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Exploring the Impact of Individual Differences on the Knowledge Construction Process of Chinese College Students

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Abstract. The current research explored how individual differences in learning motivation and cognitive strategies affect the process of knowledge construction of Chinese college students. Previous studies explored these factors separately and failed to scrutinize their interaction effects and the effect of technology. This study further focused on how such differences collectively influence learning behaviours and outcomes and provide implications for designing personalized educational strategy development. A qualitative approach was utilized through semi-structured interviews with 20 students across diverse academic disciplines. Data were analysed using thematic analysis in search of patterns related to learning challenges, motivational drivers, and cognitive strategies. Results showed that both intrinsic and extrinsic motivations seem to be vital in driving engagement in learning, and cognitive flexibility together with reflective practices supported deeper knowledge construction. Besides, students often resorted to technological tools, such as online platforms and AI-driven applications, in overcoming challenges and enhanced strategies. This research throws new light on the interaction of motivation, cognitive strategies, and technology for bridging gaps that are critical in research findings in this area and has underlined the integral involvement of these factors in bringing about an improvement in education quality.

Keywords: Individual differences; cognitive strategies; knowledge construction; cognitive load

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1. Introduction

Knowledge construction is a dynamic process in which learners actively integrate, analyze, and transform information to form meaningful understandings, which is essential for modern education. As education systems around the world become increasingly complex, students face a growing number of cognitive and affective challenges that affect their ability to effectively construct knowledge (Ryan & Deci, 2020). Individual differences in cognition, learning strategies, and motivation may account for the greatest variation in how students learn amidst these challenges.

Understanding these differences is crucial especially in higher education, which must take into account the variety of learners' needs (Hellín et al., 2023). This issue, which requires learners to adapt to new modes of interaction and self-regulation, has recently gained further importance due to the rapid spread of technology-driven learning environments (Kleimola et al., 2024; Mohd, 2025). While much progress has been made, research is still incomplete with respect to how individual differences influence knowledge construction in specific cultural and educational contexts.

There are some potential solutions in this direction to improve learning outcomes by addressing individual differences. For example, personalized learning environments have gained popularity by leveraging adaptive technologies such as gamification platforms and learning analytics to meet the needs of different learners (Hellín et al., 2023; Do et al., 2023). These approaches help reduce cognitive load and stimulate intrinsic motivation through customized content delivery.

However, they often emphasize general strategies and ignore the intricate interactions between cognitive characteristics, behavioral strategies, and motivational factors (Ryan & Deci, 2020). In addition, while there is a growing focus on educational inclusion, the unique challenges faced by students from specific cultural backgrounds remain underexplored. For example, Chinese college students often study in a highly competitive academic environment that prioritizes high performance, making it a unique context for studying individual differences in knowledge construction (Cao & Meng, 2022).

This study aligns with the United Nations Sustainable Development Goal 4 of ensuring inclusive and equitable quality education and contributes to global efforts to provide lifelong learning opportunities for all (United Nations, 2015). The current study also investigates the interaction of cognitive traits, learning strategies, and motivation based on cognitive load theory (Sweller ,1988), motivation theory (Ryan & Deci, 2020), and constructivist learning theory (Vygotsky,1978). Despite extensive research on learning and knowledge construction, limited attention has been given to how individual differences shape this process within specific cultural and educational contexts. In particular, the cognitive, emotional, and behavioral traits that students bring into the learning environment can significantly influence how they construct and internalize knowledge.

However, existing literature has not sufficiently explored these dynamics among Chinese college students, whose learning experiences are often shaped by unique socio-cultural and institutional factors. This study addresses this gap by investigating the role of individual differences such as cognitive styles, motivational orientations, and emotional engagement in the knowledge construction process of Chinese higher education learners. By doing so, it aims to offer culturally grounded insights that extend and enrich current theoretical and empirical understandings of learner variability in knowledge construction.

1.1 Research Objective

The main aim of this study is exploring the impact of individual differences on the knowledge construction process of Chinese college students

1.2 Research Question

How do individual differences influence the knowledge construction process among Chinese college students?

2. Literature Review

In recent years, knowledge construction has been highly valued as an important topic in the research field of education. Knowledge construction is a process where learners form a deep understanding by integrating, analyzing, and transforming information. It is one of the key goals to promote education, practice and improve the outcomes of learning. There is evidence to show that individual differences, learning motivation, and cognitive strategies have an influence on knowledge construction (Vygotsky ,1978; Sweller ,1988; Ryan & Deci, 2020). This section systematically explores, from the relevant literature, the mechanism of such factors with regard to knowledge construction, analyzes the shortcomings of current research, and provides a theoretical and methodological basis for this study.

Individual differences are one of the most important variables in knowledge construction, including a variety of dimensions such as cognitive traits, behavioral patterns and emotional factors (Taddese et al., 2025; Tlili et al., 2023; Shaw et al., 2018). For example, cognitive traits include attention, the capacity for memory and cognitive flexibility; these factors directly determine learners' capacity to handle complex tasks (Forsberg et al., 2021). It has been evidenced that students with higher cognitive flexibility can adaptively adjust their learning strategies in dynamic learning situations, cope with cognitive load better, and thus achieve deep learning (Kleimola et al., 2024).

On the contrary, students with weak cognitive ability may fall into the trap of learning barriers due to improper information processing, which in turn hinders the smooth progress of knowledge construction (Bagaskara et al., 2022). In terms of behavioral strategies, the self-regulation ability of learners is regarded as one of the key factors that will affect knowledge construction. Effective behavioral strategies include goal setting, time management, and reflective learning that may effectively reduce cognitive load and promote deep learning (Hellín et al., 2023). Students who can use reflective learning methods can integrate new and

old knowledge into their long-term memory more effectively, thereby improving the efficiency of knowledge construction (Huang & Sui, 2021).

Individual differences, influenced by the test-oriented education, manifest especially in the Chinese educational context. Guided by external goals, Chinese students often adopt inflexible single learning strategies in their learning. This phenomenon further underlines the importance of the role of individual behavioral strategies in knowledge construction (Huang, 2023).

Motivation for learning is one of the important driving forces for a learner to participate actively in knowledge construction (Taddese et al., 2025). According to the self-determination theory proposed by Ryan and Deci (2020), motivation can be divided into two types: intrinsic motivation and extrinsic motivation. Intrinsic motivation depends on learners' interest in knowledge and curiosity about problems. Moreover, it is closely related to deep learning and creative task completion (Reeve et al., 2020). For instance, it was proved that students with higher intrinsic motivation can continue to choose learning activities that are high in challenge and, hence, complete knowledge integration and problem-solving better (Bagaskara et al., 2022).

On the contrary, while extrinsic motivation-test scores and social recognitions-can improve the efficiency of learning within a short period, its effect on the long-term knowledge retention is relatively weak (Zhu et al., 2022). Moreover, extrinsic motivation in concert with intrinsic motivation has been found to raise the learning effect significantly in students (Huang & Sui, 2021). This implies that we should contrive the learning environment in such a way so as to stimulate the potential of intrinsic motivation toward maximum knowledge construction.

In the Chinese cultural context, learning motivation is influenced by unique sociocultural factors. Cao and Meng (2022) pointed out that many Chinese college students are driven by family expectations and social competition, and their motivation structure shows the characteristics of external goal orientation. Although this motivation pattern can improve short-term academic performance, it may limit learners' creative development and in-depth understanding of knowledge.

Cognitive strategies including collaborative learning, critical thinking, and reflective learning are important regulatory factors in the process of knowledge construction. Collaborative learning plays a crucial role in knowledge construction (Do et al., 2023). Through teamwork, learners can share cognitive resources and share learning tasks, thereby reducing individual cognitive load and improving learning efficiency. Critical thinking and reflective learning can help students better understand and apply what they have learned, improving the depth and breadth of knowledge construction (Kleimola et al., 2024). In addition, technology-supported learning environments provide new possibilities for the implementation of cognitive strategies.

For example, learning analytics technology helps students identify learning patterns and make targeted adjustments by tracking their learning behaviors (Hellín et al., 2023). At the same time, the gamified learning environment improves students' participation and knowledge conversion ability through incentive mechanisms (Zaini, 2023). However, research also shows that the effectiveness of these technological tools depends largely on students' ability to apply cognitive strategies and the rationality of teaching design (Huang et al., 2020). Interestingly, Awidi and Paynter (2019) conducted a quantitative study on flipped classrooms and confirmed that student motivation and strategy adoption significantly correlated with performance outcomes. Such findings reinforce the current study's qualitative observations.

With the acceleration of globalization, the importance of cross-cultural education research has become increasingly prominent. Students from different cultural backgrounds show obvious individual differences in the process of knowledge construction. Chinese students are more inclined to rely on teacher guidance in a collectivist cultural context, while Western students pay more attention to independent learning (Habók et al., 2021). Students with strong cultural adaptability can better integrate different cultural perspectives, thereby showing higher flexibility and creativity in knowledge construction (Civitillo et al., 2019).

Theory Underpinning

The theoretical basis for this research generally includes the cognitive load theory, motivation theory, and the theory of constructivism learning; it gives many dimensions when explaining the function of individual differences in knowledge construction. It first emphasizes, in cognitive load theory, that the cognitive resources available for learners to use are limited, and different types of cognitive load-intrinsic load, extrinsic load, and relational load-jointly determine the learning effect (Sweller, 1988).

Large individual differences in cognitive flexibility and the ability to process information obviously affect learners' efficiency in distributing and managing cognitive load in complex tasks and, further, performance in knowledge construction. Individual differences regulate cognitive load as possible paths to optimizing learning design and behavioral strategies (Forsberg et al., 2021). Second, the motivation theory presents a driving-force viewpoint to understand learners' behaviors. It differentiates motivation from intrinsic motives, such as interest in knowledge, and extrinsic motives, such as test scores or social expectations, emphasizing different roles of these two in learning behavior.

According to Ryan and Deci (2020), intrinsic motivation is generally associated with higher persistence in learning and greater innovation, while extrinsic motivation is more commonly linked to short-term, goal-oriented learning behaviors. Based on the theory of motivation, the present study examines how different motivational types have an influence on the efficiency of knowledge construction through regulating learners' behavior patterns.

Lastly, the learning theory of constructivism highlights learners' initiatives in constructing knowledge. As such, the constructivist theory asserts that knowledge is constructed through active integration, reflection, and interaction with others at an individual level (Vygotsky, 1978). Individual differences refer to learning style and behavioral strategies that influence not only the depth of knowledge integration but also the role and contribution of learners in collaborative learning (Do et al., 2023). In this study, the exact manifestations of behavioral strategies in constructing knowledge are investigated with the help of the constructivist theory, cognitive load theory, and motivation theory, each integrated into a systematic framework to understand how individual differences operate in the learning process.

Taken together, these three theories provide a complementary theoretical basis for this study, which helps to reveal the complex interaction of cognitive traits, behavioral patterns and motivation in knowledge construction, and provide theoretical guidance for the design and implementation of personalized learning support.

Research Gap

Existing studies often analyze a single factor, but the interaction and comprehensive impact of factors such as learning motivation and cognitive strategies in individual differences in knowledge construction have not been systematically studied. As for the various technical means currently applied to the field of education, the impact of individual differences on knowledge construction under the support of technology can be further studied.

3. Methodology

This study used a qualitative research design to delve into how individual differences affect knowledge construction. Qualitative methods are very useful and rich in detail in the study of complex phenomena (Lanka et al., 2021; Ugwu & Eze, 2023). As noted by Peel (2020), qualitative methods such as thematic analysis are particularly effective for exploring complex educational phenomena and learners' perspectives.

Its properties make it particularly suitable for exploring complex learning behaviors and motivational mechanisms. Through the semi-structured interviews aimed at gaining insights into the cognitive, behavioral, and motivational aspects of learners and revealing their contributions to the knowledge construction process, this approach should allow for an understanding of the experiences and experiences of each respondent.

3.1 Sampling and Participants

This study adopted a purposive sampling method, focusing on selecting Chinese college students with different individual differences as research subjects. The selected subjects have a diversity of cognitive styles, learning motivations, and behavioral strategies. Purposive sampling methods are widely used in qualitative research because they can ensure that the sample is highly relevant to

the research objectives (Alamri, 2019). This method is suitable for exploring the deep-seated characteristics and behavioral patterns of a specific group.

For the screening of participants, selection was carried out through social networks, including university student organizations, course classes, and student clubs. They were invited to participate through social platforms, and the purpose of the study and participation criteria were detailed in the invitation. The participation criteria include three main points. First, they are currently studying in Chinese universities. Second, they must come from different disciplinary backgrounds to ensure the diversity of cognitive and motivational differences. Finally, they must confirm their willingness to participate in semi-structured interviews.

To ensure the diversity of data, participants are from multiple disciplines such as engineering, social sciences, and the arts. Gender balance and a combination of undergraduates and postgraduates were also considered to reflect different academic experiences (Aung et al., 2021). In the end, the study recruited a group of participants who met the criteria. This diverse sample design improves the reliability and applicability of the research results and enables in-depth analysis of the relationship between individual differences and knowledge construction. Demographic and professional details of the participants are presented in Table 1.

Table 1: Demographic and professional details of the participants

Participant ID	Major	Gender	Education Level
A	Mechanical Engineering	Male	Undergraduate
B	Education	Male	Undergraduate
C	Economics	Male	Undergraduate
D	Chemistry	Female	Undergraduate
E	Art Design	Male	Undergraduate
F	Accounting	Female	Undergraduate
G	Information technology	Male	Undergraduate
H	Psychology	Female	Undergraduate
I	Law	Male	Undergraduate
J	Medicine	Female	Postgraduate
K	Business Administration	Male	Undergraduate
L	Sociology	Female	Undergraduate
M	Civil Engineering	Male	Undergraduate
N	Environmental Science	Female	Undergraduate
O	Computer Science	Female	Undergraduate

P	Journalism	Female	Undergraduate
Q	Architecture	Male	Undergraduate
R	Pharmacy	Female	Postgraduate
S	Political Science	Male	Undergraduate
T	International Relations	Female	Undergraduate

3.2 Research Instruments

This study adopted semi-structured interviews and set open questions to guide the interviewees to share their learning behaviors, motivational driving forces, and knowledge construction strategies in depth. This method effectively obtained in-depth answers and could flexibly explore new topics based on the interviewees' responses during the interview, achieving the effect of expanding the content of the findings (Cohen et al., 2011).

Interview questions:

What do you think is your biggest difficulty in the learning process? How do you usually solve these problems?

What methods or tools do you usually use to help yourself in the face of complex or difficult learning tasks?

What keeps you motivated to learn? Do you think interest is more important or external pressure (such as grades or teacher's requirements) is more important?

When you feel bored or difficult to persist in learning, what measures do you usually take to adjust your state or continue learning?

Do you often complete learning tasks with classmates? What role do you usually play in teamwork? Is this kind of cooperation helpful to you?

After completing the study, do you review and summarize your learning process? Do you think these reflections are helpful to improve your learning ability?

If you can improve the current learning methods or resources provided by the school, what do you most want to improve? Why?

3.3 Data Collection Methods

This study adopted a qualitative research design, aimed to explore the role of behavioral differences and learning motivation in the process of knowledge construction via the semi-structured interviews (Kang and Hwang 2021). 20 undergraduate and graduate students were recruited from various universities in China, and the snowball sampling method was used to screen participants to ensure the diversity of the sample and the representativeness of the research results (Goodman, 1961).

Semi-structured interviews were used as the main tool, focusing on six open-ended questions covering learning behavior, motivation drive, and knowledge integration. The semi-structured interviews were conducted online using WeChat and QQ. They were flexibly arranged to not only improve the convenience of the participants but also promote their more natural and open

communication (Saldaña, 2021). During the process, the researchers guided the participants to describe their learning experience, behavior adjustment strategies, and motivation sources in detail.

All interviews were recorded with the informed consent of the participants and then transcribed verbatim to ensure the accuracy and completeness of the data. After the interview, the data was imported into the AI tool for management and analysis to ensure the systematic and standardized classification of themes. The research team familiarized themselves with the data content by reading the transcripts repeatedly and coded the fragments related to behavior, motivation, and knowledge construction.

These codes were then organized into broader themes such as "behavioral adaptability" and "drive by intrinsic motivation." The entire data analysis process strictly followed the thematic analysis framework, and team discussions ensured the consistency of classification and the reliability of analysis results (Braun & Clarke, 2006).

Through this detailed design and implementation, this study guaratees the depth and breadth of qualitative data, laying a solid foundation for exploring the impact of behavioral differences and learning motivation on the knowledge construction process.To ensure the validity and trustworthiness of the collected data, several strategies were implemented during both the interview design and analysis stages:
First, the semi-structured interview protocol was developed based on an extensive literature review on cognitive load theory, constructivism, and learning motivation, ensuring content validity aligned with theoretical constructs.

Second, the protocol was pilot tested with two representative students to refine question clarity and relevance. Third, two domain experts in educational psychology reviewed the questions for conceptual alignment and language appropriateness. During thematic analysis, chat gpt an AI-assisted tool was used to support initial coding. The AI-suggested codes were manually reviewed, and all final codes were validated through dual-coding by two independent researchers. Discrepancies were discussed and resolved to enhance inter-rater reliability. These practices collectively reinforced the credibility of the research findings.

Table 2: Interview Instrument and Validity Assurance

Research Focus	Sample Interview Questions	Purpose	Validation Strategies
Learning Difficulties & Strategies	What is your biggest difficulty in the learning process? How do you usually solve these problems?	To understand barriers and coping strategies in learning	Content Validity: Developed based on literature on cognitive load and constructivism; refined through pilot feedback.
Cognitive Strategies	What methods or tools do you use for complex tasks?	To explore self-regulated learning and strategy selection	Expert Review: Evaluated by educational psychology specialists for alignment with learning strategy theories.
Learning Motivation	What keeps you motivated to learn? Is it interesting or external pressure?	To identify intrinsic and extrinsic motivational influences	Content Validity: Supported by self-determination theory and triangulated with cross-participant consistency.
Reflective Practices	Do you review and summarize your learning process? How does it help you?	To assess the role of reflection in metacognitive development	Triangulation: Verified through repeated patterns in responses and relevance to metacognitive regulation.
Collaboration	Do you often complete tasks with classmates? What role do you play in teamwork?	To evaluate peer interaction and collaborative roles	Pattern Confirmation: Validated by comparison across multiple participant responses.
Resource Needs	What improvements would you like in learning methods/resources?	To collect suggestions for educational resource improvement	Cross-Validation: Confirmed through recurring feedback and consistent emergent themes.

3.4 Confidentiality

This study implemented the following measures to ensure strict protection of participants' privacy and compliance with confidentiality requirements (Kang and Hwang, 2021).

Anonymization of Personal Information: All identifying information of participants was anonymized. No information that could lead to the identification of participants was used during data collection, storage, or reporting. Participants were assigned unique numbers to ensure their privacy was protected.

Data Storage: Study data, including audio recordings of interviews, transcribed documents, questionnaire backend data, and notes, were securely stored on encrypted devices or in a protected cloud environment. Access to this data was limited to the research team and required unanimous consent.

Confidentiality of Findings: Research findings were presented only in summarized formats, such as aggregated numbers and figures. No personal details or identifiable information were included in the results.

3.5 Ethical Considerations

The following steps were taken to strictly follow the ethical research standard:
Informed Consent: Participants were clearly informed about the study's purpose and use it through voluntary questionnaires and communication records. The materials provided were proof of the consent of participation.

Voluntary Participation: They were also informed that participation was strict on a voluntary basis, and they could withdraw from the process at any time if they felt so without any adverse consequences.

Risk Minimization: It was made sure by the researcher that any potential risk to participants was minimal. Necessary precautions were made to avoid psychological or social jeopardy due to participation.

These approaches were adopted in the study for the protection of privacy and rights of participants, while making sure that the research method is transparent and ethically sound.

4. Results

This section uses interview results from a group of Chinese college students to reveal the multidimensional influence of individual differences – such as cognitive traits, behavioral strategies, and learning motivation – on knowledge construction. The difficulties, behavioral patterns, motivational influences, reflection, and resource needs of students in learning are summarized through the thematic analysis.

Diversified manifestations of learning difficulties and coping strategies

The results of the interview reflect that Chinese college students tend to have multilevel learning difficulties during the process of knowledge construction, which mainly includes several aspects: complex knowledge comprehension, time management under pressure, and lack of motivation continuously. For example, R5 said:

> "*The complex formula derivation makes me feel confused, and I need to keep looking up information in order to keep up*."

Additionally, R4 stated,

> "*The accumulation of tasks sometimes makes me not know where to start, which eventually leads to inefficiency*."

These statements reveal a recurring theme in that most students struggle with either the cognitive complexity of content or the volume of tasks under strict time constraints. Regarding coping strategies, different students have displayed personalized behaviors. For instance, some students gradually overcome the learning pressure by decomposing tasks and planning time.

As R9, pointed out,

> "*I will divide complex content into small pieces and complete a part every day, which will reduce the pressure a lot*."

This reflects a strategic adaptation pattern whereby students optimize task processing by breaking large tasks into manageable components. This view was shared by many of the respondents. Besides, "*the use of technological tools"* plays an important role in "*helping students overcome learning difficulties*".
R6, R8, R10 andR12 added that

> "*Online resources and learning software help improve learning efficiency*."

This suggests a shared reliance on technology to support comprehension and workload management, especially in self-directed settings.

The watershed between active and passive learning
Individual behaviors show significant differences in learning. Students with high cognitive flexibility always learn more actively, such as in-depth reading, collaborative discussion, and practical operations.
R11 noted,

> *"I like to verify theories in the textbook through experiments. That makes me understand things better. I then discuss with friends and my instructor.*"

On the other hand, passive learning students depend more on repeated exercises or mechanical memory to deal with learning tasks.
As mentioned by R7,

> *" The lecture notes, textbook and past year questions are sufficient for me to do well in exams*".

R9 viewed learning and knowledge construction

> "*As an individual journey'* where *"independent learning and time investment was required".*

These quotes illustrate the divide between active engagement that seeks understanding and passive compliance aimed at performance. This difference in behavior patterns directly influences the effect of knowledge construction. During the interviews, R6, R9, R11 and R14 acknowledged that active behavior can integrate more knowledge points into the overall framework, short-term knowledge will easily become fragmentary in passive behavior. Thus, active learning not only leads to deeper comprehension but also supports sustainable knowledge structures.

How internal and external motivations shape the knowledge construction path
Motivation is considered the core driving force of knowledge construction. Intrinsic motivation (such as interest in learning content) enhances the persistence and depth of learning.

R7 mentioned,

> "*I feel excited about designing new works, and I am often willing to spend more time to perfect the details.*"

In contrast, extrinsic motivation (such as grades or scholarships) improves efficiency in the short term but may be difficult to maintain long-term effects.

Respondent R8 expressed,

> *"Exam scores are my motivation, especially when the goal is to get a scholarship."*

These statements reflect the dual motivational structure where intrinsic drives sustain engagement and extrinsic pressures enforce discipline. It is worth noting that some students show the ability to integrate internal and external motivations.

For example, R9 expressed,

> *"I want to get high scores and am interested in code optimization, so I try my best to do my best in every project."*

Such integration supports both academic goals and personal development, creating a more resilient learner profile. This motivation integration encourages students to pursue academic achievement and personal growth in knowledge construction. Furthermore, as per R4, R6 and R9, "motivation types" drive students' choices of behavior and further influence learners' learning path. This shows how motivation shapes not just effort levels but also strategic decisions during learning.

Reflective ability and the potential for improving learning

Interviews revealed that reflective ability significantly influences students' knowledge construction processes. With a high level of reflective ability, students can summarize experiences and lessons from previous learning experiences. For instance,

R13 mentioned:

> *"After finishing the task, I will summarize what I did well and what can be improved."*

Such reflection not only improves the efficiency of learning but also promotes the optimization of knowledge construction incessantly. This view was shared by many respondents. This indicates a pattern where students with stronger reflective ability are not only more aware of their performance but also more capable of adapting their strategies based on prior outcomes. This reflective practice reinforces metacognitive regulation and fosters knowledge integration.

However, some respondents acknowledged they have relatively" weak *reflective abilities*" and tend to "*repeat existing ways instead of exploring better learning strategies actively*". Some respondents mentioned the *"need of appropriate guidance and support*" in resources that will help students develop reflective skills, which will improve the overall learning effect.

Resource optimization and educational innovation

In the interviews, students generally expressed the need for improvement in educational resources and teaching support.

For example, R15 suggested that the school add case studies and practical courses such as

> "*Theoretical learning alone is far from enough, more practice can help us better understand the content*."

R16 hopes to strengthen the cultivation of teamwork as

> *"Through more team projects, I can improve my collaboration and communication skills."*

In addition, technical support is considered an effective means to improve the efficiency of knowledge construction. Some students suggested that schools should promote more online learning platforms and increase the availability of technical resources.

R20 who is studying political science pointed out:

> *"Modern technology can help us better understand complex knowledge, especially in a distance learning environment."*

This reflects a wider theme in which students perceive hands-on experience and technical integration as vital components for bridging theoretical knowledge and real-world application. This call for personalized support emphasizes that educational design and resource allocation need to be more in line with students' actual needs.

5. Discussion

Research Objective: To explore the impact of individual differences on the knowledge construction process of Chinese college students.

Research Question: How do individual differences influence the knowledge construction process among Chinese college students?

According to the results of this investigation, individual differences, especially learning motivation and cognitive strategies significantly affect the process of knowledge construction among Chinese college students. The learning strategy identified among the respondents' showed variations in that students with higher cognitive flexibility were more inclined towards advanced problem-solving methods and collaborative techniques.

This is consistent with previous research emphasizing the role of effective strategies in promoting deep understanding and cognitive engagement (Forsberg et al., 2021). Both intrinsic motivation and extrinsic motivation are considered key drivers of learning. Students with intrinsic motivation show longer engagement in learning and creativity consistent with their self-determination (Ryan and Deci, 2020). Alternatively, extrinsic motivation is more conducive to short-term achievement in goal-oriented tasks.

Meanwhile, the study also disclosed the reflective learning behavior of students. Learners need both effective strategies and motivation to use them, which vary by subject and task. Improving these requires attention to the learner, teacher, and learning environment as mentioned by Dinsmore, D. L., & Fryer, L. K. (2019). It was noticed that students with good reflection ability gained more from knowledge building, could recognize effective strategies and areas for improvement. However, other students may not have developed this skill, in accordance with earlier findings showing that reflection is imperative for the betterment of learning outcomes (Silvennoinen et al., 2022).

This study thus fills the critical research gap with new insights on how learning motivations and cognitive strategies interact. By contrast with previous works that focused on either element of the two, this study unfolds in which way they jointly shape learning behaviors and outcomes. For instance, students who report intrinsic motivation are more likely to adopt flexible cognitive strategies, which lead to deeper knowledge construction. This result extends the knowledge of individual differences and highlights the interaction of these differences.

Moreover, this research is the first to point out the role of technology as a mediator in individual differences. The respondents reported frequent use of technological tools, online platforms, and AI-driven applications to address the difficulties in learning and enhancing strategies. The use of AI-driven tools was observed not only as a support mechanism but also as a modulator of the effectiveness of cognitive strategies. Students using AI platforms could better manage cognitive load and organize knowledge.

This aligns with the theoretical claims of cognitive load theory, where technological scaffolds reduce extraneous load and facilitate deeper learning (Patac, 2025); Gerlich, M. (2025). This finding extends the existing discussion and emphasizes how technological support can amplify the impact of motivation and strategy on knowledge construction, a topic that has rarely been explored in previous studies. These results form the basis for developing personalized learning interventions that integrate motivation, cognitive strategies, and technological resources to optimize educational outcomes.

6. Conclusion

This study explored how individual differences in cognitive traits, behavioral strategies, and learning motivation influence Chinese college students during the knowledge construction process and discloses how their interactions influence learning efficiency and effectiveness. It explored in detail how individual traits influence handling learning tasks and how motivation serves as a drive for learning behavior; it also identifies the core role of reflective learning and teaching support in knowledge construction through interviews with 20 college students and thematic analysis.

The study has shown that individual differences are of great importance for students' performance while facing any challenging learning task. For instance,

students with more developed cognitive flexibility tend to apply diversified strategies and manage learning resources more effectively. On one hand, the balance between intrinsic and extrinsic motivation has been proved to maintain the key to long-term learning effects; reflective learning has played a core role in the improvement of the quality of knowledge construction. In addition, students generally expressed their needs about teaching resources and personalized support, such as more efficient learning tools, stronger team collaboration mechanisms, and more practical practice opportunities.

The findings of this study highlight the importance of developing personalized teaching strategies. Educators should fully consider students' cognitive traits and behavioral preferences, design learning activities that can stimulate intrinsic motivation, and maintain their learning engagement through external incentives. Research by Rasli et al., (2022) using the expert method highlights the importance of flexibility in higher education, including flexible teaching, delivery, distributed learning, networked learning, open learning, online learning, and e-learning. With this, the cultivation of students' reflective learning ability should be strengthened, and students should be helped to optimize their learning strategies by providing clear guidance and practice opportunities.

6.1 Limitations and Future Research

Although this design research has provided valuable insight into the influence of individual differences in knowledge construction, several limitations are leading to further improvement and exploration.

First, the small sample size limits the participants to 20 Chinese college students, which may not represent the diverse college student population and may miss significant individual differences. Second, this qualitative approach is effective in exploring learning experiences and motivational issues but may limit the generalization of findings due to its subjective nature. Besides, reliance solely on self-report data without integrating objective measures such as test scores or behavioral records could affect the accuracy of the results.

This study does not consider the influence of individual differences within different education systems and cultural backgrounds as it is confined only to Chinese college students. Thus, its generalization in global educational settings is limited. Cross-cultural comparisons enable deeper insights into how cultural backgrounds shape learning behavior, motivation, and learning strategies and thus provide more globally relevant educational practice.

Further, the role of emergent technologies, such as AI-assisted tools and learning analytics, in personalizing support and knowledge construction is a promising direction. These directions will serve to fine-tune theoretical understanding but also to inform practical strategies aimed at improving education in diverse contexts.

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