RESEARCH PAPER

Towards the Design and Development of a Constructivist Learning Environment Model for Enhancing Metacognitive Skills in Career Planning among Chinese Vocational College Freshmen

FANG HOU [1], Pornsawan Vongtathum [1*], Parama Kwangmuang [1]

[1]Innovation Technology and Learning Science Department, Faculty of Education, Khon Kaen University, Mueang District 40002, Khon Kaen, Thailand

Authors: FANG HOU[1], Pornsawan Vongtathum[1*], Parama Kwangmuang[1]

Abstract

In an increasingly competitive labor market, first-year students in Chinese higher vocational institutions often encounter difficulties in long-term career planning due to limited metacognitive awareness and insufficient cognitive tools for self-directed career management, despite the availability of conventional career guidance programs. Addressing this gap, the present study aims to design a constructivist learning environment (CLE) that explicitly supports the development of metacognitive skills for career planning. Guided by Richey and Klein's model research framework, the study focuses on the design and development phases, drawing on an extensive review of the literature, analysis of authentic teaching and learning contexts, and synthesis of relevant empirical and theoretical findings. The proposed CLE model is theoretically grounded in constructivist learning theory, sociocultural perspectives, and cognitive psychology, with particular emphasis on metacognitive regulation. The resulting model comprises seven interrelated components: a problem base and learning mission, a learning resource center, a cognitive tools center, a collaboration center, a metacognitive skills center, a scaffolding center, and a tutoring center. Collectively, these components are designed to activate learners' cognitive structures, maintain cognitive equilibrium, enhance career-related problem-solving processes, and provide sustained support for knowledge construction and metacognitive development. By offering an integrated and theoretically informed design framework, this study contributes a novel approach to fostering self-directed career planning and responds to the urgent need for explicit metacognitive skill development among students in Chinese higher vocational education.

Keywords: Constructivist Learning Environment Model; Metacognitive Skills; Career Planning Learning, Chinese Vocational students

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INTRODUCTION

Career planning is often conceptualized as a rational process of aligning personal interests and abilities with occupational opportunities (Hertig, Powell, & Richardson, 2020; Valls et al., 2020). Within this view, individuals are assumed to evaluate available options and select career paths based on informed comparisons (Melović et al., 2022). Yet, this conceptualization only partially captures the nature of career decision-making, particularly for students who must navigate uncertainty, limited experience, and evolving identities. For vocational college freshmen, career planning is therefore not a one-time choice but a learning process that requires learners to interpret information, regulate goals, reflect on personal values, and continuously evaluate decisions over time (Jiang, 2019). Engaging in these activities requires learners to be aware of how they think, to monitor the effectiveness of their decisions, and to adjust strategies accordingly - core functions that define metacognitive regulation (Flavell, 1979; Pintrich, 2004; Robillos, 2019).

These metacognitive demands become particularly consequential within educational contexts characterized by high structural and competitive pressures. In China, the urgency of effective career planning is intensified by conditions in the graduate labor market. According to the Ministry of Education, the number of college graduates is projected to reach 12.22 million in 2025, resulting in heightened employment competition nationwide. In response, career planning has been institutionalized as a mandatory component of higher education curricula, with the aim of strengthening students' capacity for informed decision-making and proactive career development. Despite this policy emphasis, empirical

evidence suggests that many students, particularly those in vocational colleges, continue to demonstrate unclear career goals, superficial planning behaviors, and weak self-evaluative capacities (Guo, 2022; Song & Xu, 2024). These patterns indicate that curricular inclusion alone does not guarantee effective career learning.

From a learning sciences perspective, this limitation reflects a deeper pedagogical issue. Career planning instruction in vocational settings has traditionally adopted an information-transmission model, emphasizing labor market knowledge and skill–job matching while giving limited attention to the cognitive processes through which students internalize and apply such information. As a result, learners often remain dependent on external guidance and struggle to regulate their own decision-making processes. Research in educational psychology consistently shows that metacognitive skills do not develop automatically through exposure to content; rather, they require explicit scaffolding embedded within meaningful learning activities (Azevedo & Hadwin, 2005; Schraw & Dennison, 1994).

Although research on career development has extensively examined variables such as career adaptability, employability, and decision outcomes, significant limitations remain at the level of instructional design. On the one hand, while social constructivist learning theory and metacognitive regulation frameworks have been well developed within the learning sciences, their systematic integration in career planning education remains limited, particularly with respect to comprehensive design models tailored to vocational education contexts. On the other hand, studies addressing metacognition in career planning have predominantly treated it as an individual difference or correlational factor subject to measurement and analysis, rather than as a capacity that can be explicitly cultivated through pedagogical design. As a result, existing research has struggled to explain a critical question: how metacognitive development in career planning can be effectively promoted through concrete instructional mechanisms.

Social constructivist theory provides a strong theoretical foundation for addressing this challenge. Drawing on Vygotsky's (1978) conception of learning as a socially mediated process occurring within the zone of proximal development, knowledge and higher-order cognitive functions develop through guided interaction, dialogue, and the use of cultural tools. Within this framework, scaffolding enables learners to gradually internalize strategies for independent regulation. Applied to career planning, this perspective suggests that students must be supported in externalizing their thinking, reflecting on choices, and monitoring progress before they can effectively self-regulate their career decisions. Thus, career planning should be understood not merely as informational guidance but as a socially mediated, metacognitively rich learning process.

In response to these theoretical and methodological gaps, the present study adopts social constructivist theory as its core framework and employs a design-and-development approach to systematically construct a constructivist learning environment model for career planning. By embedding problem scenarios, cognitive tools, collaborative mechanisms, and metacognitive scaffolding within authentic career planning tasks, the proposed model reconceptualizes career planning from an information-transmission–oriented guidance activity into a learning process centered on learners' active knowledge construction and self-regulation.

Constructivist learning environments operationalize these principles by positioning learners as active agents in meaning-making and by embedding reflection, collaboration, and authentic problem-solving within instruction. Empirical studies across educational contexts have demonstrated that such environments are particularly effective in fostering metacognitive awareness and self-regulated learning (Biggs, 1996; Panadero, 2017). However, despite strong theoretical alignment, constructivist approaches have been only sparsely applied to career planning education, especially within vocational contexts where students face early specialization and high-stakes career decisions.

More critically, existing research on career education has tended to prioritize outcome variables, such as career adaptability, employability, or decision certainty, while paying limited attention to the instructional mechanisms that produce these outcomes (Lent & Brown, 2013). Studies that examine metacognition in career development often treat it as an individual trait or correlational factor rather than as a capacity that can be deliberately cultivated through pedagogical design. Consequently, there is a clear lack of empirically grounded models that articulate how a constructivist learning environment can be designed and developed

to enhance metacognitive skills for career planning, particularly for vocational college freshmen at the formative stage of career identity construction.

This absence represents a significant theoretical and methodological gap. Although social constructivist theory and metacognitive frameworks are well established independently, their integration into a coherent design-based learning environment model for vocational career planning remains underexplored, particularly within the Chinese educational context. Addressing this gap is critical, as vocational college freshmen require structured yet flexible learning environments that support guided participation, reflection, and the gradual development of autonomous career regulation.

In response, the present study focuses on the design and development of a constructivist learning environment model, explicitly grounded in Vygotsky's social constructivist theory, aimed at supporting the development of metacognitive skills for career planning among Chinese vocational college freshmen.

The contributions of this study are threefold. First, at the theoretical level, it proposes a career planning instructional model that integrates social constructivist principles with metacognitive regulation mechanisms, thereby enriching the interdisciplinary dialogue between vocational education and the learning sciences. Second, at the methodological level, it articulates the design logic and key components of a constructivist learning environment for career planning, providing an operational framework for subsequent empirical research and model validation. Third, at the practical level, it offers a systematic and scalable instructional design approach for career planning courses for vocational college freshmen, supporting the gradual development of autonomous, reflective, and sustainable career planning capabilities in contexts characterized by uncertainty.

By embedding metacognitive scaffolding within authentic career planning activities, the proposed model conceptualizes career education as a learning-oriented and cognitively engaging process, rather than a solely information-based intervention. This study contributes to the literature by advancing a theoretically grounded pedagogical model that integrates constructivist learning theory, metacognitive regulation, and vocational career education, thereby offering a foundation for future empirical implementation and evaluation in instructional design and educational practice.

LITERATURE REVIEW

Career Planning as a Cognitive and Developmental Learning Process

Early career planning research, rooted in rational and trait-based traditions, conceptualized career decision-making as a process of aligning stable individual characteristics with occupational demands. Super's (1980) life-span, life-space theory marked an important shift by situating career choice within a developmental trajectory shaped by evolving self-concepts. However, across both traditions, career planning was predominantly treated as a predictable progression toward decision certainty, with limited attention to how learners actively process uncertainty during early career stages. Comparative analyses of these models suggest that while they account for what individuals decide, they offer weaker explanations of how learners cognitively manage exploration, revision, and self-doubt - processes that are especially salient among first-year students.

In response to these limitations, learning-oriented perspectives such as Social Cognitive Career Theory (SCCT) reconceptualize career planning as an iterative process of cognitive regulation shaped by both experience and contextual influences. Drawing on multiple empirical investigations, Lent and Brown (2013) demonstrate that self-efficacy beliefs and goal-regulation processes mediate how individuals interpret career-related information and respond to perceived barriers, suggesting that the quality of career decision-making depends less on mere access to information than on learners' capacity to regulate their own thinking. When these insights are synthesized with the findings of Valls et al. (2020), a consistent pattern emerges: students seldom follow linear or sequential decision-making trajectories; rather, they repeatedly cycle between exploration and reconsideration. This dynamic pattern indicates that career planning functions more as a recursive learning process than as a single, rational choice event (Akkermans et al., 2020).

This developmental and cyclical nature of career planning becomes even more pronounced in studies focusing on early-stage learners. Jiang (2019) and Wang (2023) reported that college students often lack coherent career schemas and rely heavily on external

validation when metacognitive support is absent. When examined alongside SCCT-based studies, these findings converge on a critical insight: early career planning success is not determined by decisiveness, but by learners' ability to monitor uncertainty, reflect on misalignment, and recalibrate goals. Vocational students, in particular, face compressed timelines for specialization, amplifying the consequences of insufficient cognitive and metacognitive engagement during career planning instruction (Mårtensson et al., 2024; Savaengkan & Chaijaroen, 2025).

Despite increasing recognition of career planning as a developmental and cognitively demanding process, a misalignment persists between theoretical advances and instructional practice. While frameworks such as SCCT emphasize iterative learning, goal regulation, and adaptive decision-making, career planning instruction in higher education, particularly in vocational contexts, continues to prioritize information transmission and outcome-based indicators such as decisiveness or employability. As a result, students are often evaluated on what they decide rather than on how effectively they engage in the cognitive processes that support sustained career development (Fischer et al., 2024). This imbalance suggests that, although the importance of cognitive and metacognitive processes in career planning is well established, limited attention has been given to how educational environments can be deliberately structured to support their development, especially during the formative first year of vocational education.

Metacognition in Career Decision-Making and Career Development

Metacognition has long been recognized as a central mechanism through which learners regulate complex cognitive activities. Flavell (1979) conceptualized metacognition as encompassing both metacognitive knowledge, awareness of one's cognitive processes, and metacognitive regulation, which involves the planning, monitoring, and evaluation of thinking. Subsequent models refined this distinction by emphasizing regulation as the active component that enables learners to adapt strategies in response to task demands (Raković et al., 2022; Schraw & Dennison, 1994; Pintrich, 2004). Within educational research, these regulatory processes have been consistently linked to improved learning outcomes in ill-structured and self-directed tasks, suggesting their relevance beyond academic problem-solving to broader domains of decision-making.

Career planning represents one such domain in which metacognitive regulation plays a critical role (Sari et al., 2025). Unlike routine academic tasks, career decision-making requires individuals to integrate self-knowledge, contextual constraints, and future-oriented goals under conditions of uncertainty. Planning enables learners to set tentative career goals and identify information needs; monitoring allows them to assess alignment between aspirations, abilities, and emerging experiences; and evaluation supports the revision of decisions over time (Pintrich, 2004; Robillos, 2019). Empirical studies examining decision-making processes indicate that individuals who actively engage in these regulatory behaviors demonstrate greater adaptability and persistence when navigating career-related challenges (Veenman & Verheij, 2003). These findings suggest that effective career planning depends not merely on possessing career information, but on the capacity to regulate thinking throughout the decision-making process (Dik et al., 2008).

Recent research in career development has begun to explicitly link metacognitive engagement with career-related outcomes. Robillos (2019), for instance, found that students who demonstrated higher levels of metacognitive awareness exhibited more reflective exploration and less reliance on external directives. When considered alongside broader self-regulated learning research, a consistent pattern emerges (Panadero, 2017): learners who lack metacognitive regulation tend to approach career planning superficially, focusing on immediate choices or socially prescribed options without sustained reflection or strategic adjustment. This tendency is particularly evident among early-stage learners, who may possess limited experience and undeveloped self-concepts, making them more vulnerable to unexamined or externally driven decisions (Seufert et al., 2024).

Despite growing acknowledgment of the role of metacognition in career development, its treatment within career education remains theoretically recognized but pedagogically underdeveloped. While theoretical frameworks clearly articulate the importance of planning, monitoring, and evaluation, instructional practices often assume that these skills emerge naturally through exposure to guidance activities or career information. Consequently, many learners engage in career planning tasks without explicit support for regulating their thinking, resulting

in fragmented or short-term decision strategies. This pattern highlights the need for educational approaches that move beyond awareness-raising toward intentional support for metacognitive regulation, particularly during formative stages of career development when learners are still acquiring the capacity to manage complex, future-oriented decisions.

Career Planning Education in Vocational and Higher Education Contexts

Vocational college students represent a distinct population within higher education, characterized by earlier specialization, stronger links to labor market demands, and more heterogeneous academic backgrounds compared to students in academic universities (Savaengkan & Chaijaroen, 2025). Research consistently shows that vocational students often enter higher education with pragmatic employment goals but limited opportunities to engage in extended career exploration or identity development (Fang et al., 2024; Oswald-Egg & Renold, 2021). As a result, career planning for this group is both urgent and complex, requiring learners to make consequential decisions at an early stage while still developing cognitive, motivational, and self-regulatory capacities. These characteristics position vocational education as a critical site for examining how career planning is learned, rather than merely instructed (Bailey et al., 2024).

Comparative analyses of career education across vocational and academic tracks indicate systematic differences in instructional emphasis (Backes-Gellner & Geel, 2014; Kriesi & Sander, 2024). In academic contexts, career planning is more frequently framed as an exploratory and reflective process situated within broader developmental and identity trajectories (Stephen, 2024). In contrast, career education in vocational colleges tends to prioritize employability, skill alignment, and immediate labor market outcomes, reflecting institutional mandates and employer expectations (Ruijuan et al., 2024). While this pragmatic orientation addresses short-term transition goals, prior studies have noted that it may constrain learners' engagement with reflective and self-regulatory aspects of career planning (Iliescu et al., 2025; Kuijpers & Meijers, 2012). Empirical evidence further suggests that when career education is predominantly outcome-oriented, students may demonstrate early decisiveness but show limited capacity to revisit, revise, or adapt career decisions in response to changing personal or contextual conditions (Akkermans et al., 2020; Lent & Brown, 2013; Pang et al., 2025).

Within the Chinese context, career planning education has been strongly shaped by national policy imperatives (Kou & Yang, 2025). In response to intensified graduate employment pressures, career planning has been institutionalized as a mandatory component of higher education curricula, including vocational colleges (Wang & We, 1998; Wei et al., 2021). Policy documents emphasize informed decision-making, employability enhancement, and alignment with economic needs. However, empirical investigations indicate that implementation has often focused on curriculum inclusion rather than instructional quality. Studies conducted in Chinese vocational institutions report persistent challenges, including students' reliance on external guidance, unclear long-term goals, and limited engagement in reflective or self-directed career planning activities (Guo, 2022; Song & Xu, 2024). These findings suggest that policy-driven adoption does not automatically translate into effective career learning.

Across these strands of research, a consistent pattern emerges regarding the limitations of current career planning education in vocational settings. While structural support and curricular mandates have expanded access to career guidance, learners frequently remain positioned as passive recipients of information rather than active agents in decision-making. The prevalence of dependency, superficial goal setting, and low self-regulation points to instructional approaches that insufficiently address the cognitive demands of career planning. Particularly for vocational college freshmen—who must negotiate early specialization under high-stakes conditions—career education that lacks explicit support for reflective and regulatory processes risks reinforcing short-term compliance rather than fostering sustainable career agency.

Social Constructivist Theory and Metacognitive Scaffolding

Social constructivist theory conceptualizes learning as a process that is fundamentally mediated by social interaction and cultural tools. Vygotsky (1978) argued that higher-order cognitive functions originate in social activity before being internalized by the learner, positioning development as a movement from other-

regulation to self-regulation. Central to this view is the Zone of Proximal Development (ZPD), defined as the distance between what learners can accomplish independently and what they can achieve with guidance. Within the ZPD, learning is not simply the acquisition of information but the gradual appropriation of cognitive strategies through interaction, dialogue, and shared problem-solving.

The concept of scaffolding, later articulated by Bruner and colleagues, provides a pedagogical mechanism for operationalizing Vygotsky's theoretical insights (Stapleton & Stefaniak, 2019). Scaffolding involves the temporary and adaptive support provided by more knowledgeable others to assist learners in performing tasks they could not yet manage alone. Over time, this support is systematically withdrawn as learners gain control over the underlying processes. When examined through a metacognitive lens, scaffolding does more than facilitate task completion; it externalizes planning, monitoring, and evaluation processes, making them visible and accessible for learners to internalize (Schraw & Dennison, 1994). This perspective positions scaffolding as a critical bridge between social interaction and individual self-regulation.

Empirical research on self-regulated learning further clarifies how metacognitive regulation develops through guided interaction. For example, Azevedo & Hadwin (2005) demonstrated that learners engaging in complex, open-ended tasks showed significantly improved metacognitive monitoring and strategy use when instructional support was explicitly designed to prompt reflection and regulation. Rather than emerging spontaneously, metacognitive skills were fostered through structured prompts, feedback, and dialogic exchanges that modeled expert thinking (Robillos, 2019). These findings align with social constructivist assumptions that regulation is initially distributed across social and material resources before becoming internally managed by the learner.

Taken together, social constructivist theory and research on metacognitive scaffolding converge on a view of learning as a progressive transfer of regulatory responsibility from the environment to the individual. Learning environments that prioritize interaction, dialogue, and guided reflection create conditions under which learners can appropriate metacognitive strategies and apply them independently. Within such environments, learners are not merely supported in completing tasks but are engaged in the development of cognitive control itself. This theoretical orientation provides a coherent foundation for examining how instructional design can support the emergence of metacognitive regulation in complex, future-oriented learning domains such as career planning.

Constructivist Learning Environments for Developing Metacognitive Skills

Constructivist learning environments (CLEs) are designed to engage learners as active participants in knowledge construction through meaningful tasks, social interaction, and reflection. Drawing on constructivist and learning-oriented pedagogies, CLEs emphasize authentic problem-solving, learner autonomy, and the integration of prior knowledge with new experiences. Biggs' (1996) constructive alignment framework underscores the importance of aligning learning activities and assessment with intended cognitive processes, positioning metacognitive engagement as a central instructional goal rather than a by-product of content exposure. Within this view, learning environments are not neutral contexts but deliberate designs that shape how learners think, regulate, and apply knowledge.

Empirical research across educational domains provides consistent evidence that CLEs are particularly effective in fostering metacognitive awareness and regulation. For instance, He et al. (2023) demonstrated that learning environments incorporating collaborative inquiry and structured reflection significantly enhanced students' ability to monitor understanding and adjust learning strategies. Similarly, Le & Nguyen (2024) showed that learners engaged in constructivist, open-ended tasks exhibited higher levels of metacognitive monitoring when instructional supports were embedded within the environment. Synthesized across studies, these findings suggest that metacognitive development is most robust when learners are placed in contexts that require them to plan, justify, and evaluate decisions rather than merely follow prescribed procedures.

Design-oriented analyses suggest that metacognitive development within constructivist learning environments (CLEs) is shaped not by isolated instructional features, but by how particular design elements function together to support learners' regulatory activity (Qu & Chaijaroen, 2025). Authentic, ill-structured tasks place learners in situations that require them to plan strategically, monitor their

understanding, and evaluate possible courses of action rather than follow predetermined procedures. Within these tasks, collaborative engagement plays a complementary role by externalizing learners' thinking through dialogue, allowing regulatory processes such as monitoring and justification to become visible and open to feedback (Robillos, 2019). Reflective components then consolidate these experiences by providing structured opportunities for learners to assess outcomes, reconsider assumptions, and adjust strategies based on prior performance. When these elements are coherently integrated within a single learning environment, instructional support gradually shifts from explicit guidance to learner-controlled regulation, enabling students to assume increasing responsibility for their own cognitive processes (Savaengkan & Chaijaroen, 2025). The convergence of these design principles across empirical studies underscores the capacity of CLEs to function as powerful contexts for the development of higher-order metacognitive control.

Despite their demonstrated effectiveness, applications of CLEs within career education remain limited and uneven. Existing career planning programs often adopt constructivist elements in fragmented ways, such as isolated reflection activities or group discussions, without systematic integration of metacognitive scaffolding. Moreover, many studies applying CLEs focus on academic learning domains such as science or problem-based learning, leaving questions about their adaptation to future-oriented, identity-related tasks like career planning. As a result, while the potential of constructivist environments for metacognitive development is well established, their translation into coherent, design-based models for vocational career education remains underdeveloped, particularly for early-stage learners facing high-stakes career decisions.

Taken together, the reviewed literature converges on the view that career planning is not a singular rational act but a cognitively demanding and developmental learning process that unfolds over time, particularly during early educational transitions (Super, 1990; Lent & Brown, 2013; Jiang, 2019). Across the reviewed studies, career planning is increasingly understood as requiring learners to engage in metacognitive regulation, specifically planning, monitoring, and evaluation, in order to navigate uncertainty, reassess goals, and sustain adaptive decision-making in changing personal and contextual conditions (Flavell, 1979; Pintrich, 2004; Robillos, 2019). At the same time, empirical evidence from vocational and higher education contexts, especially in China, indicates that career planning instruction remains largely policy-driven and information-oriented, with many vocational college students demonstrating dependency on external guidance, unclear career goals, and limited self-regulatory engagement despite the institutionalization of mandatory career planning curricula (Guo, 2022; Song & Xu, 2024). When considered in relation to one another, these strands of research suggest that although the cognitive and metacognitive foundations of effective career planning are well established, limited attention has been given to how constructivist learning environments can be systematically designed to support the development of metacognitive regulation for career planning, particularly among vocational college freshmen facing early specialization and heightened labor-market pressures (Azevedo & Hadwin, 2005; Schraw & Dennison, 1994; Panadero, 2017; Vygotsky, 1978;) These unresolved issues provide a clear conceptual basis for the research questions that guide the present study:

1. What theoretical principles from social constructivism and metacognitive regulation inform the design of a constructivist learning environment model for career planning?

2. What key components and design elements are incorporated into the constructivist learning environment model to support vocational college freshmen's career planning?

3. How are these components structured and aligned within the model to facilitate the development of students' metacognitive skills in the career planning process?

Theoretical Framework

This study is grounded in the integration of career development theory, metacognitive theory, and social constructivist learning theory, positioning career planning as a cognitively demanding and developmentally situated learning process. Career development theories emphasize that career decision-making unfolds over time and is shaped by individuals' evolving self-concepts and learning experiences. Super's (1980) life-span, life-space theory conceptualizes career development as a continuous process rather than a discrete choice, while Social Cognitive Career Theory highlights the role of learning

experiences, self-efficacy, and contextual factors in shaping career-related decisions (Lent, Brown, & Hackett, 1994). Building on these perspectives, the present study conceptualizes career planning among vocational college freshmen as an iterative learning process that requires learners to interpret information, regulate goals, reflect on personal values, and evaluate decisions over time. These processes align closely with metacognitive regulation, defined as individuals' ability to plan, monitor, and evaluate their own thinking and decision-making (Flavell, 1979; Pintrich, 2004).

From a cognitive–educational perspective, metacognition functions as the mediating mechanism through which learners transform career-related information into meaningful and self-directed decisions. Metacognitive regulation supports learners in setting realistic career goals, monitoring alignment between personal aspirations and occupational opportunities, and revising plans in response to feedback and changing conditions. When such regulatory processes are underdeveloped, career planning tends to remain externally driven and superficial, characterized by reliance on institutional guidance rather than autonomous decision-making (Schraw & Dennison, 1994; Robillos, 2019). Importantly, research in educational psychology demonstrates that metacognitive skills do not develop automatically through exposure to content alone; rather, they require explicit instructional support embedded within learning activities (Azevedo & Hadwin, 2005; Pintrich, 2004). Accordingly, this study assumes that metacognitive competence in career planning must be intentionally cultivated, particularly among vocational college freshmen who are at a formative stage of career identity development.

Social constructivist theory provides the pedagogical foundation for operationalizing metacognitive development within career planning instruction. According to Vygotsky (1978), higher-order cognitive functions emerge through socially mediated activity within the Zone of Proximal Development, where learners gradually internalize strategies initially supported by more knowledgeable others. Within constructivist learning environments, scaffolding—such as guided questioning, modeling, reflection prompts, and collaborative dialogue—supports learners in externalizing their thinking and progressively assuming control over regulatory processes (Azevedo & Hadwin, 2005; Bruner, 1986). While the theoretical perspectives informing this study are not context-specific, their relevance becomes particularly pronounced in educational systems characterized by early specialization and strong structural pressures. In the Chinese vocational education context, where career planning is institutionalized early and students face heightened employment competition, these theories provide a lens for understanding how metacognitive regulation may support learners in navigating complex and constrained career decision-making environments (Liu et al., 2023). Accordingly, this study advances a Constructivist Learning Environment Model for Career Planning, in which social interaction, scaffolded reflection, and authentic career tasks are systematically aligned to foster students' metacognitive regulation and autonomous career decision-making.

METHODOLOGY

Research Design

The purpose of this study was to develop a web-based model of a constructivist learning environment to enhance the career planning skills of freshmen at a vocational university. The model, which draws on the research of Richey and Klein (2007), is dedicated to building an interactive and collaborative learning platform that helps students develop the metacognitive skills needed for career planning by promoting their active participation.

This study is based on the Richey and Klein modeling approach and focuses on the first phase (model design and development). This phase of the study consists of three core steps: (1) conducting a comprehensive literature analysis and review to analyze and find out the relevant theories and principles that underpin the study; (2) exploring teaching scenarios in the context of teaching practice to support the practical application of the theories; and (3) integrating the research results and designing and developing a constructivist learning environment to enhance the career planning skills of freshmen students in vocational colleges and universities.

Participants

The design and development of a constructivist learning environment model (Phase 1) were carried out by a collaborative team of experts to ensure a robust and theoretically grounded approach. This phase did

not involve students, as the focus was on creating the framework and core elements of the model. The process was led by a PhD candidate from the study-university in Northeastern Thailand, who spearheaded the development with a deep understanding of the research objectives and target learner needs. Collaborating closely was an educational technology specialist with five years of professional experience, who provided valuable input on integrating effective digital tools and constructivist principles into the model. Additionally, the team benefited from the guidance of a senior advisor with over 10 years of expertise in educational model design, whose extensive experience contributed to ensuring the alignment of the model with best practices and research-based strategies. This multi-tiered collaboration ensured that the design phase laid a strong foundation for fostering scientific thinking skills while maintaining educational relevance and reliability.

Instruments

Literature Review and Analysis Record Form. This was designed to systematically analyze and document relevant literature, theories, and principles related to metacognitive skills and career planning education among vocational college students. Guided by the design and development research framework proposed by Richey and Klein (2007), this instrument organizes key concepts, empirical findings, and theoretical perspectives drawn from career development theory, metacognitive theory, and social constructivist learning theory. The form supports critical examination of existing research and facilitates the identification of conceptual and methodological gaps in career planning instruction, particularly within vocational education contexts. By structuring the literature analysis process, this instrument ensures that the subsequent development of the Constructivist Learning Environment Model is firmly grounded in a coherent and theoretically robust knowledge base, thereby strengthening the model's conceptual validity and instructional relevance.

Survey of the Instructional Context. This was developed in accordance with Richey and Klein's (2007) design research framework to examine contextual factors influencing the development of metacognitive skills in career planning among Chinese vocational college freshmen. This survey systematically investigates key aspects of the instructional environment, including institutional support for career education, instructional strategies employed in career planning courses, availability of learning resources, and opportunities for student reflection and self-regulation. In addition, the survey captures learners' experiences with career guidance practices and their perceived challenges in planning and regulating career decisions. By providing a comprehensive picture of the instructional and contextual conditions, this instrument ensures that the proposed learning environment model is contextually responsive and aligned with the specific needs and constraints of vocational college students. Such contextual grounding enhances the applicability and ecological validity of the model.

Theoretical Framework Synthesis Form. This form was designed to consolidate and integrate relevant theories underpinning the proposed Constructivist Learning Environment Model for enhancing metacognitive skills in career planning. Drawing on Chaijaroen's (2016) design synthesis principles, this instrument facilitates the systematic integration of career development theories, metacognitive frameworks, and social constructivist perspectives. The synthesis process clarifies the relationships among these theoretical foundations and explicates how they collectively inform the design principles of the model. By articulating the theoretical coherence of the framework, this instrument strengthens the conceptual foundation of the study and ensures that the model is grounded in established educational and psychological theories relevant to vocational career education.

Designing Framework Synthesis Record Form. This form was developed to document and organize theories and principles related to metacognitive regulation, cognitive development, and constructivist learning that inform the design of the Constructivist Learning Environment Model for career planning. Based on Chaijaroen's (2016) model design approach, this instrument provides a structured synthesis of theoretical elements guiding the instructional design process, including learner-centeredness, scaffolding, reflection, and authentic task engagement. By systematically aligning these theoretical principles with the objectives of career planning education, the form ensures that the model design is theoretically sound and pedagogically coherent. This structured synthesis enhances the potential effectiveness of the learning environment in fostering students' ability to plan, monitor, and evaluate their career-related

thinking and decisions.

Constructivist Learning Environment Model Synthesis Record Form. This form was designed to document the integration of core components of the proposed learning environment model, following Chaijaroen's (2008) constructivist design principles. This instrument systematically synthesizes essential elements of the model, including authentic career planning tasks, learning resources, cognitive and metacognitive tools, collaborative learning activities, scaffolding strategies, and instructional coaching. Each component is analyzed in relation to its role in supporting metacognitive regulation within career planning processes. By organizing and integrating these components into a coherent framework, the synthesis record form ensures that the proposed model addresses the cognitive and developmental needs of Chinese vocational college freshmen. This structured integration promotes reflective thinking, collaborative problem-solving, and self-regulated career decision-making, thereby supporting students' long-term career development.

Data Collection

Literature Review and Analysis Record Form. The Literature Review and Analysis Record Form is carefully designed to systematically analyze and document the foundational theories, principles, and empirical studies that inform the design and development of a constructivist learning environment model aimed at enhancing metacognitive skills in career planning among Chinese vocational college freshmen. The form incorporates key theoretical perspectives such as constructivism, social constructivism, metacognition theory, career development theory, and self-regulated learning, ensuring a comprehensive examination of educational and career-planning foundations relevant to the target population. Through a structured documentation process, this form enables the synthesis of insights from diverse scholarly sources, fostering a nuanced understanding of how these theories can be applied to support students' career awareness, planning, monitoring, and reflective thinking. This systematic analysis also assists in identifying best practices and theoretical gaps, thereby strengthening the conceptual grounding of the proposed learning environment model.

Theoretical framework synthesis record form. The Theoretical Framework Synthesis Form serves as a critical instrument for analyzing and synthesizing theories and principles related to metacognitive development and career planning education among vocational college freshmen. This form systematically compiles qualitative data, including the topic, theory name, theoretical origin, core constructs, and analytical interpretations drawn from established educational and career development frameworks. By organizing and integrating these elements, the form supports a coherent synthesis of theoretical foundations that guide the study. This structured synthesis ensures that the proposed constructivist learning environment model is theoretically sound and aligned with the goal of fostering students' metacognitive awareness, strategic planning, self-monitoring, and reflective decision-making in career development contexts.

Designing framework synthesis record form. The Designing Framework Synthesis Record Form functions as an essential data collection tool for systematically documenting the theories, principles, and instructional components that support the enhancement of metacognitive skills in career planning. This form facilitates in-depth qualitative analysis by capturing key elements such as instructional design processes, learning objectives, theoretical underpinnings, learning activities, and support mechanisms integrated into the constructivist learning environment model. By providing a structured format for organizing this information, the form ensures that each design component is clearly contextualized within vocational education and career planning frameworks. This meticulous documentation contributes to the development of a cohesive instructional design that supports learners' cognitive and metacognitive growth while addressing the specific needs of Chinese vocational college freshmen.

The Constructivist Learning Environment Model synthesis record form. Constructivist Learning Environment Model synthesis record form is a vital data collection instrument designed to document the synthesis process involved in the design and development of the constructivist learning environment model aimed at enhancing metacognitive skills in career planning. This form enables the systematic recording of qualitative data, including core principles, key concepts, detailed descriptions, and analytical insights related to the integration of essential model components such as authentic career problems, learning resources, cognitive and metacognitive tools, collaboration, scaffolding, and coaching. Each entry is

carefully organized to illustrate how these components interact to support learners' reflective thinking, self-regulation, and informed career decision-making. Through this structured synthesis process, the form contributes to the development of a comprehensive and contextually relevant learning environment model tailored to Chinese vocational college freshmen.

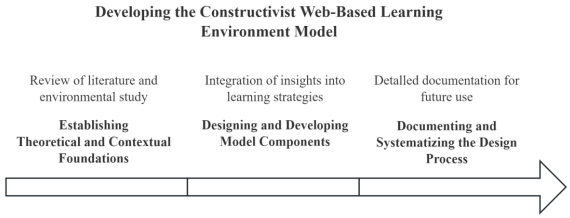
Model development record form. The model development record form collects qualitative data about the process of developing the Constructivist Learning Environment Model (Paas, 2004) including information about model performance, problems encountered during development, and reactions to the process. The researcher or research assistant will securely organize this data to maintain confidentiality.

Model component design record form. This form is used to record the theoretical framework, core principles, and key components of the constructivist learning environment model (Paas, 2004) design involving cognitive development and knowledge construction. It systematically organizes qualitative data and covers the core modules of the Problem Library, Learning Tasks, Resource Center, Cognitive Tools Library, Collaboration Platform, Metacognitive Skills Center, Scaffolded Instruction Center, and Tutoring Center. Researchers or research assistants can manage these data through a security control mechanism, effectively safeguarding the privacy and security of participants.

The Constructivist Learning Environment Model evaluation form. The evaluation form is used to assess the effectiveness of the Constructivist Learning Environment Model. Using this form, measurement and evaluation specialists assessed the model's performance in promoting metacognitive skills in career planning for freshmen in vocational institutions. After the assessment results were collected in a qualitative manner, they were submitted via email to the researcher or research assistant who organized the data securely on a dedicated computer to ensure confidentiality.

Research Procedures

This study utilizes a rigorous multi-stage approach, and this paper focuses on the design and development of the model in the first stage, a foundational stage that is critical to building a solid theoretical and practical foundation for modeling constructivist web-based learning environments. The following are the specific procedures for designing and developing the model, as shown in Figure 1:



First, establishing theoretical and contextual foundations: a comprehensive literature review of constructivism, metacognition, and career planning is conducted to build the theoretical foundation of the model. At the same time, a specific vocational school environment was investigated, including school conditions, influencing factors, and opinions of students, teachers, and model developers were collected to understand the actual environment.

Second, designing and developing model components: integrating insights from theoretical frameworks and environmental studies to systematically design a constructivist learning environment model. This involves conceptualizing all instructional strategies, learning activities, assessment methods, and technological tools.

Finally, documenting and systematizing the design process: each decision, iteration, and rationale is carefully documented in a detailed design framework and comprehensive documentation form. This ensures theoretical coherence, practical applicability, transparency, and repeatability of the model for future validation and implementation.

Data Analysis

This section outlines the procedures for analyzing data related to the design and development of the Constructivist Learning Environment Model for enhancing metacognitive skills in career planning. Data analysis is guided by principles of Instructional Design (ID) and design-based research, emphasizing the systematic integration of theory and context to support metacognitive development in vocational career education.

Literature Review Analysis. The literature review employs a combination of descriptive, analytical, and summative analysis methods to examine theories,

principles, and empirical studies relevant to career planning, metacognition, and constructivist learning environments. This analysis identifies existing conceptual frameworks and evaluates their implications for instructional design in vocational career education. By synthesizing insights across multiple domains, the literature review establishes a robust theoretical foundation that informs the development of the learning environment model and clarifies the instructional strategies needed to foster metacognitive regulation in career planning.

Synthesis of the Learning Environment Model. During Phase 1 of the study, qualitative data derived from the Theoretical Framework Synthesis Form, Designing Framework Synthesis Record Form, and Constructivist Learning Environment Model Synthesis Record Form are analyzed using descriptive, analytical, and summative techniques. This synthesis integrates theoretical perspectives and design principles into a coherent model framework, ensuring alignment with the cognitive and metacognitive demands of career planning. The synthesis process supports the articulation of a constructivist learning environment that is pedagogically grounded, contextually responsive, and specifically designed to enhance vocational college freshmen's metacognitive regulation in career decision-making.

RESULTS

This section presents the empirical and conceptual results of this study, detailing the theoretical underpinnings, the integrated framework components, and the specific contributions of the developed Constructivist Web-based Learning Environment (CWLE) model to improving the metacognitive skills of career planning of freshmen students in vocational colleges and universities in China. In accordance with the principles of design-based research, the results are presented as theoretically grounded design outputs, including (1) synthesized theoretical foundations, (2) the finalized architecture of the Constructivist Web-based Learning Environment (CWLE) model, (3) its core functional processes, and (4) the integrated instructional components developed to support metacognitive regulation in career planning among vocational college freshmen..

Theoretical Bases Informing the Development of a Constructivist Web-Based Learning Environment Model Aimed at Enhancing Metacognitive Skills in Career Planning

The design and development of the Constructivist Web-Based Learning Environment (CWLE) model are grounded in an integrated set of educational theories, including constructivism, sociocultural learning theory, and cognitive psychology, with particular emphasis on metacognition. Together, these perspectives provide a coherent theoretical foundation for conceptualizing career planning as an active, self-regulated learning process rather than a purely informational activity. The model therefore foregrounds learner engagement, contextualized problem solving, and reflective regulation as central mechanisms for enhancing vocational college freshmen's metacognitive skills in career planning.

Constructivist and sociocultural theories (Piaget, 1950; Vygotsky, 1978) inform the model's emphasis on authentic tasks, social interaction, and scaffolded learning. Within the CWLE, learners engage with realistic career scenarios, case-based activities, and interactive tools that require them to actively construct meaning related to personal interests, abilities, and career pathways. Socially mediated learning is supported through collaborative spaces and guided interaction, consistent with the Zone of Proximal Development, wherein peers, mentors, and instructors provide graduated support for complex career planning tasks. This design enables learners to externalize their thinking, receive feedback, and progressively assume greater responsibility for their learning and decision-making processes.

Cognitive and metacognitive theories (Flavell, 1979; Schraw, 1998) directly inform the model's focus on explicit metacognitive regulation. The CWLE integrates structured prompts and tools that guide learners to plan career exploration activities, monitor progress and understanding, and evaluate the effectiveness of their decisions. By embedding planning, monitoring, and evaluation within authentic career-related tasks, the model operationalizes metacognitive development as an integral component of career learning. As a result, the CWLE functions not merely as an information delivery platform, but as a theoretically grounded learning environment designed to support adaptive, reflective, and self-directed career planning.

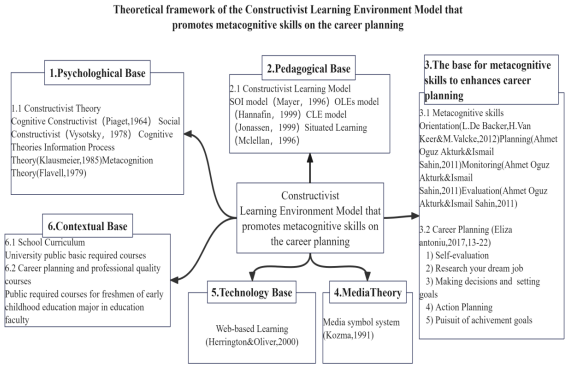


Figure 2. Theoretical Bases of the Constructivist Learning Environment Model.

Key components and design elements incorporated into the constructivist learning environment model to support vocational college freshmen's career planning

Based on the systematic analysis and synthesis of relevant learning theories, the constructivist learning environment model was structured into four interrelated processes, the first of which focuses on activating learners' cognitive structures while explicitly enhancing metacognitive skills (Figure 3). This initial process represents the foundational phase of the model and is grounded in constructivist principles that emphasize learning through engagement with authentic, ill-structured problems and the construction of personal meaning (Jonassen, 1999). Within the proposed model, such problem situations are deliberately designed to anchor career planning activities in learners' existing cognitive frameworks, thereby fostering meaningful learning rather than passive information acquisition. In alignment with McLellan's (1996) conception of contextual learning, authentic career-related contexts are embedded into the learning environment, enabling students to apply emerging knowledge and skills to realistic career planning scenarios. Central to this phase is the explicit development of metacognitive skills, drawing on the framework proposed by Aktürk and Sahin (2011), which conceptualizes metacognition as comprising orientation, planning, monitoring, and evaluation. By systematically integrating these regulatory processes into authentic learning tasks, the model equips vocational college freshmen with the self-regulatory capacities required to manage complex career planning activities. Collectively, the integration of constructivist learning principles, contextualized tasks, and explicit metacognitive regulation establishes a coherent problem base and learning mission that supports deep engagement and lays the groundwork for sustained metacognitive development in career planning.

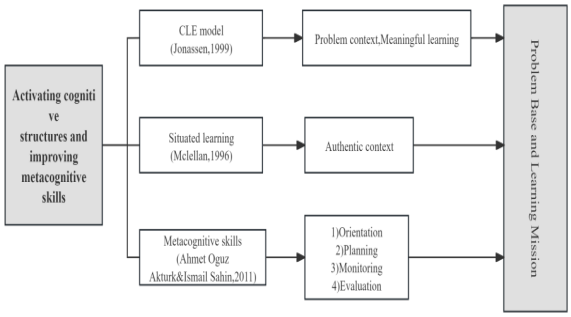


Figure 3. Problem Base and Learning Mission

As illustrated in Figure 4, the second process of the constructivist learning environment model focuses on supporting cognitive balance while strengthening learners' cognitive structures through the design of the Learning Resource Center (LRC). This process is theoretically grounded in multiple complementary frameworks that collectively guide the organization, presentation, and use of career planning resources. Drawing on the Open Learning Environments (OLEs) model (Hannafin, 1999), the LRC is designed to offer both static and dynamic resources, ensuring access to stable foundational knowledge alongside adaptable, content-rich materials that respond to diverse learning needs. In alignment with the Constructivist Learning Environment (CLE) model (Jonassen, 1999), the LRC incorporates relevant cases that situate learning within authentic career-related problems, thereby encouraging contextualized problem solving and the application of theoretical knowledge to real-world scenarios. Information processing theory (Klausmeier, 1985) further informs the structuring of content to optimize information intake and retention, while Mayer's (1996) Select–Organize–Integrate (SOI) model guides learners toward active cognitive engagement rather than passive consumption of resources. To maintain cognitive balance and prevent overload, cognitive load theory (Sweller, 1994) underpins the use of chunking strategies that segment complex career information into manageable units. Collectively, these design principles enable the LRC to support efficient information processing, promote coherent knowledge integration, and foster the development of robust cognitive structures essential for effective career planning among vocational college freshmen.

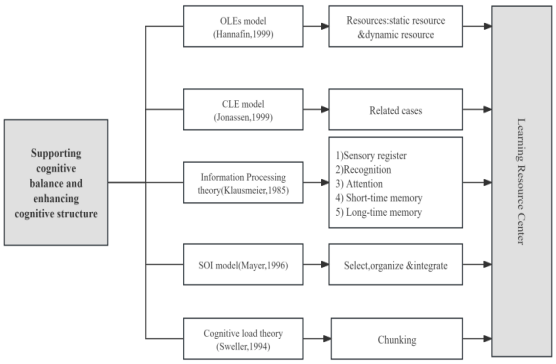


Figure 4. Supporting Cognitive Balance and Enhancing Cognitive Structure

As depicted in Figure 5, the third process of the constructivist learning environment model integrates multiple theoretical perspectives to support learners' career planning problem solving and metacognitive regulation. Central to this process is the Cognitive Tools Center, which draws on the Open Learning Environments (OLEs) framework (Jonassen, 1999) to provide learners with structured tools that externalize and scaffold complex thinking. These include tools for problem and task characterization, which help learners define and structure career-related challenges; knowledge modeling tools, both static and dynamic, that support the construction and application of conceptual representations of career pathways; and information-gathering tools that enable systematic collection, evaluation, and synthesis of career-relevant data. Collectively, these tools facilitate higher-order cognitive engagement by supporting analytical reasoning, decision modeling, and informed choice-making in career contexts.

Complementing this cognitive support, the Collaboration Center operationalizes principles from social constructivism (Vygotsky, 1978) and the Constructivist Learning Environment (CLE) model by embedding opportunities for peer interaction, shared inquiry, and collaborative problem solving. Through structured group discussions, peer feedback, and collaborative tasks, learners externalize their reasoning processes, encounter diverse perspectives, and co-construct career-related knowledge. This social mediation not only enhances problem-solving depth but also supports metacognitive development by making regulatory processes—such as monitoring understanding and evaluating alternative strategies—explicit and negotiable within a community of learners.

In parallel, the Metacognitive Skills Center provides targeted support for self-regulation in career planning by integrating established conceptions of career planning (Antoniu, 2010) with metacognitive skill frameworks (Aktürk & Şahin, 2011). This center explicitly guides learners through cycles of goal setting, strategic planning, progress monitoring, outcome evaluation, and reflective adjustment. By embedding metacognitive prompts and regulatory tools within authentic career planning tasks, the model ensures that learners do not merely engage in problem solving but also develop sustained awareness and control over their cognitive and decision-making processes. Together, these interrelated components enable the constructivist learning environment to foster adaptive, self-regulated career planning competencies among vocational college freshmen.

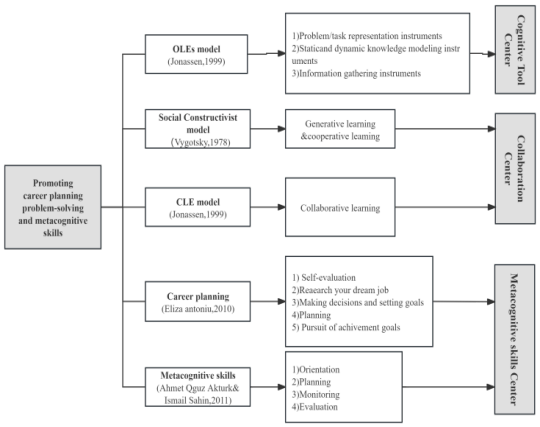


Figure 5. Promoting Career Planning, Problem Solving, and Metacognitive Skills.

As illustrated in Figure 6, the fourth process of the constructivist learning environment model provides sustained instructional support to ensure robust knowledge construction and the continued development of metacognitive skills in career planning. This process is operationalized through the coordinated functions of the Scaffolding Center and the Mentoring Center, which together create a dynamic support system that evolves with learners' developing competencies. Drawing on social constructivist principles (Vygotsky, 1978) and the Open Learning Environments framework (Hannafin, 1999), the Scaffolding Center delivers adaptive guidance calibrated to learners' current levels of understanding. Guided by the concept of the Zone of Proximal Development, scaffolding mechanisms—such as prompts, structured feedback, and graduated task support—are designed to align with learners' immediate needs and to be progressively withdrawn as learners gain greater autonomy in career planning tasks.

Complementing this adaptive scaffolding, the Mentoring Center provides individualized coaching and feedback grounded in the principles of cognitive apprenticeship (Brown et al., 1991), with explicit attention to metacognitive regulation (Aktürk & Şahin, 2011). Through modeling, guided practice, and reflective dialogue situated within authentic career planning contexts, learners are supported in making expert reasoning processes visible and transferable. This ongoing mentorship ensures that support extends beyond initial engagement, fostering continuous refinement of planning, monitoring, and evaluative strategies. Together, the Scaffolding and Mentoring Centers establish an integrated support structure that enables learners to progressively assume responsibility for their learning, thereby promoting self-directed knowledge construction and sustained metacognitive development in vocational career planning.

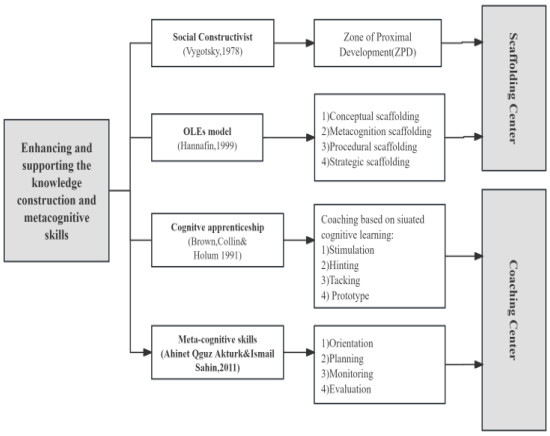


Figure 6. Enhancement and Support for Knowledge Construction and Metacognitive Skills.

The Seven Components of the Constructivist Learning Environment Model Enhance Students' Metacognitive Skills in Career Planning

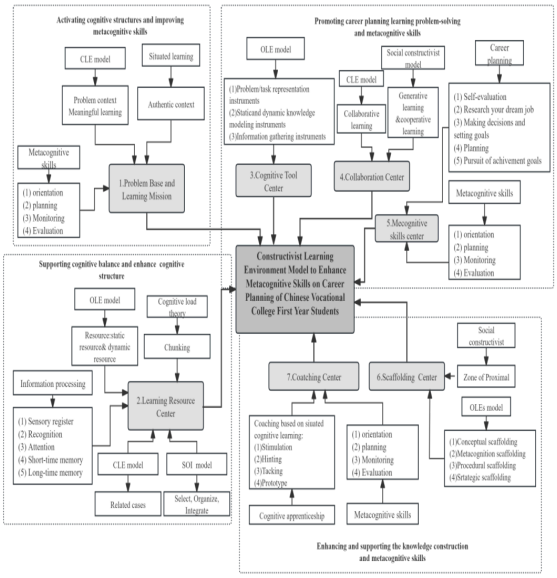


Figure 7. The seven components of the Constructivist Learning Environment Model

As illustrated in Figure 7, the web-based Constructivist Learning Environment (CLE) model comprises seven interrelated components that collectively form a coherent and theoretically grounded framework for enhancing vocational college freshmen's metacognitive skills in career planning. Rather than functioning as isolated instructional units, these components operate synergistically to support learners' cognitive engagement, self-regulation, and reflective decision-making throughout the career planning process. The model represents an integrative design in which learning tasks, resources, tools, and supports are deliberately aligned to foster deep learning and progressively autonomous career reasoning.

At the core of the framework is the Problem Base and Learning Mission, which anchors learning in authentic, ill-structured career scenarios. These problem situations simulate real-world career dilemmas and serve as the primary drivers of inquiry, requiring learners to interpret information, evaluate alternatives, and justify decisions. By positioning career planning as a problem-solving activity rather than a procedural task, this component establishes a meaningful context that activates learners' prior knowledge and initiates metacognitive engagement from the outset.

Supporting this inquiry-driven foundation, the Learning Resource Center provides access to a strategically organized body of career-related materials that accommodate diverse learning needs. Through the integration of static and dynamic resources, case-based exemplars, and cognitively optimized information structures, this component supports knowledge

acquisition while maintaining cognitive balance. The design promotes active selection, organization, and integration of information, thereby strengthening learners' cognitive structures essential for informed career planning.

The Cognitive Tools Center further extends learners' capacity to process and manage information by offering tools for searching, modeling, organizing, and synthesizing career-related data. These tools externalize cognitive processes, enabling learners to clarify complex relationships, articulate reasoning, and systematically evaluate career options. By supporting higher-order thinking and analytical problem solving, this component plays a critical role in transforming information into actionable career knowledge.

Complementing individual cognition, the Collaboration Center facilitates social interaction and shared meaning-making through peer discussion, collaborative tasks, and mentorship-oriented exchanges. This component enables learners to articulate perspectives, negotiate understanding, and co-construct career knowledge within a socially mediated learning environment. Such interaction not only enriches cognitive processing but also makes metacognitive strategies visible through dialogue and collective reflection.

The Metacognitive Skills Center serves as the regulatory core of the framework by explicitly guiding learners through key phases of metacognitive control, including problem orientation, planning, monitoring, evaluation, and adaptive adjustment. Through structured prompts, reflective tasks, and self-assessment mechanisms, this component supports learners in becoming aware of and regulating their own thinking processes during career exploration and decision-making.

Sustained instructional support is provided through the Scaffolding Center, which integrates adaptive guidance from instructors, career counselors, and automated system feedback. Drawing on learners' diagnostic learning analytics, scaffolding is dynamically adjusted to learners' evolving needs and progressively withdrawn as metacognitive competence increases. This adaptive support ensures that learners operate within an optimal zone of challenge while developing self-regulatory independence.

Finally, the Coaching Center offers personalized mentoring and expert feedback to support the refinement of career planning strategies. Through targeted coaching, learners receive individualized guidance grounded in authentic career planning cases, enabling them to consolidate metacognitive skills and translate reflective insights into coherent career decisions. Together, these seven components form a comprehensive constructivist learning environment that systematically supports cognitive development, metacognitive regulation, and self-directed career planning.

Discussion

Theoretical Bases Informing the Development of a Constructivist Learning Environment Model Aimed at Enhancing Metacognitive Skills in Career Planning

The findings concerning the theoretical underpinnings of the Constructivist Learning Environment model affirm that the design of an online constructivist learning environment for career planning must be grounded in an integrated theoretical framework rather than a single pedagogical tradition. The present study demonstrates that constructivism, sociocultural learning theory, and metacognitive theory jointly provide a coherent foundation for supporting learners' active engagement, reflective thinking, and self-regulation in career-related decision-making. This result aligns with long-standing arguments in educational psychology that complex, ill-structured domains, such as career planning, require learning environments that promote meaning-making, dialogue, and cognitive regulation rather than transmission-based instruction (Azevedo & Hadwin, 2005; Jonassen, 1999).

Consistent with constructivist theory, the model's emphasis on authentic career scenarios, interactive simulations, and reflective tasks supports Piaget's (1950) and Vygotsky's (1978) view that knowledge is actively constructed through interaction with tasks and contexts. Prior studies have similarly reported that constructivist learning environments enhance learners' ability to integrate personal experiences with new information, particularly in domains requiring self-exploration and decision-making (Biggs, 1996; Panadero, 2017). In the context of career planning, this finding reinforces earlier research suggesting that passive exposure to career information is insufficient; instead, learners benefit from activities that require them to analyze career pathways, reflect on personal attributes, and make informed judgments (Super, 1980; Lent et al., 1994). The present study extends this work by explicitly embedding these constructivist principles within an online environment tailored to career planning.

The incorporation of sociocultural learning theory further highlights the importance of social mediation in metacognitive development. The model's use of collaborative discussion, peer interaction, and scaffolded support reflects Vygotsky's (1978) concept of the Zone of Proximal Development, where learners internalize higher-order strategies through guided participation. Previous empirical studies have shown that metacognitive skills are more effectively developed when learners externalize their thinking through dialogue and receive feedback from peers or instructors (Azevedo & Hadwin, 2005). In career planning contexts, such social interaction allows students to articulate reasoning, compare perspectives, and recalibrate goals - processes that are essential for monitoring and regulating decision-making. The present study confirms these findings and demonstrates how sociocultural scaffolding can be systematically operationalized within a constructivist online learning environment.

Moreover, the explicit integration of metacognitive theory represents a critical contribution of the Constructivist Learning model. Drawing on Flavell's (1979) and Schraw's (1998) conceptualizations, the model distinguishes between metacognitive knowledge and metacognitive regulation and embeds instructional supports target planning, monitoring, and evaluation processes. Prior research has emphasized that metacognitive skills do not develop automatically through engagement alone but require intentional prompts, tools, and reflective opportunities (Azevedo & Hadwin, 2005; Pintrich, 2004; Robillos, 2019). The present findings corroborate this view by demonstrating that metacognitive prompts and self-regulatory tools can be purposefully designed into career planning activities, thereby supporting learners' autonomous and adaptive career decision-making.

Taken together, this result suggests that the theoretical strength of the Constructivist Learning Environment model lies in its integrative nature. Rather than merely confirming established pedagogical assumptions, the study illustrates how constructivist, sociocultural, and metacognitive theories can be systematically synthesized to address the specific cognitive and regulatory demands of career planning. In doing so, the present study responds to calls in the literature for clearer conceptual models that explain how constructivist learning environments function to enhance metacognitive outcomes, particularly in applied domains such as career education. This theoretical integration provides a robust foundation for the subsequent design and development phases of the model and sets the stage for examining how these principles translate into concrete instructional components.

Key components and design elements incorporated into the constructivist learning environment model to support vocational college freshmen's career planning

The findings concerning the key components and design elements of the constructivist learning environment model indicate that effective career planning instruction for vocational college freshmen requires a multi-layered and theoretically integrated design. Rather than relying on isolated instructional strategies, the present study demonstrates that career planning can be meaningfully supported through a sequence of interrelated processes that activate prior knowledge, regulate cognitive load, promote problem solving, and sustain metacognitive development. This aligns with earlier scholarship arguing that complex, ill-structured domains, such as career decision-making, necessitate learning environments that support both cognitive and metacognitive engagement across multiple stages of learning (Azevedo & Hadwin, 2005; Jonassen, 1999; Qu & Chaijaroen, 2025).

The first process, activating cognitive structures while explicitly enhancing metacognitive skills, reinforces the centrality of authentic problem situations in constructivist learning environments. Consistent with Jonassen's (1999) conception of meaningful learning, the use of real-world career scenarios encourages learners to actively construct personal meaning rather than passively consume career information. Prior studies have shown that contextualized and problem-based tasks are particularly effective in domains requiring self-exploration and decision-making, as they promote deeper engagement and personal relevance (Biggs, 1996; Clarke & Roche, 2018). The present study extends this line of research by demonstrating how such authentic contexts can be intentionally designed to trigger not only cognitive activation but also metacognitive orientation, planning, monitoring, and evaluation - processes identified as critical for self-directed career planning (Flavel, 1979; Robillos, 2019).

Importantly, the explicit integration of metacognitive skills in the activation phase addresses a limitation

noted in previous career education research, where learners often engage in activities without systematic reflection on their thinking processes. Studies in educational psychology consistently report that metacognitive skills do not emerge automatically from engagement alone; rather, they require deliberate instructional attention and scaffolding (Flavell, 1979; Pintrich, 2004). By embedding metacognitive components at the outset of the learning process, the CWLE model ensures that vocational college freshmen are equipped with self-regulatory tools necessary for navigating complex career planning tasks. This finding aligns with research suggesting that early metacognitive activation supports sustained self-regulation across subsequent learning phases (Schraw & Dennison, 1994).

The second process, supporting cognitive balance and enhancing cognitive structure through the Learning Resource Center, highlights the importance of managing cognitive load while fostering meaningful knowledge integration. Drawing on Hannafin's (1999) OLEs model, the distinction between static and dynamic resources reflects prior recommendations for flexible and learner-responsive resource design. Empirical studies have shown that access to varied resource types supports differentiated learning needs and promotes adaptive knowledge construction (Hannafin et al., 2014). In the context of career planning, this dual-resource approach allows learners to anchor understanding in stable information while also engaging with evolving labor market data and career pathways.

The integration of information processing theory (Klausmeier, 1985), Mayer's (1996) SOI model, and cognitive load theory (Sweller, 1994) further strengthens the theoretical robustness of this component. Previous research has demonstrated that learners benefit when instructional materials are designed to support selecting, organizing, and integrating information while minimizing extraneous cognitive load (Mayer, 2009). The present study confirms these findings by showing how chunking and structured presentation of career-related information can support the development of coherent cognitive structures without overwhelming novice learners. This is particularly relevant for vocational college freshmen, who often face extensive and unfamiliar career information early in their academic trajectories.

The third process, enhancing career planning problem solving and metacognitive skills through cognitive tools and collaboration, underscores the role of tools as intellectual partners in constructivist learning environments. Consistent with Jonassen's (1999) notion of cognitive tools, the Cognitive Tools Center supports learners in defining problems, modeling career options, and systematically gathering information. Prior studies have shown that such tools enhance higher-order thinking by externalizing cognition and supporting complex reasoning processes (Azevedo & Hadwin, 2005; Miri et al., 2007)**.** The present findings suggest that these tools are particularly effective in career planning contexts, where learners must integrate self-knowledge with external occupational information.

The role of collaboration further aligns the model with social constructivist perspectives. Vygotsky's (1978) assertion that learning is socially mediated is well supported by research demonstrating that dialogue, peer feedback, and collaborative inquiry enhance metacognitive awareness and strategy use (Azevedo & Hadwin, 2005). In career planning, collaborative engagement enables students to compare perspectives, articulate reasoning, and reassess assumptions - processes that are essential for informed decision-making. The integration of collaboration within the CWLE model therefore confirms prior findings while demonstrating how social interaction can be systematically embedded to support both problem solving and metacognitive development.

The fourth process, providing sustained support for knowledge construction and metacognitive development through scaffolding and mentoring, reflects established principles of guided learning and cognitive apprenticeship. Drawing on Vygotsky's (1978) ZPD and Brown et al.'s (1991) cognitive apprenticeship model, the Scaffolding and Mentoring Centers provide adaptive support that gradually fades as learners gain competence. Previous research has consistently shown that such adaptive scaffolding is crucial for developing self-regulation and independent learning skills (Azevedo & Hadwin, 2005; van de Pol et al., 2010). The present study reinforces this evidence by demonstrating how continuous, context-sensitive support can sustain metacognitive growth throughout the career planning process.

Collectively, these findings suggest that the Constructivist Learning Environment model advances existing constructivist learning environment

frameworks by explicitly aligning instructional components with the metacognitive demands of career planning. While prior Constructivist Learning Environment research has often focused on general problem solving or academic learning, the present study demonstrates how constructivist principles can be operationalized in a domain-specific manner to support vocational college freshmen's career development. By integrating authentic tasks, cognitive balance, problem-solving tools, collaboration, and sustained scaffolding, the model provides a coherent and theoretically grounded approach to fostering metacognitive regulation in career planning. This contributes to the literature by moving beyond confirmation of constructivist assumptions and offering a structured framework that clarifies how Constructivist Learning Environment components function together to support adaptive and self-directed career decision-making.

The Seven Components of the Constructivist Learning Environment Model Enhance Students' Metacognitive Skills in Career Planning

The findings indicate that the proposed constructivist learning environment model integrates seven interrelated components into a coherent instructional framework designed to enhance metacognitive skills in career planning among vocational college freshmen. This integrative design responds to long-standing concerns in career education research that traditional instructional approaches tend to emphasize information provision rather than cognitive and self-regulatory development (Super, 1980; Lent et al., 1994). By structuring career planning as an active, problem-centered, and reflective learning process, the present model aligns with contemporary views of career development as iterative and learning-oriented rather than a single rational decision (Jiang, 2019; Valls et al., 2020).

The inclusion of a problem base and learning mission as the core entry point of the Constructivist Learning Environment model reflects constructivist assertions that meaningful learning emerges from engagement with authentic and ill-structured problems (Jonassen, 1999). Prior studies have demonstrated that real-world problem scenarios promote deeper cognitive processing and transfer of learning, particularly in domains involving personal judgment and uncertainty (Biggs, 1996). In the context of career planning, such problems mirror the ambiguity and complexity of real career decisions, encouraging learners to activate prior knowledge, evaluate alternatives, and justify choices. The present findings extend earlier work by demonstrating how problem-based learning can be systematically aligned with metacognitive goals, rather than functioning solely as a content-delivery mechanism.

The Learning Resource Center further supports this problem-based approach by addressing cognitive balance and structural knowledge development. Consistent with Hannafin's (1999) OLEs model and Sweller's (1994) cognitive load theory, the integration of static and dynamic resources allows learners to access stable foundational information while engaging with evolving career data. Previous research has shown that poorly structured resources can overwhelm novice learners and hinder meaningful learning (Mayer, 2009). The present study confirms that resource design grounded in information processing principles, such as chunking and guided selection, can support vocational freshmen in organizing career-related knowledge, thereby strengthening the cognitive foundation necessary for informed decision-making.

The Cognitive Tools Center highlights the role of tools as intellectual mediators in complex learning tasks. Drawing on Jonassen's (1999) conceptualization of cognitive tools, this component enables learners to externalize thinking, structure problems, and integrate multiple sources of information during career planning. Empirical studies have demonstrated that cognitive tools enhance higher-order thinking and metacognitive monitoring by making reasoning processes visible and manipulable (Azevedo & Hadwin, 2005; Chen, 2020). The present findings reinforce these conclusions and suggest that such tools are particularly valuable in career contexts, where learners must reconcile personal attributes with external occupational demands.

Social interaction is operationalized through the Collaboration Center, reflecting social constructivist perspectives on learning as a socially mediated process. Vygotsky (1978) emphasized that cognitive development occurs through dialogue and shared activity, a view supported by research demonstrating that collaborative learning fosters metacognitive awareness and strategic regulation (Azevedo & Hadwin, 2005). In career planning, exposure to peers' perspectives allows learners to challenge assumptions, articulate reasoning, and refine decision criteria. The findings suggest that collaboration within the

Constructivist Learning Environment model does not merely enhance engagement but serves as a mechanism for metacognitive development through shared reflection and co-construction of career knowledge.

The Metacognitive Skills Center represents a distinctive contribution of the present model by explicitly structuring metacognitive regulation within the career planning process. Building on Flavell's (1979) and Pintrich's (2004) conceptualizations of metacognition, this component guides learners through planning, monitoring, evaluating, and revising career decisions. Prior studies have shown that students often lack awareness of how to regulate their thinking in complex decision-making tasks, leading to superficial or externally driven career plans (Schraw & Dennison, 1994; Robillos, 2019). The present findings suggest that embedding metacognitive guidance as a dedicated component—rather than an implicit outcome—can support deeper and more autonomous career planning.

Finally, the Scaffolding and Coaching Centers provide sustained and adaptive support that bridges learners' current capabilities and desired competencies. Grounded in Vygotsky's (1978) Zone of Proximal Development and cognitive apprenticeship theory (Brown et al., 1991), these components ensure that learners receive timely guidance, feedback, and modeling that gradually fades as competence increases. Research has consistently demonstrated that adaptive scaffolding is essential for developing self-regulated learning and metacognitive control, particularly among novice learners (Azevedo & Hadwin, 2005; van de Pol et al., 2010). The present study extends this literature by illustrating how scaffolding and coaching can be systematically integrated into a web-based environment to support vocational college freshmen's transition toward self-directed and metacognitively informed career planning.

Conclusion

This study contributes to the literature by advancing a principled understanding of career planning as a metacognitively intensive learning process rather than a static or purely informational activity. By integrating career development theory, metacognitive theory, and social constructivist learning theory, the research articulates how instructional design can meaningfully shape students' capacity to regulate thinking, reflect on decisions, and adapt to evolving career demands. In doing so, the study shifts the focus of career education from outcome-oriented guidance to process-oriented learning, emphasizing the cognitive and regulatory mechanisms that underpin effective career planning among vocational college freshmen.

The proposed constructivist learning environment model extends existing CLE frameworks by explicitly positioning metacognitive regulation as a central design objective. While prior constructivist models emphasize authentic tasks, collaboration, and learner agency, this study clarifies how these elements can be strategically aligned to support planning, monitoring, and evaluation in career-related decision-making. The model thus contributes theoretically by specifying the instructional mechanisms through which constructivist principles translate into metacognitive development within a complex and personally consequential learning domain.

Importantly, this research responds to longstanding concerns about the limited pedagogical impact of policy-driven career planning curricula. The findings suggest that effective career education requires more than structured content or institutional mandates; it demands learning environments that actively engage learners in reflection, sense-making, and self-regulation. By embedding metacognitive scaffolding within authentic career tasks and socially mediated learning processes, the model offers a coherent framework for transforming career planning instruction into a cognitively empowering educational experience.

Overall, this study enriches the theoretical and instructional discourse on career education by bridging constructivist learning theory and metacognitive development within vocational contexts. The constructivist learning environment model articulated in this research provides a conceptual foundation for rethinking how career planning is taught, learned, and supported in higher education. In doing so, it foregrounds learners' agency, reflective capacity, and cognitive growth as central outcomes of career education, reinforcing the role of instructional design in fostering adaptive and self-directed career development.

Limitation

The present study is limited by its exclusive focus on the conceptual design and theoretical development of a constructivist web-based learning environment,

without proceeding to empirical implementation or outcome measurement. Consequently, the conclusions drawn pertain to the internal logic, theoretical alignment, and pedagogical coherence of the proposed model rather than to its demonstrated impact on learners' metacognitive development or career planning competence. Although this design-oriented focus is consistent with model development and design-based research traditions, it constrains claims regarding instructional effectiveness in authentic learning contexts.

A second limitation arises from the model's reliance on synthesized theoretical and empirical literature as the primary basis for its construction. While the literature review was systematic and anchored in established educational and psychological frameworks, it inevitably reflects dominant scholarly discourses and may insufficiently capture emergent practices, tacit instructional strategies, or contextual adaptations evident in day-to-day vocational education settings. As a result, certain situated factors, such as classroom interaction patterns, instructor facilitation styles, or learners' emotional engagement with career decision-making, are not directly represented in the model.

In addition, the model operationalizes metacognitive engagement through widely recognized regulatory processes, namely planning, monitoring, and evaluation. This conceptualization enhances theoretical clarity and design coherence; however, it may oversimplify the dynamic and nonlinear nature of metacognitive activity in real-world career planning. Career decision-making often entails the interplay of cognitive, affective, and social influences that evolve over time. These dimensions are acknowledged but not explicitly foregrounded within the model, reflecting a deliberate emphasis on cognitive regulation rather than a fully holistic portrayal of career development processes.

The contextual orientation of the model also presents a limitation. Although it is developed with reference to the Chinese vocational education system, the design is primarily informed by broadly applicable learning theories rather than localized pedagogical traditions or institutional norms. This theoretical generality enhances transferability but may reduce contextual specificity. Accordingly, culturally mediated practices, such as hierarchical teacher–student relations, institutionalized career pathways, or sociocultural expectations surrounding vocational choices, may require careful adaptation when the model is enacted in particular institutional settings.

Finally, from a methodological standpoint, the study did not incorporate formal validation procedures during the model development process, such as expert review panels, Delphi consensus techniques, pilot usability testing, or iterative learner-centered refinement. While the model is theoretically robust and systematically derived, the absence of structured practitioner or learner validation limits the extent to which its feasibility, usability, and instructional practicality can be empirically substantiated at this stage. As such, several design assumptions, particularly regarding learners' readiness for self-regulated engagement and instructors' capacity to implement adaptive scaffolding, remain theoretically inferred, underscoring the need for subsequent validation-focused and implementation-based research.

References

Akkermans, J., da Motta Veiga, S. P., Hirschi, A., & Marciniak, J. (2024). Career transitions across the lifespan: A review and research agenda. Journal of Vocational Behavior, 148, 103957. https://doi.org/10.1016/j.jvb.2023.103957

Azevedo, R., & Hadwin, A. F. (2005). Scaffolding self-regulated learning and metacognition–Implications for the design of computer-based scaffolds. Instructional Science, 33(5/6), 367-379. https://doi.org/10.1007/s11251-005-1272-9

Akturk, A. O., & Sahin, I. (2011). Literature Review on Metacognition and its Measurement. Procedia: Social & Behavioral Sciences, 15, 3731–3736. https://doi.org/10.1016/j.sbspro.2011.04.364

Backes-Gellner, U., & Geel, R. (2014). A comparison of career success between graduates of vocational and academic tertiary education. Oxford Review of Education, 40(2), 266–291. https://doi.org/10.1080/03054985.2014.889602

Bailey, W., Lavender, K., Youde, A., & Jiao, J. (2024). Experiences from great vocational education policy change in China-a teacher perspective. International Journal of Training Research, 22(1), 87-104. https://doi.org/10.1080/14480220.2024.2332350

Biggs, J. (1996). Enhancing teaching through

constructive alignment. Higher Education, 32(3), 347-364. https://doi.org/10.1007/BF00138871

Clarke, D., & Roche, A. (2018). Using contextualized tasks to engage students in meaningful and worthwhile mathematics learning. The Journal of Mathematical Behavior, 51, 95-108. https://doi.org/10.1016/j.jmathb.2017.11.006

Chen, M. H. (2020). Enhancing metacognition through thinking instruction: A case study in a Taiwanese university. Journal of University Teaching and Learning Practice, 17(5), 1-31. https://doi.org/10.53761/1.17.5.16

Chaijaroen, S., Kanjug, I., & Samat, C. (2012). The Study of Learners' Critical Thinking Potential, Learning with Innovation Enhancing Thinking Potential. Procedia: Social & Behavioral Sciences, 46, 3415–3420. https://doi.org/10.1016/j.sbspro.2012.06.076

Chen, S., & Zhou, K. (2018). Career Planning decision-making of college students based on cognitive science. Neuroquantology, 16(6). https://doi.org/10.14704/nq.2018.16.6.1662

Chisanu, J., Sumalee, C., Issara, K., & Charuni, S. (2012). Design and develop of constructivist learning environment on learning management System. Procedia: Social & Behavioral Sciences, 46, 3426–3430. https://doi.org/10.1016/j.sbspro.2012.06.078

De Backer, L., Van Keer, H., & Valcke, M. (2011). Exploring the potential impact of reciprocal peer tutoring on higher education students' metacognitive knowledge and regulation. Instructional Science, 40(3), 559–588. https://doi.org/10.1007/s11251-011-9190-5

Ding, C. (2023). The influences of Mind-Map on cultivating students' metacognitive capacity. Lecture Notes in Education Psychology and Public Media, 22(1), 130–139. https://doi.org/10.54254/2753-7048/22/20230244

Dik, B. J., Sargent, A. M., & Steger, M. F. (2008). Career development strivings: Assessing goals and motivation in career decision-making and planning. Journal of Career Development, 35(1), 23-41. https://doi.org/10.1177/0894845308317934

Fang, M., Pan, R., Ding, R., Hou, Z., & Wang, D. (2024). Effect of proactive personality on career adaptability of higher vocational college students: the mediating role of college experience. Frontiers in Psychology, 15, 1333677. https://doi.org/10.3389/fpsyg.2024.1333677

Fischer, J., Bearman, M., Boud, D., & Tai, J. (2024). How does assessment drive learning? A focus on students' development of evaluative judgement. Assessment & Evaluation in Higher Education, 49(2), 233–245. https://doi.org/10.1080/02602938.2023.2206986

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. American Psychologist/ the American Psychologist, 34(10), 906–911. https://doi.org/10.1037/0003-066x.34.10.906

Guo, Z. (2022). The challenges and dilemmas of vocational education in China. In Proceedings of the 2022 International Conference on Science Education and Art Appreciation (SEAA 2022) (Vol. 675, p. 364). Springer Nature. https://doi.org/10.2291/978-2-494069-05-3_45

Garcia, E. V. (2016). Strategic planning: a tool for personal and career growth. Heart Asia, 8(1), 36–39. https://doi.org/10.1136/heartasia-2015-010684

Geiwitz, J. (1996). A conceptual model of metacognitive skills [Dataset]. In PsycEXTRA Dataset. https://doi.org/10.1037/e451712006-001

González-Salamanca, J. C., Agudelo, O. L., & Salinas, J. (2020). Key competences, education for sustainable development and Strategies for the development of 21st century skills. A Systematic literature review. Sustainability, 12(24), 10366. https://doi.org/10.3390/su122410366

He, S., Shi, X., Choi, T. H., & Zhai, J. (2023). How do students' roles in collaborative learning affect collaborative problem-solving competency? A systematic review of research. Thinking Skills and Creativity, 50, 101423. https://doi.org/10.1016/j.tsc.2023.101423

Hertig, C. A., Powell, K., & Richardson, C. (2020). Career planning. In The professional protection officer (pp. 499-503). Butterworth-Heinemann. https://doi.org/10.1016/B978-0-12-817748-8.00045-6

Hao, D., Sun, V. J., & Yuen, M. (2015). Towards a model of career guidance and counseling for university students in China. International Journal for the Advancement of Counselling, 37(2), 155–167.

https://doi.org/10.1007/s10447-015-9234-7104

Iliescu, D., Greiff, S., & Ion, A. (2025). Evidence based approaches for enhancing vocational education worldwide. NPJ Science of Learning, 10(1), 20. https://doi.org/10.1038/s41539-025-00317-2

Jiang, J. (2019). Research on the necessity of career planning education for freshmen. In 2018 International Workshop on Education Reform and Social Sciences (ERSS 2018) (pp. 575-578). Atlantis Press. https://doi.org/10.2991/erss-18.2019.114

Kou, C., & Yang, X. J. (2025). Research landscape of career planning and employment guidance education: A bibliometric analysis of Chinese literature. Open Journal of Social Sciences, 13, 22 38. https://doi.org/10.4236/jss.2025.133003

Kriesi, I., & Sander, F. (2024). Academic or vocational education? A comparison of the long-term wage development of academic and vocational tertiary degree holders. Journal for Labour Market Research, 58(1), 10. https://doi.org/10.1186/s12651-024-00368-9

Kuijpers, M., & Meijers, F. (2012). Learning for now or later? Career competencies among students in higher vocational education in the Netherlands. Studies in Higher Education, 37(4), 449-467. https://doi.org/10.1080/03075079.2010.523144

Le, H. V., & Nguyen, L. Q. (2024, June). Promoting L2 learners' critical thinking skills: The role of social constructivism in reading class. Frontiers in Education, 9, 1241973. https://doi.org/10.3389/feduc.2024.1241973

Lent, R. W., & Brown, S. D. (2013). Social cognitive model of career self-management: Toward a unifying view of adaptive career behavior across the life span. Journal of Counseling Psychology, 60(4), 557–568. https://doi.org/10.1037/a0033446

Mårtensson, S., Lidström, H., & Ekbladh, E. (2024). Students with Difficulties Managing Vocational Education in High School: Identifying Intervention Areas Related to Self-Reported Student-Environment Fit and Mental Health. Journal of Occupational Therapy, Schools, & Early Intervention, 17(3), 829–841. https://doi.org/10.1080/19411243.2023.2215763

Melović, B., Šekularac-Ivošević, S., Muslu, A., Backović, T., & Dabić, M. (2022). Proactive career planning in the maritime industry: Enhancing millennials' workplace enthusiasm in Montenegro and Turkey. NAŠE MORE: znanstveni časopis za more i pomorstvo, 69(1), 40-52. https://doi.org/10.17818/NM/2022/1.6

Miri, B., David, B. C., & Uri, Z. (2007). Purposely teaching for the promotion of higher-order thinking skills: A case of critical thinking. Research in science education, 37(4), 353-369. https://doi.org/10.1007/s11165-006-9029-2

Oswald-Egg, M. E., & Renold, U. (2021). No experience, no employment: The effect of vocational education and training work experience on labour market outcomes after higher education. Economics of Education Review, 80, 102065. https://doi.org/10.1016/j.econedurev.2020.102065

Panadero, E. (2017). A review of self-regulated learning: Six models and four directions for research. Frontiers in psychology, 8, 422. https://doi.org/10.3389/fpsyg.2017.00422

Pang, C., Xie, R., Kang, N., & Hu, Z. (2025). The impact of career education participation on academic self-efficacy: The sequential mediating role of career adaptability and learning engagement. Behavioral Sciences, 15(2), 174. https://doi.org/10.3390/bs15020174

Pintrich, P. R. (2004). A conceptual framework for assessing motivation and self-regulated learning in college students. Educational Psychology Review, 16(4), 385-407. https://doi.org/10.1007/s10648-004-0006-x

Qu, X., & Chaijaroen, S. (2025). Analyzing the effects of metacognitive regulation enhances students' authentic writing learning performance in a web-based constructivist learning environment, Journal of Combinatorial Mathematics and Combinatorial Computing. 127, 7055-7074. https://doi.org/10.61091/jcmcc127b-385

Raković, M., Bernacki, M. L., Greene, J. A., Plumley, R. D., Hogan, K. A., Gates, K. M., & Panter, A. T. (2022). Examining the critical role of evaluation and adaptation in self-regulated learning. Contemporary Educational Psychology, 68, 102027. https://doi.org/10.1016/j.cedpsych.2021.102027

Richey, R. C., & Klein, J. D. (2005). Developmental research methods: Creating knowledge from instructional design and development practice. Journal of Computing in higher

Education, 16(2), 23-38. myweb.fsu.edu/jklein/articles/Richey_Klein_2005.pdf

Robillos, R.J. (2019). Crossing metacognitive strategy instruction in an EFL classroom: Its impact to Thai learners' listening comprehension skills and metacognitive awareness. Asian EFL Journal, 21(2), 311-336. https://www.asian-efljournal.com/main-editions-new/2019-main-journal/volume-21-issue-2-22019/index.htm

Ruijuan, L., Srikhao, S., & Jantharajit, N. (2024). From classroom to career: Enhancing vocational education through collaborative and active learning. Journal of Education and Educational Development, 11(2), 332-344. http://doi.org/10.22555/joeed.v11i2.1226

Sari, S.V., Camadan, F., & Özmen, S. (2025). Relationship between metacognitive skills and career exploration outcome expectations: mediating role of parental and peer attachment styles. BMC Psychology, 13, 257. https://doi.org/10.1186/s40359-025-02594-3

Savaengkan, O., & Chaijaroen, S. (2025), Revolutionizing vocational education: implementing a web-based constructivist model to enhance industrial and problem-solving skills. Higher Education, Skills and Work-based Learning, Vol. ahead-of-print No. ahead-of-print. https://doi.org/10.1108/HESWBL-02-2025-0052

Schraw, G., & Dennison, R. S. (1994). Assessing metacognitive awareness. Contemporary Educational Psychology, 19(4), 460-475. https://doi.org/10.1006/ceps.1994.1033

Seufert, T., Hamm, V., Vogt, A., & Riemer, V. (2024). The interplay of cognitive load, learners' resources and self-regulation. Educational Psychology Review, 36(2), 50. https://doi.org/10.1007/s10648-024-09890-1

Song, X., & Xu, D. (2024). More graduates, fewer skills? Vocational education expansion and skilled labour shortages in China. The China Quarterly, 260, 970-985. https://doi.org/10.1017/S0305741023001856

Stephen, J.S. (2024). Career Planning, Professional Development, and Lifelong Learning. In: Academic Success in Online Programs. Springer Texts in Education. Springer, Cham. https://doi.org/10.1007/978-3-031-54439-2_14

Stapleton, L., & Stefaniak, J. (2019). Cognitive constructivism: Revisiting Jerome Bruner's influence on instructional design practices. TechTrends, 63(1), 4-5. https://doi.org/10.1007/s11528-018-0356-8

Super, D. E. (1980). A life-span, life-spate approach to career development. Journal of vocational behavior, 16, 282-298. https://doi.org/10.1016/0001-8791(80)90056-1

Valls, V., González-Romá, V., Hernandez, A., & Rocabert, E. (2020). Proactive personality and early employment outcomes: The mediating role of career planning and the moderator role of core self-evaluations. Journal of Vocational Behavior, 119, 103424. https://doi.org/10.1016/j.jvb.2020.103424

Van de Pol, J., Volman, M., & Beishuizen, J. (2010). Scaffolding in teacher–student interaction: A decade of research. Educational Psychology Review, 22(3), 271-296. https://doi.org/10.1007/s10648-010-9127-6

Veenman, M. V., & Verheij, J. (2003). Technical students' metacognitive skills: Relating general vs. specific metacognitive skills to study success. Learning and Individual differences, 13(3), 259-272. http://dx.doi.org/10.1016/S1041-6080(02)00094-8

Wang, L. J., & Wei, M. Z. (1998). Vocational guidance and career planning in China. International Journal for the Advancement of Counselling, 20, 27-35. https://doi.org/10.1023/a:1005371605011

Wei, L., Zhou, S., Hu, S., Zhou, Z., & Chen, J. (2021). Influences of nursing students' career planning, internship experience, and other factors on professional identity. Nurse Education Today, 99(104781). https://doi.org/10.1016/j.nedt.2021.104781