

The Path of AI Empowering College Education: A Study of Large Model Interview and Questionnaire Survey from the Perspective of Mental Models

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Abstracts: Today's "Post-00" college students grow up in the era of highly developed Internet and social media, while the open and diverse social environment provides a broad learning and development platform for college students, but also contains numerous risks and challenges, threatening the healthy development of students' mental models. Therefore, college education should focus on the guidance and optimization of the students' mental development. In this paper, the large model research method is first employed to comprehensively and deeply understand the critical role of mental model cultivation in personal development through dialogue interviews. On this basis, the key points are summarized, questionnaires are designed and distributed to college students nationwide, and empirical analysis is conducted on the key points identified by the large model through online research. At the same time, data was collected on students' understanding of mental model cultivation, the acceptance, impact, and technical methods of artificial intelligence applied to college education. The path was explored for AI technology to empower college education from the perspective of mental models, aiming to assist educators in effectively utilizing various AI technologies to accurately recognize and analyze students' mental states, adjust educational content and methods promptly, and flexibly manage the educational rhythm. This would enhance the relevance and effectiveness of education and promote the comprehensive improvement of students' overall abilities.

1. Introduction

Education is a vital national strategy and a major priority for the Party. As the cognitive foundation, mental models profoundly influence students' understanding, acceptance, decision-making and action strategies. By deeply understanding, cultivating, and optimizing students' mental models, erroneous thinking patterns and cognitive biases can be corrected, helping students develop scientific thinking and positive habits, thereby promoting holistic development. With rapid advancements in AI, big data, blockchain, and other technologies, both talents' demands and educational models have undergone profound changes. Moreover, educational environments, concepts, and methods continue to innovate with emerging technologies, facilitating the realization of intelligent, personalized, and precise college education.

2. Literature Review

2.1. Overview of the Theory of Mental Models

The concept of mental models originated with psychologist Kenneth Craik in his 1943 book *The Nature of Explanation*, where he argued that the human brain understands the world by creating internal mental images or models that explain past events and predict future ones^[1]. The field of management, as represented by Peter Senge, is posited to assert that mental models are firmly

entrenched assumptions, preconceptions, and impressions in the minds of individuals, which influence how the world is perceived and actions are taken^[2]. In 2006, psychologist Johnson-Laird further developed this idea, defining mental models as abstract, underlying, and image-like structures that underpin human reasoning^[3]. Generally, these fields share several common features: mental models reflect the cognitive structure of external systems, present beliefs about objects and the inferences derived from them, and assist in constructing the real world^[4]. In summary, mental models are assumptions, images, and impressions rooted in individuals' minds regarding themselves, others, organizations, and the world; they represent pre-existing perceptions of how the surrounding world operates^[5] and serve as tools for comprehending and managing complex information, aiding in organizing complex information. Personal experiences, education, and culture significantly shape an individual's mental models, guiding thinking, decision-making, and behavior.

2.2. The Cultivation of Mental Models in College Students

The mental model profoundly affects an individual's way of thinking, behavioral habits, and problem-solving abilities, which are related to the enhancement of students' personal capabilities and the overall development of comprehensive quality, a vital aspect of higher education. Qi and Cui (2010) pointed out that the cultivation of mental models is a crucial component of talent quality education, and the absence of mental model cultivation in higher education may lead to one-sided and biased development among students. As the most critical stage for developing mental models, higher education should actively assume the responsibility of fostering this development^[6]. Using the educational philosophy, system, and practical experience of Xi'an Jiaotong-Liverpool University as an example, Xi (2020) noted that the core task of education is to assist students in developing a healthy mindset that enables them to thrive and grow in future societies. Education that integrates professional, industrial, management, entrepreneurship, and quality components is an effective means of cultivating complex minds^[7]. Zhou (2010) analyzed the mechanism of knowledge creation based on mental models from a cognitive perspective, positing that there exists a close internal correlation between the two, and emphasized that adjusting, perfecting, and cultivating mental models is key for individuals to enhance their knowledge creation abilities^[5].

3. Research Subjects and Methods

This research targets students in colleges and universities nationwide. Questionnaires primarily designed through large model interviews, complemented by individual offline interviews and online literature searches as shown in Figure 1. Online questionnaires were distributed via the Questionnaire Star platform, resulting in the collection of 227 valid questionnaires. The research aims to understand the current state of mental model cultivation in higher education, analyze the impact of AI technology on students' mental models, explore specific applications of AI tools in this cultivation, and propose strategies for utilizing AI to promote the development of students' mental models.

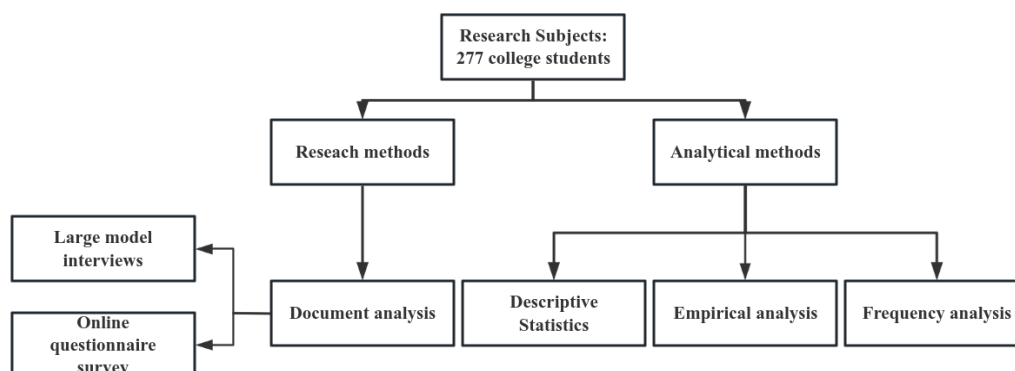


Figure 1 Research subjects and methods.

4. Large Model Research and Data Analysis

4.1. Large Model Dialogue Interviews and Questionnaire Design

In this paper, the Baidu Wenxin Yiyan 4.0 Turbo Large Model was used as the interview object to conduct a dialogue interview regarding the important role of mental model cultivation in colleges and universities in students' personal development. The responses are summarized in Table 1.

Table 1 Summary of large model dialogue interviews

Question content	Summary
What important role does the cultivation of mental models play in the personal development of college students?	<p>Cognitive enhancement: Deepen self-awareness, enhance information processing abilities, improve learning efficiency and quality of life.</p> <p>Optimization of decision-making and action capabilities: Improve decision-making quality, overcome procrastination and hesitation, and strengthen the power of action.</p> <p>Emotion and Stress Management: Regulate emotions, improve mental health, reduce the impact of negative emotions such as anxiety and depression, and cope with stress more positively.</p> <p>Improvement of social and interpersonal relationships: Enhance communication skills, promote teamwork, friendship and trust among students.</p> <p>Long-term planning and career development: Recognize professional interests and advantages more clearly, clarify career goals and development direction, better adapt to the workplace environment, and improve professional quality and competitiveness.</p>

The key points generated by the large model based on big data provide a more comprehensive and diversified perspective for understanding the important role of mental model cultivation in the personal development of college students. However, the large model is based on probability and pattern matching, which lacks in-depth contextual understanding and may have limitations, including issues like "hallucinations." To verify the viewpoints of the large model and gain a deeper understanding of the attention colleges and universities pay to cultivating students' mental models, as well as students' perceptions and opinions regarding mental model cultivation and their preferences and expectations for AI-enabled mental models, a questionnaire was designed. The questionnaire consists of 14 questions, including single-choice, Likert-scale, and multiple-choice questions, which was distributed to college and university students nationwide via the "Questionnaire Star" platform, with data collected through online research.

4.2. Data Collection and Descriptive Statistics

A total of 227 valid questionnaires were collected. Figure 2 shows the geographical distribution of participants from 29 provinces and municipalities across China, with the majority from Hunan (20.7%) and Guangdong (11.89%).

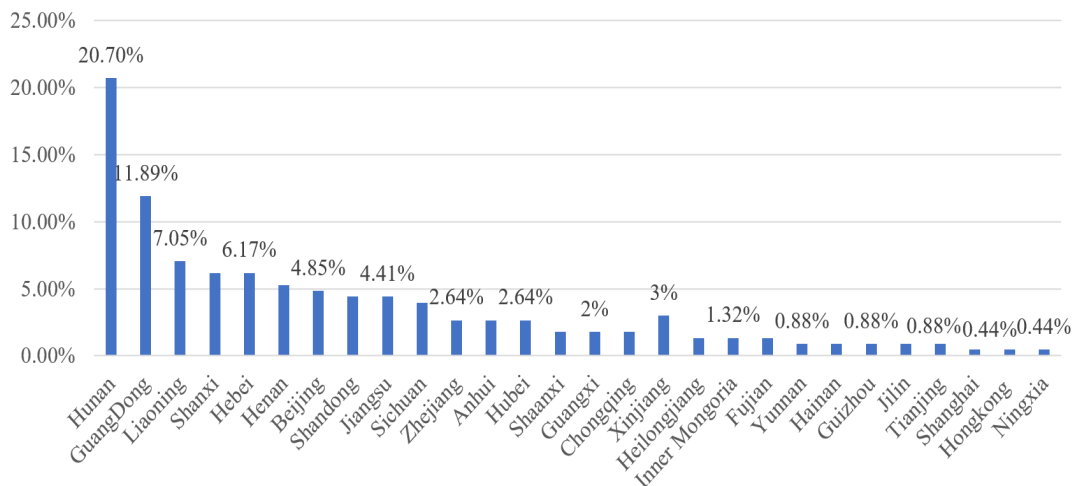


Figure 2 Geographical distribution of research respondents.

Figure 3 shows the gender distribution of the research respondents, with 47.58% female and

52.42% male, indicating a slightly higher proportion of males. Figure 4 presents the distribution of respondents' fields of study, with 48.9% in humanities and social sciences and 51.1% in engineering, technology, and natural sciences, indicating a relatively balanced distribution.

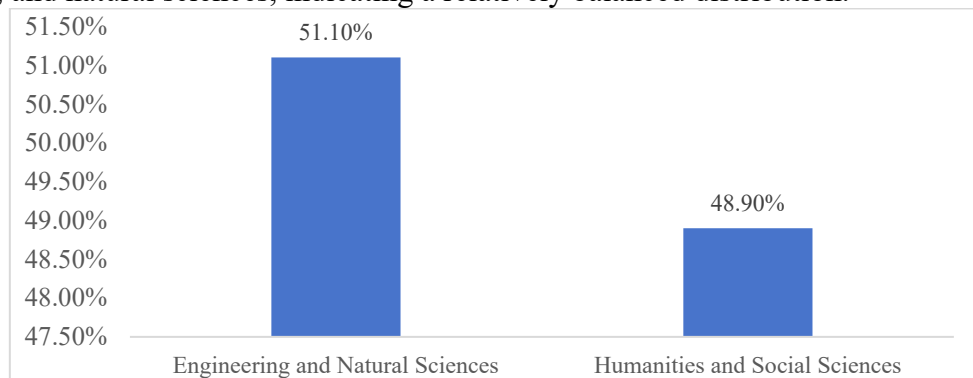


Figure 3 Distribution of professional fields of the survey respondents.

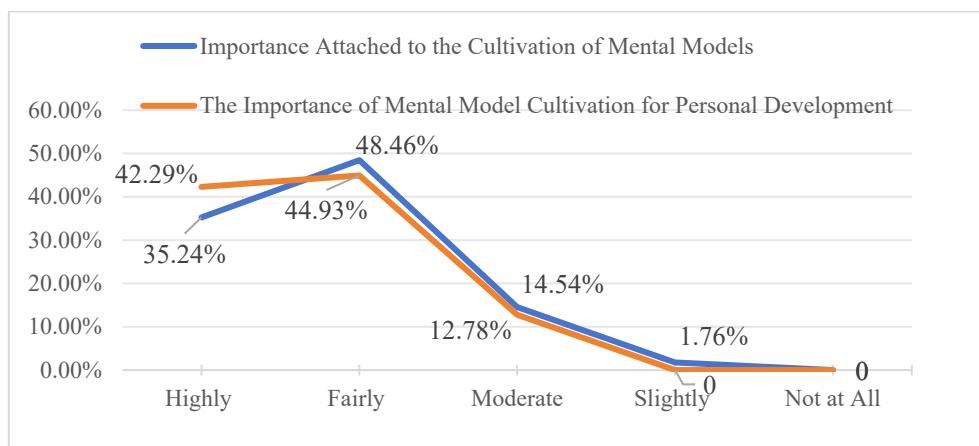


Figure 4 Current status of mental model cultivation in college students.

Most respondents indicated their schools place high importance on cultivating students' mental models (83.7%), while some colleges consider it moderately (14.54%) or slightly important (1.76%). Additionally, 87.22% of students consider mental model cultivation crucial to personal development, with only 12.78% rating its importance as moderate. Engineering, technology, and natural sciences students show a slightly higher interest (2%) compared to humanities and social sciences students, with none rating mental model cultivation as slightly or not important.

4.3. Empirical Analysis of Large Model Interviews

The second part of the questionnaire explores the role of mental model cultivation in personal development, summarizing key points from interviews with the Baidu Wenxin Yiyan 4.0 Turbo model. This section uses a 5-point scale (from "Strongly Disagree" = 1 to "Strongly Agree" = 5), where higher total scores indicate greater overall agreement among students with the key points.

Table 2 Cronbach's reliability analysis.

Name	Correction term total correlation (CITC)	Deleted alpha coefficients for item	Cronbach's alpha coefficient
Cognitive enhancement	0.477	0.722	0.752
Optimization of decision-making and action capabilities	0.493	0.716	
Emotion and Stress Management	0.473	0.723	
Improvement of social and interpersonal relationships	0.540	0.700	
Long-term planning and career development	0.604	0.674	

First, a reliability test was conducted for the second part of the questionnaire as shown in Table 2.

Using Cronbach's Alpha (α) as the reliability standard (with $\alpha > 0.7$ indicating good reliability), the α coefficient of this questionnaire is 0.752, and the CITC values for all analysis items are greater than 0.4, indicating a strong correlation among the analysis items. Overall, this suggests that the data reliability of the questionnaire is relatively high.

Validity testing used the KMO and Bartlett's sphericity test, with a KMO > 0.7 and $p < 0.05$ indicating good validity for factor analysis. The questionnaire's KMO is 0.754, and p-value is 0.000, suggesting high validity as shown in Table 3.

Table 3 KMO and Bartlett's test.

KMO value	0.754	
Bartlett Sphericity Check	Approximate chi-square	107.282
	df	10
	p-value	0.000

Finally, mean scores, standard deviations, and coefficients of variation analyzed students' overall opinions, differences, and dispersion regarding the questions are shown in Figure 5.

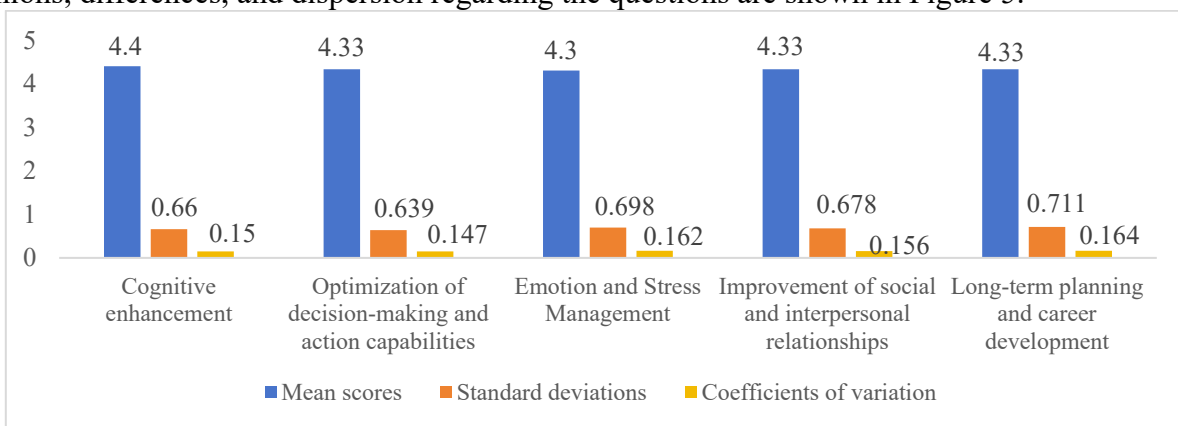


Figure 5 The important role of mental model cultivation in personal development.

The data of Figure 5 shows that all five points in this section scored above 4.0, with standard deviations under 1 and coefficients of variation below 0.2, indicating high respondent agreement with the large-model interview summaries. "Cognitive enhancement" scored the highest, followed by "Decision-making optimization", "Social relationships", and "Career planning" each at 4.33 points. Differences in standard deviations and coefficients of variation suggest slight variance in opinions, but overall agreement remains high.

4.4. Frequency Analysis of Multiple Response Sets

The fourth section of the questionnaire contains 5 multiple-choice questions, where participants can select 1 to 3 options for each question based on their actual situation. This section employs a binary scoring method, where "1" represents a selected option and "0" represents an unselected option. The frequency of selected options was coded and statistically analyzed, with the specific data displayed as line graphs for more intuitive observation and analysis.

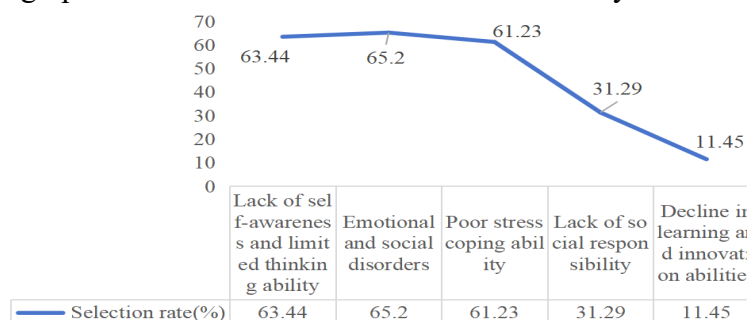


Figure 6 The possible consequences of the lack of mental model cultivation in higher education.

As illustrated in Figure 6, the respondents identified “Emotional and social disorders” (65.2%), “Lack of self-awareness and limited thinking ability” (63.44%), and “Poor stress coping ability” (61.23%) as the possible consequences of insufficient intellectual model cultivation in higher education, with the first three options significantly higher than the others.

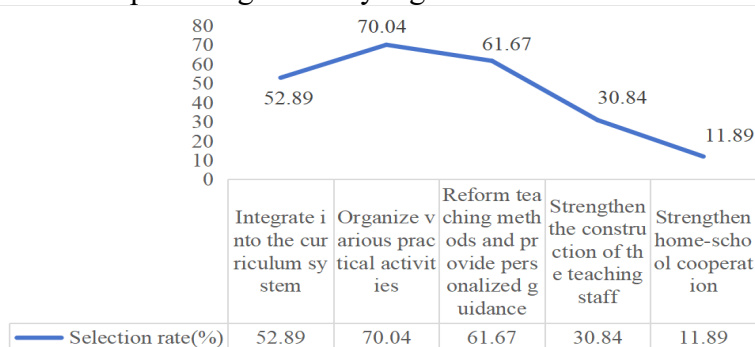


Figure 7 How should colleges and universities develop mental models.

As illustrated in Figure 7, respondents favored methods for cultivating mental models in colleges: “Organizing various practical activities (debates, mock courts, cultural salons, etc.)” (70.04%), “Reforming teaching methods and providing personalized guidance” (61.67%), and “Integrating into the curriculum system (such as psychology and ideological education, etc.)” (52.86%).

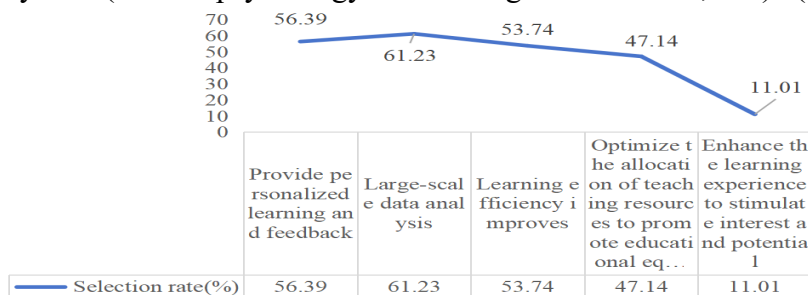


Figure 8 The biggest advantage of AI technology in cultivating mental models.

As shown in Figure 8, participants believe that AI offers significant advantages for mental model cultivation, including “Large-scale data analysis” (61.23%), “Providing personalized learning and feedback” (56.39%), “Improving learning efficiency” (53.74%), all of which enhance the cultivation of model development.

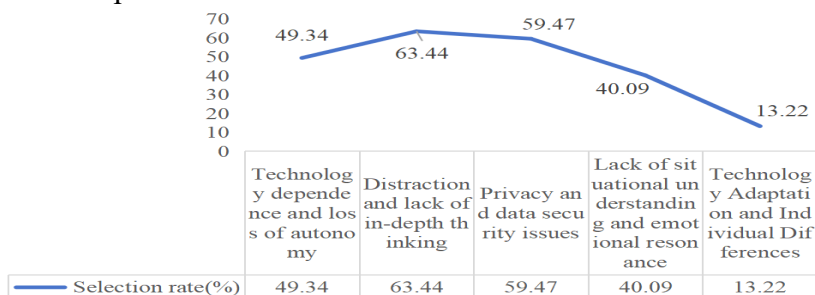


Figure 9 The biggest problem with AI technology in cultivating mental models.

According to the statistics in Figure 9, respondents express the greatest concern regarding “Distraction and lack of in-depth thinking” (63.44%) when applying AI technology for mental model cultivation in colleges, followed by “Privacy and data security issues” (59.47%) and “Technology dependence and loss of autonomy” (49.34%).

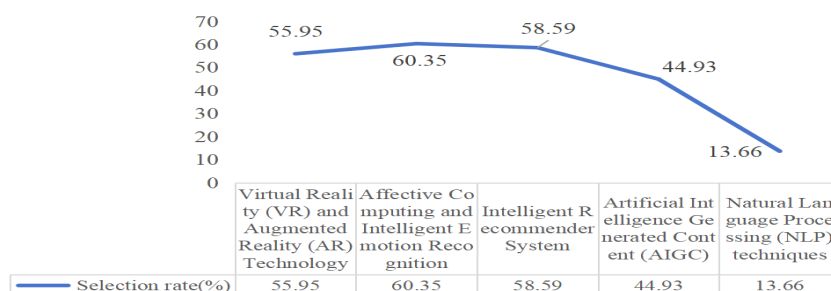


Figure 10 Which AI technologies hold the most promise for mental model development.

According to Figure 10, respondents show a strong interest in technologies such as “Affective computing and intelligent emotion recognition” (60.35%), “Intelligent recommender system” (58.59%), “VR and AR technology” (55.95%). Therefore, colleges can utilize this information to integrate students' expectations concerning the role and effects of AI technology in mental model cultivation and their interests in various technologies and methods, thus formulating educational goals and plans. By innovating educational methods, they can enhance student engagement and initiative, thereby maximizing educational efficiency and effectiveness.

5. Research Summary and Recommendations for Countermeasures

With the upgrading and transformation of China's economic and social structure, the social development of the new era has introduced new requirements for both the structure and quality of talent^[8]. The application of advanced technologies, such as artificial intelligence, has accelerated the process of social intelligence in China and infused new vitality into higher education in the new era. Based on the data collected from the survey and the preceding analysis, this paper summarizes the following three policy recommendations.

5.1. Treat Artificial Intelligence Dialectically and Strengthen the Concept of Mental Models Cultivation

The development of science and technology is a “double-edged sword”. While it promotes social progress and creates efficient, intelligent learning and working modes, it also introduces potential issues such as personal privacy breaches, passive thinking, and technology dependency. Therefore, colleges should adopt a dialectical approach to education, rationally employing various emerging technologies and AI tools, effectively mitigating risks, and flexibly leveraging their advantages.

Today’s “post-00s” college students often exhibit distinct personalities and strong self-awareness. However, due to the implicit nature of mental models, it remains challenging for educators to gain deep insights into students' true thoughts and emotional changes during the educational process. This challenge can hinder timely corrections of cognitive biases, lead to misjudgments about teaching effectiveness, result in wasted educational resources, and limit the relevance and efficacy of education. To address this, with students' consent, tools like EEG (electroencephalography) and fNIRS (functional near-infrared spectroscopy) can be used to detect neural activity characteristics and external behaviors. Additionally, big data analysis can help establish comprehensive emotional profile for students. Based on this, monitoring and collecting emotional information can capture shifts in students' emotions and identify states such as interests, learning preferences, and negative feelings^[9]. Using AI technology, brain responses to various types of cognition can be monitored, enabling educators to understand students' acceptance of teaching content and their genuine thoughts on related issues. This insight allows educators to adjust the difficulty, pacing, and presentation of learning materials, as well as the educational approach and direction. This approach aims to better align with students' mental model development, ultimately helping to maintain or restore positive learning states.

Mental models profoundly affect individuals' understanding and responses to information. Emotional intelligence technology aids educators in keenly capturing students' emotional changes, providing a reliable source aid. This emotional recognition and regulation process can essentially

guide and shape students' mental models. Through managing and redirecting negative emotions, as well as reinforcing positive ones, this approach fosters the constructive development of students' mental models. It enhances students' participation and recognition in educational settings, advancing their understanding and internalization of educational content during interactions between educators, AI, and students. Ultimately, it improves students' learning efficiency and effectiveness, allowing them to achieve deeper educational goals.

5.2. Innovate Educational Methods and Embed Mental Models Cultivation Programs

Beyond imparting theoretical knowledge, it is crucial to mobilize students' motivation to learn, stimulate their interest and engagement in the learning process, and foster habits and abilities for self-directed and lifelong education. To better adapt to the cognitive characteristics of modern college students, it is essential to innovate educational methods that match their cognitive styles and psychological needs.

Firstly, diverse interactive teaching methods, such as immersive role-playing and VR classrooms, can be introduced. In these environments, college instructors can devise problems and tasks based on real cases and utilize VR technology to recreate real-world situations. This approach enables students to shift from merely memorizing textbook principles to critically engaging with problems from their own perspectives, enhancing their sense of participation and initiative. Additionally, it helps students understand and apply theoretical knowledge in complex situations, bridging the gap between theoretical concepts and real-life applications. Such interactive teaching not only enlivens traditional classrooms, but also promotes the enhancement of students' cognitive abilities and facilitates more efficient internalization of educational content. Furthermore, it helps students gradually develop a more comprehensive mental model as they explore and solve problems through diverse experiences. In the classroom, deep learning and computer vision technologies can be employed to automatically analyze and identify students' behaviors, enabling teachers to efficiently and intuitively assess each student's learning status. This technology provides more accurate data support subsequent evaluations of learning outcomes and adjustments in teaching design^[10]. Next, generative AI tools like ChatGPT and Baidu Wenxin Yiyan, can gather extensive data within permitted scopes through Q&A and interactive discussions with students. By applying semantic analysis and intelligent reasoning, these tools analyze this data to accurately identify students' cognitive blind spots, areas of interest, and learning habits. By leveraging learning path recommendation technology, these tools provide personalized learning suggestions and resource recommendations based on each student's existing knowledge structure. This approach facilitates the on-demand configuration and intelligent supply of teaching services^[11], guiding students in gradually constructing a more comprehensive cognitive framework and a mature mental model, ultimately improving their learning efficiency. Finally, the introduction of "digital intelligence" can support personalized learning for students. The "Digital Intelligence Doppelganger" is a highly intelligent virtual teacher developed with digital human and generative AI technologies. This virtual teacher can simulate a real educator's appearance, performance skills, and teaching styles, possessing extensive professional knowledge and teaching experience. Through human-computer interaction, it assesses students' learning status and needs, delivering tailored tutoring accordingly^[12]. The "Digital Intelligence Doppelganger" can analyze students' learning behaviors in real time, continuously tracking and recording their learning process. It assists students in self-monitoring, identifying their strengths and weaknesses based on learning performance, analyzing potential deviations or limitations in their mental models, and providing targeted feedback and adjustment suggestions. Additionally, it can create multi-dimensional learning situations tailored to students' needs, allowing students to select the appearance and teaching style of their "digital alter-ego", enhancing engagement and motivation. Meanwhile, the teacher can oversee interactions between students and the "Digital Intelligence Doppelganger", intervening only when necessary. These AI technologies will inject new vitality into university education, offering more flexible, efficient, and personalized educational methods. This will empower a new generation of youth^[13] who "have ideals, dare to take responsibility, endure hardship, and are willing to work hard."

5.3. Enhance Students' Cognitive Judgment Ability and Unleash the Potential Functions of Mental Models

Mental models shape individuals' entire thought processes in interpreting information, predicting results, and making judgments. A well-developed mental model can enable students to approach complex problems with greater scientific rigor and rationality. Therefore, it's crucial for colleges and universities to focus on cultivating and optimizing students' mental models throughout the educational process and enhancing their dialectical thinking and judgment abilities.

Firstly, AIGC can be utilized to design research questionnaires for students by combining typical campus cases and significant societal events, such as campus bullying, student suicides, fraud cases, and pressures related to further education, employment, and family life among school-age individuals. It can also intelligently analyze and interpret students' responses, enabling more accurate identification of their ideological tendencies, thinking patterns, and character traits. For the identified psychological problems or cognitive deviations, intelligent algorithms that can read emotions and predict thoughts may be employed to activate students' implicit mental schemas and spiritual needs through personalized cognitive training, which includes establishing suspense, emotional summoning and role model demonstrations. This should be based on an analysis of students' psychological characteristics to guide and enhance their critical and appreciative faculties, optimize their mental modes, and gradually improve their cognitive levels and judgment abilities^[14].

Secondly, colleges and universities should integrate resources from various departments, including mental health center, career guidance offices, and academic affair offices, while utilizing an AI system to conduct comprehensive and in-depth assessments of students. This approach will assist students in recognizing their career interests and strengths more clearly, clarifying their career goals and development directions, better adapting to workplace environments, and enhancing their career literacy and competitiveness. Additionally, colleges and universities should actively develop online moral education positions, optimize the campus network environment, and provide guidance that encourages students to internalize positive moral values during independent learning processes^[15].

Simultaneously, schools can use natural language processing (NLP) and multimodal sentiment analysis technologies to monitor online content in real time^[16]. They can analyze and filter content on campus LANs and social platforms, removing misinformation, negative emotions, inappropriate videos, and other undesirable information. Based on students' emotional states and browsing habits, schools can also promote positive content, such as high-quality academic articles, positive news reports, and constructive social commentary. This strategy aims to purify the network environment and subtly guide students' mindset development, fostering a more natural and effective educational environment within colleges and universities.

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