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Table of Contents

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Management Strategies of Tourism Enterprises under the Background of "Internet Plus"

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Abstract

In the "Internet Plus" era, China's tourism industry is experiencing profound structural transformation driven by digital technologies and evolving consumer behavior. Traditional travel agencies and business models are increasingly challenged by online platforms, data-driven marketing, and the growing demand for personalized travel experiences. This study investigates strategic management adaptation among tourism enterprises within this changing environment by analyzing the evolution of the tourism value chain and the role transformation of travel agencies. Drawing on policy analysis, market data, and a big data–driven CPCR innovation framework, this research identifies emerging trends in digital integration, online–offline collaboration, and consumer participation. The results demonstrate that tourism enterprises leveraging information technology, big data analytics, and cross-platform collaboration achieve higher service efficiency, optimized resource allocation, and enhanced customer experience. Moreover, the "Internet Plus" paradigm is shown to reshape enterprise structures and facilitate value co-creation between suppliers and consumers. The study contributes theoretical and managerial implications for promoting sustainable development and strategic upgrading of China's tourism industry in the digital economy era.

Keywords
Internet plus; Tourism management; Integrated development strategy

1. Introduction

In recent years, China's tourism industry has undergone rapid change. As social and economic development accelerates, tourists have become more independent, self-directed, and diverse in their preferences. They now expect higher-quality and more personalized travel experiences, requiring the market to offer products and services that align with individual needs and improve convenience (Gretzel et al., 2020). The growing demand for personalization also reflects a wider global trend of "smart tourism," in which digital tools support tailored and seamless travel experiences (Kuo, Chen, & Tseng, 2022).

Advances in computer and information technology have fundamentally reshaped industrial ecosystems worldwide. The tourism industry has been particularly affected, as e-commerce platforms and digital intermediaries redefine how services are designed and delivered (Sigala, 2020). These technological innovations have disrupted the traditional tourism value chain and replaced many functions once controlled by conventional travel agencies (Huang, Song, &

Lee, 2021). According to Boto-García and Leoni (2021), digital transformation not only alters business processes but also enhances firm performance and industry specialization through data integration and analytics.

At the same time, upstream enterprises—such as travel suppliers, destination marketing organizations, and accommodation providers—are now able to reach customers directly. They distribute products through websites, online networks, and mobile applications, forming new digital ecosystems that bypass traditional intermediaries (Li, Nguyen, & Coca-Stefaniak, 2021). Mobile Internet operators have promoted diverse tourism applications that help users plan, book, and experience travel more efficiently. As Yang, Zhang, and Chen (2020) note, these platforms have become essential for real-time interaction and service innovation. Meanwhile, Xiang, Fesenmaier, and Werthner (2021) emphasize that social media and e-ticketing systems enhance both convenience and immediacy, transforming how tourists engage with destinations.

Against this background, Chinese tourism enterprises face both challenges and opportunities under the "Internet Plus" initiative. This national strategy encourages the integration of the Internet with traditional industries to promote innovation and competitiveness (Romão & Nijkamp, 2020). In the tourism sector, it represents a shift toward intelligent management, data-driven collaboration, and user-centered innovation. As Kim, Lee, and Preis (2020) observe, enterprises that combine technological advancement with service innovation achieve stronger performance in the digital economy.

This study therefore explores how Chinese tourism enterprises can strategically transform within the "Internet Plus" framework. It analyzes changes in the tourism value chain and applies strategic management theory to propose an integrated development pathway. Specifically, the study addresses two key questions:

(1) How does the "Internet Plus" paradigm influence the structure and function of tourism enterprises?

(2) What strategies can help these enterprises build sustainable competitiveness in the digital era?

Building on prior research, this paper argues that innovation and integration are the essential directions for China's tourism development. Through digital transformation, tourism enterprises can move beyond traditional service delivery to achieve intelligent management, cross-platform collaboration, and value co-creation with consumers (Gretzel & Koo, 2021). These capabilities allow firms to create adaptive, networked, and sustainable models of tourism growth suited to the demands of the "Internet Plus" era.

2. Literature Review and Theoretical Framework

Research on the tourism value chain has developed through two main perspectives: the traditional linear model and the digital, networked model. In the traditional model, suppliers, intermediaries, and consumers formed a closed sequence in which travel agencies played a key coordinating role (Gössling, Scott, & Hall, 2021). Each participant added value through its own specialized function, while intermediaries combined products and services from multiple suppliers to form integrated tour packages. However, this system was often criticized for high transaction costs and limited flexibility. Scholars such as Huang, Song, and Lee (2021) have pointed out that traditional agencies struggled to respond to fast-changing consumer needs

and global competition.

With the rise of digital technologies and e-commerce, the value chain has become more dynamic, decentralized, and consumer-oriented. Li, Nguyen, and Coca-Stefaniak (2021) observed that digital tourism connects suppliers and consumers through open online ecosystems, while Boto-García and Leoni (2021) showed that such systems improve firm efficiency and reduce distribution costs. At the same time, Sigala (2020) emphasized that technological advances are driving structural convergence across the tourism and service sectors, creating new competitive logics. Xiang, Fesenmaier, and Werthner (2021) further argued that the evolution of e-tourism represents not only disintermediation—where traditional agents are bypassed—but also "reintermediation," as new digital platforms act as intelligent intermediaries that personalize services for users.

The literature increasingly agrees that digitalization has transformed value creation from a supply-driven to a demand-driven model. Tourists are no longer passive consumers but active co-creators of experiences. Through social media and online communities, they generate and share content that influences others' travel choices (Mariani, Borghi, & Cappa, 2021). Gretzel and Koo (2021) emphasized that such participatory engagement is central to "smart tourism" and co-creation, while Law, Li, Fong, and Han (2022) demonstrated that data-driven forecasting can better capture changing tourist preferences. Romão and Nijkamp (2020) provided empirical evidence from Europe showing that innovation, specialization, and productivity collectively enhance regional tourism competitiveness. Together, these studies confirm that digital transformation fundamentally redefines how value is created and shared in the tourism sector.

Despite growing research attention, few studies have analyzed how China's "Internet Plus" initiative specifically reshapes enterprise management and value-chain structure. Kim, Lee, and Preis (2020) discussed innovation capabilities in hospitality firms, noting that digital tools improve both operational efficiency and customer experience. Similarly, Kuo, Chen, and Tseng (2022) examined service quality and tourist satisfaction in smart-tourism contexts, suggesting that technological integration strengthens loyalty. These findings imply that innovation and customer orientation are crucial for success in the digital era. Yet, as Sigala (2020) observed, existing literature still lacks a comprehensive framework to explain how digitalization interacts with management strategy, especially in emerging markets like China.

To address this gap, the present study adopts a strategic integration framework that emphasizes the interaction between technological capability and managerial innovation. Building on prior research by Huang, Song, and Lee (2021) and Gretzel et al. (2020), it proposes that competitiveness in the "Internet Plus" era depends on combining online and offline resources, merging digital tools with organizational systems, and integrating technology with human creativity. This approach reflects the broader understanding of digital tourism as a process of continuous adaptation, where enterprises co-evolve with consumers, markets, and policies (Romão & Nijkamp, 2020; Xiang, Fesenmaier, & Werthner, 2021).

3. Methodology

This study uses a qualitative and conceptual research design to examine how Chinese tourism enterprises adapt their management strategies under the "Internet Plus" initiative (Sigala, 2020). Instead of collecting new primary data, it combines a comprehensive literature review, policy analysis, and interpretation of secondary data. This qualitative approach provides a broad understanding of how digital transformation is reshaping the strategic and managerial

logic of tourism enterprises in China.

A conceptual qualitative design is suitable because the phenomenon of strategic transformation in the digital economy is still developing and involves complex, multi-level interactions. Following an interpretive research tradition (Romão & Nijkamp, 2020), the study focuses on identifying patterns and mechanisms that explain how policies, technologies, and markets interact to influence enterprise transformation. The goal is to generate theoretical insights rather than statistical generalizations, which fits the exploratory nature of this research.

The study draws on three main types of secondary data: national policy documents, academic and industry publications, and official statistics. The first type includes major government frameworks such as the Guiding Opinions on Promoting Smart Tourism (Huang, Song, & Lee, 2021) and the Internet Plus Action Plan issued by the State Council and the China National Tourism Administration in 2015. These policies emphasize the use of big data, mobile Internet, and digital platforms to improve service efficiency and management innovation. They form the institutional foundation for understanding the digitalization of China's tourism industry. The second data source consists of peer-reviewed research, white papers, and industry reports from organizations such as the World Tourism Organization and the China Academy of Tourism, which offer both theoretical and practical perspectives. The third source includes market statistics, annual reports, and datasets from the Ministry of Culture and Tourism, providing quantitative context on digital adoption and industrial restructuring.

All collected materials were analyzed using qualitative content analysis (Xiang, Fesenmaier, & Werthner, 2021). Policy documents, academic papers, and reports were systematically reviewed and coded to identify key themes related to digitalization, innovation, and organizational change. These codes were grouped into broader categories—policy drivers, technological enablers, and organizational responses. Together, they form an analytical framework that shows how external policy pressures and internal capabilities interact to shape digital transformation in the "Internet Plus" environment.

Table 1 Major policy on big data and tourism development promulgated by the state in 2015

Policy name	Time of issuing	Unit of promulgation	Main content
Guiding opinions of the National Tourism Administration on promoting the development of smart tourism	2015.1	National Tourism Administration	It's proposed to realize the intelligentization of tourism by using the new generation of network technology, and promote the transformation and improvement of tourist formats to integrated and fusion type
Guidance on actively promoting the "Internet plus" action	2015.7	The State Council	It's put forward clearly to accelerate and promote the development of "Internet plus"
Several opinions of the general office of the State Council on further promoting investment and consumption in tourism	2015.8	The State Council	It's proposed to actively promote the development of online travel platform enterprises, and promote the integration of tourism and the Internet industry
Action outline on promoting the development of big data	2015.9	The State Council	To systematically deploy the development of big data
Circular of the National Tourism Administration on the implementation of the "tourism + Internet" action plan	2015.9	National Tourism Administration	To put forward concrete train of thought and target to the integration of tourism and Internet

To strengthen the reliability of the results, the study employed data triangulation across all three data sources (Law, Li, Fong, & Han, 2022). Comparing evidence from policy documents, academic literature, and market statistics helped minimize bias and ensure analytical

consistency. The emerging framework was also compared with existing theories of strategic management and digital transformation to confirm theoretical coherence and robustness.

The second type of data includes macroeconomic indicators that describe the broader environment of China's tourism industry. As shown in Figure 1, China's gross domestic product (GDP) grew steadily from 2008 to 2015—a period marked by stable economic expansion, structural upgrading, and rising household income. This sustained growth stimulated domestic tourism demand and created favorable conditions for the rise of online travel platforms and digital services. The steady increase in GDP therefore provides essential context for understanding the evolution of China's tourism market and the economic foundations of its digital transformation (Boto-García & Leoni, 2021).

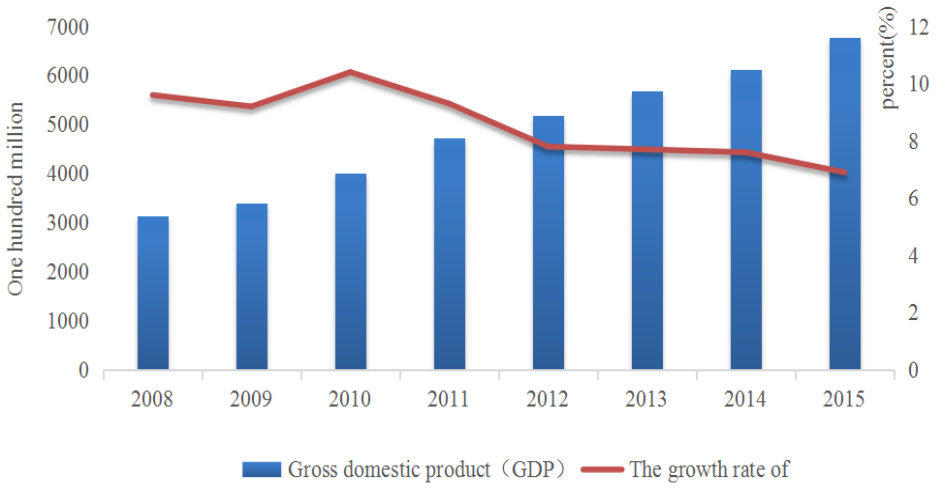

Figure 1 Changes in China's gross domestic product (GDP) in 2008-2015

The third type of data focuses on consumer behavior and the use of mobile Internet technologies in tourism. As shown in Figure 2, the use of mobile applications among Chinese Internet users has increased sharply over the past decade, reflecting the rapid spread of digital connectivity in daily life. Data summarized in Table 2 show that most tourists now rely on online travel guides, booking platforms, and social media as their main tools for obtaining information, planning trips, and interacting with services. These findings indicate a major shift in tourist behavior—from dependence on traditional intermediaries to a more independent, technology-driven, and participatory form of travel. This transformation highlights the growing influence of digital ecosystems on travel decision-making and supports analysis of how tourism enterprises are responding strategically to the "Internet Plus" environment.

Table 2 Adoption rate and reliability on sources of tourism information for Chinese outbound tourists in 2014

Sources of tourism information	Adoption rate (%)	Reliability (%)
Travel Guidance	53	10
Friends around	52	14
Accommodation booking website / travel website	48	13
travel agency	47	10
Travel magazines and travel brochures	39	4
Social media	33	5
Travel promotion / discount	31	7
Mobile applications	30	5

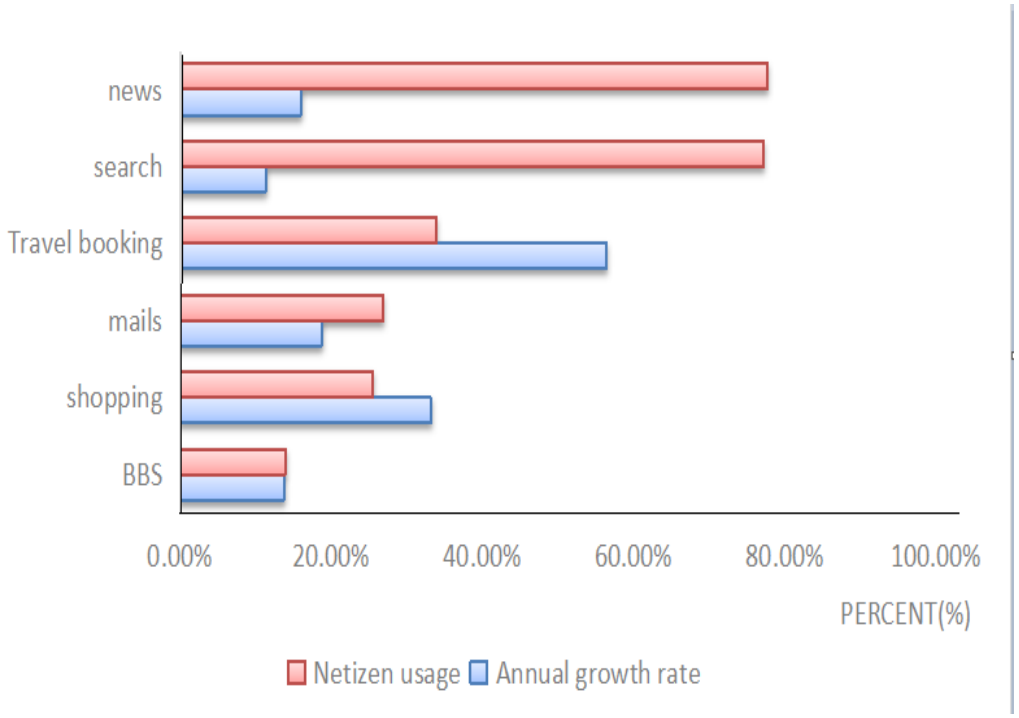

Figure 2 Schematic diagrams of various types of mobile Internet applications for Internet users in China in 2015

Building on these datasets, this study follows a three-stage analytical process to explore how Chinese tourism enterprises adapt to the "Internet Plus" environment. The first stage, environmental scanning, identifies key policy trends and market forces driving digital transformation in the tourism industry. The second stage applies a comparative analysis to distinguish between the structural characteristics of traditional and digital tourism value chains, emphasizing how value creation and business relationships have evolved. The third stage involves a strategic synthesis, combining the previous findings to generate practical insights and managerial implications for enterprise transformation.

To support this analysis, Figure 3 introduces the CPCR model, which represents the cyclical process of Customer Perception–Processing–Customization–Refeedback in digital tourism marketing. The model explains how big data connects enterprises and consumers through continuous interaction: firms collect consumer information, process it through data analytics, customize services, and refine strategies based on user feedback. This iterative cycle enables precision marketing, personalized experiences, and long-term customer engagement (Xiang, Fesenmaier, & Werthner, 2021).

By integrating quantitative indicators with qualitative insights, the study builds a coherent, multidimensional framework for analyzing digital transformation in tourism. The combination of national policy review, macroeconomic context, and consumer behavior analysis offers both empirical and theoretical support for developing integrated strategies that enhance the sustainable competitiveness of China's tourism enterprises in the digital era.

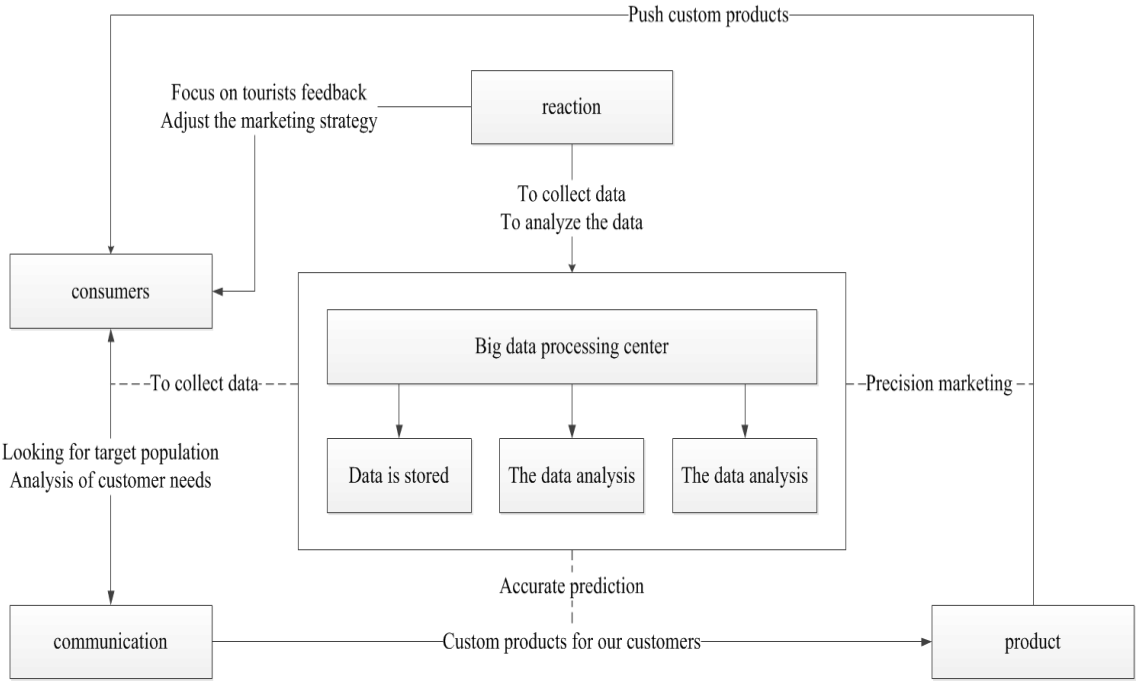

Figure 3 Innovation model of tourism marketing: CPCR

4. Results and Discussion

China's tourism market has entered a stage of deep development in which travelers increasingly move beyond traditional group tours toward personalized and experience-oriented forms of travel. As tourists demand more diversity and customization, service providers must offer richer, real-time information and more flexible solutions. Offline tourism services have also become more adaptive. In addition to offering itineraries, they now provide real-time updates on transport, dining, and entertainment, improving the immediacy and quality of the travel experience. The findings show that the integration of the "Internet Plus" framework with tourism has deeply reshaped both the value-chain structure and the managerial logic of the industry (Huang, Song, & Lee, 2021).

Digital platforms now function as hubs of cross-industry collaboration, connecting attractions with banking, insurance, retail, and e-commerce sectors to jointly design and promote tourism products (Boto-García & Leoni, 2021). For instance, LY.COM has partnered with multiple enterprises—such as Didi Taxi, JD Mall, Ping An Insurance, Dianping, China Merchants Bank, and Vinda Paper—to launch the "Happy Spot Tour" campaign, which offered millions of discounted tickets to encourage secondary spending at destinations. Such collaboration increases tourism flow and generates additional revenue for restaurants, shops, and leisure facilities, demonstrating the value-creating potential of digital integration (Romão & Nijkamp, 2020).

At the same time, platforms such as Qyer.com exemplify data-driven transformation. By using data analytics and algorithmic modeling (Gretzel & Koo, 2021), Qyer helps users filter travel information and customize their experiences. Its cooperation with Airbnb through API integration allows travelers to link accommodation choices directly to personalized itineraries. Qyer has thus evolved from a simple B2C transaction model to a Cost-per-Sale (CPS) commission model—shifting from an intermediary to an active facilitator of value co-creation in the "Internet Plus" ecosystem (Xiang, Fesenmaier, & Werthner, 2021).

Traditionally, travel agencies dominated the tourism value chain. Their advantage lay in wide sales networks, bulk purchasing power, and control of information flows. Because tourists and service providers—such as hotels and attractions—lacked direct communication, agencies acted as intermediaries that bundled products, set prices, and managed distribution. This information asymmetry allowed them to control market access and, in many cases, monopolize value creation (Gössling, Scott, & Hall, 2021).

In the "Internet Plus" era, digital platforms have enabled direct transactions between suppliers and consumers, disrupting this model. Online systems now allow suppliers to communicate directly with travelers, bypassing intermediaries (Li, Nguyen, & Coca-Stefaniak, 2021). This disintermediation reduces information distortion, shortens transaction chains, lowers costs, and leads to better quality and pricing. As a result, the traditional role of travel agencies has weakened, pushing them to reconfigure their business models and explore new value propositions in the digital tourism ecosystem (Sigala, 2020).

Table 3 Basic business and functions of travel agencies

The decision-making process of travel (tourists)	The basic business of a travel agency (travel agency)	The basic function of a travel agency (travel agency)
Tourism motivation	Development and design of tourism products	Production function (assembly function)
Information search	Travel products and promotions	Agency sales function
Intentional consultation	Consultation service	Information providing function
Purchase	Sales = purchasing	Sales distribution function
Travel	Reception	Organizational coordination function
Return	After-sale service	Information providing function

In summary, the application of the "Internet Plus" framework has reshaped the value chain of tourism enterprises, transforming it from a linear system of production and distribution into a networked system of collaboration and interaction (Mariani, Borghi, & Cappa, 2021). As reflected in Table 3, this transformation signifies a deeper structural shift—from information monopoly to information sharing, from standardization to personalization, and from isolated operations to integrated cooperation. These changes collectively lay the theoretical and practical foundation for the next stage of strategic discussion on how tourism enterprises can achieve integrated, innovative, and sustainable development in the digital era.

5. Conclusions

This study investigates how Chinese tourism enterprises are transforming their management strategies under the framework of the "Internet Plus" initiative. Through the analysis of policy documents, statistical data, and prior research, the findings demonstrate that the integration of Internet technology and tourism has not only redefined operational models but also fundamentally reshaped the structure of the tourism value chain.

First, the convergence of Internet technology and the tourism industry is transforming the sector's operational logic and profit-generation mechanisms. The rise of independent travel, the expansion of online platforms, and the evolution of digital marketing collectively pose significant challenges to the traditional tourism model. To adapt, tourism enterprises must adopt Internet-oriented thinking—emphasizing openness, interconnectivity, and user-centric design—to reconstruct their value chains and organizational ecosystems. Concepts such as large-scale data analytics, platform-based collaboration, and shared-value management are becoming essential tools for enterprise innovation and competitiveness. This transformation challenges

not only traditional travel agencies but also emerging online travel enterprises, both of which must continuously evolve to meet the changing expectations of digital consumers.

Second, the research highlights that integration is the prerequisite for sustainable development in the "Internet Plus" era. The strategic fusion of online and offline resources, digital technology and human expertise, and enterprise innovation with consumer participation enables tourism firms to enhance service quality, expand market reach, and achieve long-term value co-creation. In this context, "user-centered integration" emerges as a key guiding principle for digital transformation within the tourism industry.

Finally, it must be acknowledged that this study represents an initial exploration rather than a definitive model. Future research should further examine the mechanisms through which integrated development strategies optimize the tourism industry's value chain, particularly focusing on how travel agencies can transition from intermediaries to strategic coordinators within the digital ecosystem. Empirical studies combining firm-level data and network analysis would also strengthen the theoretical propositions presented here and provide a more comprehensive understanding of China's tourism digitalization process.

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Conflicts of Interest

The author(s) declare no conflicts of interest regarding the publication of this paper.

Ethics Statement

Not applicable.

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A Theoretical Analysis of Factors Influencing Nursing Professionals' Lifelong Learning in AI-Enhanced Environments

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Abstract

The rapid development of artificial intelligence (AI) has brought profound transformations to education systems worldwide. Nursing, as a profession that requires continuous learning and up-to-date clinical competence, faces both new challenges and opportunities in the AI era. The paper draws upon adult learning theory to analyse how AI-driven learning environments affect nurses' lifelong learning. This study analyzes the key factors influencing lifelong learning among nursing professionals in the context of AI: the convenience of intelligent applications, the diversity of learning places, the personalization of learning content, the interactivity of the learning process, and the effectiveness of learning evaluation. Finally, the study concludes with the presentation of a series of practical recommendations for nursing educators, hospitals, and policymakers, with a view to enhancing the integration of AI technology into continuing nursing education.

Keywords
Artificial intelligence; Lifelong learning; Nursing professionals; Adult learning

1. Introduction

Since the end of the 20th century, the rise of various "man-machine battles" has made people increasingly interested in AI. More and more countries have incorporated the development of AI into their national strategy (Ayeni et al., 2024). In May 2025, the International Conference on Artificial Intelligence and Education (ICAIE) was held in Suzhou, China, once again emphasizing the important role of AI in education and promoting the deep integration of AI and education. At present, AI has permeated various fields of society such as healthcare, finance and education, bringing about significant changes to our lives (Zhai et al., 2021). As AI technology continues to evolve, its impact on education and learning will become even more pronounced.

In recent years, there has been an increasing application of technologies such as intelligent tutoring systems, adaptive learning platforms, data-driven assessment, and virtual simulation to the training of nursing professionals (Hwang et al., 2024). It is imperative that nurses con-

tinually update their clinical knowledge, digital literacy, and decision-making skills in order to adapt to the rapidly evolving environment of healthcare. Consequently, lifelong learning is not merely a personal development requirement but also an essential professional competency for nurses. This is because nursing professionals frequently encounter onerous workloads, variable duties, and rapidly evolving clinical practices. Conventional forms of continuing education, including workshops, lectures and short-term training, frequently entail considerable time investment, are often constrained by geographical location, and can prove challenging to align with nurses' schedules (Mlambo et al., 2021). Consequently, a significant proportion of nurses encounter difficulties in sustaining consistent professional development while effectively managing their work and personal obligations. The advent of AI has furnished novel solutions to these challenges. AI-supported learning systems enable nurses to study at their own pace, utilising digital modules, micro-courses, or virtual clinical simulations that can be accessed at any time and in any location. Intelligent algorithms have the capacity to recommend learning content according to individual experience, practice area, or professional goals, while real-time analytics track progress and competency development (Ma et al., 2025).

Against this background, it is essential to explore the key factors that influence nurses' willingness and ability to engage in lifelong learning under the impact of AI. By identifying these factors, the study can provide insights into how hospitals, nursing associations, and policymakers can better design effective lifelong learning systems for nurses. This study uses a qualitative and literature-based conceptual approach to discuss these factors. Instead of collecting new data, the study relies on a careful review of existing research and theoretical discussions about nursing education, adult learning, and technology. It aims to build a clear understanding of how AI and adult learning theory together explain the process of lifelong learning for nursing professionals. The results are based on logical reasoning and integration of prior research, not on statistical testing. Although the study does not include field data, it offers a theoretical view that can guide future empirical research and practical strategies for supporting lifelong learning in nursing.

2. Artificial Intelligence and Lifelong Learning

Artificial Intelligence (AI) is a branch of computer science that constructs intelligent machines or intelligent systems through artificial methods and techniques, enabling machines or systems to simulate, extend and expand human intelligence. According to the process of the development of AI technology, it can be divided into three main stages: computational intelligence, perceptual intelligence, and cognitive intelligence. Computational intelligence is the most basic form of AI that uses the ability of computers to store and process data quickly to give machines the ability to calculate, store and transfer information like humans. In the field of education, computational intelligence can be used to store and transfer the resources needed for learning, and to build intelligent student information management systems. Perceptual intelligence, which enables machines to have various perceptual abilities such as sight, hearing and touch, and to interact with humans, is currently the main stage of AI development. In the field of education, it can be applied to areas such as speech teaching, oral language assessment, and image search. Cognitive intelligence is the ability to simulate human reasoning, association and knowledge organization. It is a hot topic in AI research and a breakthrough point for future development. It can support personalized and self-directed learning in the field of education (Wu et al., 2017).

AI is a further upgrade of Internet technology, which not only have the typical openness and globality of the Internet, but also fully demonstrate personalization and interactivity. The

development and application of the Internet have transformed the way people learn, and various online education industries are booming. With devices such as mobile phones, iPads and computers, people can search for a vast amount of learning resources and choose the time and place that suits them to study. However, in the face of various forms and difficulties of learning resources, many people do not know how to find a suitable learning path for themselves, resulting in problems such as "learning disorientation" and "knowledge overload", constantly facing questions such as "what to learn" and "what to learn next", this phenomenon greatly reduces the personalized advantage of online learning (Jiang et al., 2018). By using AI technologies such as data mining and personalized recommendations to conduct personalized analysis based on the characteristics of learners, it is possible to plan learning paths specifically, precisely recommend learning resources needed by different learners, thereby enhancing learning enthusiasm, improving learning quality, and promoting personalized development of learners (Feng, 2019). The application of perceptual intelligence technologies such as facial recognition and voice recognition can help teachers focus on the learning process of students, enable real-time interaction among students and between students and teachers, and fully enhance the experience of online courses. The combination of AI and virtual reality will further enrich the learning experience. In particular in the field of vocational education and training, through virtual classrooms, training in projects such as lathe operation and car repair can be achieved without being restricted by venues and equipment (Rojas-Sánchez et al., 2023).

To sum up, AI facilitates a continuous process in which individuals can acquire, update, and apply knowledge throughout their lives. This transformation is indicative of a more extensive shift towards Education 4.0, a paradigm in which learning systems are characterised by flexibility, interconnectedness, and a perpetual capacity for adaptation to technological and social change (Arias et al., 2025). Intelligent systems have the capacity to enable individuals to transfer skills and knowledge between workplaces, online platforms and educational institutions. This integration is congruent with the global demand for upskilling and reskilling, wherein learning is regarded as a lifelong necessity rather than a discrete phase of human development. Moreover, the field of AI has the potential to facilitate the establishment of learning societies that prioritise adaptability, digital competence, and equitable access to educational opportunities (Laupichle et al., 2022). A representative context for analyzing lifelong learning in the AI era is provided by nurses, who are typical adult learners who need to continuously update their professional knowledge. Therefore, it is essential to use adult learning theory, which provides a theoretical framework for comprehending the traits and requirements of adult learners, in order to more accurately interpret their learning behavior and motivation.

3. Adult Learning Theory and Its Relevance to the Lifelong Learning of Nursing Professionals

The characteristics of adult learning are determined by the uniqueness of adult learners themselves, which are quite different from those of general education learners. On the one hand, different adults have different developmental backgrounds and thus have certain uniqueness in terms of physical and mental development such as cognition, emotion and will. On the other hand, as adults are learners in society, they inevitably take on the role of workers, which significantly affects adult learning. In general, the characteristics of adult learning are mainly reflected in many aspects such as self-directed learning, practical learning content, relatively flexible learning time, unstable learning location and diverse learning forms.

First, the learning is self-directed. Knowles argues that as adults grow older, their self-concept shifts from dependent to self-directed, and psychologically and socially from dependent, het-

ero-regulated to independent, self-disciplined (Liu & Feng, 2016). This transformation turns adults into self-directed individuals, and as adult learners mature, their self-directed nature gradually increases. Adults are able to critically examine their situation and define the learning objectives they need. Generally speaking, adult learning purposes can be divided into three types. For the first category, the main purpose of learning is to improve technical skills, give oneself an advantage in competition, and thus find a better job or get a promotion and a raise. The main purpose of the second category of people is to obtain the corresponding diploma. In today's employment process, "academic qualifications" remain an extremely important stepping stone, so they must obtain the corresponding diplomas. Of course, there are also people who are forced to improve their academic qualifications for purposes such as promotion or professional title evaluation. The third group of people, whose main purpose of learning is to achieve self-improvement, view learning as a need for self-actualization, often without obvious utilitarianism.

Second, the learning content is practical. According to existing research results, intelligence can be divided into fluid intelligence and crystalline intelligence (Yuan, 2000). Fluid intelligence, which is based on physical development and gradually weakens with age, mainly refers to the ability of mechanical memory. Crystallized intelligence is closely related to social factors such as energy and experience. Generally, it does not decline with age and may even improve. It is mainly manifested as the use of already acquired knowledge and experience to absorb new knowledge and handle new problems. For adults, although the decline in fluid intelligence may affect memory ability, they have a certain experience and knowledge base, and are more likely to connect the learning of knowledge related to work and life with the existing knowledge structure, and can solve problems in real-world experience very well. Therefore, practical learning content related to work and life is more likely to be accepted by adult learners. Moreover, for the majority of adult learners who have left school, their learning content is often oriented towards various problems or difficulties encountered in real work and life, and the demand for learning content is obviously practical.

Third, the study time is relatively flexible. Adult learners are generally people who have entered society and hold some social positions. Financial burdens or job responsibilities make adult learning time relatively tight, with a prominent contradiction between work and study. Flexible schedules are a prerequisite for adults to study effectively. Adult learning is dominated by fragmented time utilization, making it difficult to ensure stable learning conditions for longer periods (Moore et al., 2023). In addition, adult learning usually occurs when problems or difficulties are encountered, and if the problems or difficulties are resolved, the learning activity comes to an end. Learning activities resume only when new problems or difficulties arise, so adult learning time is also discontinuous.

Fourth, the place of study is unstable. On the one hand, the entities providing services to adult learners are diverse, including institutions of higher learning and other social organizations such as companies, enterprises and communities. Schools are no longer the only place for learning. On the other hand, due to various reasons such as work, time and distance, the location of adult learning activities can only be chosen according to actual needs and is difficult to be fixed. Even for students participating in formal adult higher education, it is not guaranteed that they will study on campus for a long time. However, various forms such as correspondence and distance education allow for the selection and flexible arrangement of study locations as needed. In addition to formal and informal learning venues, many learning activities also take place in informal learning locations such as at home, on the vehicle, and in the workplace. Learning that takes place in the workplace alone can take place in meeting rooms,

workshops, restaurants, or even on sofas in leisure areas (Hrastinski et al., 2024).

Finally, the forms of learning are diverse. The particularity of adults enables adult learning to take on both formal and informal forms, as well as non-formal ones (Johnson & Majewska, 2022). In terms of the forms of adult higher education in our country, there are various forms such as traditional face-to-face courses, correspondence education based on correspondence materials through communication, and online education using the Internet and other communication media. Adult informal learning, on the other hand, is more flexible, with the ability to study anytime and anywhere through portable devices such as mobile phones and ipads.

In summary, adult learning theory emphasizes autonomy, self-direction, practical relevance, and flexibility—features that perfectly match the professional characteristics of nurses. Nurses, as adult learners, often balance clinical responsibilities, family life, and professional development. They prefer learning experiences that are relevant, problem-centered, and immediately applicable to their work. Adults learn best when they can control their learning pace, connect new knowledge with prior experiences, and understand the real-world purpose of learning. These principles apply directly to nursing continuing education, where learning should be authentic, flexible, and task-oriented. Based on this understanding, this study adopts adult learning theory as its main conceptual framework to analyze and interpret the factors that influence lifelong learning among nursing professionals. The theory serves as the bridge between the conceptual background and the analytical framework described in the next section, ensuring that the study's logic remains coherent and theoretically grounded.

4. Influencing Factors of Lifelong Learning for Nursing Professionals in the AI Era

In the context of AI-driven education and learning, lifelong learning for nurses is influenced by several interconnected factors. Based on the characteristics of AI and adult learning, this study identifies five core aspects: the convenience of intelligent applications, the diversity of learning places, the personalization of learning content, the interactivity of the learning process, and the effectiveness of learning evaluation. These factors jointly determine how nurses perceive, engage in, and benefit from lifelong learning supported by intelligent technologies.

First, the convenience of intelligent applications refers to the accessibility, flexibility, and efficiency of AI-based learning systems. Adult learners, due to the characteristics of physiological development, will gradually decline in mechanical memory and reaction speed, and due to social pressure and other reasons, are often less interested in new things than minors in coming into contact with and learning. Adults have a strong sense of self-esteem, and if they encounter insurmountable difficulties when exposed to new things, it may affect their self-confidence and, in turn, their enthusiasm for learning. The convenience of operating AI can affect adults' interest in using the technology to learn. Nursing professionals often work long and irregular hours, which makes it difficult to attend traditional training sessions. Intelligent online platforms allow them to learn anytime and anywhere, using mobile devices or hospital-based systems. For example, an AI-assisted continuing education platform can automatically recommend short learning modules during breaks or after shifts. When learning resources are embedded into daily work processes, such as electronic medical records linked to educational materials, nurses are more likely to engage in continuous learning without feeling an additional burden.

Second, the diversity of learning places represents the richness and variety of learning resourc-

es provided by AI environments. The particularity of adults makes it difficult to fix the place where adults study. While people can choose different places for online and mobile learning, there are still many things to learn that have to go to a fixed place or cost a lot of money, such as training content that requires large equipment, or training that requires a lot of materials to repeat practical operations. The application of AI is expected to break down these barriers that restrict adult learning and completely change the situation. The combination of virtual reality technology and AI can not only provide a sense of "reality" in terms of perception such as vision and hearing, but also achieve a sense of "real" touch. If educators no longer have to spend a lot of money on materials and equipment, and learners do not have to squeeze out time to go to fixed places of study, learners' enthusiasm and efficiency will be greatly enhanced. The diversity of learning places should not be limited merely to the transformation of physical Spaces, but rather to the combination of physical and virtual Spaces. Traditional nursing training often relies on lectures or printed manuals, but AI technologies enable multi-modal learning experiences, such as video tutorials, virtual simulations, interactive quizzes, and case-based discussions (Roveta et al., 2025). For instance, a nurse learning about wound care may simultaneously watch clinical videos, interact with virtual patients, and participate in AI-facilitated peer discussions. The diverse formats not only make learning more engaging but also address different learning preferences and cognitive styles among nurses.

Third, the personalization of learning content is one of AI's most significant contributions to lifelong learning. The realization of personalized learning should first be based on the different characteristics of adult learners, with tailored learning strategies and personalized learning guidance provided at the same time; rich and personalized learning resources should also be provided for adult learners in different time and space settings; and it should enhance meaningful interaction between learners and learning resources as well as among learners themselves (Zhou, 2018). The development of the Internet has provided adults with a vast amount of learning resources, but adult learners have difficulty choosing the appropriate content to study, let alone planning their learning paths well. To truly achieve personalized learning, AI needs to have a deep understanding of adult learners and provide them with personalized learning methods and content. For example, intelligent algorithms analyze nurses' learning behaviors, previous performance, and interests to tailor content and pacing. An AI-driven learning management system might recommend advanced modules on intravenous therapy to a nurse who excels in basic nursing procedures, while another nurse might receive more foundational materials. Personalization ensures that learning remains relevant and efficient, helping each nurse to achieve competence at an appropriate level and speed. It also aligns with the self-directed nature of adult learning, giving nurses more control over their learning pathways.

Fourth, the interactivity of the learning process refers not only to the input and output of information between humans and machines, but also to the communication and interaction between learners as well as between learners and educators. Learning situations with good interactivity have a significant effect on efficient learning in adults. The better the interactivity, the more it can enhance the learning experience and efficiency of learners. Effective interaction between humans and machines enables timely understanding of adults' learning needs and learning dynamics, thereby providing corresponding feedback. Educators can also adjust their teaching strategies in a timely manner based on the learning situation of learners. Adult learners need to exchange learning experiences with each other and create a relaxed and supportive learning atmosphere. And this will all be thanks to the further development and application of AI technologies such as voice and facial recognition. For example, AI-based virtual patients can respond dynamically to nurses' interventions, creating a safe yet authentic learning environment. In addition, online communities supported by AI tools enable peer learning and mentor-

ship across institutions. Such interactive features strengthen motivation and improve clinical reasoning skills.

The final influencing factor is the effectiveness of learning evaluation, which involves real-time evaluation and feedback on the learning process and learning outcomes. Being accustomed to evaluating the outcome of learning while neglecting evaluation throughout the learning process not only affects the effectiveness of evaluation, but also affects learning enthusiasm and learning outcomes due to the lack of effective feedback during the learning period. To fully leverage the advantages of AI, real-time monitoring and analysis of various factors such as the characteristics, time and place of adult learning, and comprehensive assessment according to certain rules, both learners and educators can receive corresponding evaluation results in a timely manner. In addition, we should view the evaluation results dialectically, seek guidance and analysis from educators or others in a timely manner, and draw more appropriate conclusions. The era of subjective evaluation by educators is fading away. For instance, a nursing simulation system may track how accurately a nurse performs procedures and provide instant feedback. Predictive analytics can also identify them at risk of falling behind, allowing educators to offer timely support. Intelligent evaluation thus transforms assessment from a final check into an ongoing, formative process that guides learning improvement. Human-machine assistance will lead to more timely and effective learning evaluations, thereby better promoting nursing professionals' learning.

5. Strategies for Enhancing AI-Enabled Lifelong Learning in Nursing

Based on the five influencing factors discussed above, several strategies can help improve the integration of AI into lifelong learning for nursing professionals. These recommendations are aimed at three levels—institutions, educators, and individual nurses.

5.1 Institutional strategies

First, develop intelligent learning platforms. Hospitals, universities, and nursing associations should invest in digital infrastructure that supports AI-based learning management systems. A well-designed platform can offer modular courses, virtual simulations, and personalized progress tracking. For example, hospitals can collaborate with universities to create shared platforms where nurses complete required continuing-education credits through AI-assisted micro-courses.

Second, integrate learning with clinical workflows. AI systems can link learning resources with electronic medical records or daily clinical tasks. When a nurse documents patient care, the system might suggest short, relevant learning materials such as updated wound-care guidelines. This contextualized learning reduces time barriers and makes education a seamless part of professional practice.

Third, ensure data security and equity. Institutions must also guarantee information safety and equal access. Data collected through AI platforms should be anonymized and used only for educational purposes. Special attention should be paid to nurses in rural or resource-limited hospitals to ensure they have equal opportunities for AI-supported learning.

5.2 Strategies for nursing educators

First, adopt a blended-learning mindset. Nursing educators should combine AI-enabled online learning with traditional mentoring and clinical instruction. Blended models can balance effi-

ciency and human interaction, which remains critical in developing professional empathy and ethical judgment.

Second, enhance digital literacy and instructional design skills. Educators need professional development to design effective AI-based courses. Understanding how to interpret learning analytics, adjust algorithms, and evaluate learner data will help teachers use AI more meaningfully. Universities can organize training workshops or certification programs on digital pedagogy for nursing faculty.

Third, focus on reflective learning and critical thinking. While AI can provide information quickly, educators must guide nurses to reflect, question, and apply what they learn. Assignments that connect AI-generated feedback with real clinical cases can strengthen critical thinking and judgment.

5.3 Strategies for individual nurses

First, strengthen self-management and motivation. Lifelong learning requires self-discipline. Nurses should actively schedule learning time, set personal goals, and use AI tools to monitor their progress. Gamified learning modules or digital badges can increase motivation.

Second, develop digital and information literacy. Nurses need to understand how AI systems operate and how to evaluate digital resources. Basic knowledge of data ethics, privacy, and algorithm bias can help them use AI safely and responsibly.

Third, build collaborative networks. AI platforms that support social learning allow nurses to share experiences and solutions. Participating in online communities of practice encourages knowledge exchange across departments or hospitals, enhancing professional growth.

6. Conclusion

The integration of AI into nursing education marks a new stage in the development of lifelong learning. AI technologies expand the possibilities for continuous professional development by making learning more accessible, diverse, and data-driven. This study identified five major influencing factors that shape nurses' engagement with AI-based learning: the convenience of intelligent applications, the diversity of learning places, the personalization of learning content, the interactivity of the learning process, and the effectiveness of learning evaluation. As adult learners, nurses benefit from flexible and relevant learning experiences that connect directly to their clinical work. AI provides technical means to support these needs through intelligent recommendation systems, adaptive simulations, and real-time feedback. Yet technology alone cannot guarantee effective learning. Institutional support, educator competence, and individual motivation remain decisive factors.

Future research should explore empirical evidence on how AI affects learning outcomes and patient care quality. Longitudinal studies and mixed-methods approaches could measure how nurses' skills, satisfaction, and confidence evolve through AI-supported learning. Policymakers and hospital administrators should view AI not as a substitute for human instruction but as a collaborative partner that enhances the capacity of both teachers and learners. Ultimately, AI-enabled lifelong learning can offer a sustainable pathway for building a professional, innovative, and compassionate nursing workforce capable of meeting the complex demands of modern healthcare.

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The author(s) declare no conflicts of interest regarding the publication of this paper.

Ethics Statement

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Research on the Multi Interactive Teaching Mode of College English Under the Information Technology Environment

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Abstract

With the rapid development of information technology, traditional College English teaching can no longer meet the needs of individualized and interactive learning. Many current models still rely on teacher-centered instruction and lack flexibility in promoting students' initiative. This study aims to explore a multi-interactive teaching mode for English for Specific Purposes in a network environment. Based on constructivist learning theory and the goal-level theory of English learning, the model integrates classroom teaching, online self-learning, and multiple forms of evaluation. It emphasizes interaction among teachers, students, and digital resources to build an open and student-centered learning system. The findings show that this approach helps students set higher learning goals, improves learning motivation and efficiency, and enhances cooperation and participation. The study suggests that information technology can effectively support the reform of College English teaching, promote students' independent learning ability, and create a sustainable environment for personalized and interactive education in higher institutions.

Keywords
Multi-interactive teaching; Constructivism; Network environment; ESP

1. Introduction

In recent years, the rapid development of information technology has brought new opportunities and challenges to College English teaching. The promotion of English for Specific Purposes (ESP) course construction within a network environment constitutes a primary issue that merits meticulous consideration (Liu et al., 2024). Drawing upon constructivist learning theory and the concept of interactive teaching, this study explores ways to enhance the effectiveness of ESP teaching in the network environment. The programme places emphasis on a variety of pedagogical approaches, including classroom instruction, self-directed learning post-class, and the assessment of learning outcomes. Additionally, it supports the creation of educational resources to facilitate the teaching of English for specific purposes. Network-based learning aligns with the core ideas of constructivism, providing students with an autonomous and open learning environment. In this setting, the conventional 'lecture-based' approach, predicated upon a didactic model, is supplanted by a student-centred and praxis-oriented paradigm. Autonomous online English learning has been identified as a highly effective solution to the contradiction between the needs of the modern era and the current limitations of English teaching. It has been demonstrated to meet the demands of new educational paradigms, encourage stu-

dents' active participation, promote innovation in learning methods and processes, and serve as an important extension of classroom instruction for realizing personalized learning (Bahari & Gholami, 2023).

The reform of English teaching in higher education has evolved from a practical exploration of pedagogical methods to a theoretical level (Li et al., 2022). This progress has led to the proposal of a multi-dimensional interactive teaching mode for College English. The present paper introduces the Theory of English Learning Objective Hierarchies, a framework designed to assist students in establishing clearer and higher learning objectives, and to enhance teachers' ability to stimulate students' interest and intrinsic motivation. The Theory of English Learning Objective Hierarchies divides English learning goals into three ascending levels. Action research is a pedagogical approach that encourages students to progress from lower-level objectives to higher-level goals, ultimately achieving the highest level of self-realization. Moreover, this study proposes the Grid Theory of College English Teaching Modes, which maps various existing models into a "College English Teaching Mode Grid." This proposal is based on a comprehensive analysis of existing college English teaching models in China. This framework illustrates the ideal state of a multi-dimensional and interactive College English teaching model in the information technology era.

Previous studies have mainly focused on online or blended English teaching but have often treated technology as a tool rather than as part of a complete learning system. In practice, many College English classes still rely on one-way teacher explanations, which limits students' engagement and creativity. To address this problem, this study aims to construct a multi-interactive teaching mode for College English under the information technology environment. The goal is to improve students' motivation, participation, and learning effectiveness through multiple forms of interaction, including teacher–student, student–student, and student–computer communication.

2. Significance of the Study

Research in practice, accelerate the transformation of scientific research results in teaching practice. When it comes to research, the first thing to think about is experimental research, which fully embodies the scientific spirit and is the most objective. However, this research method from natural science has obvious shortcomings in the research of humanities. Language teaching itself is a multi factor interactive process. In fact, in the teaching process, it is impossible to completely control all kinds of complex factors or simulate the laboratory conditions to complete the whole teaching process (Burns, 2019). This complexity makes it difficult to describe the relationship between teaching process and result with concrete and clear causality. In addition, in the field of foreign language teaching, various teaching thoughts, theoretical schools and teaching methods emerge one after another.

In the teaching practice, we also feel that many research papers and achievements on second language learning or foreign language teaching are out of touch with the teaching practice, or it is difficult to provide ready-made answers to specific problems in our daily teaching, and can not solve the problems encountered by teachers in daily teaching. This phenomenon has been recognized by many applied linguists and educators. Therefore, in order to effectively improve the quality of education in foreign language teaching, it is also necessary to train teachers in applied linguistics research methods, encourage teachers to summarize their own methods by analyzing, thinking, exploring and summarizing the actual teaching situation, and finally put the methods summarized in practice back into teaching practice to guide teaching

practice (Consoli, 2021). Only in this way can we solve the problems in our teaching directly and effectively. Moreover, it is increasingly recognized that it is more and more important to encourage teachers to use non experimental research methods to study the teaching process and results in foreign language teaching research.

3. The Cultivation of Learning Ability under the Network Teaching Mode

3.1 The characteristics of network teaching

The traditional teaching mode does not fully consider the differences of students, even if teachers consider the actual needs of students in classroom teaching. The unified teaching mode determines that teaching can only be arranged according to the level and requirements of most students. It is very likely that some students who have spare energy can not eat enough and some students with poor foundation can not keep up with it. The new model only stipulates the basic learning tasks. When students encounter difficulties in learning, they can seek help from teachers or graduate assistants at any time. Teachers can carry out personalized teaching according to the problems raised by students in learning (Walkington & Bernacki, 2020).

3.2 Application of the goal level theory of English learning for college students

In order to encourage students to develop towards a higher goal level, teachers should first fully understand the level of students' English learning objectives and objectively analyze the current position of students in English learning objectives. Among them, teachers should help students to achieve their basic learning goals through a variety of learning objectives. For students with social needs, teachers should give full play to the role of organizers and instructors, help students set up the second classroom English learning, and actively participate in the guidance. For students with high-level goals, teachers should encourage and praise their good performance in time, so as to meet their respect goals. After the students achieve the existing goals, teachers should help students to establish a higher level of goals. This goal should not only be higher than the original goal, but also not unattainable. If the goal is set too low, it is not conducive to the development of students' potential, affecting the students' initiative. On the contrary, if the goal is set too high, the students and teachers will be frustrated and even frustrated, which will affect students' interest in learning. Harmonious teacher-student relationship is very important in helping students set learning goals scientifically. Teachers need to pay attention to strengthen the emotional communication with students. They should be both teachers and beneficial friends of students (Yu, 2023).

4. Theoretical Foundation of the Multi-Interactive Teaching Mode

4.1 Constructivist learning theory

Constructivist learning theory is comprised of two aspects: the meaning of learning and the method of learning. In relation to the notion of "the meaning of learning", the theory posits that the acquisition of knowledge by learners does not occur in a passive manner through simple stimulus-response mechanisms. Rather, it is achieved through the construction of meaning, which is facilitated by interpersonal cooperation activities and the utilisation of necessary learning resources in specific circumstances. With regard to the question of "learning methods", constructivist learning theory advocates a learner-centred approach to education, overseen by teachers. Firstly, it is important to note that learners cannot be considered passive recipients of external stimuli; rather, they should be regarded as cognitive subjects. They have

the capacity to actively process external information and construct knowledge meaning. Secondly, the role of the teacher has evolved from that of the mere transmitter of knowledge to that of the facilitator and promoter of students' construction of meaning (Gao & Xu, 2023).

4.2 Goal level theory of college English learning

According to the hierarchy theory of College English learning objectives, college students' English learning goals and needs can be divided into four levels: (1) minimum goal: Safety/examination goal level; (2) general goal: social goal level; (3) higher goal: respect goal level; (4) highest goal: self realization goal level (Meşe & Sevilen, 2021). Figure 1 illustrates the overall hierarchy of these English learning goals.

Figure 1 A map of the goal level of English learning for college students

The safety goal in college students' English learning corresponds to their instrumental motivation, which belongs to the lowest level of English learning and is also the lowest goal of many college students' English learning. The third chapter constructs the theoretical basis of the multi-dimensional interactive teaching mode of College English. As a major course, College English has a direct relationship with students' examination and graduation. If the exam fails, students will face the threat of not graduating. In addition, in recent years, the recognition of CET-4 certificate in the society also forces students to learn English for the sake of employment safety. In a large number of interviews with students in this study, many students reported that they lacked motivation to practice oral English. This phenomenon has something to do with the absence of oral test in all kinds of academic examinations and CET-4. This fully exposes a common phenomenon: at present, the only motivation for many college students to learn English is to be able to safely pass the academic examination and band 4 examination, and to graduate safely for employment. In other words, "being able to pass the English test" has become the basic goal of many college students' English learning. For these students, once the goal is achieved or the goal is broken, they will lose their interest and motivation in learning. In fact, the phenomenon that many college students' English learning objectives are still at the lowest level has become the main factor hindering College English teaching, especially oral English teaching.

5. Model Construction of the Multi-interactive Teaching Mode

In this study, the design idea of multi-element interactive teaching mode of ESP in the network environment is to establish a course teaching mode based on the network, with text, pictures, audio and video as the main interactive media, and the network teaching platform, e-mail and online chat tools as the main interactive mode. In the whole teaching process, the learning environment is designed by using the elements of situational creation, collaborative learning and conversation communication, and a classroom teaching mode of "learner centered and teacher

led" is established. At the same time, through the analysis of learners' background knowledge, language level and cognitive level, a learning resource database can meet the needs of different levels of learners. And through setting specific "tasks" based on a specific discipline, teachers can establish after-school autonomous learning under the guidance of teachers, and encourage learners to complete tasks through the cooperation of teachers and students, students and students.

Based on the concept of ESP course construction, the author constructs a multi interactive teaching mode under the network environment. It is defined as: under the guidance of constructivism learning theory and interactive teaching concept, relying on computer network technology, to improve the two-dimensional structure of learners' emotion and cognition. Taking the specific "task" as the starting point, the multi interactive teaching mode of "classroom teaching + after class autonomy + interactive learning + multiple evaluation" is established, which is "learner centered and teacher led". In this model, learners are the active constructors of language knowledge and the meaning of subject knowledge; teachers are the organizers, guides and promoters of learning activities, and use appropriate teaching strategies to help students complete the self construction of knowledge. The specific "task" is the starting point. Through the design and implementation of specific tasks, learners not only complete the perfect combination of subject knowledge and language comprehensive application ability (cognitive goal), but also improve the ability of autonomous learning, cooperation and knowledge inquiry (emotional goal).

Multimedia network is not only a tool for situation creation and knowledge transfer, but also a medium for multiple interaction and cooperation between teachers, students and students inside and outside class. It is also a cognitive tool to assist learners to complete autonomous learning and collaborative exploration. The rich network resource database is the main learning content of learners and an important guarantee for students to realize knowledge self construction. It is a beneficial attempt for College English teaching reform to make up for the defects of traditional English teaching and greatly improve the teaching efficiency and quality by using the network assisted autonomous teaching of College English, combining the principles of foreign language teaching with modern educational technology. Although the new teaching mode has many advantages, but in the process of implementation, due to the influence of teachers and students and objective environmental factors, there are some problems that can not be ignored.

First of all, teachers and students have different recognition of College English teaching reform, and the actual operation ability of computer and network is uneven, which will bring a lot of problems to teaching. Therefore, in order to confirm that computer and network assisted college English teaching is the future development direction, teachers and students should change their ideas and apply computer and network technology to teaching practice. Secondly, in the process of using network to teach college English independently, although students are allowed to set their own learning objectives, choose learning contents and design learning methods and strategies independently, they can not let themselves go. Teachers should follow the cognitive law of students, focus on students' autonomous learning, provide learning methods and learning resources that can be selected by students themselves, help and guide students at any time through the network, so as to make the autonomous interactive learning more reasonable. Through the cultivation of self-control ability, students will gradually obtain higher self-learning ability, and have the ability to reasonably allocate learning time, timely feedback learning effect, and properly adjust learning behavior. Thirdly, it is the objective environmental factors. Objective environment mainly refers to computer hardware configuration,

LAN network connection and multimedia learning courseware and other supporting facilities. The new mode has higher requirements for computers and networks. Although the school has arranged the best computer room for us to manage and maintain, due to the computer network failure and shortage of manpower from time to time, the normal teaching is also affected.

6. Conclusion

This study explores the construction and application of a multi-interactive teaching mode for College English in the information technology environment. Guided by constructivism and goal-level learning theory, the research designed a teaching model that integrates teacher–student, student–student, and human–computer interaction. Through classroom practice and reflection, the study shows that this model can create a more active, engaging, and student-centered learning atmosphere.

Taking "task" as the breakthrough point, this paper constructs the ESP learning environment from class to class, online to offline, and realizes the multiple interactive activities between teachers and students, students and computers, students and learning content. This not only changes the traditional teaching environment and means, but also changes the relationship between "teaching and learning" which takes teachers as the center and learners accept passively, and promotes the curriculum construction and reform to have a qualitative leap. The implementation of this model can effectively improve the problems in the current teaching. Based on the information technology environment, the research of College English multiple interactive teaching mode is an attempt in teaching ideas, teaching ideas and teaching methods. In the pilot teaching, this new mode has shown its advantages, which can greatly stimulate the enthusiasm and initiative of students, and lay a good foundation for the development of lifelong learning.

Looking at the current situation of foreign language teaching interactive teaching mode at home and abroad, most of them stay on the interactive relationship between teaching elements in the classroom (such as teacher-student interaction, student-student interaction, student-textbook interaction, etc.). In the few researches on the interaction between inside and outside the classroom (such as multimedia learning and campus culture), students' dormitories are ignored, and the interaction between teaching policy, teaching process and teaching effect is also ignored. After three rounds of teaching practice, this action research takes "interaction between classroom teaching and English Dormitory" as the core measure. By making use of the intimate relationship between the members of the dormitory and the convenient advantages of space and time, the action research makes students' Classroom English learning and dormitory English learning closely linked, and cooperates with a series of long-term interactive measures to make many elements in English teaching and teaching environment (Teng, 2021). For example, campus culture and teaching policy interact to form a kind of dormitory English and even campus English culture, so as to improve students' Comprehensive English ability in an all-round way, which is highly innovative.

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Optimizing College Students' Mental Health Education from the Perspective of Positive Psychology

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Abstract

College mental health education in China has developed rapidly in recent years, but most programs still emphasize psychological problems and neglect students' positive growth. Many courses remain theoretical, lack practical value, and fail to inspire students to build resilience or well-being. This study aims to explore how positive psychology can optimize mental health education for college students. Based on literature review and survey findings, it identifies several key issues: limited integration of positive concepts, insufficient teacher training, and low engagement in learning activities. The research suggests that incorporating positive psychology into course design, promoting interactive learning, and creating a supportive campus environment can help students form optimistic attitudes and strong coping abilities. The study finds that when colleges shift from a problem-centered to a strength-based approach, students show higher motivation, better emotional balance, and improved social adaptation. These findings highlight that positive psychology is not only a useful theoretical framework but also a practical tool for reforming college mental health education. It provides new insights for universities to enhance students' well-being and to cultivate a culture of positivity and growth in higher education.

Keywords
Positive psychology; College students; Mental health education

1. Introduction

The mental health of college students has become an increasingly important concern in higher education. In 1980s, in order to comprehensively raise both the quality and level of college education and meet college students' objective needs for mental health education in the daily learning process, all colleges in China gradually built the mental health education course system and established mental counseling centers (Yu, 2025). Besides, based on the actual needs of social development and the development trend of educational system, the governmental departments concerned continuously introduced various policies to guide and support mental health education. Owing to the joint efforts in many efforts, a prominent result has been achieved in mental health education in China's colleges and college students' mental health level has been improved significantly (Diener et al., 2018). Mental health education has thus evolved from a supportive service into a key part of comprehensive quality education.

However, we must realize that such mental health education in the conventional sense only works for some students with mental diseases and cannot raise the mental health level of the

whole college student group due to its failure to develop positive factors in mental potential, although it can effectively avoid and eliminate a mental disease and raise college students' mental quality and health level. With the deepening of educational activities in China's colleges, the mental health education in colleges will inevitably face an increasingly heavy work stress and diversified working requirements in the process, it is of extremely great realistic significance to organically combine positive psychology with college students' mental health education and excavate the positive factors in mental health education for improving the current situation of mental health education in colleges at the current stage and raising the overall mental health education level of college students (World Health Organization, 2013).

The purpose of this study is to explore how to optimize college students' mental health education from the perspective of positive psychology. Through literature analysis and practical reflection, this paper discusses the current problems in mental health education, explains the key ideas of positive psychology, and proposes strategies for improvement. The aim is to provide a theoretical reference and practical guidance for building a more effective and positive mental health education system in colleges and universities.

2. Positive Psychology

Positive psychology provides the main theoretical foundation for this study and offers new ideas for improving mental health education among college students. It was first put forward by Sheldon, an American psychologist. He thinks that positive psychology is based on the potential and morality of human. It emphatically develops the positive factors in human nature and realizes the cultivation of a good psychological state of individuals or groups by excavating positive factors. Therefore, they can take an optimistic attitude towards the daily life and learning (Seligamn et al., 2009). As a branch of psychology, positive psychology perfects the frame system of psychology via its new theory and makes up for the deficiencies of traditional psychology in the research direction and content. The analysis on the characteristics of positive psychology can help us to further clearly understand its key parts and core requirements in the development process, distinguish the difference between positive psychology and traditional psychology and create extremely favorable conditions for the effective application of positive psychology in practice.

The first is the positive psychological orientation. Positive psychology not only pays attention to the treatment of mental diseases and the adjustment of mental status that the traditional psychology concerns but also emphatically excavates people's innermost positive factors, achieves the all-sidedness and integrity of psychology and makes up for the deficiencies of traditional psychology to meet the social and economic development's appeal for psychology. There is a positive psychological value orientation in positive psychology, which, thus, discovers and excavates people's innermost positive factors to guide them to develop a good behavioral habit and value orientation. As a result, individuals can take a more optimistic attitude towards various mental problems in their work and life, enhance the mental health level and successfully cure mental diseases (Seligman, 2011).

The second is realizing the return of value. In positive psychology, it is hoped that individuals can pay more attention to the positive and beneficial factors in social life and work to realize their social values by giving play to and excavating their own positive strength. Meanwhile, as a psychology branch pursing human values, positive psychology not only focuses on the treatment and curing of mental diseases the traditional psychology concerns and eliminates the negative effects of a bad mental state on individuals, but also calls for treasuring people's

own values, makes psychology to return to its essence again, tries to correct any errors in the development of traditional psychology, gives full play to the social value of psychology and facilitates its comprehensive healthy development (Seligman et al., 2009). At the same time, to guarantee the scientific and effective development of positive psychology when realizing the return of value, it is required to verify related activities and studies. As an independent science, the guidance of scientific thinking is needed in the development and application of positive psychology. Moreover, scientific research ways and methods, tests, evaluations, inspections and other means should be used to comprehensively improve the correctness of theoretical studies in positive psychology so that it can really meet the objective needs for psychology in the social development process (Suldo & Shaffer, 2008).

Studies on theories concerning positive psychology and explorations into its characteristics can help enhance the understanding of the importance of positive psychology and, thus, create favorable conditions for the follow-up mental health education in colleges. First, emphasizing balance in positive psychology. As a humanistic science, psychology considers human psychology as the focus and core of research and emphasizes the curing of human's psychological and mental diseases to improve the public's life satisfaction and train and excavate talents. The traditional psychology focuses more on the prevention and treatment of mental diseases in the research experiences. Although it can effectively cure relevant mental diseases, it can neither really meet the whole society's mental needs nor guide people to cultivate and maintain a good mental state in the normal status because it uses minority people as service objects (Fredrickson, 2001). Different from the traditional psychology, positive psychology emphasizes the balance of psychology, comprehensively analyzes and studies positive and negative factors in human's mental health and tries to give play to the social value of psychology so that psychology can not only cure various psychological and mental diseases but also achieve a good mental state and the formation of value to meet the social life's objective needs of psychology (Li & Zhang, 2013).

Second, considering positive factors as key research points. Positive psychology studies and excavates positive factors in multiple aspects. Subjectively, positive psychology requires the objects of research to recall the good days in the past, optimistically feel the reality and take a positive attitude towards life and work in the research process (Liu & Lu, 2017). In individual studies, positive psychology emphatically studies the calculation of positive factors in individuals' living habits based on their intelligence and hobbies. However, in social studies, researchers pay attention to the degree of influence of positive factors on the behavioral habit of social members, and chiefly study the psychological relation among individuals, families and colleges, guaranteeing the excavation of positive factors and raising both the social research value and social value of positive psychology.

Third, solving problems with a positive attitude. Different from the traditional psychology, positive psychology emphasizes take a positive attitude towards a mental health issue in the solving process. In addition, positive psychology provides people with more possibilities in solving and handling problems by excavating and cultivating the positive aspects in psychological factors. Taking a positive attitude towards mental health problems can not only effectively respond to possible various mental health problems and achieve the effective prevention of mental diseases, but also comprehensively enhance the mental health level of the whole social group (Park & Peterson, 2009).

In summary, positive psychology provides both theoretical and practical guidance for optimizing mental health education in colleges and universities. It transforms the focus from "psy-

chological problems" to "psychological development," promoting the idea that every student can achieve happiness and growth through positive self-awareness and active learning. This perspective also aligns with the modern educational concept of whole-person development, emphasizing that mental health education is not limited to helping a few students in difficulty but is a process of fostering strength and vitality for all. Based on these theoretical perspectives, the following section introduces the research methods used in this study to explore the application of positive psychology in college students' mental health education.

3. Methodology

This study adopts a qualitative and descriptive research approach, combining literature review, document analysis, and theoretical reflection. The aim is to explore how positive psychology can be effectively applied to improve college students' mental health education. Instead of focusing on quantitative data, this research emphasizes conceptual understanding and theoretical interpretation. The research mainly relies on the review and analysis of existing studies, policy documents, and practical reports related to positive psychology and mental health education. By comparing previous findings and summarizing successful cases, the study identifies the main challenges in the current education system and extracts useful insights from schools that have implemented positive psychological principles. Furthermore, the research draws on real cases and experiences from universities that have attempted to apply positive psychology to their teaching and counseling systems. These examples show how theoretical concepts–such as optimism, resilience, and self-efficacy–can be transformed into practical guidance for mental health programs.

The analysis process follows three main steps. First, it builds a theoretical foundation through a comprehensive review of key concepts in positive psychology. Second, it analyzes the current situation of mental health education in colleges based on literature and observed practices. Finally, it summarizes strategies and suggestions for improvement according to the theoretical framework. This methodological design connects theory with practice and lays the groundwork for the following analysis of existing problems in college mental health education.

4. Current Situation and Problems in College Students' Mental Health Education

Understanding the current situation of mental health education in colleges is very important. It helps us see how positive psychology can be linked with mental health programs for students. This connection allows educators to design better methods to support students' emotional well-being. It also provides useful guidance for improving college mental health education in the future (Zhang & Chen, 2020).

4.1 Current situation of the content of mental health education in colleges

In order to obtain a more objective understanding of the current status of mental health education in colleges, a structured questionnaire survey was conducted among 102 college students. The questionnaire focused on students' perceptions of the teaching content in existing mental health education courses. Based on the collected data, the survey results were summarized and visualized in the form of a pie chart, as shown in Figure 1.

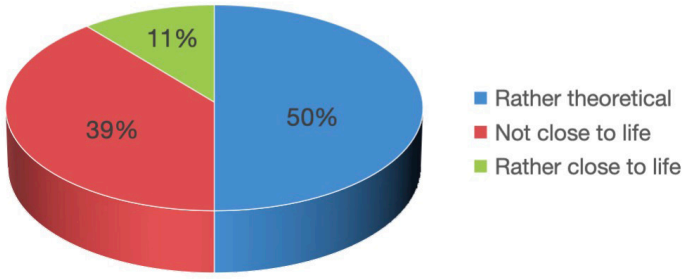

Figure 1 Students' Perceptions of Current Mental Health Education

As is directly shown in the pie chart above, most students are dissatisfied with the mental health education in colleges at the present stages; 89 % of students think the current content of mental health education is not sufficient and perfect enough; 50% of respondents think that the excessively theoretical content in mental health education courses cannot be combined with practice and, thus, cannot give play to its necessary guiding function to improve their mental health conditions (Wang & Wang, 2019). Meanwhile, 39% of respondents think that the content of mental health education in colleges is not close to the social life and lack flexible knowledge content. Therefore, the content in such an abstract mental health teaching mode cannot meet college students' objective requirements for mental health education, and it is difficult for students to quickly and efficiently learn the knowledge about mental health in their learning process, resulting in the low learning efficiency and the difficulty in giving play to the positive function of mental health education in colleges (Waters, 2011).

4.2 Current situation of the forms of mental health education in colleges

Although the significant achievements made in mental health education in China's colleges, the continuous adjustment and optimization of educational forms and the establishment of mental education courses, mental consultancy organizations and research teams have greatly raised the college students' level of mental health, there are still problems in the forms of mental health education. For example, although some colleges provide a series of mental health education courses, the course system is too formal. It is difficult to stimulate college students' enthusiasm and initiative in participating in mental health education via such formalized educational forms in the learning process (Zhou & Ee, 2012). Besides, colleges keep enriching the educational forms when implementing the mental health education, keep organizing all sorts of mental lectures and organize mental health clubs in addition to classroom teaching, greatly satisfying mental health education's objective needs for educational forms. However, it is difficult for college students to resonate with such forms so they don't want to participate. Meanwhile, most colleges wrongly combine mental health education with mental education in the process of mental health education and include it into the teaching of other discipline system. Although this way can guarantee the excavation of faculty to some extent, it also results in the lack of independence and flexibility in the forms of mental health education in colleges as well as the lowered quality and level of teaching.

5. Application of Positive Psychology in College Students' Mental Health Education

Based on the theoretical and methodological framework established in the previous chapters, this section focuses on how positive psychology can be practically applied to optimize mental health education in colleges and universities. By shifting the focus from problem-solving to

strength cultivation, positive psychology provides new directions and methods for building a more effective and developmental education system.

5.1 Principles for mental health education of college students under positive psychology

The application of mental health education of college students under the positive psychology must follow the principle of scientificity (Zhao & Sun, 2018). It is required to fully show the principle of scientificity to attain the application goal of mental health education of college students in positive psychology. Only the meticulous and comprehensive consideration of the realistic significance and operating flow of the application of college students' mental health education under positive psychology from the scientific perspective can maximally guarantee that the mental health education mechanism of college students can meet the actual needs of mental health education under positive psychology. Besides, only under the guidance of scientific spirit, means and concepts can we ensure the scientific and efficient realization of mental health education of college students under positive psychology based on the existing educational means and technical ways.

Mental health education of college students must follow the principle of practicalness. There are various contents and much information data in mental health education of college students under positive psychology. Thus, in order to guarantee the orderliness of mental health education of college students, it is required to necessarily standardize and guide the measures for mental health education of college students. Besides, positive psychology has rather strict requirements on the steps and flows of mental health education of college students at the present stage (Zhang & Chen, 2020). Therefore, technicians concerned are required to necessarily and detailedly handle and operate the application schemes for mental health education of college students and relevant operations. Maximally increase enterprises' compatibility of application schemes for mental health education of college students and reduce the adverse impacts of complicated and redundant information data on mental health education activities of college students under positive psychology. Meanwhile, it is also required to simplify the application flow of mental health education of college students, lower the operating difficulty, and enhance the practicalness of application schemes for mental health education of college students so as to raise the level of mental health education in a short time and guarantee the smooth implementation of mental health education of college students (Zheng & Guo, 2016).

5.2. Approaches to carry out mental health education of college students under positive psychology

The implementation of mental health education from the standpoint of positive psychology necessitates not only theoretical guidance but also practical and systematic approaches. In light of the prevailing deficiencies and limitations in the realm of college mental health education, a range of approaches can be contemplated.

(1) Curriculum Integration and Reform

Colleges should integrate positive psychology concepts into mental health education curricula. Rather than an exclusive emphasis on psychological problems or disorders, courses should cultivate resilience, optimism, and social-emotional competencies. The integration of lectures, group discussions and experiential learning activities within modular courses has been demonstrated to facilitate the internalisation of positive mental health concepts among students (Waters, 2011).

(2) Training and Professional Development of Educators

It is vital to acknowledge the pivotal function that educators and counsellors fulfil in the implementation of positive psychology within educational settings. It is recommended that regular professional development workshops be offered to strengthen their understanding of positive psychology theories and interventions, equipping them with effective strategies to apply in both classrooms and counselling settings.

(3) Diversified Teaching Methods and Interactive Activities

Mental health education should adopt flexible and engaging methods, such as scenario simulations, role plays, mindfulness practices, and peer support groups. These approaches encourage student participation and make mental health education more practical and relatable to daily life.

(4) Campus Environment and Supportive Culture

A supportive campus culture is imperative for the effective delivery of mental health education. In order to promote the mental well-being of students, it is recommended that universities establish student organisations and peer networks with a focus on well-being. Furthermore, the creation of a positive and inclusive environment is to be encouraged, as is the integration of mental health promotion into extracurricular activities.

(5) Application of Information Technology

In the contemporary era of digital learning, information technology provides powerful tools for promoting mental health. Online platforms, mobile applications, and social media can be used to deliver resources, organise interactive campaigns, and offer anonymous counselling services. This approach facilitates the dissemination of mental health education beyond the confines of the classroom environment and ensures the provision of ongoing support.

(6) Evaluation and Continuous Improvement

In order to ensure the effectiveness of such programmes, it is essential that colleges regularly assess the outcomes of mental health education programmes. This can be achieved by using student feedback, psychological assessments and well-being surveys. The necessity of continuous monitoring and improvement is predicated on the assumption that this will ensure that the approaches remain relevant to students' needs and aligned with the principles of positive psychology.

6. Conclusion

This study explores how to optimize college students' mental health education from the perspective of positive psychology. Conventional approaches have placed a strong emphasis on the prevention and treatment of mental illness; however, they have frequently overlooked the cultivation of students' strengths, resilience, and positive emotions, which are equally essential for their holistic development. The application of positive psychology provides a more balanced framework, enabling universities to move beyond deficit-oriented models and towards fostering well-being, personal growth, and social adaptability.

In summary, the integration of positive psychology into the mental health education of college students is not only a theoretical innovation but also a practical necessity. By emphasising

the strengths of students alongside the prevention of problems, colleges can create a more comprehensive and student-centred model of mental health education. It is asserted that such efforts will ultimately contribute to enhancing students' resilience, well-being, and capacity to thrive in the face of academic and social challenges.

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Ethics Statement

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Integrating Liu Wansu's Theory of Fire-Heat into Modern Chinese Medicine: Clinical Applications and Future Prospects

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Abstract

The Theory of Fire-Heat, first established by Liu Wansu in the Jin Dynasty, remains a fundamental idea in Traditional Chinese Medicine (TCM). It teaches that excessive internal fire and emotional imbalance are important causes of disease. Although this theory has guided clinical work for centuries, its relevance and application in modern medicine deserve new interpretation. This paper reviews the historical origins, theoretical foundations, and clinical applications of the Theory of Fire-Heat, as well as its value for future development. Based on literature review, analysis of clinical cases from several TCM hospitals, and expert interviews with experienced clinicians, the study explores how Liu Wansu's ideas continue to guide modern treatments for metabolic, cardiovascular, skin, and emotional disorders. The discussion also connects these traditional concepts with biological mechanisms such as inflammation and oxidative stress and considers how technologies like artificial intelligence and big data can support future studies. By combining classical wisdom with evidence-based medical thinking, this paper provides a practical perspective for the modernization and internationalization of TCM.

Keywords
Liu Wansu; Theory of Fire-Heat; Modern Chinese medicine; Clinical application

1. Introduction

The Theory of Fire-Heat has a long and rich tradition in Chinese medicine. Its earliest ideas appeared in the Huangdi Neijing (Zhang et al., 2025), and were later developed into a systematic framework by Liu Wansu in his work Suwen Xuanji Yuanbingshi (Li & Zhao, 2012). Liu proposed that "all six qi originate from fire" and that extreme emotions can transform into internal heat, becoming a key cause of illness (Liu et al., 2024). This view profoundly influenced later medical schools and shaped the foundation of many diagnostic and treatment principles in TCM. Even in modern times, the Theory of Fire-Heat remains important for un-

derstanding diseases linked to heat, such as hypertension, diabetes, and various inflammatory disorders (Liu & Cui, 2023). Studying this theory in a contemporary context helps preserve its philosophical depth while improving its relevance to current clinical practice.

This paper aims to explore how Liu Wansu's Theory of Fire-Heat can be integrated into modern TCM practice. It examines both its classical roots and its practical applications, emphasizing how its key principles—clearing heat, purging fire, and nourishing yin—continue to provide therapeutic guidance. The analysis draws from a wide review of historical and modern literature, case studies from several TCM hospitals, and interviews with senior clinicians who apply Fire-Heat theory in their daily work. These sources help build a comprehensive understanding of how ancient insights connect with modern evidence and clinical experience.

By combining historical analysis with practical observation, this study contributes to the ongoing modernization of TCM. It offers a framework for interpreting Fire-Heat theory in the language of modern science while maintaining its original spirit. The following section introduces the theoretical foundations and historical development of Liu Wansu's Fire-Heat theory.

2. The Foundations and Historical Evolution of Liu Wansu's Theory of Fire-Heat

2.1 Theoretical foundations of the Theory of Fire-Heat

Liu Wansu established the Theory of Fire-Heat as the core of his academic system. He analyzed how fire, as a natural element, relates to the body's physiological and pathological changes. The theory holds that both normal functions and disease processes are closely connected with the nature of fire. Since fire has a burning and consuming tendency, it can easily damage body fluids and lead to various disorders (Zhang et al., 2024). Liu further argued that "all six qi originate from fire," meaning that many external pathogenic factors may transform into heat after entering the body and then cause internal imbalance (Mao et al., 2021).

The Fire-Heat theory is deeply rooted in the main principles of Traditional Chinese Medicine, such as Yin–Yang, the Five Elements, organ theory, and meridian theory. In Yin–Yang theory, fire belongs to yang and tends to consume yin fluids, which breaks the balance of Yin and Yang and produces illness (Lu et al., 2019). Within the Five Elements framework, fire corresponds to the heart and small intestine. When fire becomes excessive, it disturbs the heart and affects emotional stability, often causing symptoms like irritability, insomnia, or restlessness (Li & Jia, 2023). From the perspective of organ theory, fiery pathogenic qi can disturb the internal organs. Too much heart fire, for example, may lead to palpitations, mouth ulcers, or thirst (Han et al., 2023). These ideas provide a systematic explanation for how heat develops and spreads in the body.

Liu Wansu's Fire-Heat theory also reflects clear academic features. He emphasized the importance of recognizing heat syndromes and using "heat-clearing and fire-purging" treatments. His thoughts later became the main foundation of the Hejian School, which he founded himself (Liu et al., 2024). Scholars from related traditions, such as Zhang Yuansu and Li Dongyuan of the Yishui School, further expanded his theory by refining organ differentiation and treatment principles (Li, 2024). Through this academic inheritance, the Fire-Heat theory gradually evolved into one of the most important theoretical systems in TCM.

2.2 Historical Inheritance and Modern Development

The theory of Fire-Heat proposed by Liu Wansu during the Jin Dynasty had a long-lasting influence on later generations. In the Yuan Dynasty, Zhu Zhenheng extended this concept and introduced the idea of "phase fire" (xianghuo), emphasizing its role in the origin and transformation of disease (Sun et al., 2025). During the Ming Dynasty, Li Shizhen explored its clinical value in Introduction to Medicine, promoting the principles of clearing heat, purging fire, nourishing yin, and reducing internal heat (Song, 2016). In the Qing Dynasty, further studies deepened the understanding of this theory. Wu Youke, in Differentiation of Febrile Diseases, pointed out that early use of heat-clearing medicine was essential for febrile conditions (Liu et al., 2016). Ye Tianshi later summarized and refined these ideas in Clinical Guide to Medical Cases, proposing the method of "heat-clearing and detoxification," which became the cornerstone of the Warm Disease school (Xie & Wei, 2006).

In modern times, scholars of Traditional Chinese Medicine have continued to develop the Fire-Heat theory through both theoretical study and clinical research. Many have verified its value in treating common modern diseases such as hypertension, diabetes, and tumors accompanied by heat-related symptoms (Zhuang, 2021). Researchers have also enriched its pathological framework by proposing mechanisms like "heat-fire injuring yin" and "heat-fire activating blood," which make the theory more compatible with current medical understanding. In pharmacological research, modern studies have optimized traditional formulas based on the principles of clearing heat and purging fire, leading to better clinical results (Mei, 2004).

Contemporary research on Fire-Heat theory has also introduced interdisciplinary methods. Studies that combine literature analysis, historical research, and philosophical reasoning have deepened understanding of its structure and logic (Wan et al., 2016). Advanced scientific tools such as molecular biology and immunology have been used to validate traditional ideas like "heat damaging body fluids" and "heat disturbing blood circulation," giving the theory modern scientific evidence. At the same time, researchers have examined its limits and possible extensions within the modern medical framework, suggesting integration paths that bring together classical theory and contemporary healthcare (Si & Shao, 2020).

The ongoing modernization of Liu Wansu's Fire-Heat theory demonstrates that traditional TCM concepts can be explained, tested, and applied with modern scientific methods. This integration not only preserves the cultural and philosophical depth of TCM but also enhances its practical value in today's medical environment.

3. Application of Fire-Heat theory in modern clinical practice of Traditional Chinese Medicine

3.1 Application in internal medicines

In modern clinical practice, the Theory of Fire-Heat is widely applied in internal medicine. It helps guide the diagnosis and treatment of many chronic and metabolic diseases. For example, in patients with diabetes, TCM physicians often observe signs such as thirst, dry mouth, feverish sensations, and dark urine. These symptoms are understood as results of excessive internal heat damaging body fluids. Treatments based on clearing heat, purging fire, nourishing yin, and promoting fluid production—using herbs such as Trichosanthes root, raw Rehmannia root, and Ophiopogon tuber—can relieve symptoms and help control blood sugar levels (Yang, 2014).

The Fire-Heat theory is also useful for cardiovascular diseases. Patients with hypertension often show liver-fire syndromes such as headaches, dizziness, facial redness, and irritability. In these cases, physicians usually apply methods to clear liver fire and calm rising yang energy. Classic prescriptions like Gentiana Liver-Clearing Decoction and Gastrodia Hook-Root Drink are commonly used to lower blood pressure and reduce the risk of cardiovascular events (Ding et al., 2007). These examples show that Liu Wansu's ideas continue to play a guiding role in internal medicine today.

3.2 Application in surgical and otorhinolaryngology

In surgical diseases, the Theory of Fire-Heat is often used to explain and treat conditions caused by heat toxins. Many skin disorders, including acne and eczema, fall under this category. TCM treatments focus on clearing heat, removing toxins, cooling the blood, and dispersing stasis. Formulas such as Huanglian Jiedu Tang (Coptis Detoxifying Decoction) and Xijiao Dihuang Tang (Rhinoceros Horn and Rehmannia Root Decoction) are frequently used to reduce inflammation and promote healing (Min & Zhang, 2020).

The theory also applies to otorhinolaryngological diseases. Conditions like acute tonsillitis and pharyngitis are often viewed as results of external wind-heat invasion or excessive heat in the lung and stomach. Treatment commonly includes Yinqiao San (Honeysuckle and Forsythia Powder) and Qingyan Lihuo Tang (Throat-Soothing Decoction) to remove heat, detoxify, and relieve swelling (Han et al., 2023). Clinical observations show that patients treated under the Fire-Heat framework usually recover faster and experience less recurrence. This demonstrates the continuing clinical value of Liu Wansu's theory in surgical and ENT medicine.

3.3 Application in emotional and mental disorders

The Theory of Fire-Heat also provides useful insight into the treatment of emotional and mental disorders. In TCM, emotional imbalance is considered an important internal cause of disease. Conditions such as depression, anxiety, and irritability are often linked to the concept of "Five Emotions Transforming into Fire." When emotional stress becomes excessive, it generates internal heat that disturbs the heart and liver. Treatments aim to clear heat, purge fire, and soothe the liver to restore emotional balance. Classical formulas such as Chaihu Shugan San (Bupleurum Liver-Relieving Powder) and Danzhi Xiaoyao San (Coptis and Gardenia Harmonizing Powder) are commonly prescribed to regulate emotions and relieve mental tension (Lyu et al., 2020).

In addition, the Fire-Heat theory has been applied to sleep disorders such as insomnia and neurasthenia. These conditions are often associated with excessive heart fire or liver fire ascending, disturbing the mind and spirit. Physicians use principles of clearing heart fire and calming the mind, with formulas such as Zhusha Anshen Wan (Cinnabar Calming Pill) and Longgu Muli Tang (Dragon Bone and Oyster Shell Decoction) to improve sleep and reduce anxiety (Zhang et al., 2022). These applications illustrate how Liu Wansu's ancient theory continues to guide the treatment of modern psychological and psychosomatic conditions.

Through these examples, the Fire-Heat theory proves to be both flexible and enduring. Whether used in internal medicine, surgical care, or emotional therapy, it continues to offer effective diagnostic frameworks and treatment strategies for a wide range of modern diseases. Its principles help bridge classical medical knowledge and modern clinical science, enriching the therapeutic system of Traditional Chinese Medicine.

4. Clinical Case Analysis under the Guidance of Fire-Heat Theory

This study draws on clinical cases collected from several Traditional Chinese Medicine (TCM) hospitals to illustrate the practical value of Liu Wansu's Fire-Heat theory. The selected cases cover internal medicine, surgery, otorhinolaryngology, and emotional disorders. Each case follows diagnostic and treatment principles rooted in Fire-Heat theory, with careful observation of treatment outcomes. The analysis also includes insights from experienced clinicians who apply these methods in their practice. Through these examples, the therapeutic value and modern relevance of the Fire-Heat theory are demonstrated.

Case Study: Internal Medicine. Taking diabetes as an example, patients often show symptoms of excessive internal heat damaging body fluids, such as thirst, dry mouth, and general restlessness. Following Liu Wansu's principle that "heat excess consumes yin," physicians applied treatments focused on clearing heat, purging fire, and nourishing yin. Herbal combinations based on Trichosanthes root and raw Rehmannia root were used to reduce heat and restore internal balance. After treatment, most patients showed noticeable improvement in thirst and body temperature regulation, and blood sugar levels became more stable (Zhang & Zhang, 2021). These results suggest that the Fire-Heat approach helps regulate metabolic disorders in modern TCM practice.

Case Study: Surgical Diseases. For skin diseases such as acne, the Fire-Heat theory explains inflammation as "heat rising to the surface." Treatments therefore aim to clear heat, detoxify, cool blood, and disperse stasis. Formulas such as Huanglian Jiedu Tang and Xijiao Dihuang Tang were applied to patients with inflammatory skin lesions. The conditions improved steadily, with reduced redness and faster healing compared to conventional treatments (Shao & Peng, 2020). These observations confirm that clearing fire and heat-toxin remains an effective principle in treating inflammatory and purulent conditions.

Case Study: Otorhinolaryngology. Acute tonsillitis and similar throat infections are often linked to the idea that "fire-heat injures body fluids and disturbs the upper passages." Guided by this understanding, physicians used heat-clearing and throat-soothing prescriptions such as Yinqiao San and Qingyan Lihuo Tang. Patients reported relief from sore throat and fever within a short period. Clinical feedback showed faster symptom reduction and improved comfort compared with general antibiotic treatment (Zhang & Zhu, 2022). These findings highlight the value of Fire-Heat-based therapies in treating modern inflammatory diseases of the respiratory tract.

Case Study: Emotional Disorders. Depression and related emotional disorders are described in TCM as conditions of "excessive heat caused by emotional extremes." Physicians used approaches that combined clearing heat, purging fire, and soothing the liver to relieve stagnation. Formulas such as Chaihu Shugan San and Danzhi Xiaoyao San were prescribed. Patients generally reported improved mood, reduced irritability, and better sleep quality. Follow-up observations suggested a lower recurrence rate compared with conventional psychotherapy (Wu & Lyu, 1999). This supports the idea that Fire-Heat theory can also guide treatments for psychosomatic and mood-related disorders.

Overall, the analysis of these clinical cases shows that Liu Wansu's Fire-Heat theory continues to provide a strong foundation for modern TCM diagnosis and therapy. Treatments guided by its principles not only relieve symptoms but also improve overall well-being. By emphasizing individualized adjustment of yin and yang, the Fire-Heat framework enhances the precision

and adaptability of TCM, showing that ancient insights can remain effective and relevant in modern medical practice.

5. The Modern Development and Future Prospects of the Theory of Fire-Heat

5.1 The status of the Theory of Fire-Heat in modern TCM

The Theory of Fire-Heat remains one of the key theoretical systems in modern Traditional Chinese Medicine (TCM). In medical education, it is taught as part of core courses such as Fundamentals of TCM Theory, Diagnostic Studies, and Internal Medicine. Through classroom instruction, case discussions, and clinical observation, students learn both the basic principles and their applications. It is also included in postgraduate programs, where in-depth studies and case analyses help students develop clinical reasoning and research skills (Fan, 2015).

Modern TCM teaching emphasizes the integration of theory with practice. Clinical internships and expert lectures help students understand how the Fire-Heat theory applies in real treatment settings. At the same time, educators encourage cross-disciplinary thinking by connecting TCM ideas with modern biomedical knowledge, which helps students interpret traditional theories with new perspectives (Wang, 2008).

The Fire-Heat theory also plays an active role in research. Modern scholars have explored its relationship with inflammation, immunity, and neuroendocrine regulation, revealing how classical "heat" concepts may correspond to biological processes observed in modern medicine (Song, 2016). This theoretical exploration has inspired the creation of new herbal combinations, acupuncture treatments, and external therapies. Many of these studies have been published internationally, enhancing the visibility of TCM and demonstrating the continuing value of classical theory (Liu, 2018; Bao et al., 2020; Liu & Wei, 2020; Kong, 2010; Zhao et al., 2025).

5.2. Challenges and prospects of Liu Wansu's Theory of Fire-Heat

Under the framework of modern science, Liu Wansu's theory of Fire-Heat faces several challenges. Modern medicine relies on measurable physiological indicators and standardized evaluation systems, while TCM concepts such as "heat syndrome" describe functional changes in a more holistic and qualitative way (Feng & Pan, 2025). In addition, modern lifestyles have changed disease patterns. Stress, poor diet, and environmental factors now create new types of "internal heat," requiring adaptation of traditional treatments to new clinical realities (Zheng et al., 2013). Another challenge lies in patient behavior—TCM treatments often demand active cooperation and lifestyle adjustment, which some patients find difficult to maintain (Jiang et al., 2016).

Despite these challenges, the future of the Fire-Heat theory is promising. With the support of modern technology, many classical ideas can now be studied scientifically. Molecular biology and genomics allow researchers to explore the biological basis of "heat-related" syndromes, helping to explain their mechanisms at the cellular level (Wu et al., 2024). Pharmacological research is being used to analyze and optimize traditional formulas, improving both safety and effectiveness (Qin et al., 2024). Digital tools such as artificial intelligence and big data make it possible to collect large amounts of clinical data and identify treatment patterns, providing a stronger evidence base for TCM applications (Ma et al., 2024). Online education and telemedicine platforms have also made it easier to spread and teach Fire-Heat theory internationally

(Wang et al., 2024).

Looking ahead, the Fire-Heat theory will likely play a larger role in preventive medicine and health management. As people pay more attention to lifestyle and emotional health, the theory's focus on internal balance becomes increasingly relevant (Yang & Zhu, 2007). Continued research can lead to innovative treatment protocols for chronic and stress-related diseases (Yang & Wang, 2005). At the same time, the global spread of TCM creates new opportunities for integrating Fire-Heat theory with other medical traditions, forming a more inclusive healthcare model (Meng, 2010). Ethical and legal issues related to clinical application should also be carefully considered to ensure responsible development in the modern context (Liu et al., 2024).

The combination of traditional philosophy, clinical experience, and scientific methods shows that Liu Wansu's Fire-Heat theory is not only a historical legacy but also a living framework that continues to evolve. It connects ancient understanding with modern evidence and offers valuable insight for future medical innovation.

6. Conclusions

This study examined the application of Liu Wansu's Fire-Heat theory in modern Traditional Chinese Medicine (TCM), focusing on its theoretical foundation, clinical use, and value for education and research. By reviewing classical literature, analyzing representative clinical cases, and incorporating expert opinions, the study showed that the Fire-Heat theory continues to provide important guidance for diagnosis and treatment in today's medical practice. The findings suggest that Liu Wansu's ideas remain highly relevant for treating diseases across different areas, including internal medicine, surgery, otorhinolaryngology, and emotional disorders. Clinical observations show that therapies guided by the principles of clearing heat, purging fire, and nourishing yin can effectively relieve symptoms, improve treatment outcomes, and reduce recurrence. In medical education, the Fire-Heat theory helps students connect theoretical knowledge with real clinical experience, while in research, it continues to inspire studies that explore links between traditional ideas and biological mechanisms.

Several limitations must be recognized. The number of analyzed cases and the available data were limited, which may affect the generalizability of the results. In addition, current scientific studies on the Fire-Heat theory still need stronger evidence and more standardized research methods. The integration between traditional theory and modern biomedical science remains a long-term task that requires both clinical validation and conceptual dialogue.Nevertheless, this study supports the idea that Liu Wansu's Fire-Heat theory is not only a part of TCM history but also a living framework that continues to evolve. It reflects a way of thinking that values balance, prevention, and holistic understanding—ideas that remain important in modern medicine. Through deeper research and continued innovation, the Fire-Heat theory can contribute to building a more comprehensive and human-centered healthcare system, linking traditional wisdom with modern science for the benefit of future generations.

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Conflicts of Interest

The author(s) declare no conflicts of interest regarding the publication of this paper.

Ethics Statement

Not applicable.

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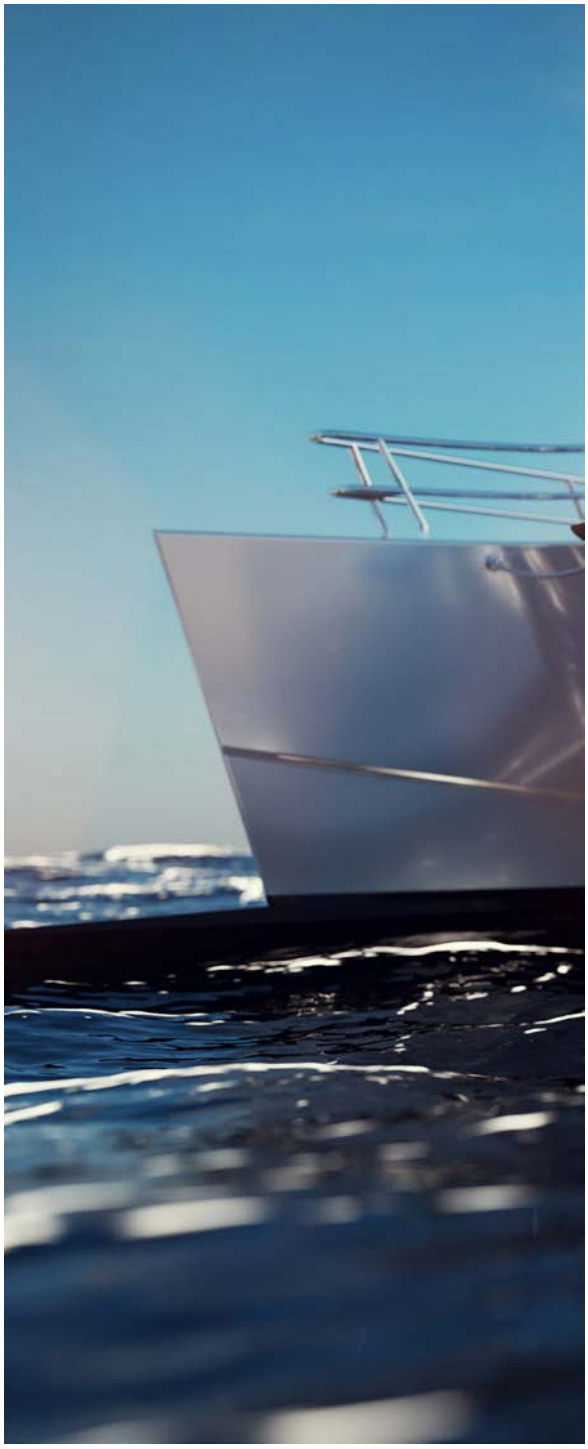

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