RELATIONSHIP BETWEEN DATABASE COURSE DIFFICULTY AND STUDENT PROFESSIONAL INTERESTS: AN EMPIRICAL STUDY AT GUFL, CHINA[*]

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Abstract

The objectives of this study are: (1) To analyze the current levels of perceived database course difficulty and student professional interest.; (2) To compare differences across demographic factors such as gender, grade level, and parental education; (3) To examine the correlation between course difficulty and professional interest.; and (4) To propose instructional and curricular recommendations that enhance learning engagement and professional motivation. This research adopts a quantitative survey design. The population consists of undergraduate students enrolled in database-related courses, and the sample comprises 538 valid participants selected through convenience sampling from four majors: Computer Science, Software Engineering, Network Engineering, and Artificial Intelligence. Data were collected using a self-developed questionnaire measuring four dimensions of course difficulty (knowledge depth, knowledge breadth, study time investment, and exercise difficulty) and four dimensions of professional interest (external factors, individual interest, learning

engagement, and career relevance). Data were analyzed through descriptive statistics, t-tests, one-way ANOVA, and Pearson correlation analysis.

The research results show that: (1) Students generally perceived database courses as moderately to highly difficult (M ≈ 3.7); (2) Male and junior students reported higher professional interest and study-time investment; (3) Students with highly educated parents perceived greater course difficulty and higher interest; and (4) All correlations between course difficulty and professional interest dimensions were positive and significant (r = .51–.84, p < .001). The study concludes that moderate course difficulty enhances student motivation and engagement, while both overly easy and overly difficult content diminish learning interest. The recommended strategies include differentiated curriculum design, project-based instruction, feedback-driven teaching, and interest-oriented learning environments.

Keywords: Database Course Difficulty; Professional Interest; SPSS; Higher Education; ITAI Strategy

Introduction

In the digital economy era, databases serve as the foundation of information management, artificial intelligence, and big data applications. As organizations across sectors accelerate digital transformation, the demand for database professionals has surged globally (International Data Corporation [IDC], 2024). According to IDC's Datasphere Report (2024), the total volume of global data is projected to reach 393.8 zettabytes by 2028, indicating an exponential increase in the need for professionals proficient in data processing, storage, and management. Consequently, database education has become a critical component of information technology (IT) curricula in higher education institutions, shaping students' technical competence and professional orientation.

In China, the government's Information Technology Application Innovation (ITAI) initiative, also known as the Xinchuang Project, emphasizes self-reliant development of database technologies and national digital sovereignty (Qianzhan Industry Research Institute, 2024). This strategic direction has compelled universities to reform their database curricula to enhance teaching quality and talent cultivation. However, challenges remain in calibrating course difficulty, ensuring conceptual coherence, and sustaining students' professional motivation (Hu, Zhao, & Yuan, 2024). Courses that are overly theoretical often discourage students, while those that are overly simplified fail to develop professional competence (Wang et al., 2024).

From an educational psychology perspective, course difficulty is a key factor influencing students' learning motivation and engagement. Studies by Vygotsky (1985) and Bruner (1977) proposed that learning effectiveness depends on the balance between cognitive challenge and learner readiness—known as the "zone of proximal development." When difficulty exceeds learners' capacity, it leads to frustration and anxiety; conversely, when too easy, it results in boredom and low engagement (Meng & Huang, 2019). Therefore, optimal difficulty is essential for achieving sustained learning interest and knowledge mastery.

Professional interest, on the other hand, refers to an individual's positive emotional and behavioral inclination toward a particular field of study or career (Pan, 2017). It serves as an internal motivational mechanism that drives continuous learning and professional development. Empirical evidence indicates that students with higher professional interest exhibit stronger persistence, creativity, and academic achievement (Feng & Yue, 2023; Zhao, Shao, & Chen, 2023). Yet, many Chinese students experience a mismatch between their academic major and career aspirations, leading to disengagement and poor learning outcomes (Zhang, Liu, & Pan, 2023).

Although prior studies have examined course difficulty and motivation separately, few have empirically investigated the interaction between course difficulty and professional interest in database education, particularly within the Chinese higher education context. This study addresses this research gap by analyzing how students perceive the difficulty of database courses and how these perceptions correlate with their professional interests at Guangxi University of Foreign Languages (GUFL). This study contributes both theoretically and practically. Theoretically, it enriches the understanding of learning difficulty as a determinant of interest formation and motivation in technical education. Practically, it provides actionable insights for database instructors, curriculum designers, and educational policymakers to optimize course design, balance cognitive load, and foster sustained student engagement under China's ITAI framework.

Objectives

1. To analyze the current levels of perceived database course difficulty and student professional interest.

2. To compare differences across demographic factors such as gender, grade level, and parental education.

3. To examine the correlation between course difficulty and professional interest.

4. To propose instructional and curricular recommendations that enhance learning engagement and professional motivation

Literature Review

The concept of course difficulty has long been recognized as a crucial determinant of learning motivation, engagement, and academic performance. In the context of computer science and database education, course difficulty

reflects the extent of cognitive, technical, and temporal demands imposed upon learners (Smith & Johnson, 2020). Previous research suggests that database-related courses are often perceived as abstract and conceptually demanding due to their dual reliance on theoretical foundations—such as relational models and normalization—and practical components like SQL syntax and data management (Su & Wenjin, 2021). When course complexity exceeds students' cognitive capacity, learning efficiency declines markedly, a phenomenon explained by Cognitive Load Theory (Sweller et al., 2019). Conversely, excessive simplification of instructional content can lead to superficial understanding and disengagement. Thus, achieving an optimal level of difficulty—a balance between cognitive challenge and learner readiness—is essential for sustaining motivation and knowledge retention, consistent with Vygotsky's notion of the Zone of Proximal Development (Vygotsky, 1985) and Bruner's theory of scaffolding (Bruner, 1977). Within the field of educational psychology, course difficulty is conceptualized as a multidimensional construct encompassing knowledge depth, knowledge breadth, study time investment, and exercise or task complexity (Ding, Liu, & Yang, 2023). These dimensions collectively determine both the intellectual challenge and pedagogical design of a course. When instructional materials are sequenced logically and supported by scaffolded exercises, learners perceive difficulty as stimulating rather than discouraging, thereby enhancing their persistence and self-efficacy (Wang, Zhao, & Liu, 2024). In contrast, unbalanced task structures or excessive theoretical density can heighten anxiety and diminish performance (Li & Desheng, 2017; Liu & Pan, 2022). Recent pedagogical reforms in China, particularly under the Information Technology Application Innovation (ITAI) initiative, emphasize the need to recalibrate the difficulty of database curricula to align with national objectives of technological self-reliance and professional competence (Qianzhan Industry Research Institute, 2024). Professional interest constitutes another critical variable influencing learning persistence and career development. It is defined as

a relatively stable psychological disposition that integrates cognitive, affective, and behavioral orientations toward a particular discipline or profession (Pan, 2017). According to Holland's (1959) Vocational Interest Theory, congruence between individual traits and learning environments enhances satisfaction, motivation, and long-term career success. Likewise, Bourdieu's (1984) theory of cultural capital posits that family background, social networks, and educational context shape the formation of professional dispositions and identity. In higher education, professional interest operates as both a motivational driver and an outcome of educational engagement, influencing not only academic performance but also future career alignment (Feng & Yue, 2023; Zhao, Shao, & Chen, 2023). Sustained professional interest arises when academic experiences satisfy students' psychological needs for autonomy, competence, and relatedness, as proposed by Self-Determination Theory (Deci & Ryan, 2020). The relationship between course difficulty and professional interest is complex and bidirectional. Moderate difficulty has been shown to stimulate curiosity, deepen understanding, and enhance self-regulated learning, whereas excessive difficulty can elicit frustration and avoidance behaviors (Meng & Huang, 2019; Hu, Zhao, & Yuan, 2024). Empirical research within Chinese higher education indicates that students who perceive database courses as appropriately challenging exhibit higher levels of learning motivation, satisfaction, and persistence (Liu & Pan, 2022). Furthermore, learning environments that integrate project-based and case-based instruction can mitigate perceived difficulty and strengthen professional engagement, suggesting that the design of instructional activities plays a mediating role between cognitive challenge and motivational outcomes (Wang et al., 2024). These findings underscore that difficulty, when pedagogically balanced, serves as a catalyst for professional identity formation rather than an obstacle to learning. Despite the growing body of research on course difficulty and learning motivation, there remains a paucity of empirical studies exploring

their interaction specifically within the context of database education in Chinese universities. Existing literature predominantly addresses general computer science courses, neglecting the unique theoretical and applied characteristics of database instruction under the ITAI policy framework. Consequently, a comprehensive investigation of how perceived difficulty influences students' professional interest is both timely and necessary. The present study seeks to address this research gap by examining the multidimensional relationship between database course difficulty and professional interest among undergraduates at Guangxi University of Foreign Languages (GUFL). Through this inquiry, the study aims to contribute to the refinement of curriculum design, the enhancement of motivational pedagogy, and the broader discourse on aligning academic rigor with professional competence in the era of digital transformation.
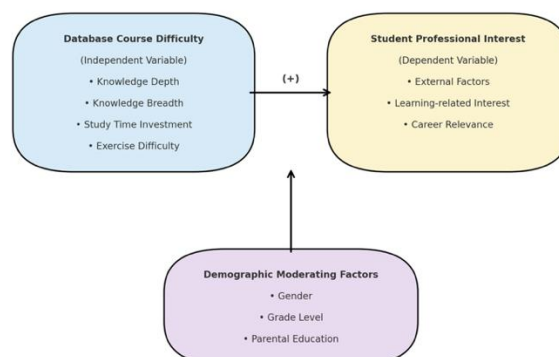

Figure 1: Conceptual Framework

Methodology

This study adopted a quantitative research design using a cross-sectional survey to examine the relationship between database course difficulty and students' professional interest at Guangxi University of Foreign Languages (GUFL), China. The population consisted of undergraduate students enrolled in database-related courses across four majors: Computer Science, Software Engineering,

Network Engineering, and Artificial Intelligence. A total of 600 questionnaires were distributed through convenience sampling, and 538 valid responses were analyzed after data screening.

Data were collected using a self-developed structured questionnaire comprising two main scales: the Database Course Difficulty Scale (knowledge depth, knowledge breadth, study time investment, and exercise difficulty) and the Professional Interest Scale (external factors, individual interest, learning engagement, and career relevance). All items used a five-point Likert scale. Content validity was verified by experts, and a pilot test yielded a Cronbach's alpha of 0.91, confirming high reliability.

Questionnaires were distributed online via the university's learning management system after obtaining consent and ethical approval. Participation was voluntary and anonymous. The data were analyzed using SPSS version 26, employing descriptive statistics, independent-sample t-tests, one-way ANOVA, and Pearson correlation analysis. These methods were used to determine status, demographic differences, and correlations between the two variables. The findings were interpreted under Cognitive Load Theory, Self-Determination Theory, and Vygotsky's Zone of Proximal Development, providing empirical evidence for improving database course design and student engagement.

Result

The final valid sample comprised 538 students from four majors at Guangxi University of Foreign Languages (GUFL): Computer Science, Software Engineering, Network Engineering, and Artificial Intelligence. Gender distribution was balanced (male = 51.3%, female = 48.7%), and most respondents were in their second or third academic year, with parental education levels spanning from basic to tertiary education.

The Database Course Difficulty Scale revealed overall moderate-to-high difficulty (M = 3.71, SD = 0.67). Among the four dimensions, Exercise Difficulty (M = 3.75) and Knowledge Depth (M = 3.68) were rated highest, indicating that students found the conceptual and practical components most demanding. Conversely, Knowledge Breadth (M = 3.59) was comparatively lower, suggesting manageable content scope.

For Professional Interest, students exhibited generally positive engagement (M = 3.86, SD = 0.64). The highest mean was observed in Learning-related Interest (M = 3.93), followed by Career Relevance (M = 3.85) and External Factors (M = 3.81). These results indicate that students' intrinsic motivation and perception of professional value were major drivers of interest formation.

Table 1 Descriptive Statistics of Database Course Difficulty (n = 538)

Dimension	Mean (M)	SD	Level of Perception	Rank
Knowledge Depth	3.68	0.70	Moderate–High	2
Knowledge Breadth	3.59	0.65	Moderate	4
Study Time Investment	3.73	0.68	Moderate–High	3
Exercise Difficulty	3.75	0.67	High	1
Overall Mean	3.71	0.67	Moderate–High	—

Table 2 Comp Descriptive Statistics of Student Professional Interest (n = 538)

Dimension	Mean (M)	SD	Level of Interest	Rank
External Factors	3.81	0.64	High	3
Learning-related Interest	3.93	0.66	High	1
Career Relevance	3.85	0.62	High	2
Overall Mean	**3.86**	**0.64**	**High**	—

Inferential analyses (t-tests and one-way ANOVA) examined differences across gender, academic year, and parental education. Results showed no significant gender differences in perceived course difficulty or interest, supporting the assumption of gender-neutral engagement patterns in IT disciplines. However, academic year differences were significant: third-year students reported higher professional interest (M = 3.96) than second-year students (M = 3.83; t = −2.31, p = .021), reflecting the impact of advanced coursework and internship exposure on motivation. Parental education exhibited a notable main effect (p < .001) on both difficulty and interest dimensions. Students whose parents held tertiary education degrees perceived greater difficulty but also demonstrated stronger professional interest—consistent with the influence of family cultural capital on academic persistence and self-expectation.

Table 3 Differences in Professional Interest by Academic Year

Academic Year	n	Mean (M)	SD	t / F	p-value	Interpretation
2nd Year	243	3.83	0.68			
3rd Year	295	3.96	0.61	−2.31	0.021*	Significant difference
Total	538	—	—	—	—	3rd-year students show higher interest

Table 3 Pearson correlation analysis confirmed strong positive relationships between all dimensions of database course difficulty and professional interest (r = .51–.84, p < .001). The highest correlation appeared between Study Time Investment and Learning-related Interest, suggesting that students who dedicate more time to study perceive greater enjoyment and value in the subject.

Table 4 Correlation Matrix Between Database Course Difficulty and Student Professional Interest

Difficulty Dimension	External Factors	Learning-related Interest	Career Relevance	r (Average)
Knowledge Depth	.62**	.68**	.64**	.65
Knowledge Breadth	.53**	.59**	.56**	.56
Study Time Investment	.70**	.84**	.72**	.75

Exercise Difficulty	.57**	.63**	.60**	.60
Overall Correlation	.61	.69	.63	.64

Table 4 The findings confirm strong positive relationships between all dimensions of database course difficulty and professional interest. The highest correlation appeared between Study Time Investment and Learning-related Interest, suggesting that students who invest more study time experience higher enjoyment, confidence, and motivation in database learning.

These results corroborate Cognitive Load Theory and Self-Determination Theory (Vygotsky, 1985; Bruner, 1977; Pan, 2017), demonstrating that optimal difficulty fosters meaningful learning and sustained interest. Students' professional interest increases when instructional design encourages problem-solving, project-based tasks, and applied practice aligned with real-world database operations.

Practically, educators should calibrate course complexity to maintain engagement while preventing overload, integrate applied projects to connect theory with industry practice, and tailor teaching strategies to account for academic year progression and parental education background. This alignment between difficulty and motivation ensures that learning remains both challenging and rewarding—fostering higher academic achievement and stronger professional identity in IT education.

Conclusions

This study investigated the relationship between the perceived difficulty of database courses and students' professional interest among undergraduates at Guangxi University of Foreign Languages (GUFL), encompassing four majors: Computer Science, Software Engineering, Network Engineering, and Artificial Intelligence. Employing quantitative methods—including descriptive statistics, t-

tests, one-way ANOVA, and Pearson correlation analysis—the research provides empirical evidence on how cognitive challenge interacts with motivational engagement in the context of China's ITAI (Information Technology Application Innovation) educational reform. The findings reveal that students generally perceived database courses as moderately to highly difficult, with the greatest challenges stemming from conceptual depth and practical exercises. Despite this, learners demonstrated consistently high levels of professional interest, particularly in the dimensions of learning engagement and career relevance. This suggests that difficulty, when perceived as meaningful and aligned with career development, can enhance rather than hinder motivation. Differences across demographic variables further enrich the interpretation. Third-year students exhibited higher levels of professional interest than second-year students, likely due to increased exposure to applied coursework and internships. Students with highly educated parents reported both greater perceived difficulty and stronger professional interest, underscoring the influence of cultural capital and educational background on learning attitudes. No significant gender differences were observed, indicating that database learning motivation may be relatively gender-neutral within IT disciplines. Statistical analysis confirmed strong positive correlations between all dimensions of perceived course difficulty and professional interest ($r = .51–.84$, $p < .001$). The most pronounced association was found between study time investment and learning-related interest, demonstrating that time commitment positively reinforces intrinsic motivation and perceived value of learning. These results support both Cognitive Load Theory and Self-Determination Theory, emphasizing that optimal difficulty promotes autonomy, competence, and sustained engagement. From a pedagogical perspective, the study concludes that moderate cognitive challenge is beneficial for developing students' professional identity and commitment. Rather than reducing difficulty, educators should focus on calibrating it— maintaining academic rigor while providing sufficient scaffolding and contextual

support. Effective strategies include project-based learning, feedback-oriented assessment, and differentiated instruction to accommodate learners' backgrounds and abilities. Moreover, motivational frameworks should be explicitly integrated into database course design to balance theoretical abstraction with practical application.

In summary, this research demonstrates that perceived difficulty functions not as a barrier but as a motivational catalyst when aligned with students' learning goals and professional aspirations. By translating cognitive challenge into relevance and achievement, educators can cultivate both academic excellence and professional competence among IT students. The study thus contributes theoretical insight into the interplay between difficulty and interest and offers practical guidance for curriculum reform in higher education under China's ITAI framework.

Discussion

The findings of this study reveal that students perceived database courses as moderately to highly difficult, yet simultaneously demonstrated high professional interest. This pattern suggests that difficulty alone does not discourage learning motivation; rather, when instructional challenge aligns with students' cognitive readiness and professional goals, it functions as a motivational enhancer. Such an outcome reinforces Cognitive Load Theory, which posits that optimal—not minimal—cognitive challenge fosters meaningful learning and retention (Sweller et al., 2019). The strong positive correlations between course difficulty dimensions and professional interest ($r = .51–.84$, $p < .001$) confirm that learning engagement increases when students invest more time and effort in cognitively demanding yet achievable tasks. This is consistent with Self-Determination Theory (Deci & Ryan, 2020), indicating that learners experience greater satisfaction when their need for competence and

achievement is fulfilled through appropriately challenging coursework. Differences by academic year and parental education further highlight the role of experience and cultural capital in shaping learning motivation. Senior students and those from highly educated families tend to perceive greater value in academic difficulty, interpreting challenge as an indicator of professional growth rather than as a barrier. This interpretation aligns with Vygotsky's Zone of Proximal Development, where scaffolded challenge stimulates sustained curiosity and self-efficacy.

The results demonstrate that perceived difficulty, when balanced and supported through effective pedagogy, enhances professional identity formation and deepens commitment to IT-related careers. Consequently, curriculum designers should avoid simplifying content excessively; instead, they should provide structured guidance that transforms cognitive challenge into opportunities for intellectual and professional advancement.

Recommendations

The study highlights the importance of maintaining an appropriate level of academic challenge in database education. Rather than simplifying course content, instructors should design learning experiences that balance cognitive demand with adequate scaffolding. Integrating project-based and case-based activities can connect theoretical knowledge with real-world applications, thereby increasing engagement and professional relevance. Teaching strategies should be guided by motivational frameworks such as Self-Determination Theory, promoting autonomy, competence, and collaboration in learning. Continuous feedback and formative assessment can further enhance students' self-efficacy and sustain their interest throughout the learning process. Universities are encouraged to strengthen faculty development programs that emphasize motivational pedagogy and innovative teaching design aligned with the ITAI

educational framework. At the same time, mentorship and academic support systems should be provided for students who face greater learning challenges or lack confidence in technical courses.

Future research should expand to multiple institutions and adopt mixed-method approaches to gain deeper insights into how course difficulty shapes motivation and professional identity over time. By transforming cognitive challenge into meaningful engagement, educators can cultivate both academic excellence and professional competence among students in information technology disciplines.

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