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The Influence of Academic Self-Efficacy on Learning Engagement in Online Education in China: The Mediating Role of Effort

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Abstract: The shift towards online intelligent learning has become the norm in education and is now a fundamental part of modern educational activities. However, this new model can influence students' learning behavior and lead to changes in their approach to learning. Based on online intelligent learning, we investigated how the academic self-efficacy of nursing students affects their engagement with learning and explored the role of academic attribution as a mediator. Five hundred fifty-three nursing college students from Hebei and Hunan provinces in China participated in the online questionnaire. The results revealed that effort plays a mediating role in the relationship between academic self-efficacy and learning engagement.

Keywords: Academic self-efficacy; Learning engagement; Online learning; Mediating role; Effort

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1. Introduction

The advancement of intelligent technology is driving changes in education [1]. With the evolution of global innovative education, education has been enriched with resource sharing, open space, interactive diversity, personalized learning, diverse teaching methods, and teaching data. This is likely to challenge learners to become more independent in their learning. Unlike traditional classrooms, online learning can easily lead to burnout due to social limitations and lack of structure and discipline [2]. Research indicated that nursing learners have experienced burnout due to stress [3]. A meta-analysis suggested that academic burnout significantly impacts academic achievement [4]. Therefore, it is crucial to focus on improving nursing learners' efficient and positive online intellectual and academic performance.

Numerous studies have shown that active engagement in learning significantly positively impacts academic performance [5-8]. High levels of learning engagement are often related to the learning atmosphere [9], learning motivation [7], emotional interaction [10], and metacognition [11]. It is evident that the individual subjective

factors of learners play a crucial role in this. Academic self-efficacy, a commonly studied individual cognitive factor [12,13], has been found to be associated with learning engagement [14-16]. However, the specific way in which academic self-efficacy relates to learning engagement is not fully understood. Therefore, this study aims to further investigate the connection between academic self-efficacy and learning engagement in online intelligent education and to explore the mediating role of academic achievement attribution.

2. Materials and methods

2.1. Participants

Convenience sampling was employed to recruit nursing students from Hebei and Hunan provinces in China. The inclusion criteria were: (1) being nursing students, (2) having experience with online learning, and (3) providing informed consent and participating voluntarily. Before completing the questionnaire, all participants read and signed the informed consent online. This study was approved by the Ethics Committee of Hebei University of Traditional Chinese Medicine (Approval number: YXLL202309003). The online questionnaire was distributed from September to October 2023 by trained professional counselors, who were available to answer questions and clear doubts. A total of 553 valid questionnaires were collected, demonstrating an effective rate of 95.43%.

2.2. Measurement of structures

2.2.1. Demographic profiles

Information on the following was gathered: participants' age, gender, educational background, single child, family residence, degree of liking in nursing, whether to engage in nursing-related work after graduation, and other details.

2.2.2. Academic self-efficacy scale

This scale was made by Pintrich *et al.* [17], and later translated and revised by Liang [18]. The tool used in the study had two dimensions: academic ability self-efficacy (11 entries) and academic behavior self-efficacy (11 items). The scale used in the study showed a Cronbach's α of 0.940.

2.2.3. Learning engagement scale

The study used the Utrecht Work Engagement Scale-student (UWES-S) [19], which was translated and adapted into Chinese by Li and Huang [20]. This scale consisted of 17 items, categorized into three dimensions: dedication, vigor, and concentration. It employed a 7-point Likert scale (0–6). In this study, the Cronbach's α of this scale was found to be 0.967.

2.2.4. Academic achievement attribution scale

The achievement attribution subscale in Multidimensional-Multiattributional Causality Scale (MMCS) [21] was used in this study, including 24 items adopting a 5-point Likert score (0–4). This study mainly examined the tendency of participants to internal attribution (ability, effort) and external attribution (context, luck) of academic achievement in online learning. In this study, the Cronbach's α of this scale was 0.905.

2.3. Data analysis

Statistical analysis was conducted using SPSS24.0 and AMOS24.0. Firstly, SPSS24.0 was used for statistical description to test the differences of dependent variables in different groups and to determine the relationship between variables using Pearson correlation analysis. Multiple linear regression analysis was used to identify influencing factors. Following the guidelines of Baron and Kenny [22], AMOS24.0 was used to construct a hypothetical model with three explicit variables. The Maximum Likelihood (ML) method was employed to verify the relationship between the variables and the suitability of the model, as suggested by Hu and Bentler [23]. Finally, the mediation effect was tested using the Bootstrap method with 5,000 repeated samples, and 95% confidence intervals were calculated. A significance level of $P < 0.05$ was considered statistically significant.

3. Results

3.1. Common method deviation test

The data in this study was processed and analyzed using Harman's single-factor method. The results indicated that there are ten factors with eigenvalues greater than 1. The first factor explains 19.20% of the variance, well below the critical threshold of 40%. This suggests that the data is not significantly affected by common method bias and can be further analyzed.

3.2. Comparing the engagement levels of nursing students with different characteristics in online learning

The average age of 553 nursing majors was 19.85 ± 1.021 years old. The comparison of learning engagement levels of nursing majors with different characteristics in online learning is presented in **Table 1**.

Table 1. Description of the participants' characteristics and comparison of levels of learning engagement (n = 553)

		Frequency	% Mean	Learning engagement			
				x	*t/F*	*P*	
Gender	Male	91	16.5	59.451	14.189	1.617	0.106
	Female	462	83.5	57.004	12.984		
Educational background	Junior college	257	46.5	57.152	13.627	-0.423	0.673
	Undergraduate	296	53.5	57.628	12.852		
Family residence	City	106	19.2	58.6321	14.32834	0.564	0.569
	Town	139	25.1	57.0791	13.09169		
	Village	308	55.7	57.1331	12.87468		
Single child	No	430	77.8	57.2698	12.82050	-0.456	0.649
	Yes	123	22.2	57.8862	14.52652		
Degree of liking in nursing	Strongly dislike	10	1.8	51.3000	21.92436	11.910	0.000
	Dislike	33	6.0	51.3939	9.26667		
	Neutral	294	53.2	55.7313	12.15258		
	Like	188	34.0	59.5266	12.72138		
	Strongly like	28	5.1	70.0357	17.19492		
Whether to engage in nursing-related work after graduation	No	70	12.7	55.2571	13.97584	-1.459	0.145
	Yes	483	87.3	57.7184	13.07858		

3.3. Correlation analysis of research variables

Pearson correlation analysis indicated a significant positive correlation between academic self-efficacy, academic achievement attribution, and learning engagement ($P < 0.05$), as shown in **Table 2**.

Table 2. Correlation analysis of study variables (r)

		1	2	3	4	5	6
1	Academic self-efficacy	1					
2	Learning engagement	0.596**	1				
3	Internal attribution: Ability	0.322**	0.356**	1			
4	Internal attribution: Effort	0.263**	0.367**	0.664**	1		
5	External attribution: Context	0.171**	0.170**	0.535**	0.163**	1	
6	External attribution: Luck	0.193**	0.221**	0.580**	0.214**	0.848**	1

*$P < 0.05$, **$P < 0.01$

3.4. Multiple linear regression analysis of factors influencing learning engagement in online education for nursing students

In this study, we considered the learning engagement of nursing students in online learning as the dependent variable, and the independent variables were the ones with statistical significance in the univariate analysis and academic self-efficacy. The results of the multiple linear regression analysis indicated that academic self-efficacy ($t = 13.717$, $P < 0.001$) and internal attribution effort ($t = 4.183$, $P < 0.001$) were the factors that affect the learning engagement of nursing students in online learning, as shown in **Table 3**.

Table 3. Multiple linear regression analysis of factors influencing learning engagement ($n = 553$)

	B	Standard error	Beta	*t*	*P*
Constant	-6.602	3.420		-1.931	0.054
Degree of liking in nursing	1.137	0.625	0.064	1.819	0.069
Academic self-efficacy	0.568	0.041	0.503	13.717	0.000
Internal attribution: Ability	0.082	0.232	0.020	0.353	0.724
Internal attribution: Effort	0.729	0.174	0.195	4.183	0.000
External attribution: Context	-0.190	0.209	-0.057	-0.911	0.363
External attribution: Luck	0.449	0.239	0.122	1.881	0.060

Notes: $R^2 = 0.412$, Adjusted $R^2 = 0.406$, $F = 63.879$, $P < 0.001$

3.5. Testing the structural model and examining the relationships between constructs

The model fitting results indicated that the model had 0 degrees of freedom, suggesting that the estimated parameters were equal to the covariance matrix elements. The relationships between the variables were demonstrated in **Table 4** and **Figure 1**, while the indirect effects were presented in **Table 5**. Bootstrapping analyses (5,000 process repetitions) showed that the indirect effects of academic self-efficacy on learning engagement through effort were significant and positive (standardized indirect effect 0.059, 95% CI [0.033, 0.093], excluding 0, $P < 0.01$). The three dimensions of academic attribution—ability, context, and luck—were found to be insignificant in multiple regression analysis and were therefore not included in the structural

equation model analysis.

Table 4. Results of the structural model: Tests of hypothesized associations between constructs.

	Estimate	Standard error	Critical ratio	*P*
ASE → E	0.263	0.012	6.393	***
ASE → LE	0.536	0.038	15.73	***
E → LE	0.226	0.128	6.64	***

Abbreviations: ASE: Academic self-efficacy; E: Effort; LE: Learning engagement; ***$P < 0.001$

Table 5. Bootstrap truncated regression results

Relationships	Point estimate	Product of coefficients		Bootstrapping 5,000 times 95% CI				*P*
		Standard error	Z	Bias-corrected		Percentile		
				Lower	Upper	Lower	Upper	
Standardized indirect effects								
ASE→E→LE	0.059	0.015	3.933	0.035	0.095	0.033	0.093	
Standardized direct effects								
ASE→LE	0.536	0.039	13.744	0.458	0.609	0.458	0.609	
Standardized total effects								
ASE→LE	0.596	0.037	16.108	0.516	0.66	0.519	0.662	

Abbreviations: ASE: Academic self-efficacy; E: Effort; LE: Learning engagement

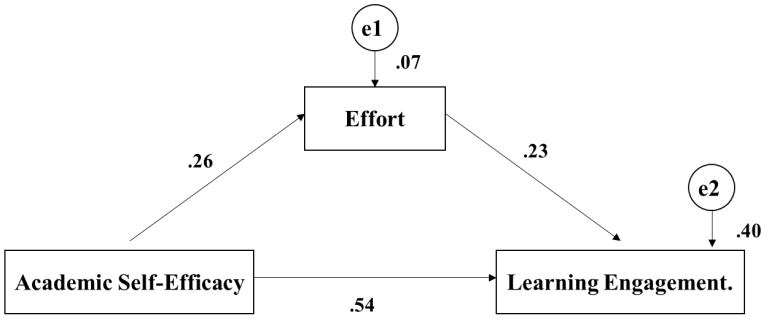

Figure 1. Standardized path coefficient of the model

4. Discussion

Online education in China is flourishing. With the rise in academic burnout, many educational researchers are focusing on the key factor of learning engagement. There is limited research on the connection between academic self-efficacy and learning engagement. Therefore, this study explored how academic achievement attribution affects the relationship between academic self-efficacy and learning engagement among nursing majors in online learning. The findings of this study indicated that the academic self-efficacy of nursing college students directly and positively influences their learning engagement. In other words, higher academic self-efficacy leads to higher levels of learning engagement among nursing college students. This result is in line with previous studies [14].

According to Bandura's social cognitive theory [24], academic self-efficacy refers to a learner's belief that their learning or behavior can achieve a certain level. Additionally, academic self-efficacy was identified as one of the attributes of academic resilience among nursing students [25]. Halverson and Graham [26] proposed that learners' participation in blended education encompasses two aspects: cognition and emotion. These findings indicated that nursing educators can utilize tiered strategies to enhance students' academic self-belief and individual cognitive factors in online learning, thereby boosting students' engagement. The results of this study indicated that the effort dimension in internal attribution significantly acts as a mediator in the relationship between academic self-efficacy and learning engagement. This finding is supported by previous research. Studies have shown that reflection could help to increase engagement in learning [27], and there was an intrinsic relationship between attribution style and learning self-efficacy [28]. According to attribution theory, attribution refers to how people's beliefs, feelings, and behaviors influence future events [29]. Therefore, enhancing learners' positive internal attribution in online education can regulate self-cognitive beliefs and learning engagement.

5. Limitations

This study has a few limitations. Firstly, using convenience samples restricts the generalizability of the results. Secondly, the cross-sectional design only looks at the variable level of the sample at a specific time and does not provide dynamic longitudinal data. Lastly, many factors in online learning influence learners' engagement. This paper focuses explicitly on two cognitive factors: academic self-efficacy and attribution. Therefore, future studies should explore whether the relationship between academic self-efficacy, academic attribution, and learning engagement changes over time. Additionally, other factors should be included to examine whether there is a more complex mediating effect.

6. Conclusion

This study utilized a structural equation model to explore how academic self-efficacy influences learning engagement in online learning and the mediating role of academic attribution. The results indicate a positive correlation between academic self-efficacy and learning engagement in nursing students' online learning. Additionally, the effort dimension of academic attribution significantly impacts the level of learning engagement and acts as an intermediary between academic self-efficacy and learning engagement. These findings highlight the importance of academic self-efficacy, learning engagement, and positive attribution in online learning. These results can serve as a valuable resource for educators using online resources for teaching. This information is useful for developing effective educational strategies and interventions that encourage students to adopt positive and active learning behaviors, ultimately enhancing the effectiveness of online education.

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