value of 4.253, and a p-value of 0.000 indicate significant moderation of the teacher competency and social support interaction effect on professional self-efficacy (H8).

This shows how social support boosts students' trust in skilled teachers and vocational self-efficacy. Social support significantly mediates the association between academic-industry collaboration and career self-efficacy (H9) with a path coefficient of 0.095, a t-value of 2.215, and a p-value of 0.000. The findings show that social support helps students internalize the benefits of academic-industry interactions and gain career-related confidence. The data show that social support improves academic-industry collaboration and instructor competency on career self-efficacy and vocational outcomes, stressing its value in vocational education.

Table 6. Moderation analysis.

Hypotheses	Relation	Path coefficient	t value	P value
H6	SoS x IC -> VA	0.146	2.339	0.010
H7	SoS x AIC -> VA	0.134	2.336	0.010
H8	SoS x IC -> CSE	0.082	4.253	0.000
H9	SoS x AIC -> CSE	0.095	2.215	0.000

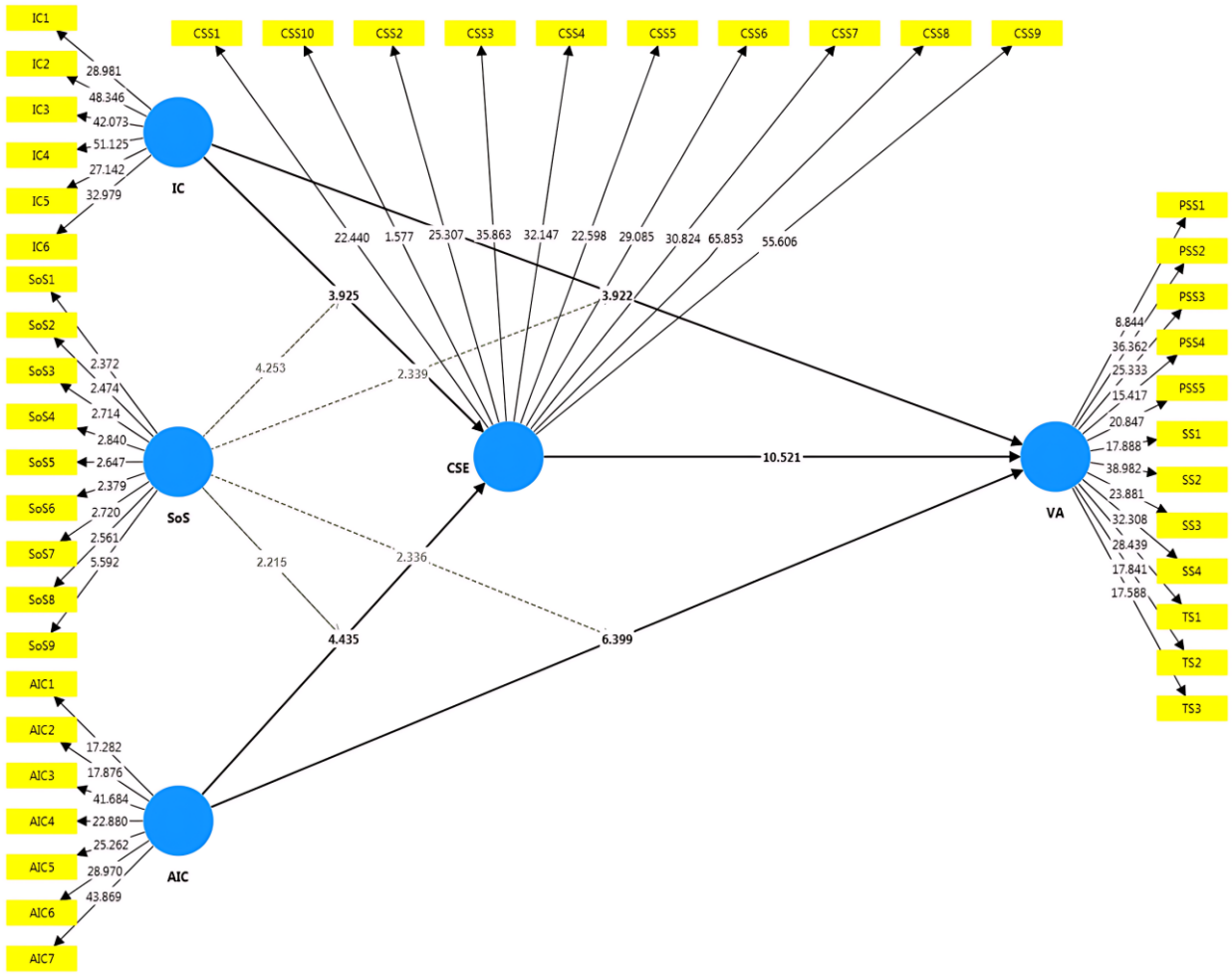

Figure 3. Structural model.

5. DISCUSSION

This study shows the complicated links between teacher competency, industry-academic collaboration, professional self-efficacy, social support, and vocational ability. The results confirmed all expectations, suggesting that these variables are interrelated and strongly affect students' occupational skills. This discourse interprets these findings and connects them to earlier research to contextualize these relationships in vocational education, particularly for Chinese students at higher vocational institutions. The study's major finding is that vocational skills improve teacher competence. This conclusion supports prior research showing that teachers are crucial to students' occupational development (Stephen & Festus, 2022). Professors with extensive subject matter experience and teaching skills can help students improve their technical, problem-solving, and interpersonal skills, including communication and teamwork. This supports the idea that effective instruction improves hard and soft skills to prepare students for the workforce (Wang et al., 2022). Vocational education teachers must be skilled since skill acquisition leads to employment. Multiple studies have shown that teachers' topic understanding and teaching qualities improve academic performance and real-world competency (Li, 2021). This study strengthens the case for quality vocational education by showing that students' ratings of their teachers' effectiveness are positively correlated with their vocational aptitude.

The study found that industry-academia cooperation and teacher proficiency improve occupational capabilities. This supports prior research on the benefits of educational-industry collaboration in acquiring labor-market-relevant skills (Birendra, Dhungana, & Dangi, 2021). Industry-academic partnerships give students internships, training, and industry contacts. Students need experiential learning to use theoretical knowledge in real-world circumstances to improve technical and analytical skills (Ma & Ding, 2022). Working with industry partners helps

students develop soft skills like adaptability, communication, and cooperation, which are crucial in the workplace. This study emphasizes the benefits of industry-academic collaboration by incorporating industry experiences into vocational education programs to prepare students for successful employment. These alliances ensure that school curriculum meet industrial needs in the fast-changing employment market (Kuper, 2020). The study discovered a substantial positive correlation between occupational aptitude and professional self-efficacy. This finding supports career self-efficacy research, which shows that people with high self-efficacy are more likely to pursue career-related tasks, persevere through challenges, and develop the skills needed for success. Career self-efficacy affects students' confidence in using their talents and drive to learn (Zeng et al., 2022). Vocational students with high professional self-efficacy are more likely to believe in their future career success, which encourages skill acquisition. Career self-efficacy affects how students handle educational issues with stronger self-efficacy predicting resilience (Kang & Zhang, 2022). The study shows that career self-efficacy in vocational education improves students' occupational abilities by raising their confidence in their skills.

Career self-efficacy mediated the association between teacher proficiency and vocational ability, as well as industry-academic partnership and vocational competence. The findings showed that career self-efficacy affects both interactions, revealing how teacher competency and industry-academic collaboration affect vocational capability. This supports social cognitive theory, which emphasises self-efficacy in student learning (Han, Kelley, & Knowles, 2021). Career self-efficacy mediates teacher competency. Students who view their teachers as competent are more likely to develop strong self-beliefs, improving their vocational skills. Industry-academic collaboration improves vocational competence by boosting career self-efficacy, so students who benefit from industry relationships are more likely to use their abilities in the workplace. Professional self-efficacy, which is essential for industry-academic cooperation and educator proficiency, emphasizes the importance of student self-confidence. A previous study found that self-efficacy mediates the relationship between environmental characteristics including classroom quality and industry exposure and professional achievement (Zhao, Zeng, & Deng, 2024). The study found that social support affects the association between teacher competency and professional self-efficacy and industry-academic collaboration. Social support strengthened professional self-efficacy-independent factor relationships. This suggests that students with stronger social support from peers, family, and mentors will benefit more from outstanding instruction and industry-academia collaboration. The social support hypothesis states that emotional, informational, and instrumental support reduces stress and boosts confidence. This discovery supports this theory. Social support is crucial to vocational students' career self-efficacy. It equips and inspires people to overcome obstacles and achieve professional goals. Studies show that social support boosts students' motivation, perseverance, and well-being, improving academic and career performance. The study shows that students need supportive surroundings to get emotional and practical help from their social networks. This support boosts teacher proficiency and industry-academic partnerships, giving students confidence in their career-relevant abilities.

6. CONCLUSION

This analysis highlights the role of teacher proficiency, industry-academic relationships, professional self-efficacy, and social support in determining higher vocational school students' vocational abilities. Data shows that teacher proficiency and industry-academia partnerships improve occupational aptitude. Career self-efficacy mediates and social support moderates these linkages. These findings emphasize the relevance of instructional quality, professional connections, supportive learning environments, and student self-esteem. The study adds to vocational education literature by showing how these attributes affect students' technical, problem-solving, and soft skills. Despite its limitations, cross-sectional design, small sample size, and self-reported data, the study provides a solid foundation for future research. Future studies that address these limitations and investigate new elements and mechanisms can clarify this research's theoretical and practical implications. This will enhance vocational education and prepare students for the workforce.

6.1. Implications

6.1.1. Practical Implications

This research is important for improving vocational education programs, especially in China's higher vocational institutions. These findings emphasize the importance of teacher knowledge in developing students' vocational abilities. Developing technical and emotional competences requires subject matter understanding and teaching skills from vocational teachers. Since vocational ability and teacher competency are positively correlated, institutions should fund professional development programs that focus on instructional effectiveness, giving teachers the tools they need to engage students and improve learning. Vocational schools should foster subject matter experts and mentors who can help students learn job skills including communication, cooperation, and problem-solving. Teaching quality and job readiness can improve in schools that promote teacher competency. This study emphasizes industry-academic cooperation. This type of teamwork improves students' technical, problem-solving, and interpersonal skills, according to the research. Vocational institutions must work closely with industry partners to create sector-specific curricula and training programs to reap these benefits. Internships, apprenticeships, and industry partnerships give students practical skills. Educational institutions may develop business advisory groups to keep the curriculum current and relevant to labor market needs. This study shows that industry interaction improves students' technical competency and workplace readiness. Thus, vocational schools should prioritize industrial relationships.

Career self-efficacy's mediation of teacher competency, industry-academic collaboration, and vocational skills has significant practical effects. The research shows that students' work skills confidence is crucial to their vocational competency development. Career self-efficacy treatments should be included in educational programs, especially for students who may be less confident. Career development, goal-setting, and self-esteem workshops and counseling can boost students' self-efficacy. Teachers and mentors should also give constructive feedback, encourage tenacity, and foster a growth mindset to boost students' self-efficacy. This study shows that vocational education is essential to professional and academic success, not only self- confidence. This study found that social support moderates vocational education program design. The data show that students with strong social support networks benefit more from teacher proficiency and industry-academia collaboration. Vocational schools should establish caring cultures that help students emotionally and practically. Mentorship programs, peer support networks, and better professor-student communication are examples. Social assistance helps students overcome obstacles and move into the workforce, in addition to academic success. By emphasizing social support, institutions can help students build resilience for vocational training and employment.

6.1.2. Theoretical Implications

This finding has major theoretical consequences, especially for our understanding of vocational skill development mechanisms. The study shows that teacher proficiency and industry-academia partnership drive vocational competency. This discovery fits vocational education theoretical frameworks. The study highlights career self-efficacy's mediation role, improving the literature. According to social cognitive theory, self-efficacy motivates people to achieve goals and overcome obstacles (Bandura, 1986). The study shows that career self-efficacy mediates the relationship between instructor competency, industry-academic collaboration, and vocational skills, expanding social cognitive theory in vocational education. This emphasizes the need for self-confidence in applying schoolwork to work. This finding helps explain how internal elements like self-efficacy interact with external factors like industry experience and instructional quality to affect students' occupational achievement. This study also confirms that social support moderates the relationship between educational and professional qualities. Social support enhances teacher competency and industry-academic collaboration on professional self-efficacy, promoting personal development in vocational education. According to the social support theory (Chan, 2020) external social influences can boost psychological resources and minimize stress. Social support boosts career self-efficacy and

provides emotional relief in vocational education. This moderating effect shows that individual, contextual and institutional factors are essential for professional self-efficacy and vocational competence. The study's findings advance theoretical discussions on vocational education and career growth. This study examined how teacher competency, industry-academic collaboration, career self-efficacy, and social support affect vocational skills results and found that internal and external factors affect vocational education outcomes. This comprehensive approach is essential for creating occupational development models that include individual and institutional factors. The findings show that vocational education involves technical knowledge, professional self-efficacy, and social network building. This theoretical contribution clarifies the complex relationship between variables that determine vocational results. It also prepares for future research on other variables or educational contexts.

6.2. Imitations and Future Direction

6.2.1. Limitations

The study has improved our understanding of higher education occupational ability factors, although it has certain limitations. The study's cross-sectional design is problematic. Cross-sectional studies capture variable interactions at a specific time, making causal correlations difficult to discern. Teacher competency, industry-academic collaboration, professional self-efficacy, social support, and vocational ability have significant relationships, but the study's cross-sectional methodology limits causation conclusions. Future research should use a longitudinal approach to better understand these connections' development and causal pathways. Longitudinal research would reveal how teacher competency, industry involvement, and social support affect professional self-efficacy and vocational skills. Another drawback is the study's narrow emphasis on Chinese students in higher vocational institutes. The findings provide valuable insights into Chinese vocational education, but they may not apply to other educational or cultural environments. The socioeconomic, educational, and labor market variables of different nations may affect this study's relationships. Therefore, future research should repeat this work across other cultural or geographic contexts to determine if the found connections are consistent throughout educational systems. Cross-cultural research would refine vocational education theoretical models influenced by varied cultural contexts, improving generalizability. This study had 150 participants, which was enough for statistical analysis but small. The limited sample size may limit the application of the findings to higher vocational institution students, but they support the predictions. A larger and more diverse sample should be used in future studies to improve external validity. A larger sample size might improve results robustness and generalizability. This would allow researchers to study demographic subgroups, such as gender, socioeconomic background, and academic achievement-related vocational aptitude disparities. This may help explain how these traits affect vocational abilities. Due to the survey technique, this study relies on self-reported data. Social desirability bias is common in self-report questionnaires. This bias makes people say what they think is socially acceptable or expected rather than the truth. Career self-efficacy, teacher competency, and industry-academic collaboration may have been overestimated or underestimated due to this bias. In future studies, objective vocational skill evaluations or peer assessments may supplement self-reported data to overcome this limitation. This would improve the evaluation of affecting factors and reduce self-report biases.

6.2.2. Future Direction

No other potentially relevant variables were evaluated; the study examined teacher competence, industry-academic collaboration, career self-efficacy, social support, and occupational skills. Motivation, academic success, and personality might affect students' self-efficacy and occupational abilities. Including these variables in future studies may help explain occupational competency determinants. The study did not explore how institutional factors like curriculum quality or career services affect occupational competence. Further research may incorporate these attributes and evaluate how their interactions with the variables analyzed in this study affect occupational

outcomes. This work improves our understanding of occupational competency factors but does not address the underlying mechanisms. The study shows that career self-efficacy links occupational aptitude, teacher proficiency, and industry-academic collaboration but it does not explain why. Qualitative research should examine the cognitive, emotional, and motivational processes that underlie these linkages to better understand students' perspectives. This would clarify how this study's components affect vocational outcomes. Future research could evaluate how different teaching methods, social support structures, and business collaborations affect vocational competence and career self-efficacy, providing more precise educational recommendations.

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Transparency: The authors state that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
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