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AI Reliance in Domain-Specific Learning and Employment Anxiety: Evidence from Vocational College Students in China

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Abstract: The widespread use of artificial intelligence (AI) in education has greatly changed the learning behaviors of college students, yet its potential psychological consequences, particularly ， employment anxiety, remain underexplored. This study was designed to investigate the association between AI reliance in mathematics learning and employment anxiety among vocational college students, and to examine whether mathematical self-efficacy accounts for this relationship. A quantitative cross-sectional survey design was adopted, using self-reported questionnaire data from 613 vocational college students in Jiangsu Province, China. The results indicate that AI reliance is at a moderate level and is significantly and positively associated with employment anxiety among vocational students ($p < 0.001$). Regression analysis further shows that AI dependence remains a significant predictor of employment anxiety ($p < 0.001$). Additional analyses reveal that mathematical self-efficacy does not play a significant mediating role in this relationship ($p > 0.05$), suggesting that the effect of AI reliance on employment anxiety may operate directly. These findings highlight the potential psychological risks caused by excessive reliance on AI technology in mathematics learning among vocational students.

1. Introduction

Nowadays, the development of artificial intelligence (AI) technologies has greatly reshaped the learning and teaching patterns in college. AI-assisted tools enable students to obtain the solutions across various academic problems directly. Although the AI may enhance efficiency and accessibility, growing concerns have focused on the potential over-reliance on this technology during learning processes [1,2].

The most previous studies studied the pedagogical benefits of AI, including personalized learning methods and improved academic performance [3]. However, the potential limitations of over-reliance on AI tools may impair the independent thinking and problem-solving abilities of college students

[4]. In mathematics, this problem is extremely obvious. The mathematics learning requires deep thought and understanding. Using AI frequently reduces active effort and builds a habit of depending on external help of students.

From the perspective of Social Cognitive Theory, individuals' beliefs about their competence play an important role in shaping both behavior and psychological outcomes [5]. In educational contexts, the frequent reliance on external tools may weaken students' perceived competence [6]. Especially, those changes may cause broader psychological implications for vocational college students, whose learning experiences are closely tied to skill development and employability.

Employment anxiety is a prevalent issue among vocational college students, who often face strong pressure directly related to labor market competitiveness and skill requirements. Previous studies have identified several factors like perceived skill insufficiency and career uncertainty as key contributors to employment anxiety [7,8,9]. However, little attention has been paid to how emerging learning behaviors, particularly AI reliance, may influence the employment-related psychological states of college students.

Although existing studies on AI in education have grown rapidly, a few studies link domain-specific AI reliance to employment anxiety. In mathematics learning, over-reliance on AI may weaken the problem-solving competence and leads to the loss of confidence of students, which could in turn impact their job prospects in the future.

To address this gap, our study focuses on vocational students in China. We examine how relying on AI in mathematics relates to employment anxiety. Specifically, we assess the degree of AI dependence, its correlation with employment anxiety. Besides, the role of math self-efficacy is also examined.

2. Methods

2.1. Research Design

In this study, quantitative cross-sectional research is designed to examine the relationship between AI dependence in mathematics learning and employment anxiety among vocational college students. The questionnaire-based survey was conducted to collect the data about students' AI usage behaviors, psychological perceptions and demographic characteristics.

2.2. Participants and Procedure

In this study, a total of 613 valid responses were collected from vocational college students in Jiangsu Province, China. Participants were recruited from multiple institutions and included students from different academic years (freshman, sophomore and junior) and disciplinary backgrounds (engineering, economics and management).

Data collection was conducted through an online questionnaire platform. This participation was voluntary and respondents were informed of the purpose of the study. All responses were anonymous to ensure confidentiality and reduce potential social desirability bias.

2.3. Measures

2.3.1. AI Dependence in Mathematics Learning

AI dependence in mathematics learning was measured using an 8-item scale developed for the present study [10-12]. The scale assessed the extent to which students relied on AI tools when solving mathematical problems. The items captured behaviors such as directly obtaining answers from AI

systems, relying on AI for complex problem-solving and reducing independent thinking during learning. Responses were rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating greater AI dependence.

2.3.2. Employment Anxiety

Employment anxiety was measured using a 7-item scale based on prior research on job-search anxiety, employability concerns and future employment anxiety [8,13]. The scale captured students' concerns about employment competitiveness, perceived skill insufficiency and uncertainty for future career prospects. Responses were rated on a 5-point Likert scale, with higher scores indicating higher levels of employment anxiety.

2.3.3. Mathematical Self-Efficacy

Mathematical self-efficacy was assessed using a scale based on Bandura's [5] self-efficacy theory and prior studies in mathematics education, particularly Pajares and Miller [6]. The scale measured students' confidence in their ability to understand and solve mathematical problems. Participants rated their agreement with each item on a 5-point Likert scale, with higher scores indicating stronger perceived self-efficacy.

2.4. Statistical Analysis

Data analysis was conducted in R and SPSS software. Descriptive statistics like gender and majors were calculated to examine the distribution of key variables. Reliability and validity were assessed using Cronbach's alpha and exploratory factor analysis (EFA).

Pearson correlation analysis was performed to examine the relationships between AI reliance and employment anxiety. Hierarchical multiple regression analysis was conducted to examine the predictive effect of AI dependence on employment anxiety.

In addition, mediation analyses were conducted using Hayes' PROCESS macro (Model 4) with 5,000 bootstrap samples to examine the potential mediation role of mathematical self-efficacy between AI reliance and employment anxiety.

3. Results

3.1. Descriptive Statistics

Descriptive statistics were conducted to examine the overall distribution of the AI dependence and employment anxiety. As shown in Table 1, the mean score of AI dependence was 2.574 (SD = 0.834), indicating a moderate level of reliance on AI tools in mathematics learning. The mean score of employment anxiety was 3.00 (SD = 0.792), suggesting that students generally experienced a moderate level of employment-related anxiety.

Table 1: Descriptive Statistics of Main Variables (N=613).

	N	Minimum	Maximum	Mean	SD
AI Dependence	613	1.000	5.000	2.574	0.834
Employment Anxiety	613	1.000	5.000	2.995	0.792
Valid N (listwise)	613				

3.2. Distribution of AI Dependence and Employment Anxiety

To further examine the distribution of AI dependence, participants were categorized into low,

moderate and high dependence groups based on tertile cutoffs. As shown in Figure 1, the majority of students (54.8%) were in the moderate dependence category group, followed by 38.2% in the low dependence group and only 7.0% in the high dependence group.

Similarly, the degree of employment anxiety in these students was at a moderate level (63.6%). The proportions of students reporting low and high levels of anxiety were 17.9% and 18.4%, respectively.

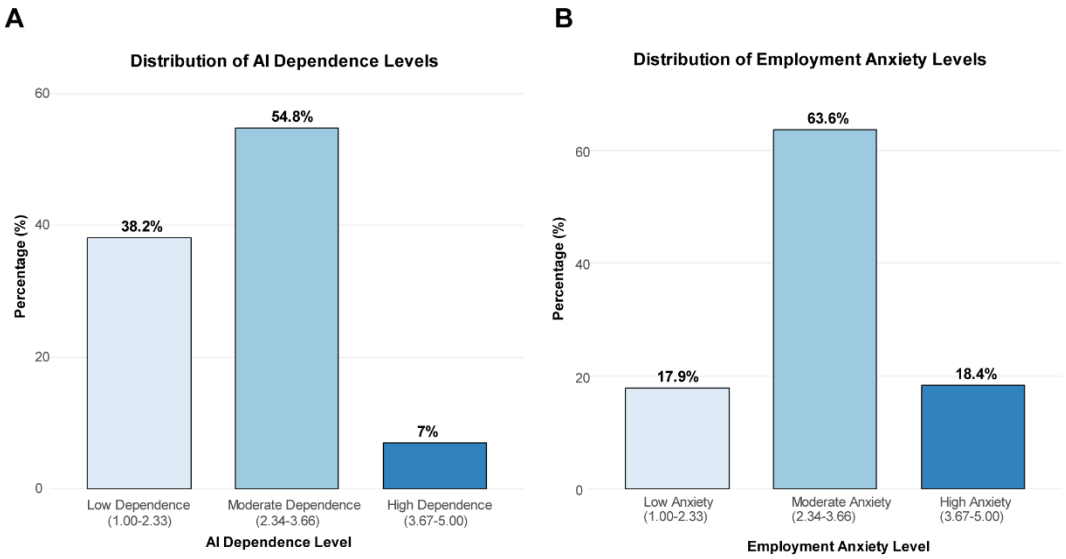


Figure 1: Distribution of AI Dependence (A) and Employment Anxiety (B) across students.

3.3. Reliability and Validity

Furthermore, we assessed the psychometric properties of the scales through reliability and validity tests. As reported in Table 2, internal consistency was excellent for both the AI dependence and employment anxiety scales, each yielding a Cronbach's α of 0.939. The KMO values were above 0.90, and Bartlett's test of sphericity was significant at $p < 0.001$, confirming the data's suitability for factor analysis. Moreover, the cumulative variance explained exceeded 70% for both constructs, suggesting adequate construct validity.

Table 2: Reliability and Validity Analysis Results (N=613).

Scales	Number of Items	Cronbach's α	KMO Value	Bartlett's Sphericity Test (χ^2)	p Value	Cumulative Variance Explained (%)
AI Dependence Scale	8	.939	.928	4003.092	<0.001	70.231
Employment Anxiety Scale	7	.939	.921	3514.270	<0.001	73.296

3.4. Group Differences

Table 3 showed the group differences in AI dependence and employment anxiety by gender, grade and major. The results of independent t-tests found no gender gap in AI dependence. But for employment anxiety, females scored significantly higher than males ($p<0.01$). Besides, the results of One-way ANOVA test suggested both variables were stable across grade levels (Table 4). By contrast, the Kruskal–Wallis test showed significant differences in AI dependence by major ($p < 0.05$), while

employment anxiety did not differ significantly across majors.

Table 3: Differences in Main Variables by Gender (N=613).

	Gender	N	Mean	SD	SE	t	Sig.
AI Dependence	Male	410	2.554	0.860	0.042	-0.850	0.396
	Female	203	2.615	0.779	0.054	-0.878	0.380
Employment Anxiety	Male	410	2.927	0.797	0.039	-3.052	0.002
	Female	203	3.133	0.766	0.053	-3.093	0.002

Table 4: Differences in Main Variables by Grade (N=613).

		N	Mean	SD	SE	95% CI	F	Sig.
AI Dependence	Freshman	511	2.591	0.846	0.037	2.517-2.664	1.246	0.265
	Sophomores and juniors	102	2.490	0.769	0.076	2.339-2.641		
Employment Anxiety	Freshman	511	2.994	0.799	0.035	2.924-3.063	0.014	0.907
	Sophomores and juniors	102	3.004	0.762	0.075	2.854-3.153		

3.5. Correlation Analysis

Furthermore, the Pearson correlation analysis was conducted to study the relationship between AI dependence and employment anxiety. The results showed a significant positive correlation between the two variables ($r = 0.449$, $p < 0.001$), indicating that higher levels of AI dependence are associated with greater employment anxiety.

3.6. Hierarchical Regression Analysis

To test whether AI dependence could predict employment anxiety among college students, we conducted a hierarchical regression. As shown in Table 5, only gender reached significance ($p < 0.01$) with demographics controlled (Model 1). Furthermore, after introducing AI dependence (Model 2), it explained an additional 19.7% of the variance ($\Delta R^2 = 0.197$, $p < 0.001$). The result showed that AI dependence was a robust positive predictor ($\beta = 0.446$, $p < 0.001$). Diagnostic checks showed no multicollinearity (VIF < 2) and acceptable residual independence.

Table 5: Hierarchical Multiple Regression Analysis Results (N=613).

Model		uSC		SC		Sig.	95% CI for B		Collinearity Statistics	
		B	SE	Beta	t				Tolerance	VIF
1	(Constant)	2.796	0.133		20.951	0.000	2.534	3.058		
	Department	-.019	0.023	-0.034	-0.804	0.422	-0.065	0.027	0.914	1.094
	Gender	.215	0.069	0.128	3.111	0.002	0.079	0.350	0.960	1.042
	Grade	-.023	0.091	-0.011	-0.249	0.803	-0.201	0.156	0.885	1.129
2	(Constant)	1.646	0.152		10.858	0.000	1.348	1.944		
	Department	0.006	0.021	0.011	0.296	0.767	-0.035	0.048	0.906	1.104
	Gender	0.179	0.062	0.106	2.887	0.004	.057	0.300	0.958	1.044
	Grade	0.001	0.081	0.001	0.017	0.986	-0.158	0.161	0.885	1.130
	AI Dependence	0.424	0.034	0.446	12.326	0.000	0.356	0.491	0.987	1.013

4. Discussion

The present study examined the relationship between AI dependence in mathematics learning and employment anxiety among vocational college students. The findings provided several important insights into how emerging learning behaviors might influence students' psychological status in the

context of vocational education.

Firstly, the results revealed that AI dependence in mathematics learning is positively associated with employment anxiety. This finding suggested that students who rely more heavily on AI tools when solving mathematical problems tended to experience higher levels of anxiety regarding their future employment. One possible explanation to this phenomenon was that over-reliance on AI might reduce opportunities for independent problem-solving [4]. Over time, students might become less confident in their own abilities, particularly in cognitively demanding domains such as mathematics [1,2]. For vocational college students, whose employability was closely tied to practical skills and competence, this perceived lack of ability may translate into heightened concerns about job competitiveness and career prospects.

Consistent with previous research, the heavy dependence on external learning tools could erode learners' autonomy and confidence. At the same time, this study extended that research by connecting AI reliance directly to employment-related psychological outcomes [4,14].

Secondly, the regression results indicated that AI dependence remains a significant predictor of employment anxiety even after controlling for gender, grade and major. This suggested that the relationship was robust. Notably, gender was also found to be a significant predictor, with female students reporting higher levels of employment anxiety. This finding consisted with prior research indicating that female students might experience greater career-related stress and uncertainty compared to male students, possibly due to social expectations and perceived barriers in the labor market [15,16].

Contrary to initial expectations, mathematical self-efficacy was not found to mediate or moderate the relationship between AI dependence and employment anxiety. This finding challenged the commonly assumed role of self-efficacy as a central psychological mechanism linking learning behaviors to affective outcomes. One possible interpretation was that, employment anxiety might depend less on domain-specific academic confidence and more on broader perceptions of employability and external labor market pressures for vocational college students. Unlike students in general academic tracks, those students tended to be more sensitive to practical skill demands and job market competition. Therefore, their anxiety about employment might come more from a general uncertainty about whether they were truly ready for work [7,16]. Additionally, the absence of mediation might be caused by the nature of AI reliance itself. AI tools provided quick answers and reduced cognitive effort, but they could undermine students' sense of agency and autonomy. That suggested a more direct psychological path: AI dependence fostered a reliance mindset or lowered perceived control over learning, instead of operating indirectly through self-efficacy [4,14].

This finding indicated that the relationship between AI reliance and employment anxiety might involve alternative psychological pathways that were not captured in the current study, such as perceived employability, learning autonomy or career adaptability [7,16].

Moreover, the findings of this study had several theoretical and practical implications. Theoretically, this study contributed to the literature on AI in education by highlighting its potential psychological consequences [1,2]. Besides, it also extended research on employment anxiety by identifying AI reliance as a novel behavioral factor associated with students’ career-related concerns.

Practically, the results suggest that educators should guide students toward more balanced and effective use of AI tools. Rather than discouraging AI use, educational practices should emphasize its role as a supportive learning aid rather than a substitute for independent thinking. In addition, interventions aimed at reducing employment anxiety among vocational students should consider not only skill development but also students’ learning behaviors and their reliance on technology.

5. Conclusions

This study examined the relationship between AI dependence in mathematics learning and employment anxiety among vocational college students in China. The findings indicate that AI reliance is at a moderate level and is significantly and positively associated with employment anxiety, and that this association remains robust after gender, grade and major are controlled for. Mathematical self-efficacy neither mediates nor moderates this relationship, suggesting that the influence of AI reliance on employment anxiety may operate through more direct psychological pathways rather than through domain-specific academic confidence.

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