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Vocational Teachers' Professional Identity Work in Platform-mediated, Datafied Vocational Education and Training: A Grounded Theory Study in China

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Abstract: *Against the backdrop of platform-mediated and datafied educational digital transformation, vocational education and training teachers are increasingly required to reorganize their teaching, assessment, and interactional practices through digital platforms and data-driven systems. These changes profoundly reshape teachers' professional identity, yet empirical research has rarely examined how VET teachers actively engage in professional identity work under such conditions. Drawing on social constructivism and identity work theory, this study adopts a grounded theory approach to explore how vocational teachers in China construct, negotiate, and sustain their professional identity in platform-mediated, datafied VET contexts. Based on in-depth interviews with 21 vocational college teachers across disciplines, career stages, and institutional settings, the study identifies 62 initial concepts, 14 categories, and four main dimensions—personal background, institutional environment, interactional practices, and identity roles. The findings reveal a dynamic process model in which vocational teachers' professional identity is continuously produced through cycles of policy sensemaking, platform enactment, data-based reflection, and institutional legitimation. The study further proposes optimization pathways for supporting VET teachers' professional development by strengthening teacher agency, platform governance, and identity recognition in digitally transformed vocational education systems.*

Keywords: *Professional Identity; Identity work; Vocational Education and Training; Platformization; Datafication; Grounded Theory; China*

1. Introduction

The professional identity of teachers has emerged as a critical area of study in educational research, particularly in the context of digital transformation. In vocational education and training , the rapid adoption of digital platforms and data-driven systems has reshaped not only how teaching is conducted but also the professional identities of those who teach. As VET teachers are increasingly required to incorporate these technological innovations into their practice, understanding the ways in which these changes influence their professional self-concept becomes essential. Despite the growing body of research on teacher identity, empirical studies that explore how VET teachers engage in identity work in the context of digital transformation are still limited.

Existing frameworks of professional identity have largely focused on its multidimensional aspects, including cognitive, emotional, and relational factors[1]. Scholars argue that teacher identity is a dynamic and evolving construct, shaped by the interaction between teachers and their professional environments[2]. This dynamic process of identity formation requires teachers to continuously negotiate their roles, adapting to new policies, technologies, and pedagogical practices. Research has shown that professional identity is not a static set of characteristics, but rather a process of negotiation and adaptation in response to both external and internal influences[3]. At the macro level, national policies and institutional reforms influence teachers' sense of professional purpose, while at the micro level, teachers' personal experiences, including their educational background and teaching practice, shape their identity[4].

In the context of digital transformation, VET teachers face new challenges that complicate traditional understandings of professional identity. The shift towards digital platforms, datafication of

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education, and changing pedagogical demands require teachers to adopt new roles that integrate technology, industry knowledge, and traditional educational methods. However, the ways in which these technological and societal changes influence VET teachers' professional identity—how they interpret and negotiate their roles, and how they navigate their personal and professional values within these new frameworks—remain underexplored. This study aims to fill this gap by examining the professional identity work of vocational education teachers in China, with a focus on how they navigate digital platforms and data-driven educational environments.

2. Literature Review

Teachers' professional identity has garnered significant attention in educational research, particularly in the context of evolving teaching environments. In the rapidly transforming landscape of vocational education and training , where technological advances and digital platforms are increasingly integrated into teaching, understanding how these changes impact the professional identity of VET teachers is crucial. Existing studies on teacher identity have largely focused on its cognitive, affective, and relational dimensions, conceptualizing it as a dynamic construct that evolves through continuous negotiation between teachers' personal values and external contextual pressures. This dynamic nature of professional identity highlights the need for a comprehensive understanding of how VET teachers navigate the complex intersections between technology, pedagogy, and industry.

Research on professional identity has consistently shown that it is not a static trait but rather a developmental process shaped by both internal and external factors. From a macro perspective, national educational policies and socio-political agendas exert a profound influence on teachers' role perceptions and professional positioning. At the meso level, institutional factors such as organizational climate, professional development opportunities, and teacher-student relationships play a critical role in fostering positive identity formation[5].Furthermore, individual-level factors—such as teachers' personal experiences, educational backgrounds, and career trajectories—have been found to significantly influence their professional identity.

Empirical studies also highlight the reciprocal relationship between professional identity and professional development. Higher levels of professional identity are linked to greater motivation and engagement in professional development activities, which, in turn, reinforce teachers' professional growth[6]. Moreover, a strong professional identity is seen as a driving force behind the development of teachers' competencies, particularly in areas related to moral and professional behavior[7]. Professional development initiatives, such as curriculum reforms, further encourage teachers to reflect on and adapt their professional identities, enabling them to align their personal growth with evolving educational practices[8].

Despite the growing body of research on teacher professional identity, most studies have concentrated on general education contexts, with relatively little attention paid to the vocational sector[9]. Furthermore, while research has conceptualized identity as a relatively stable set of attributes, less emphasis has been placed on how vocational education teachers actively engage in professional identity work in the face of technological transformation[10]. In particular, the integration of digital platforms, datafication of educational practices, and related policy reforms remain underexplored in existing literature. This study addresses this gap by examining how VET teachers in China engage with and negotiate their professional identity within the context of digital transformation.

3. Method

3.1 Theoretical Framework

This study adopts a social constructivist approach, which offers a comprehensive framework for understanding how vocational teachers construct and negotiate their professional identities in the context of digital transformation. Social constructivism emphasizes that knowledge and understanding are co-constructed through interactions with others in specific sociocultural contexts[11]. The foundation of this theory can be traced to Piaget's cognitive development theory, which posits that individuals actively build cognitive schemas through assimilation and accommodation when engaging with their environment. Vygotsky's extension of this theory highlights the importance of social interaction in cognitive development, particularly within the "zone of proximal development," where individuals advance their understanding through collaboration with more experienced others. This theoretical lens

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is crucial for understanding how VET teachers integrate new technologies, pedagogies, and professional practices into their teaching, shaping their identities in the process.

In the digital age, these interactions are mediated not only by traditional sociocultural factors but also by digital tools and platforms. Thus, this study utilizes social constructivism to explore how vocational teachers' identities evolve through their engagement with digital platforms and datafication in VET contexts. By applying grounded theory, the study aims to reveal the underlying processes and structures that inform teachers' professional identity formation in response to these new educational environments[12].

3.2 Participants and Sampling

The study employs purposive sampling to select 21 vocational education teachers from various disciplines, career stages, and institutional settings across China. The sample includes early-career teachers, mid-career teachers, and senior teachers nearing retirement, ensuring a diverse range of experiences and perspectives. This varied sample is critical to understanding how professional identity is shaped across different career trajectories and institutional contexts.

The participants were selected based on their teaching experience and engagement with digital transformation in vocational education. As shown in Table 1, the sample encompasses diversity in terms of different age groups, academic disciplines, and teaching backgrounds, ensuring a comprehensive observation of how professional teachers construct their professional identities in a platform-based, data-driven environment. Teachers' educational backgrounds, professional qualifications, and experiences in adapting to digital platforms were central criteria in the selection process, as these factors are likely to influence their identity work in significant ways.

Table 1: Profile of interview participants (n = 21).

No.	Age	Years of Teaching Experience	Subject Taught	Educational Background
A1	26	2	Machine Manufacturing	Bachelor's Degree
A2	38	6	New Energy	Master's Degree
A3	29	4	Cost Accounting	Bachelor's Degree
A4	36	11	Chinese Language	Bachelor's Degree
A5	32	5	Current Affairs and Policy	Master's Degree
A6	60	37	Biological and Food Engineering	Master's Degree
A7	31	9	Political Education	Bachelor's Degree
A8	27	2	Agricultural Science	Master's Degree
A9	47	22	Mathematics	Bachelor's Degree
A10	44	21	Political Education	Master's Degree
A11	25	1	Chinese Language	Bachelor's Degree
A12	30	8	Political Education	Master's Degree
A13	41	16	Mechanical Numerical Control	Bachelor's Degree
A14	38	15	High-Star Hotel Operations and Management	Bachelor's Degree
A15	45	22	Mathematics	Bachelor's Degree
A16	40	17	Computer Science	Bachelor's Degree
A17	34	6	Electrical Engineering	Master's Degree
A18	43	22	Agricultural Science	Bachelor's Degree
A19	48	21	Physics	Bachelor's Degree
A20	35	12	Architecture	Bachelor's Degree
A21	31	6	Nursing	Bachelor's Degree

3.3 Data Collection and Analysis

Data collection was conducted through semi-structured interviews with the selected participants. The interviews focused on teachers' experiences with digital platforms, data-driven evaluation, and their professional practices in digitally mediated environments. These interviews aimed to capture how VET teachers engage with and adapt to technological changes, and how these changes shape their professional identity.

The interview questions were designed to probe teachers' perceptions of their evolving roles, challenges faced during the digital transformation process, and their strategies for adapting to new technologies in teaching. All interviews were transcribed verbatim and analyzed using NVivo software. Thematic analysis was used to identify and categorize key themes that emerged from the data. Following grounded theory procedures, data analysis proceeded in stages: open coding, axial coding, and selective coding. As shown in Table 2, through continuous comparison, a total of 62 initial concepts were identified and clustered into 14 categories. Subsequently, these categories were

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integrated into four main dimensions: personal background, institutional environment, interactive practices, and identity roles.

Table 2: Examples of open coding categories.

Categories	Initial Concept Coding	Primary Materials and Event Extracts
Personal Perception	Digital Teaching Capability Awareness	As educators, we should optimize digital teaching resources, promote the application of online teaching platforms, and innovate teaching and assessment models.
	Perceptions and Understanding of Vocational Education	In the past, society viewed vocational education as detached from practical realities. This perception must now change
	Understanding Digital Policies in Vocational Education	After transitioning to vocational education, I discovered that it truly holds immense potential. The nation's development model and direction for vocational education are becoming increasingly clear.
Personal Experience	The Opportunity to Pursue a Career in Vocational Education	At the time, I chose vocational education to secure employment. After prolonged exposure, I found it quite challenging, yet it significantly contributed to my personal growth.
	Challenges in Integrating Technology into Teaching	To adapt to the university's development and transfer to the New Energy College, I need to adjust my professional knowledge structure, which has been quite challenging. Although online resources are abundant, the university offers limited systematic training in this area.

The core task of core coding is to deeply explore the intrinsic logical connections among the initial categories formed through open coding. By rationally categorizing and associating these categories, higher-level main categories are constructed to enhance the rigor and clarity of the research's logical structure. Based on a comprehensive and in-depth analysis of the initial concepts derived from open coding. (See Table 3) These concepts were further refined and consolidated through iterative sorting and distillation into four main categories.

Table 3: Spindle Encoding.

Primary Category	Category	Interpretation of the Implied Meaning
Personal Background	Personal perception	"Personal cognition" refers to vocational education teachers' perception of their own digital teaching capabilities, their understanding of the essence of vocational education, and their interpretation of the policy environment. "Personal experience" refers to the technical application experience accumulated by vocational education teachers in digital teaching practices. "Personal competence" refers to teachers' digital literacy, teaching method innovation capabilities, and lifelong learning abilities.
	Personal Experience	
	Personal Capabilities	
Environment	Social Development	"Social Development" refers to the demand for technical and skilled personnel in the era of intelligent manufacturing, the impact of demographic shifts on vocational education enrollment, and society's reevaluation of vocational education's value. "External Policy and Institutional Environment" denotes the top-level design of national policies guiding vocational education's digital transformation, along with the opportunities and challenges arising from institutional reforms. "School-Driven Promotion" signifies institutions supporting teaching innovation by providing digital equipment, organizing teacher training, and establishing industry-academia collaboration platforms.
	External Policy and Institutional Environment	
	The school encourages and promotes	
Interactive	Digital Dynamic Feedback Between Teachers and Students	"Digital Dynamic Feedback Between Teachers and Students" refers to real-time interactive feedback and formative assessment of learning issues facilitated by digital tools. "Digital Home-School Collaboration" denotes parents participating in students' learning processes through digital platforms to foster a unified educational effort. "Digital Collaborative Experience Among Colleagues" describes the process of teachers jointly addressing teaching challenges and innovating educational practices.
	Digital Home-School Collaboration	
	Digital Collaboration Experience for Colleagues	
Identity Role	Character Value	"Role value" refers to vocational education teachers' recognition of their own value in the digital era. "Role understanding" refers to teachers' interpretation of the essence of their professional identity. "Role identity" refers to teachers' sense of belonging and professional dignity associated with their identity as digital vocational educators. "Role responsibilities" refer to the specific duties teachers must fulfill.
	Character Understanding	
	Role identification	
	Role Responsibilities	

Selective coding is a critical step in grounded theory research[13], aimed at precisely identifying and integrating core concepts from numerous categories to refine the theoretical framework and reveal the essence and inherent logic of the research phenomenon[14]. By further clarifying the relationships among the four main categories, the core categories of this study were distilled[15]. Figure 1 systematically constructs the analytical model for "factors influencing vocational education teachers' professional identity[16].

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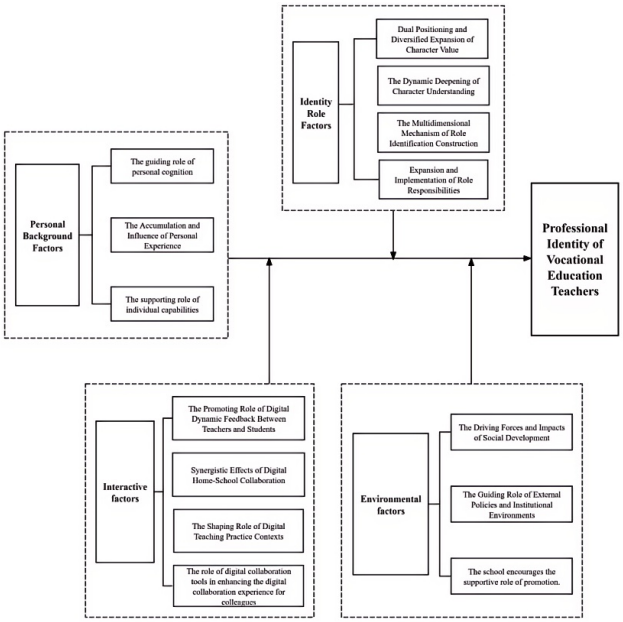

Figure 1: Process model of vocational teachers' professional identity work in platform-mediated, datafied VET.

Following Pandit's theoretical saturation testing methodology, the reserved three interview datasets underwent a new round of open, axial, and selective coding.

The analysis followed an iterative process, where categories were refined and interrelationships were explored through a systematic, inductive approach. Theoretical saturation was achieved when no new categories or subcategories emerged from the ongoing analysis, indicating that the model of professional identity work developed in this study had reached a point of conceptual completeness.

4. Factors Influencing the Professional Identity of Vocational Education Teachers in the Era of Digital Education

Through in-depth analysis of interview data, this study reveals key factors influencing vocational education teachers' professional identity from multiple dimensions—personal background, environment, interaction, and identity roles. These factors intertwine to collectively shape teachers' perceptions and positioning of their professional roles.

4.1 Personal Background

The personal background of vocational education teachers is a fundamental factor in shaping their professional identity, particularly in the context of digital education. Teachers' perceptions of their own digital competencies play a significant role in influencing their confidence and initiative when integrating digital tools into their instructional practices. Educators who view their digital teaching abilities positively—believing that they can effectively utilize digital resources—are more likely to engage actively in exploring innovative teaching methods and participating in digital reform initiatives. Teacher A19 highlighted this shift, stating, "We educators should optimize digital teaching resources, promote the application of online teaching platforms, and innovate teaching and assessment models. Digital transformation means evolving from mere instructors to becoming guides, collaborators, and facilitators for students." This statement reflects the evolving self-perception of educators in the digital era, with teachers recognizing their expanded role as facilitators rather than just knowledge transmitters. Such transformations reinforce their identification with their changing professional identity.

Furthermore, teachers' accumulated experience with digital teaching practices has a profound impact on their professional identity. With time and experience, teachers become more familiar and proficient in utilizing digital tools, which enhances their teaching effectiveness. Teacher A10 remarked, "From the early days of chalkboards, overhead projectors, and computer labs, to today's smart lab equipment, interactive teaching devices, and simulation software—these innovations continuously

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challenge traditional educational models and enhance the appeal of teaching in the digital age." As teachers transition from traditional methods to digital tools, they develop a deeper appreciation for these innovations. The increasing proficiency in using such tools not only improves teaching outcomes but also strengthens teachers' professional identity as digital educators. This continuous process of adaptation and integration of technology into teaching is integral to shaping their role and identity in the digital age.

Additionally, teachers' personal competencies, including digital literacy and lifelong learning abilities, further influence their professional identity. Those who engage in continuous professional development and strive to enhance their digital competencies are better equipped to navigate the challenges of digital transformation[17]. Teacher A13 emphasized the importance of ongoing learning, stating, "The school annually organizes a certain percentage of teachers to participate in national and provincial training programs, covering topics like digital education training and professional knowledge updates. Participating in these activities has made me feel more valued." Such professional development initiatives not only improve teachers' technological skills but also reinforce their sense of professional worth, contributing to a stronger sense of identity and pride within the educational community.

4.2 Institutional Environment

The institutional environment plays a critical role in shaping vocational education teachers' professional identity, particularly in the context of digital transformation. The availability of digital equipment and the provision of training and professional development opportunities are central to fostering an environment that supports teachers in adapting to digital education. Schools that invest in technology and provide platforms for continuous learning help teachers feel valued and competent in their digital teaching roles. Teacher A13 noted, "The school annually organizes a certain percentage of teachers to participate in national and provincial training programs, covering topics like digital education training and professional knowledge updates. Participating in these activities has made me feel more valued." This recognition of the institution's role in professional development reinforces teachers' sense of belonging and strengthens their professional identity.

In addition to institutional support, societal recognition of vocational education as a vital educational sector has become increasingly important. The demand for skilled technical personnel in the era of intelligent manufacturing has highlighted the significance of vocational education. Teacher A11 emphasized, "Under the current talent demand structure where '70% of the workforce consists of technical industrial workers,' vocational education must strengthen its integration with industry to cultivate more high-quality technical and skilled personnel who meet the practical needs of enterprises." This recognition has helped teachers redefine the purpose and goals of vocational education, making them more focused on developing students' practical abilities and professional competencies. As vocational education continues to gain societal respect, teachers in this field experience greater recognition of their professional value, which enhances their professional identity and pride.

Moreover, the implementation of national policies has significantly impacted teachers' professional identity. The top-level design of policies, such as the 21 Measures for Vocational Education and the new Vocational Education Law, provides clear direction for the digital transformation of vocational education. Teacher A2 remarked, "Vocational education holds great potential. This is reflected in policies such as the 21 Measures for Vocational Education, the new Vocational Education Law, and the construction of dual-high schools." Teachers' understanding of these policies enables them to align their teaching practices with national goals, thereby reinforcing their professional identity and ensuring that their work contributes to the broader educational and economic development agenda[18]. By adapting to these policy frameworks, teachers not only fulfill their responsibilities but also enhance their professional standing in the digital age.

4.3 Interactional Practices

A collaborative support network emerges among vocational education teachers through resource sharing and joint curriculum design. In digital teaching environments, educators often encounter similar instructional challenges. As Teacher A12 noted, "By sharing digital teaching resources, teachers can save lesson preparation time and enhance teaching quality." This mutual exchange not only facilitates teaching but also enables teachers to innovate together, collaboratively designing courses based on

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specific instructional needs. Such collaborative efforts—ranging from exploring curriculum goals to selecting teaching methods—serve to strengthen teachers' sense of professional responsibility and value.

Real-time interaction and formative assessments, facilitated by digital tools, create new opportunities for communication and exchange between teachers and students. Teacher A7 emphasized, "We use online quizzes to gauge students' mastery of key concepts and promptly adjust teaching content and pacing based on the results." This capacity for immediate feedback enhances the ability of teachers to address individual student needs more effectively, providing tailored support that boosts their confidence in their teaching and reinforces their professional identity. Through continuous, dynamic feedback loops with students, educators refine their pedagogical practices, experience stronger connections with learners, and further solidify their roles as guides in the learning process.

Moreover, the interaction extends beyond teachers and students to include parents, fostering a powerful synergy between home and school education through digital platforms. Parents can track students' assignments, grades, and overall performance, which enables them to offer timely insights and support[19]. Teacher A21 shared, "Through parent communication, I've gained insights into students' home study habits and interests, enabling me to tailor instruction to individual learning styles." This deeper collaboration with parents enhances teachers' sense of responsibility and reinforces their identity as guides not only for students' academic development but for their holistic growth as well.

4.4 Identity Roles

In the context of digital transformation, the role of vocational education teachers has diversified significantly. Teacher A19's perspective—transitioning from traditional knowledge imparting to taking on roles as facilitators, collaborators, and enablers—captures a fundamental transformation in the value of teaching roles. This shift aligns with existing research on the evolving professional self-understanding of teachers in digitally mediated contexts[20]. This transformation occurs across three dimensions. As technology enablers, teachers such as A12 integrate digital platforms into teaching, rethinking traditional methods to enhance learning. As industry connectors, teachers A2 and A7 reinforce industry-education integration by participating in corporate research and development projects, and school-enterprise collaborations. As career guides, Teacher A16 integrates professional competency development throughout the digital teaching process. This multifaceted role positioning is indicative of a larger trend where vocational educators are evolving from being sole knowledge transmitters to becoming multifaceted professionals proficient in education, technology, and industry.

Professional identity is not a static concept but a dynamic construct shaped by multiple pathways. This process is marked by clear social construction characteristics. At the policy-driven level, Teacher A2's deep interpretation and internalization of the new Vocational Education Law provided a foundation for professional recognition within the field. At the practice-driven level, Teacher A17's professional confidence was reinforced through positive student feedback following the implementation of new assessment reforms in electrical technician training. At the level of societal recognition, Teacher A16 developed a heightened sense of professional dignity by comparing the societal standing of general and vocational education. Notably, Teacher A8's self-positioning as a "transmitter of technical civilization" illustrates how internalized values and societal meaning-making processes solidify professional identity through interaction with the broader educational context.

The scope of teachers' professional responsibilities continues to expand, becoming increasingly operationalized. Traditional responsibilities, such as updating teaching content in response to Industry 4.0 technologies (Teacher A5), developing interdisciplinary curricula (Teacher A16), and providing career guidance through digital platforms (Teacher A3), are now complemented by emerging duties. These include adapting to technological advancements (as seen in Teacher A14's continuous learning practices), addressing digital ethics (demonstrated by Teacher A17's attention to students' dependence on devices), and independently developing teaching resources (exemplified by Teacher A19). Through a continual cycle of cognition, practice, and feedback, vocational educators refine and elevate their professional identity, adjusting to the digital transformation of vocational education.

5. Discussion

This study presents a grounded, process-oriented account of vocational teachers' professional identity work within platform-mediated and datafied vocational education and training contexts.

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Building on social constructivist perspectives, the findings demonstrate that professional identity is not a fixed personal trait but an ongoing, dynamic accomplishment shaped by teachers' interactions with policy discourses, digital platforms, institutional structures, and professional communities. By positioning these findings within broader international debates on platformization, datafication, and teacher professionalism, the study makes a significant theoretical contribution and offers practical insights for educators, policymakers, and institutions navigating the complexities of digital transformation in education.

Through this study, it is evident that professional identity in the digital age is increasingly influenced by the integration of technology in teaching practices. As digital platforms and datafication become more pervasive in vocational education, teachers must navigate the challenges of adapting to new educational models while preserving the core values of their profession. As shown in Figure 2, this transformation of identity stems not only from personal experiences and cognition but is also closely linked to the social education system in which teachers operate. The research findings reveal how the development of digital technology reshapes the role of teachers, profoundly highlighting the combined influence of personal characteristics, institutional environment, and social factors on professional identity in the digital age.

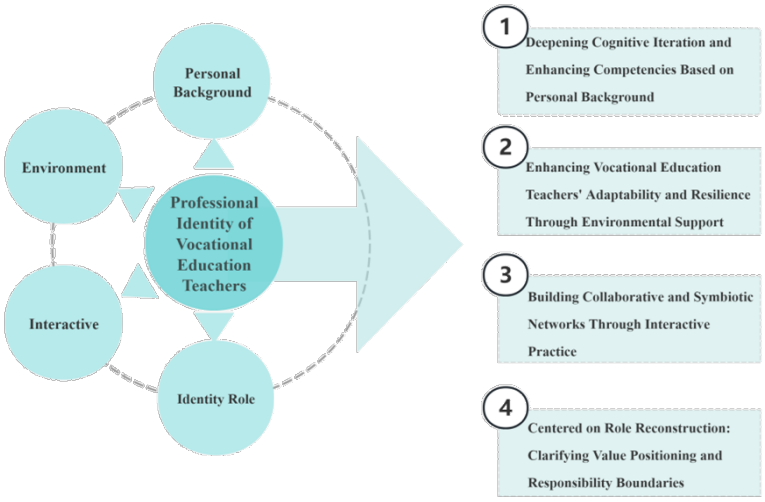

Figure 2: Flowchart of the Optimized Vocational Education Teacher Development Pathway.

5.1 Deepening Cognitive Iteration and Enhancing Competencies Based on Personal Background

Teachers' understanding of the essence of vocational education plays a crucial role in shaping their professional identity. Vocational educators are tasked with not only cultivating practical, industry-relevant skills but also developing students' professional competencies through innovative pedagogical approaches. Teachers draw upon their educational backgrounds to integrate digital teaching methods into their instructional practices, aligning them with vocational goals. This alignment reflects the socially constructed nature of professional identity formation in the context of educational transformation[21].

To respond effectively to contemporary challenges, vocational education teachers must proactively enhance their core competencies. The demand for cultivating industry-responsive and versatile talent requires teachers to go beyond traditional disciplinary boundaries, integrating multidisciplinary knowledge into their teaching. Teachers are encouraged to reconstruct their teaching content, developing cross-disciplinary instructional approaches that prepare students for the increasingly complex demands of the workforce. Within digitally mediated teaching environments, educators should leverage technological tools strategically to innovate pedagogical approaches and enhance student motivation. Furthermore, in the face of rapid technological iterations, teachers must cultivate a lifelong learning orientation, staying updated on industry developments and continuously refining their professional knowledge. The development of these competencies lays a critical foundation for adaptive identity work and ongoing professional advancement within a transforming educational landscape.

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5.2 Enhancing Vocational Education Teachers' Adaptability and Resilience Through Environmental Support

The impact of demographic shifts on vocational education enrollment cannot be overlooked. With declining birth rates and an increasingly competitive job market, vocational institutions are facing challenges in student enrollment. In response to these demographic shifts, vocational educators are tasked with enhancing the quality and appeal of their teaching practices to attract more students into vocational education. In this context, teachers must continually adjust their approaches and methods, actively adapting to new environments[22]. Teachers who embrace this adaptability demonstrate resilience and deepen their reflection on their professional identity, positioning themselves not just as knowledge disseminators but as drivers of vocational education development.

Furthermore, institutional reforms in vocational education, particularly in school management and evaluation mechanisms, play a significant role in shaping teachers' professional identity. Performance appraisal systems in some institutions place a greater emphasis on teaching outcomes and professional development, thus offering opportunities for promotion and training[23]. However, these systems also impose higher expectations on teaching capabilities and professional competence[24]. In response, educators must adjust their perspectives and practices, enhancing teaching quality through pedagogical innovation and scholarly engagement. This process of adaptation leads to significant professional growth, enabling teachers to refine their roles as both educators and lifelong learners.

In the era of digital transformation, the university-enterprise collaboration platform has become a vital bridge between educators and industry practice. Through these platforms, teachers stay informed about industry trends and corporate needs, integrating practical experiences and case studies into their teaching to enhance the relevance and applicability of the curriculum[25]. Teachers can also invite industry experts to deliver lectures and provide guidance, giving students a clearer understanding of industry developments and career requirements. This connection with the industry not only enriches the learning experience but also enhances teachers' professional identity as dual-qualified educators, strengthening their competence in both teaching and industry-related expertise.

5.3 Building Collaborative and Symbiotic Networks through Interactive Practice

In digitally mediated environments, interaction plays a pivotal role in the professional identity work of vocational education teachers. Teachers and students engage in real-time, interactive processes that enhance the learning experience. For instance, the use of Learning Progress Tracker apps enables teachers to monitor classroom engagement metrics and track homework submission progress. By integrating in-class quizzing features, teachers can assess students' understanding of key concepts and promptly adjust their teaching strategies. This dynamic interaction allows teachers to address individual student needs more effectively, enhancing both teaching quality and the professional identity of educators.

Moreover, digital platforms facilitate communication between teachers and parents, creating a collaborative network that extends beyond the classroom. Teachers post learning tasks on the platform, which are synchronized with the parent app, enabling parents to track task completion and provide feedback on home study habits. This collaborative effort between parents and teachers fosters a deeper sense of responsibility for student progress[26], enhancing the teacher's sense of professional value. Regular online parent-teacher conferences, combined with formative assessments, provide opportunities for teachers to demonstrate student progress clearly, strengthening the collaborative efforts in the educational process.

In addition, teachers must be flexible in responding to technical failures or equipment shortages. For example, if virtual simulation software malfunctions, teachers can switch to pre-recorded demonstration videos, ensuring that the learning process continues without interruption[27]. In the case of equipment shortages, teachers can adopt group hands-on activities or online virtual experiments. This adaptability reinforces teachers' professional resilience and identity, demonstrating their ability to navigate and overcome challenges in digital teaching environments.

5.4 Centered on Role Reconstruction: Clarifying Value Positioning and Responsibility Boundaries

As vocational education continues to evolve in response to digital transformation, teachers must transcend traditional roles. Teacher A19 emphasized this shift: "In digital transformation, we no longer merely impart knowledge but become learning facilitators, teamwork collaborators, technology

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enablers, and industry-academia liaisons." This transformation occurs in three stages: initially, teachers incorporate technological tools into their teaching practices, followed by a phase where they master the application of tools such as virtual simulation software and online platforms[28]. Eventually, teachers reach a stable professional positioning where they are able to systematically plan technological applications, resource allocation, and collaboration within teaching processes to maximize instructional effectiveness.

Teachers must also clearly delineate their responsibilities[29], balancing traditional duties such as updating teaching content and developing interdisciplinary curricula with emerging responsibilities like guiding technological innovation and digital ethics. Teachers are increasingly expected to stay current with new subjects and technologies, regularly updating instructional materials, guiding students on the prudent use of digital tools[30], and independently developing resources tailored to the specific needs of their professional contexts. Through this comprehensive role practice, educators build their identity and establish value within the digital education ecosystem, positioning themselves as integral players in shaping the future of vocational education.

6. Conclusion

This study, grounded in social constructivism and employing grounded theory, explores the professional identity of vocational education teachers in the context of educational digitization. Theoretically, it expands upon the traditional social constructivist interpretation of knowledge construction, revealing that vocational teachers' professional identity is a multidimensional, developmental construct shaped by their interactions with policy frameworks, technological advancements, culture, and educational practices. This approach underscores the theory's explanatory power in understanding identity transformation within dynamic, digitally-mediated environments.

Practically, the study identifies four crucial mechanisms shaping vocational educators' professional identities: individual cognition, institutional support, interactive practices, and role understanding. It further proposes actionable pathways such as cognitive iteration, institutional provisioning, collaborative practices, and role reconstruction. These findings offer a comprehensive framework for vocational educators to navigate the challenges posed by digital education, providing valuable guidance for educators, policymakers, and institutions seeking to support teacher development in the digital era.

Despite the valuable insights provided by this study, it has limitations. These include a geographically concentrated sample, a limited sample size, and the absence of quantitative validation for a predominantly qualitative research approach. Additionally, the study does not include perspectives from other key stakeholders such as students and administrators, which could enrich the understanding of professional identity formation in vocational education.

Future research should aim to expand the sample size and incorporate mixed-methods approaches to enhance the reliability of the findings. It would also be beneficial to develop multi-stakeholder interaction models to explore how various factors, including student and administrator perspectives, influence professional identity formation. Incorporating AI technologies to track the long-term evolution of identity in response to technological change will also provide valuable insights. These directions will help to foster forward-thinking policy support for vocational education teacher development, paving the way for more effective and sustainable teaching practices in the digital age.

Despite its limitations, this study contributes significantly to the theoretical and practical understanding of vocational education teacher identity in the digital transformation context. It offers a solid foundation for future research and provides actionable insights to support high-quality vocational education in the digital era.

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