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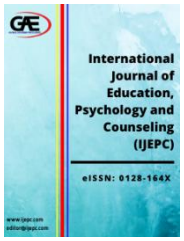

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AI-DRIVEN REFORM OF CAREER PLANNING IN CHINESE HIGHER EDUCATION: A SYSTEMATIC LITERATURE REVIEW

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Abstract:

Despite the widespread attention to the potential of AI in career preparation, there is a lack of systematic reviews of its application to career planning in Chinese higher education. To fill this research gap, this paper aims to systematically review existing research findings on AI-driven reform of career planning in Chinese higher education. This study, through analysis of 128 articles published on CNKI and Google Scholar between 2010 and 2025, found that the application of AI-based career planning in Chinese higher education is still in its infancy. Meanwhile, this study developed a conceptual framework for AI-driven career planning based on CIP theory. Finally, the review identifies gaps that make suggestions for further research in this area by systematically classifying and integrating the existing literature on the application of artificial intelligence in career planning within Chinese higher education, thereby providing a theoretical foundation for understanding how AI empowers career preparation.

Keyword:

Artificial Intelligence (AI), AI-Driven Career Planning, Chinese Higher Education, Conceptual Framework, Employability

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Introduction

Career planning is not merely a matter of employment arrangement, but a systematic process closely tied to an individual's career awareness, psychological traits, and developmental potential (Hillage & Pollard, 1998; Jackson & Tomlinson, 2020). The first task of university graduates in career planning is to have an in-depth understanding of themselves, including their own interests, character traits, ability advantages and career values (Hall, 1976). In China, researcher Qiuju Wang (2024) has also strongly endorsed this view, asserting that only by developing a clear sense of self-awareness can individuals make career choices that align with their personal traits, especially when navigating complex and evolving labor market environments (Wang, 2024).

However, the rise of the knowledge economy and the profound transformations driven by the Industrial 4.0 are fundamentally reshaping human production, consumption, and social structures at an unprecedented speed, scale, scope, and level of complexity. It encompasses cutting-edge technologies such as artificial intelligence, machine learning, robotics, the Internet of Things, nanotechnology, new materials, and other emerging fields (Peeters et al., 2017). The COVID-19 pandemic has further accelerated the digitalization of education and the transformation of career skills. These developments not only pose significant challenges to higher education but also accelerate digital transformation and promote both institutional and educational innovation (Zuo, 2022).

In response to the restructuring of the traditional employment landscape and the growing uncertainty and pressure surrounding graduate employment (Li & Xie, 2024), "The Chinese government has introduced a series of policies to promote deeper reforms in the career education system of higher education institutions and to encourage the integration of digital technologies such as artificial intelligence into career planning support services (Central Committee of the Communist Party of China and the State Council, 2024). As the key implementers of the policy, higher education institutions are actively exploring the construction of a personalised and intelligent career planning service system (Cheng et al., 2021; Huang et al., 2021). Despite the initial success of the relevant reforms, career planning education in higher education still faces many challenges in reality, such as limited implementation effect, low satisfaction of graduates, and disconnection between course content and employment reality. This is evidenced by the findings of a survey on the current status of career planning among young people (2023), which showed that nearly half of the respondents had a low level of satisfaction with the career planning services provided by universities (People's Data Research Institute & School of Journalism and Communication, 2023).

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Although artificial intelligence (AI) has been regarded by many organisations as a revolutionary technology with disruptive potential, driven by technological advances and growing public interest (Brock & Von Wangenheim, 2019), AI has remained a relatively obscure and practically limited field of study in the scientific community for more than half a century (Haenlein & Kaplan, 2019; Wirtz & Müller, 2018). In recent years, this situation has changed significantly. AI-related technologies have been progressively integrated into various service delivery systems, thus providing substantial benefits to the general public (Marr, 2019; Reis et al., 2020). This paradigm shift has facilitated the expansion of AI beyond its traditional roots in computer science and technology into key societal domains such as finance, education, and healthcare (Rosete et al., 2020).

Although existing international research has begun to focus on specific applications of AI in career preparation, such as intelligent resume analysis, virtual interviews and career matching systems (Kothari et al., 2024; Lewton & Haddad, 2024; Pompedda et al., 2020), and few studies have attempted to develop preliminary conceptual frameworks to investigate how it empowers education (e.g., research on the relationship between AI and employability) (Shi & Wang, 2025), the majority of these studies have focused on individual technologies or tools, lacking systematic integration and in-depth theoretical development. In contrast, research in this area is still at an early stage in China, with existing literature largely focused on conceptual analyses, while systematic theoretical development and localized practical summaries remain limited, making it difficult to support in-depth reforms in the career planning system.

In order to fill this research gap, this paper formulates the following three research questions, based on an extensive review and analysis of the relevant literature, so as to systematically examine how AI can reshape career planning practices in higher education and lay the groundwork for subsequent theoretical development and practical application.

RQ1: What is the trend of AI-driven career planning in higher education?
RQ2: What conceptual frameworks can be employed to guide the application of AI in career planning within higher education institutions?
RQ3: What are the key research gaps and opportunities for further research in applying AI for reforming career planning?)

Definitions and Review of The Existing Literature

Definition of Artificial Intelligence (AI) and Career Planning (CP)

Artificial Intelligence (AI)

In the current era, Artificial Intelligence (AI) has emerged as one of the most widely discussed and influential technological concepts worldwide. It not only plays a key role in business operations, but also profoundly changes the way people live their daily lives (Rankila, 2020). Although the definitions of AI show diversity in the existing literature, there is a general agreement among researchers that the core components of AI include: computers (processors), algorithms (models) anddata (Walter et al., 2025). Beyond computers, algorithms and data, most definitions of AI converge on similar core concepts, particularly the capacity to simulate or replicate human intelligence. In order to understand the conceptual system of AI more comprehensively, Table I summarises representative AI definitions in the current mainstream

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literature to reveal their commonalities and differences at the level of theoretical construction and technological implementation.

Table 1: Selected AI Definitions In The Literature

Year	AI definition	Reference
1956	The term "Artificial Intelligence (AI)" was formally introduced by John McCarthy and others at the Dartmouth Conference, where they proposed that "the study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can, in principle, be so precisely described that a machine can be made to simulate it."	(Jeevanandam, 2022)
2010	AIisreferred toastheuseofcomputers forreasoning, recognising patterns, learning orunderstanding certain behaviours from experience, acquiring and retaining knowledge developing various forms ofinference tosolve problems in decision-making situations where optimal orexact solutions areeither too expensive ordifficult toproduce.	(Min, 2010)
2016	The term artificial intelligence (AI) to describe systems that mimic cognitive functions generally associated with human attributes such as learning, speech and problem solving.	(Russell & Norvig, 2016)
2017	AI is being coined in the literature as a human behaviour that can be performed by machines, systems or networks.	(Li & Du, 2017)
2019	Artificial intelligence is a system's ability to interpret external data correctly, to learn from such data, and to use those learnings to achieve specific goals and tasks through flexible adaptation.	(Kaplan & Haenlein, 2019)
2020	Artificial Intelligence: istechnology thattriestoautomate oneormore (human) cognitive functions orprocesses. Itprovides predictions, recommendations, or decisions toachieve specific objectives. Itdoessobycontinuously learning about itsenvironment orresults from itsactions.	(Kazakova et al., 2020)
2021	The term defined asthecapability ofmachines tocommunicate with, andimitate the capabilities of,humans.	(Toorajipour et al., 2021)
2022	The term "artificial intelligence" refers to a category of digital technology systems capable of autonomously learning and solving problems with cognitive characteristics without human intervention.	(Madan & Ashok, 2022)
2024	Artificial Intelligence is a class of digital technology systems capable of autonomously learning from networked data, forming knowledge, reasoning with wisdom, and performing goal-directed actions without human intervention.	(Yucong Duan et al., 2024)

Source(s): Authors' own work

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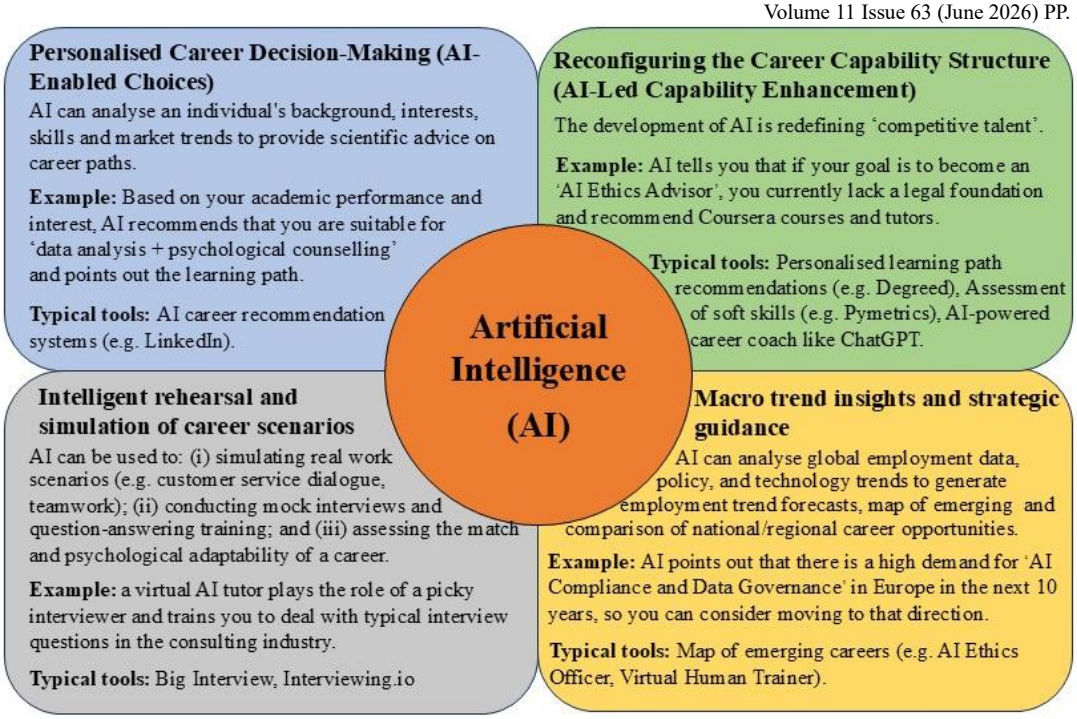

Figure 1: Four Dimensions of AI-Driven Career Planning

Source(s): Authors' own work

Since the release of generative AI such as ChatGPT-4 in 2023, higher education has seen a change in career planning, and AI is becoming an important tool to enhance the employability of students (Uppalapati et al., 2025). The use of artificial intelligence in career preparation systems also has gradually evolved from an information processing tool to an intelligent system with advanced cognitive functions such as learning capabilities, logical reasoning and experience transfer (Reis et al., 2021). Figure I shows that AI is not only a promoter of career replacement, but also an enabler of career planning.

Therefore, AI is driving people to change from "passive adaptation" to "active planning" and opening a new mode of career based on data and intelligence (Reis et al., 2021). Related tools such as Big Interview, Interviewing.io and other cutting-edge technologies show strong potential in simulated interviews, behavioural feedback analysis and personalised coaching (Chen et al., 2024; Koutsoumpis et al., 2024). They have been widely applied in resume optimization, job matching, and situational interview training to help graduates enhance the efficiency of their career decision-making and improve their interview performance (Suen & Hung, 2023).

Despite the variety of digital tools and platforms available for candidates' career preparation and the growing trend of integrating technology into career planning education in higher education institutions (Xia & Zhou, 2024). However, in the context of career planning education in higher education institutions of China, several issues remain prominent, including rigid instructional models, a lack of inspirational teaching and personalised counselling, insufficient stimulation of students' intrinsic motivation, and the absence of a diversified evaluation system (Ying et al., 2023). Figure II shows that the integration of AI and career planning has not yet become a mainstream research topic on the China National Knowledge Infrastructure (CNKI).

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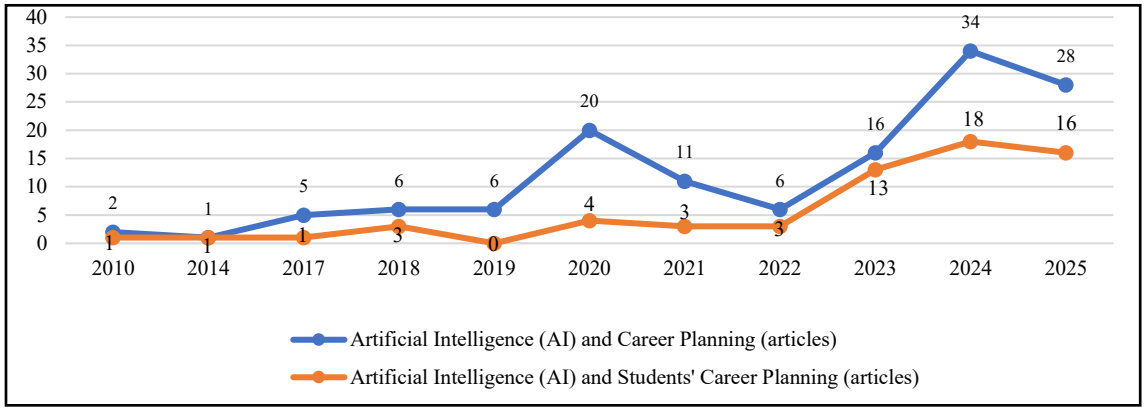

Figure 2: The Publication Trends of Academic Journals on the Theme "Artificial Intelligence (AI) and Career Planning" in CNKI (2010-2025)

Source(s): Authors' own work

It is evident that, although the value of applying artificial intelligence to career planning has gradually garnered attention from the international academic and industrial communities, current research in this area remains in its early stages. In particular, within the context of higher education in China, research on the deep integration of artificial intelligence and career planning remains relatively limited. Most existing research focuses on the functional applications of AI, such as resume optimization, job recommendations, mock interviews, and analysis of employment information. However, there remains a significant lack of research on how AI can systematically support students' career awareness development, enhance their career decision-making abilities, and facilitate long-term career planning. Furthermore, career planning education in Chinese universities currently relies primarily on traditional teaching models, and AI technology has not yet been fully integrated into the career development education system. Many studies remain largely confined to the levels of technical feasibility or tool application, and there is still a lack of mature theoretical frameworks and practical pathways regarding how AI can be integrated with vocational education objectives, individual student differences, and dynamic labor market demands. At the same time, compared to the rapid growth of international research on AI-enabled career development, the volume of relevant research in China remains limited, with research topics being relatively scattered; a systematic and sustained research framework has yet to be established. Therefore, it is necessary to further explore the practical application models, development potential, and mechanisms through which AI influences students' career development in career planning. This will promote the deep integration of AI and career planning education and provide theoretical support and practical guidance for the digital transformation of career development education in higher education institutions.

Career Planning

Super first formally introduced the academic concept of "career" in his 1957 book The Psychology of Careers. He proposed that a career is the sum of all the positions a person holds throughout their lifetime and is a continuously evolving process (Dietrich & Kracke, 2009). Jackson and Tomlinson (2020) state that career planning involves how individuals achieve desired career goals through a series of actions (Jackson & Tomlinson, 2020), a view that can be traced back to Gould's (1979) early research on career goal setting and pathway design. Career planning is also considered a key component of the highly regarded DOTS model of

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career competencies—which includes DOTS model of career competencies—and serves as a far-reaching practical tool in career development theory (Watts, 1977). From a theoretical perspective, Rothwell (1984) defines career planning as a process of analysing an individual's personal attributes in relation to the social environment, with the aim of determining the direction, timeline, and action plan necessary to achieve career goals (Rothwell, 1984). This definition reflects a more strategic approach at the practical level, highlighting goal orientation and planning.

Currently, research on career planning for university students in China mainly focuses on two core directions. On the one hand, the focus lies on analyzing the structural dimensions underlying career planning competencies, such as self-assessment, goal setting, and decision-making (Table III).

Table 3: Aligning Chinese Scholars' Career Planning Dimensions with the DOTS Model

	Watts's DOTS model (1977)	**Haiyuan Xu (2013)**	**Ruinan Zheng (2015)**	**Zhilin Zhao (2016)**	**Dai Yan et al. (2018)**	**Hao Yao (2021)**
1	Decision Making	Career Decision-making	Goal Setting	Correct Decision-making	Career Decision-making	Career Decision-making
2	Opportunity Awareness	Career Exploration	Evaluation of the Social Environment	Work Knowledge	Information Acquisition	Social Awareness
3a	Transition Learning	Career Action and Monitoring	The Timely Adjustment and Feedback of Action Plans	Professional Data Collection	Career Preparation	Career Orientation
3b				Execution	Career Management	Development Planning
3c				Planning		
3d				Evaluation Feedback Time Management		
4	Self-awareness		Self-assessment	Self-awareness	Self-awareness	Self-awareness

Source(s): Authors' own work

On the other hand, it focuses on analysing the key factors affecting university students' career planning, including personal factors (e.g. personality, interests, values), educational background, family support, social resources and employment market environment (Table IV).

Table 4: Integration of Research on the Factors Influencing Career Planning

Factors	**Family**	**Psychological**	**School**	**Demographic**
Chen, Jing (2015)	Parents' income	Self-efficacy		Gender
Fengling Lu & Changzhu		Self-efficacy; Optimism; Hope; Resilience	Group education and counseling	

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Wang (2016)				
Hu et al. (2019)		Self-efficacy in Career Decision-making		
Wang, Xing (2019)		Career values		
Cao et al. (2020)	Family location; Parents' education level	Proactiveness; Self-confidence		Gender differences
Lifang Liu (2020)			Curriculum structure; Faculty strength	
Liu, Hui (2020)				Field of study
Shi et al. (2021)	Parenting style			
Yunling Tian (2021)	Family cultural capital			
Yu et al. (2021)		Proactive; personality		
Biling Huang (2021)				Educational attainment; Gender
Wan et al. (2023)			Curriculum structure; University-industry partnership	Field of study Level of education
Chen, Jie (2023)				Gender; Place of origin; Level of education; Field of study
Qiuju Wang (2024)	Parents' occupation			Gender; Place of origin; Level of education
Xiong, Wei (2024)			Entrepreneurship education; Curriculum structure; Faculty strength;	

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Yan-lin Dai (2024)	University-industry partnership AI-based career advice and guidance; Curriculum structure; Faculty strength; Social practice

Note: Some of the data is derived from Qiuju Wang's (2024) research titled 'A Study on the Influencing Factors of Career Planning Ability of Postgraduate Students in Yunnan Universities'.

However, existing research generally remains rooted in traditional career development frameworks, with relatively little attention paid to changes in career planning models within the context of the digital environment—particularly against the backdrop of rapid advancements in artificial intelligence. A significant body of research continues to view career planning as a linear developmental process centered on individual cognitive growth and educational support, while few studies explore the structural changes in career information acquisition, decision-making logic, and career development pathways resulting from the integration of intelligent technologies. At the same time, existing research on the integration of AI and career planning remains largely confined to the application of technology and functional optimization—such as resume optimization, job recommendations, mock interviews, and job-matching services. Overall, this research emphasizes the tool-like attributes of AI, while discussions on how AI profoundly influences students' career cognition, career autonomy, and long-term career development capabilities remain limited. Particularly against the backdrop of the rapid development of generative AI, AI has gradually evolved from a traditional information-processing tool into an intelligent system equipped with learning capabilities, interactive functions, and decision-support features. However, current career planning research has not yet fully addressed the educational and developmental challenges posed by this transformation. Furthermore, judging by the current state of domestic research, studies on the integration of AI and career planning remain largely in their infancy. The number of studies is relatively limited, research topics are scattered, and a systematic theoretical framework or a sustained research system has yet to be established. Compared to the steadily growing body of international research on AI-enabled career development, Chinese universities still have significant room for improvement in both the depth of application and the breadth of research regarding AI in career planning practices. Therefore, it is necessary to further explore the application mechanisms, development pathways, and impacts of AI on career planning, as well as its influence on university students' career development, in order to drive the transformation of career planning research from traditional models toward intelligent, personalized, and data-driven approaches.

Cognitive Information Processing theory (CIP)

This theory is a systematic, actionable and inclusive theory of career problem-solving and decision-making developed by a research team at Florida State University (Sampson et al., 2004) and has now been widely applied in the field of career decision-making. This theory is visualized using a pyramid model that illustrates its core components, explaining the types of information required for an individual's career exploration and decision-making (Buzzetta et

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al., 2017), as shown in Figure III. It includes three key domains of information essential for effective career problem-solving and decision-making, primarily applied in career counseling and guidance.

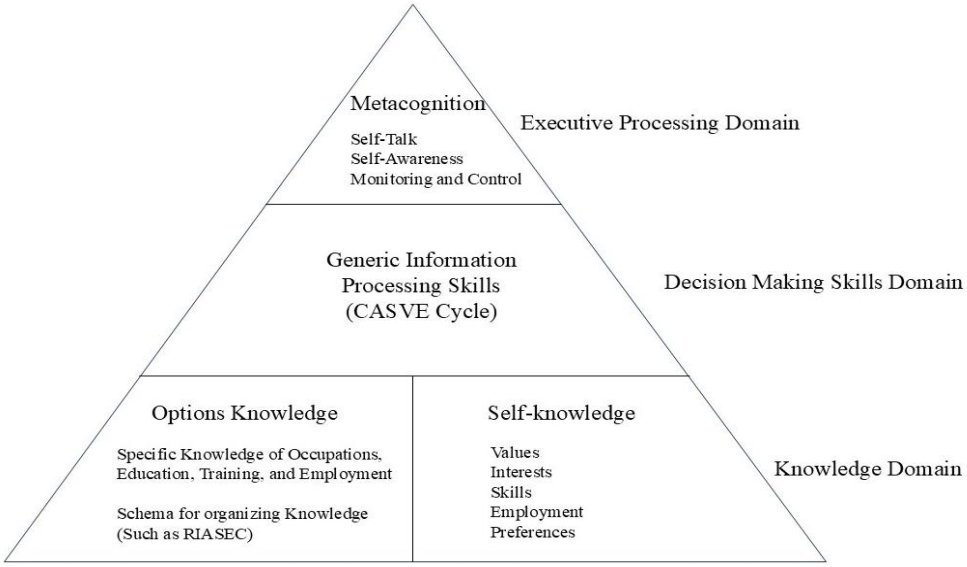

Figure 3: Cognitive Information Processing Theory's Pyramid of Information Processing

Note: The model is cited from The Development of the CASVE-CQ: A CIP Perspective on Assessing Decision-Making Progress (Werner et al., 2021)

The core component of the middle of the CIP theoretical pyramid is the CASVE cycle model (Figure IV), including Communication, Analysis, Synthesis, Valuing, and Execution, and this study focuses on this model of the career exploration process. The CASVE cycle describes an individual's thinking and behavioural processes in making career choices. Although the theoretical framework is well-defined and provides strong conceptual guidance for enhancing individuals' cognitive abilities in career decision-making, existing researches have not yet effectively integrated AI technology into this cognitive process to further enhance its intelligence and personalised support (Werner et al., 2021).

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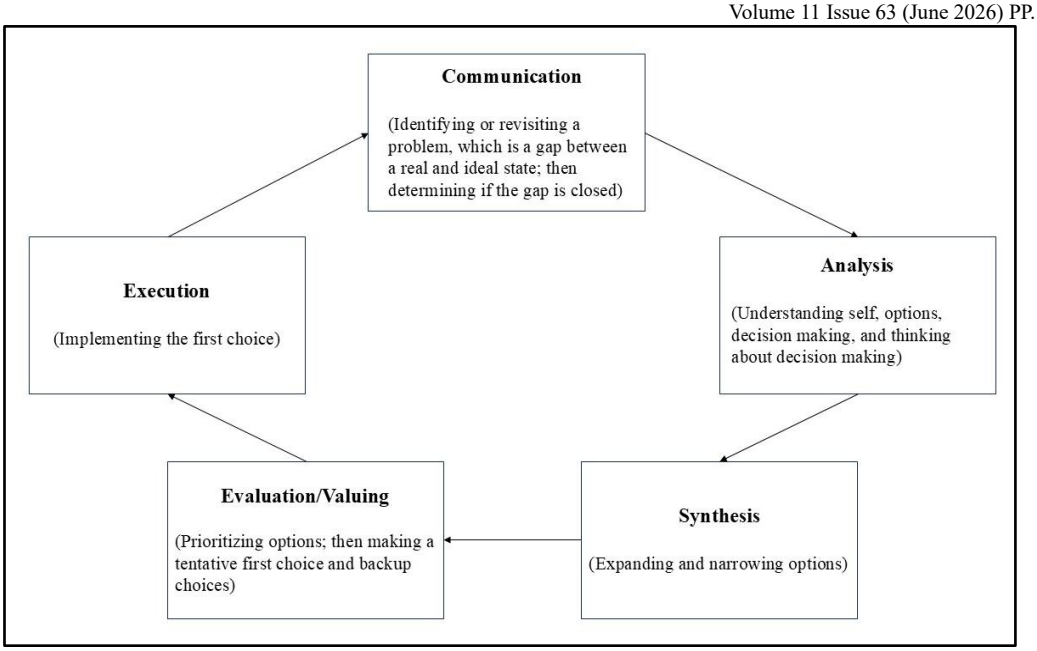

Figure 4: The CASVE cycle

Note: The model is cited from The Development of the CASVE-CQ: A CIP Perspective on Assessing Decision-Making Progress (Werner et al., 2021)

CIP theory not only considers the cognitive, emotional, and behavioral dimensions of individual career decision-making, but also highlights the dynamic interplay between these internal processes and external environmental factors—including familial, social, economic, and organizational influences—thus offering a holistic perspective on the multifaceted determinants of lifelong career development (Sampson et al., 2004). The CASVE Cycle provides a structured, clearly defined, and flexible five-phase model for guiding an individual to make systematic career decision-making. The model is not only applicable to one-off career choices but is also intended to support the evolving career development needs of individuals across various life stages, empowering them to make informed and context-sensitive decisions in an ever-changing environment (Werner et al., 2021).

These two models complement each other. The Pyramid Model establishes the framework of knowledge and skills needed for decision-making, and it views career problems as a gap between the current state and the desired state, while the CASVE Cycle provides a systematic process to help individuals clarify their goals and develop effective pathways to achieve them. However, with the rapid development of digital technologies, particularly artificial intelligence, the methods of accessing career information, career exploration pathways, and the environment for career decision-making are undergoing significant changes. However, existing research on CIP theory has offered relatively limited discussion on how digital tools can be deeply integrated into the process of career cognitive processing. Most current research on the application of CIP theory remains focused on cognitive training, decision-making guidance, and career assessment within traditional counseling settings, with limited exploration of how emerging technologies—such as artificial intelligence, big data analysis, and generative AI—can provide dynamic support at different stages of the CASVE cycle. For example, during the Communication stage, AI can help students identify career uncertainties and skill gaps through behavioral data analysis; during the Analysis and Synthesis stages, intelligent systems can provide personalized career path recommendations and information integration based on vast

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amounts of employment data; and during the Valuing and Execution stages, AI can assist students in continuously optimizing their career decisions through real-time feedback, mock interviews, and career predictions. However, current research lacks a systematic theoretical framework for integrating these digital support mechanisms. At the same time, the development of generative AI is gradually transforming the role of the "information processing agent" in traditional career decision-making. While CIP theory previously emphasized that individuals resolve career issues through autonomous cognitive processing, in environments with high AI involvement, career information screening, career matching, and decision recommendations are increasingly carried out with the participation of intelligent systems. This implies that the career decision-making process is gradually shifting from traditional "individual-led cognitive processing" to "human-machine collaborative cognitive processing." However, existing research has yet to engage in an in-depth discussion of how this shift affects individuals' career autonomy, career cognitive abilities, and the quality of long-term career development. Therefore, re-examining CIP theory in the context of digitalization and artificial intelligence and exploring pathways for its integration with intelligent career planning tools, has become a significant direction for current career planning research.

Research Methodology

A systematic literature review is a structured, reproducible method for systematically collecting and integrating existing research findings in a specific field (Kraus et al., 2022). This study draws on the three-stage review framework proposed by Tranfield et al. (2003) and references the meta-analysis (PRISMA) guidelines (Kiely et al., 2020; Tranfield et al., 2003).

Review Planning

To ensure systematicity and reproducibility, this study refers to Ahsan and Rahman's (2021) methodology, which specifies the subject area of the literature review, the unit of analysis, the databases to be used, the keywords to be searched, the inclusion and exclusion criteria, as well as the way in which the data will be stored and analysed (Ahsan & Rahman, 2022). In addition, following the PRISMA process (Moher et al., 2015), the study divided the literature screening into three stages: (i) identification, (ii) screening and (iii) inclusion (see Figure V). Given that the primary aim of this study is to investigate research trends concerning the application of AI in career planning education in the context of Chinese higher education, the unit of analysis is articles that explicitly focus on AI-based career planning. In this study, the China National Knowledge Infrastructure (CNKI) was used as the primary database, supplemented by Google Scholar to capture more recent online publications. Searches were limited to articles, conference papers, news, and dissertations published in English and Chinese from 2010 to March 2025. Keywords were applied only to the title, abstract, and keyword fields, with four sets of search terms designed to capture the core concepts of the field.

The total number of articles remaining after removing all duplicate publications was 1,414. The researchers carefully reviewed these articles to eliminate those deemed loosely related, specifically articles whose content was inconsistent with the study's objectives, a total of 128 relevant publications were selected for full review. The entire search process was thoroughly documented to ensure transparency and auditability for review and tracking purposes. For each of the 128 articles, bibliometric data such as bibliographic information, abstracts, keywords, and references were extracted for analysis.

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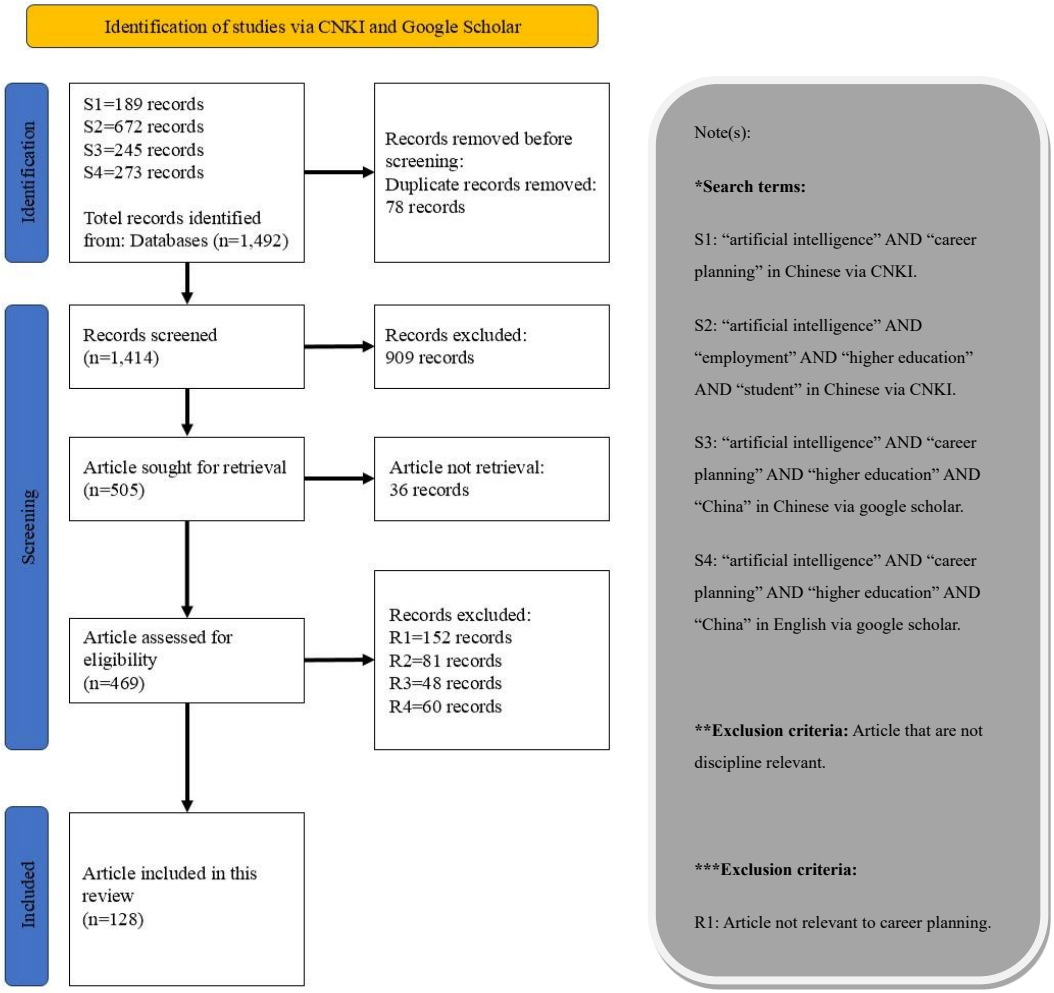

Figure 5: Article Selection Process

Source(s): Authors owns work

Execution

The reputable, reliable and validated VOSviewer software was used to perform co-occurrence analysis (van Eck & Waltman, 2014), and to construct networks of keyword co-occurrences that reveal clusters of closely related author and index keywords (i.e., thematic groupings) relevant to the focus of the study (Callon et al., 1983). Co-word analysis is a key technique used to measure the similarity between publications by analyzing the keywords they contain. It helps to map specific subject areas and establish connections among the reviewed literature (Ahsan & Rahman, 2021). This method is based on the assumption that each research area can be described by a set of keywords, and that a connection between two pieces of literature can be identified by comparing the degree of similarity in their keywords (de la Hoz-Correa et al., 2018). In keyword co-occurrence analysis, the basic unit of analysis is the "concept" rather than the literature itself, references, authors or journals, and this method of analysis is not affected by time variables (Ahsan & Rahman, 2021; Zupic & Čater, 2015)

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Before carrying out the co-word analysis, we pre-processed the original text. To ensure the consistency and parsability of the data input, two professional translation experts were invited to translate the titles, abstracts, and keywords of selected Chinese-language literature into English. Meanwhile, all formatting content (e.g., titles, copyright information), punctuation marks, and non-alphanumeric symbols were removed from the abstracts. The study standardised the terminology used to express similar concepts to enhance the aggregation and semantic clarity of the analysis, e.g., "AI technology" was united under the category of "Artificial Intelligence" (Cobo et al., 2011).

In this study, the binary counting method based on the counting method of keyword co-occurrence is selected for the analysis. For the clustering parameter settings, the minimum number of terms per cluster was set to 10, and the total number of keywords was set to 47, based on the default settings in VOSviewer. The cluster analysis generated three clusters containing 26 keywords or themes, each of which is shown in a different colour (blue, red and green) in Figure VI and Table V. These clusters are not completely mutually exclusive, and there is a certain degree of intersectionality between different clusters, for example, 'employability' acts as a key node, forming a bridge between multiple topics. In Figure VI, the nodes represent keywords, the connecting lines indicate co-occurrence relationships between them, the size of each node reflects the frequency of the corresponding keyword, and the thickness of the lines represents the strength of their co-occurrence.

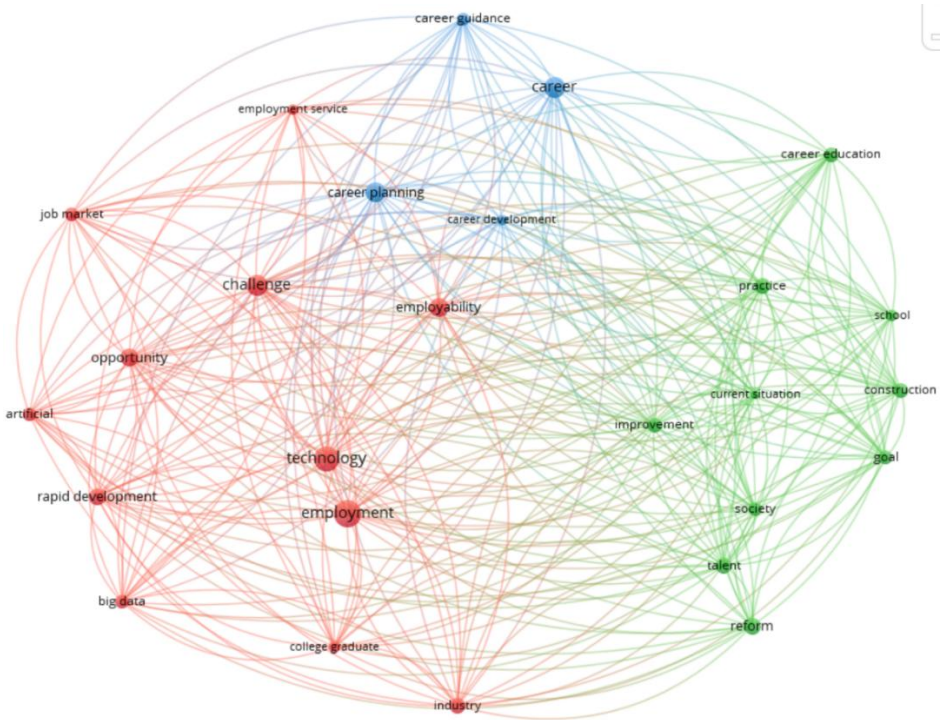

Figure 6: Bibliographic Map of Keywords and Clusters for Career Planning
Source(s): Authors' own work

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Table 5: Bibliometric Keyword Clusters of AI in Career Planning Literature

	Cluster1 Impact of AI on the employment landscape and skills demand (red)	Cluster 2 Educational reform and talent development in the context of AI (green)	Cluster 3 Intelligent exploration of career guidance and planning (blue)
Themes	Artificial intelligence Big data Challenge College graduate Employability Employment Employment service Industry Job market Opportunity Rapid development Technology	Career education Construction Current situation Goal Improvement Practice Reform School Society Talent	Career Career planning Career development Career guidance

Source(s): Authors' own work

Reporting

During the reporting stage, the literature reviewed was systematically integrated with the research questions. The study adopted the dual reporting framework proposed by Tranfield et al. (2003), which consists of two parts, descriptive and thematic analyses (Tranfield et al., 2003). Based on the econometric information of 128 literatures, we first carried out an exhaustive descriptive analysis (see Section 4.1). To further explore potential themes in the content of the literature, we used the NVivo software, which is a widely used data analysis tool for qualitative research (Ahsan & Rahman, 2021). All 128 articles were imported into NVivo in PDF format. Guided by the predefined keyword clusters, each document was systematically reviewed to assess how it engaged with the associated thematic categories. These keyword clusters guided further analysis aimed at identifying key topics and knowledge domains related to AI in career planning within higher education (see Section 4.2).

Literature Analysis

Trend Analysis of The Literature

Evolution of Research on AI in Career Planning

Research on AI-based career planning in higher education is relatively sparse until 2021, with an annual average of less than three publications between 2010 and 2021 (see Figure VII). A significant increase in research in this area has been observed since 2022, with 73% of the sample published after that year, reaching a peak in 2024 (53 articles). The review covered a

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total of 128 articles involving 229 authors, published across 94 sources, including 65 journals, 10 conference proceedings, 1 news article, and 18 dissertations.

Based on the dimensions of AI-driven career planning outlined in Section 2.3, this study identifies the role of AI in career planning education within higher education, drawing on evidence from 128 articles. As can be seen from Figure VII, 40% (51 articles) focus on AI-driven enhancement of employability, i.e., reconstruction of career competency structure, AI-driven personalised career decision-making accounts for 37 articles, AI-driven macro-trend insights and strategy guidance has 30 articles, and AI-assisted intelligent rehearsal and simulation of career scenarios is only 10 articles.

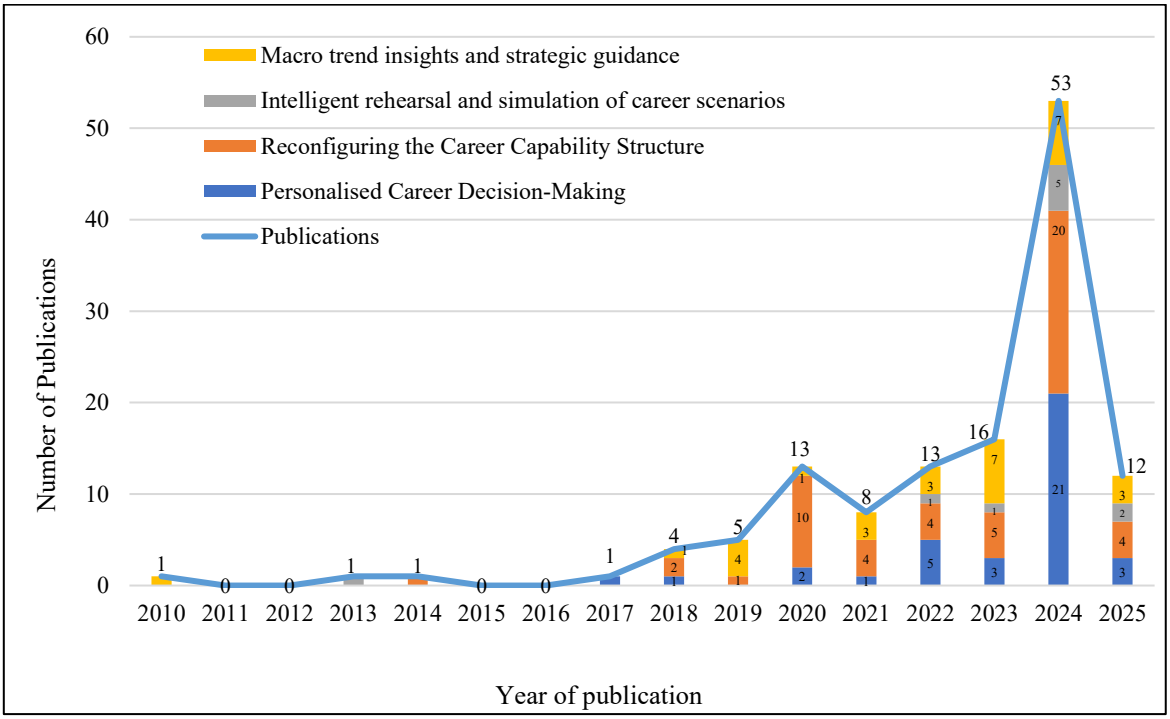

Figure 7: Publications of AI in Career Planning Per Year

Source(s): Authors' own work

Methodology Trends of Research on AI in Career Planning

According to the different research methods, the relevant literature collated can be divided into three categories: modelling research (about 12%), empirical research (about 25%) and conceptual research (about 63%) (Figure VIII) (Ahsan & Rahman, 2021; Wowak & Boone, 2015).

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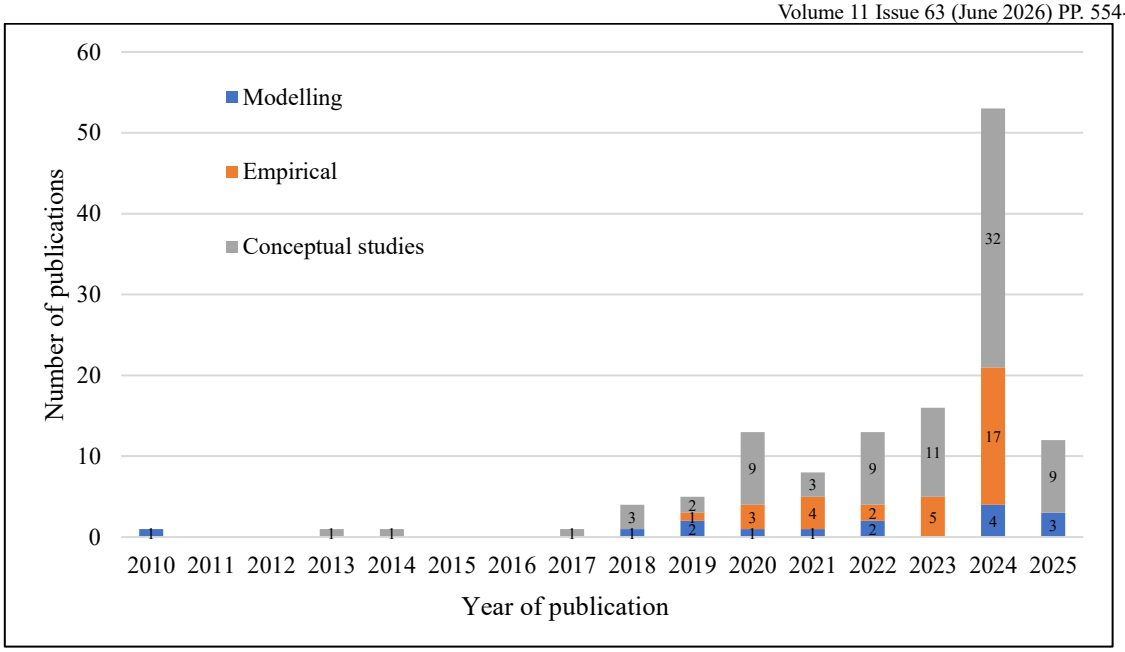

Figure 8: Research Methodologies for AI in Career planning

Source(s): Authors' own work

Among them, conceptual studies account for the largest share of the overall literature. It mainly focuses on the macro discussion of college students' employment issues in the context of AI, theoretical reflection and thoughts on educational concepts, curriculum design, employment strategies, and so on (Herath et al., 2024; Qamar et al., 2021). The proportion of empirical research is also increasing. Relevant studies use questionnaires, interviews, or case studies to obtain first-hand data for assessing the impact of AI on college students' employment perceptions, career planning abilities, and course effectiveness (Jia & Tu, 2024; Zhang, 2024). Modelling studies account for the smallest proportion in the overall literature, focusing on the use of machine learning, data mining and other technologies to construct employment prediction models and career recommendation systems, with an emphasis on technical feasibility and practical application (Huang, 2022; Zeng & Yang, 2024).

Theoretical Lens of Research on AI in Career Planning

Despite the increasing number of studies on AI for career planning in higher education and college students' employment, the theoretical support is still significantly unevenly distributed. According to our review of the relevant literature, some studies have adopted explicit theoretical frameworks, including career construction theory, competency theory, person-job matching theory, and technological change theory, etc. These studies are mostly focused on empirical research and a few modelling studies, with strong problem orientation and application background.

However, most modelling studies focus on algorithm optimization and system implementation, such as employment prediction models based on semi-supervised learning or big data-driven intelligent recommender systems (Maoyuan, 2019; Zhou, 2024), the theoretical foundation in the reviewed studies appears relatively limited, with a stronger focus on validating model effectiveness rather than offering behavioral interpretations or grounding in educational philosophy. In contrast, some empirical and conceptual studies show a strong theoretical foundation. For example, Gang Han (2018) introduces the theory of career construction and

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examines the autonomous career path development of pre-service teachers (Han, 2018), while Sun Lilu et al. (2019) systematically use competency theory to construct a talent cultivation index system (Sun et al., 2019). In addition, Liu Shuaiyao (2021) integrated Parsons' Person–Job Matching Theory, Holland's Career Interest Theory, and Super's Career Development Theory, reflecting the empirical trend of theoretical diversification and integration (Liu, 2021).

Thematic Analysis of Research on AI in Career Planning

We identified three knowledge clusters comprising 26 themes through bibliometric clustering based on the co-occurrence of publication keywords using VOSviewer. In response to RQ1, we found that research in this area can be broadly categorised into the following three themes: i) intelligent exploration of career guidance and planning; ii) the impact of AI on the employment landscape and skills demand; and iii) educational reform and talent development in the context of AI (Table V). In the next subsections, we will analyse each of these three clusters in depth.

Cluster 1: Intelligent Exploration of Career Guidance and Planning

This cluster focuses on how to use AI tools (e.g., intelligent recommender systems, career path prediction models) for improving the efficiency of career planning and the quality of personalised services among students in higher education. For example, virtual career counsellors and intelligent question-and-answer platforms are gradually replacing the traditional career counselling model to provide students with more immediate and tailored career guidance.

As AI becomes increasingly embedded in higher education, the ways in which students engage with future career opportunities are undergoing fundamental changes. "Career" is no longer merely an endpoint after graduation but has become a central theme that runs through the entire learning and preparation process in higher education. Higher education institutions are increasingly adopting data-driven strategies and using AI technologies to help students identify how their interests and abilities match external opportunities, thereby broadening their knowledge of "hidden career paths" and interdisciplinary roles (Ma, 2024; Zhai, 2023). This not only enhances the accessibility and diversity of "career" choices but also facilitates the transformation of "career guidance" in higher education institutions from a traditional manual counselling model to an intelligent system. These technologies, based on natural language processing (NLP) and machine learning—such as virtual counselling systems and mock interviews—have also been extended to the domain of "career planning" (Bhatnagar, 2025; Yan, 2023), and it can model the academic trajectories and career paths of previous students to offer current students evidence-based advice and personalised development roadmaps, while also enabling real-time interaction and continuous progress tracking to enhance the interactivity and effectiveness of "career guidance". There are 47 papers in the reviewed literature that explore at a conceptual level how higher education institutions are shifting from an experience-oriented to a data-driven model of career preparation through the deployment of AI learning planning platforms (Zhang, 2024). These shifts will ultimately contribute to the overarching "career development" orientation of higher education, in which talent cultivation is gradually transitioning from an academic-centred to a career-oriented model (Sun et al., 2019), thereby enhancing students' adaptability to migrate from the campus to the labour market (Bennett et al., 2022; Duan & Wu, 2024).

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Cluster 2: Impact of AI on Employment Landscape and Skills Demand

Within this cluster, AI is a key driver reshaping the structure of employment. Related research highlights the role of AI and automation technologies in reshaping the labour market, especially the challenges and opportunities related to graduate employability in higher education (Reis et al., 2021).

Amid the ongoing "rapid advancement" of "artificial intelligence (AI)", higher education is undergoing a profound restructuring of skills. Intelligent systems centred on technologies such as "artificial intelligence", "big data" and natural language processing (NLP) are reconfiguring the "job market" model of talent demand, facilitating the shift from conventional professions to data-driven, interdisciplinary, and human–computer collaborative domains (Healy et al., 2020; Luo et al., 2023; Yang, 2025). This transformation not only accelerates job differentiation and the blurring of professional boundaries across "industries" but also compels "college students" to develop higher levels of learning transferability and technological literacy in order to ensure the sustainability of their "employability" in a rapidly evolving "job market" (Duan & Wu, 2024; Hu & Wang, 2024; Qamar et al., 2021).

Simultaneously, this reorganisation of skills poses systemic "challenges and opportunities" for both college students and higher education. AI replaces a large number of repetitive tasks, reduces the demand for low-skilled positions, and creates new occupations such as AI trainers and data ethics consultants (Gou, 2020; Luo, 2020; Luo et al., 2023). In order to cope with the resulting skills mismatch and structural unemployment, higher education needs to respond quickly to the pace of technological updates and market changes through flexible curriculum design (e.g., microspecialisation, modular learning paths), dynamic "employment service" systems and university-enterprise cooperation (Bankins et al., 2024; Ying et al., 2023). Thus, AI's reshaping of employability represents a fundamental shift in educational logic—from an outcome-oriented approach to a competence-oriented one.

Cluster 3: Educational Reform and Talent Development under The Context of AI

This cluster focuses on how higher education, driven by artificial intelligence, can carry out institutional and structural reforms to adapt to the new needs of career planning and talent cultivation. As mentioned in the literature reviewed in this study, higher education institutions should not only promote changes in the curriculum system but also pay attention to the dynamic matching between educational goals and social needs, thereby implementing an effective articulation of "from education to employment".

In the context of the deep involvement of AI in higher education, "career education" is evolving from a traditional logic of knowledge transmission and job alignment to a more complex logic of competence development and system integration (Wong, 2024; Zeng & Mao, 2024). This transformation is not only reflected in the teaching mode but also reflects the structural reshaping of higher education in response to the demand for "talents" in the future society (Deng, 2023; Sun et al., 2019). As mentioned repeatedly in the 128 papers covered in this study, the introduction of AI technology has given rise to a new career guidance model based on "data-driven" and "dynamic feedback" (Huang et al., 2021), which not only requires "schools" to take responsibility for interdisciplinary curriculum integration and technology platform construction and AI literacy cultivation, but also forces higher education institutions to redefine

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students' career "goals" - from short-term career orientation to long-term career guidance for students (Hong-chao et al., 2020; Wang, 2023).

However, this kind of reconstruction is not simply achieved by technological substitution but involves the synergistic promotion of "construction and reform". At the level of top-level design, higher education institutions need to establish intelligent career service systems and AI-supported curriculum platforms (Hong-chao et al., 2020; Zhou, 2024). And at the organisational level, they must ensure the continuous alignment of educational content with technological advancement (Chen et al., 2025). Moreover, the role of "practice" as the core mechanism of career education is being redefined through the integration of AI-enabled tools such as virtual simulation interviews, role-playing, industry simulations, and data analytics training (Li & Huang, 2014). Even more challenging is the fact that higher education career planning is gradually being integrated into "social" governance structures. This is because responding to new job demands in the context of "digital governance" is no longer an internal matter of the university but needs to be promoted in collaboration with "society", such as the university-government-enterprise joint construction of "career development ecosystem" (Gou, 2020; Li & Huang, 2014).

Discussion and Research Gaps

Trends in the AI-Based Career Planning in Higher Education Literature

Considering RQ1, the application of AI in career planning in higher education has attracted significant attention over the past five years, with the number of related literatures continuing to grow, especially the rapid publication of conference proceedings reflecting the rapid development of the field because this medium is usually published faster and with a less rigorous peer review process.

In terms of research methodology, the field has shifted from foundational modeling studies that focus on developing AI models and predicting graduate employment trends to empirical research based on data from specific higher education institutions or student populations. Early publications primarily focused on addressing the effectiveness of career planning in higher education through AI-based modeling and conceptual research. Many of these studies, whether predictive models or theoretical explorations, aimed to expand knowledge and support the development of innovative career planning strategies. In recent years, empirical studies have mostly focused on questionnaires to explore variables such as students' career decision-making, employment confidence, self-efficacy, etc. For example, an investigation of Chinese nursing students' employability, perceptions, and demand for ChatGPT in the AI era (Luo et al., 2023). There are also some studies focusing on the algorithmic performance and technical validation of AI models, but these studies often remain disconnected from practical educational settings, repeating a common gap between theory and practice. For example, the Study of Employment Competency Construction and Enhancement Strategies for College Students Majoring in Artificial Intelligence in the Age of Digital Intelligence (Han & Zhao, 2025).

Although empirical studies help to validate the specific effects of AI tools in career planning education on the one hand, and to study the correlation of individual variables on the other hand, their scope is usually limited to a specific higher education institution or region. Moreover, the external validity of the results is limited, and they are less likely to touch on the complexity and contextual diversity of career planning practices in the higher education system.

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These shortcomings can be progressively addressed through ongoing conceptual research, which supports theory building and foundational studies, such as Application of AI/VR in Career Management Teaching and Training Practice (LI, 2022). These conceptual studies show the potential for more general research in the field of AI that can address how AI technologies and career planning education can achieve deeper integration and explore the impact of AI on education systems, student competence development and employability adaptations, thus demonstrating the potential to drive innovation in career planning in higher education.

Key Knowledge Areas and Conceptual Framework for application of AI in Career Preparation

This section discusses the key knowledge of decision intelligence, and the conceptual framework for applying AI in career preparation to enhance students' employment performance (RQ2).

The Key Knowledge of Decision Intelligence

With continuous breakthroughs in AI, especially in machine learning, natural language processing and predictive analytics, the traditional way of making decisions is gradually shifting from "information-based" to "intelligent". This shift has led to the emergence of Decision Intelligence Theory (DIT), which integrates traditional decision-making models with AI technology (Zeng et al., 2021; Кубатко et al., 2024) and provides a new perspective for dealing with increasingly complex decision-making problems in higher education. It has gradually become an important theoretical basis for decision-making systems in various fields (Zeng et al., 2021).

Since Industry 4.0, the rapid development of generative AI (e.g. ChatGPT) is profoundly transforming traditional decision-making models. With its powerful data processing and reasoning capabilities, AI can handle a wide range of high-intensity decision-making tasks, such as efficiently identifying high-quality candidates through intelligent screening systems during recruitment (Rankila, 2020). This is not only a technological innovation, but also a fundamental transformation of the decision-making paradigm (Sai-ke et al., 2023). Sai-ke et al. (2023) point out that this transformation is mainly reflected in four aspects: (i) The data source has shifted, and AI is now capable of integrating information from multiple channels; (ii) the decision-making ecology has evolved, and a collaborative mode between AI and human decision-makers has gradually taking shape; (iii) the decision-making model continues to evolve, and machine learning and big data analytics make the decision-making process more accurate and efficient; and (iv) The role of decision-makers has shifted, from traditional human decision-making to human-machine collaborative intelligent decision-making, with the responsibility and authority of decision-making being redefined (Sai-ke et al., 2023). Figure IX illustrates the evolution of the "human-machine collaborative decision-making" model.

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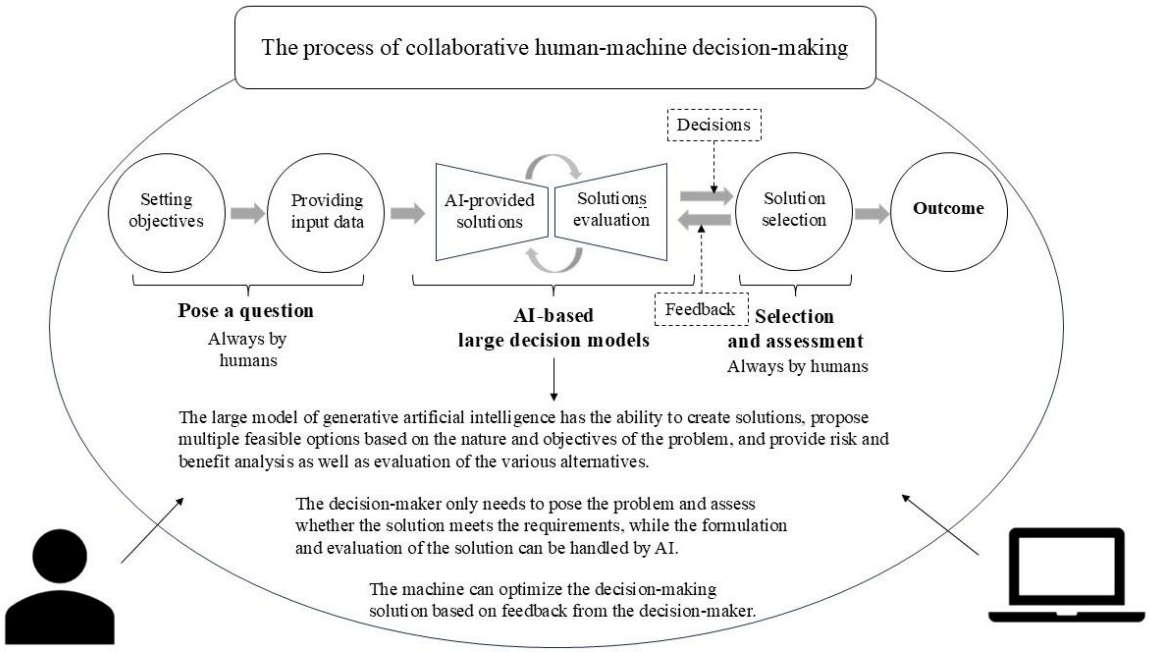

Figure 9: Human-Machine Collaborative Decision-Making

Source(s): Authors' own work

However, research on decision intelligence remains in its early stages, particularly regarding its adoption in China (Zeng et al., 2021). According to the requirements of decision intelligence theory, the integration of decision-making and AI necessitates not only the fusion of multiple data sources, methods, and tools, as well as interdisciplinary collaboration, but also research and experimentation within specific industries and practical applications (Zhang, 2021).

A Conceptual Framework for Application of AI in Career Preparation

From the theoretical perspective of career exploration and planning in section 2.2, the CASVE cyclic model provides a systematic conceptual framework for AI-assisted decision-making in the career preparation stage, emphasising the stage-by-stage and strategic nature of the decision-making process (Werner et al., 2021). As a specific application of cognitive information processing (CIP) theory (Sampson et al., 2004) in career decision-making, the CASVE cyclic model (Communication-Analysis-Synthesis-Assessment Valuing-Execution) emphasises that individuals should go through a series of logical and interlocking psychological and behavioural processes when facing career decisions (Buzzetta et al., 2017). Structurally and functionally, this model aligns closely with the intelligent decision-making process described in Section 5.2.1, and its core process covers the complete chain from problem identification, information processing, solution integration to decision-making implementation (Buzzetta et al., 2017; Sai-ke et al., 2023).

As shown in Figure X, the CASVE cycle not only guides individuals through a systematic process of identifying career problems, gathering and analysing relevant information, and generating and evaluating feasible options within cognitive and situational contexts, but also emphasises the mechanisms of action transformation and feedback adjustment during the execution phase. This demonstrates a strong theoretical alignment with the full process of intelligent decision support. Although a mature practical framework for integrating AI

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technology into the CASVE cycle is still lacking, AI's strengths in data processing, information recommendation, and dynamic feedback align closely with the model's logical structure across the phases of problem identification, information processing, option generation, and implementation evaluation from a functional perspective (Sampson et al., 2004), thus demonstrating a significant potential for adaptation and expansion in vocational decision-making counselling in the future.

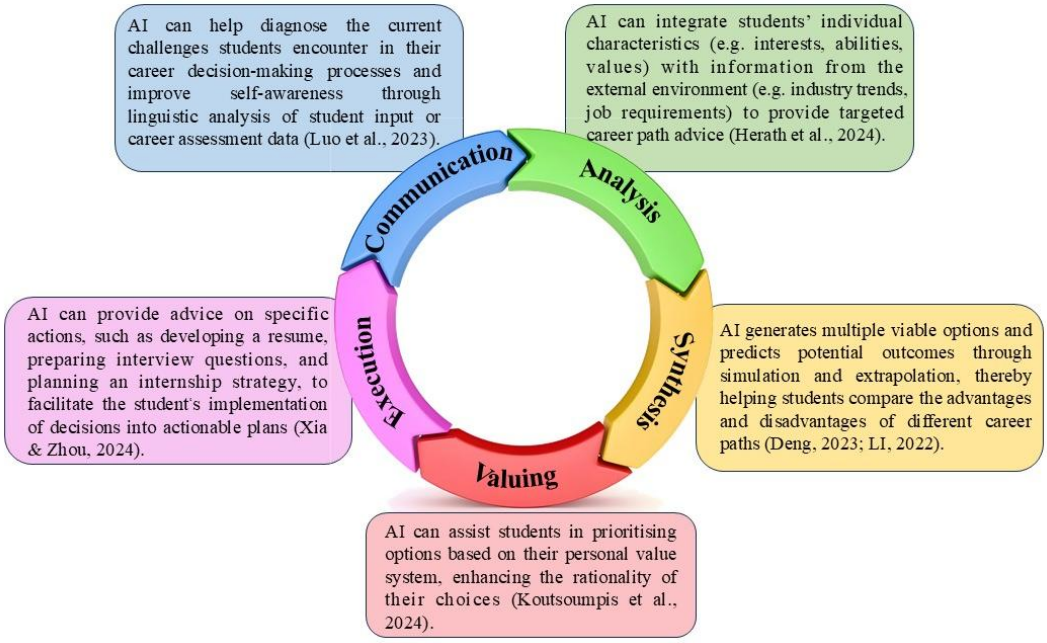

Figure 10: Conceptual Framework of AI-CASVE

Source(s): Authors' own work

In terms of overall effectiveness, the embedding of AI in the CASVE model not only improves the quality of decision-making at each stage, but also makes the career decision-making process more interactive, context-adaptive, and individual-centred through real-time feedback and intelligent recommendation, thereby creating the potential to transform the paradigm of career guidance service models in higher education institutions.

Identification of Research Gaps

Literature cluster analyses revealed a number of research gaps related to AI in career planning in higher education. To address RQ4, we categorised these gaps into two main areas: 1) research methodology and theoretical foundations; and 2) AI knowledge areas, such as specific applications of virtual career counselling.

Gaps Related to Research Methodology and Theoretical Foundations

Research methodological gaps: In the 128 papers we analysed, most of the literature focuses on conceptual studies, which emphasis on theoretical frameworks and model construction. It is followed by empirical studies, which are mainly based on the analysis of specific data and cases, while modelling studies are relatively fewer, but they do cover aspects such as model design and algorithm development.

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However, there are still significant research methodological gaps in the reviewed literature. First, although modelling studies focus on model development and validation, there is a lack of in-depth discussion on cross-model comparison and multi-method fusion, which limits the diversity and practical adaptability of the application of AI technology in career planning (Hong-chao et al., 2020; Zeng & Yang, 2024). Second, empirical studies are mostly dominated by single case or cross-sectional data, lacking long-term tracking and multi-contextual validation, which leads to insufficient generalisability and transferability of results (Huang et al., 2020; Luo et al., 2023). Finally, although conceptual studies dominate the field, some lack clear theoretical support and empirical validation, which hinders the effective promotion and application of the theories (Wang, 2020; Zhai, 2023).

Research without theoretical underpinning: Among the 128 pieces of literature reviewed, research on the application of AI in career planning in higher education has drawn upon a variety of career development and educational theories, however, the overall theoretical foundation remains weak and fragmented. Theories applied in the reviewed studies include constructivist theory, social cognition theory, experiential learning theory, career construction theory, social cognitive career theory, Super's life-span theory, Holland's career typology theory, the USEM employability model, as well as economic and sociological frameworks, industrial structure theory and Keynesian employment theory. Meanwhile, some studies have also cited theories related to the application of technology such as the theory of technological change and the theoretical framework of e-government service management (Duan & Wu, 2024; Yi, 2020; Zhao & Li, 2022).

From the perspective of AI, most of these theories remain rooted in traditional career planning and educational frameworks (Han, 2018), with few studies systematically integrating core theories of career exploration and decision-making (e.g., Cognitive Information Processing Theory, Postmodern Career Theory) with frameworks related to the adoption and application of AI technologies (e.g., Technology Acceptance Model, Decision Intelligence Theory, etc.). This has resulted in a limited understanding of the underlying mechanisms through which AI technology is applied in career planning, with theoretical models failing to effectively explain the interactive effects of technology, individuals, and organisational environments.

Research Gaps in The Knowledge Area of AI

Current research on the application of AI in career planning in higher education shows an initial exploratory trend, but there remains a significant gap in research related to AI knowledge within this field. Much of the reviewed literature centers on the introduction or functional description of individual AI technologies, such as ChatGPT, recommendation algorithms and virtual interview systems (LI, 2022; Luo et al., 2023; Qin et al., 2023), and less on evaluating their comprehensive effectiveness in career planning education from a systemic level. It can be found that AI applications mostly stay in the auxiliary or experimental stage, lacking in-depth discussions on how they are embedded in the overall career planning education system and how they can support individual career cognition, decision-making and action.

Additionally, there are significant gaps in both the depth and complexity of how these technologies are integrated into career planning practices. Although some of the research involves advanced AI tools such as natural language processing, data mining, knowledge mapping, etc., the reviewed research is largely conceptual and lacks systematic investigation into the collaborative integration of multiple AI technologies for constructing personalized

career counselling pathways (Bhatnagar, 2025; Deng, 2023; Healy et al., 2020; Sai-ke et al., 2023; Zhao & Li, 2022). This is particularly evident in the limited exploration of how AI can support dynamic and non-linear modeling of career pathways. The researcher also found a lack of empirical research on the mechanisms and effects of practical application of cutting-edge technologies, such as generative AI (e.g., ChatGPT), cognitive AI, and immersive experiential technologies (e.g., VR/AR), in career planning scenarios in the reviewed literature (LI, 2022; Luo et al., 2023; Qin et al., 2023).

Finally, most of the reviewed studies tend to analyze the functions of AI tools from the perspective of educators or system designers, while overlooking the actual interactive experiences and feedback mechanisms of learners and users. For example, there is a notable lack of studies focusing on user participatory design, the assessment of career decision-making improvements following the use of AI tools, and the personalized adaptation of these tools for different student groups (e.g., underclassmen, inter-professionals, disadvantaged background groups) (Chen et al., 2025; Chen et al., 2024; Duan & Wu, 2024). The reviewed studies also rarely addressed issues such as AI ethics, privacy protection, and technology acceptance, making it difficult to meet the standards of interpretability and user acceptability required for future large-scale implementation (Siau & Wang, 2020).

Conclusion

This study systematically reviewed 128 research publications on the application of AI in career planning within Chinese higher education since 2010, and identified three main knowledge clusters: i) intelligent exploration of career guidance and planning (e.g., virtual career counseling system, AI-assisted career matching, personalized development path recommendation, etc.); ii) the impact of AI on the employment landscape and skills demand (e.g., changes in the structure of the labour market, emerging skills prediction, job adaptation ability reconstruction, etc.); and iii) educational reform and talent development in the context of AI (e.g. education model transformation, AI literacy education, interdisciplinary ability construction, etc.). There are 26 associated themes related to these areas, which comprehensively reveal the multidimensional intervention pathways and practical applications of AI technology throughout the entire process of career planning in higher education.

An integrated conceptual framework is constructed in this study, which integrates Decision Intelligence Theory (DIT) and the CASVE career decision-making cycle model, thereby systematically revealing how AI can support individuals in making high-quality career decisions and optimize human-machine collaborative decision-making throughout the career preparation process in higher education (Sai-ke et al., 2023; Werner et al., 2021; Zeng et al., 2021). This framework not only emphasises the role of technology in information processing and assisted decision-making but also highlights how AI can enhance the intelligence and contextual adaptability of the decision-making process through the lens of Decision Intelligence Theory (DIT), especially in the face of multivariate, complex environments and uncertainty, demonstrating its synergistic capabilities.

This study is the first to systematically classify and cluster-analyze the literature on AI interventions in career planning and educational transformation. It reveals that although current studies have covered multiple AI application scenarios, they are still insufficient in terms of theoretical support, mechanism modelling and understanding of the mechanisms of students' behaviours. In particular, there is a lack of systematic modeling and empirical validation studies

addressing key mechanisms such as dynamic feedback, contextual adaptation, and multi-stakeholder interaction within the career decision-making process. The study mentioned Decision Intelligence Theory (DIT) is still in the early exploratory stage in the field of higher education in China, and its theoretical framework and application practice are almost non-existent (Zeng et al., 2021). The conceptual framework proposed in the study provides a theoretical fulcrum for understanding how AI can support personalised and sustainable career development in a complex educational ecology and provides a clear pathway guide for subsequent empirical research.

For practical significance, the conceptual framework developed in this study not only offers university administrators a roadmap for adopting AI technologies but also provides theoretical and practical guidance for career planning education practitioners to emphasize the development of individual student initiative and competence enhancement. It has demonstrated that students' digital literacy, technology acceptance, and educational environments that can support their self-directed learning and reflection are becoming key safeguards for career development in the AI era (Bankins et al., 2024; Wu et al., 2024). Therefore, the ultimate goal of this study is to provide a systematic guidance model for career planning educators in Chinese higher education institutions to help them build a student-centred, technology-enabled career planning education ecosystem. It also promotes the transformation of higher education institutions from “service providers” to “competence facilitators”, thereby providing theoretical support and practical paths for the intelligent, autonomous and personalised development of career planning education in the future.

Although this study is based solely on CNKI and Google Scholar databases, focusing on Chinese and English literature from 2010 onwards, it has some limitations in terms of database coverage and timeframe. However, this timeframe remains relevant and representative, because research on AI in career planning within Chinese higher education institutions has predominantly intensified since 2021. Future research should focus on empirical testing of the integrative framework, integrating literature across multiple databases, and expanding the application of AI in higher education beyond the scope of career planning.

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Ethics Statement: This study did not involve any human participants, animals, or sensitive data requiring ethical approval. The authors confirm that the research was conducted in accordance with accepted academic integrity and ethical publishing standards.

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