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Research Article

Influence Mechanism of Academic Motivation on Academic Achievement of College Students in Shanxi Province in China

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ABSTRACT

This study adopts a quantitative approach and the perspective of learning engagement to examine the relationship between academic motivation and academic achievement among college students in Shanxi Province in China. Tools uses the questionnaire and sample size of 400. The reliability is generally expressed by Cronbach's coefficient that greater than 0.8, which indicated that the measurement scales have high reliability. Analysis uses SPSS 25.0 and Amos 22.0. The findings demonstrate hypothesis as (1) academic achievement is positively impacted by their academic motivation; (2) learning engagement is positively impacted by their academic motivation; (3) academic achievement is positively impacted by their learning engagement; (4) learning engagement plays a mediating role between academic motivation and academic achievement. As a result, this study gives comparable countermeasures and recommendations for four levels: college students, colleges and universities, government, and parents.

1. Introduction

People's focus has shifted from the quantity to the quality of college students' training as a result of the rising popularity of higher education, the globalization of the knowledge economy, and the dire employment situation for college students year after year, then how to ensure the quality of higher education and improve the educational outcomes of college students is the common concern of society, universities, college students and their parents and other stakeholders of higher education (Ma Junfeng, & Hu Yangguang, 2022). The undergraduate period is the foundation stage for college students' academic improvement and individual comprehensive development, and also the double adaptation period of college students' campus life and social life (Zhao Pengyan, & Bai Hua, 2022).

In fact, many literatures have shown that the influence of academic motivation on academic achievement is more introverted and hidden than that of learning purpose, but the influence on students' academic achievement is very significant. Focusing on the process and benefits of college studies can help to strengthen the cultivation mechanism of undergraduates in higher education, increasing the competitiveness of our human resources and students' individual comprehensive ability. To raise the overall level of college students' academic achievement, it is crucial to understand the internal influence mechanism between academic motivation, learning engagement, and academic achievement.

2. Objectives

This study is to investigate the relationship between college students' academic motivation, learning engagement and academic achievement and to examine the mediation of learning engagement between academic motivation and academic achievement.

Literature Review

1 Academic motivation

Liu Mingjuan, et al. (2016) pointed academic motivation is a dynamic factor that stimulates and maintains learning behavior by coordinating the individual's intrinsic requirements with the extrinsic inducement of learning behavior under the action of self-regulation. According to the source of academic motivation, Pi Liansheng (1996) divided the dimensions of academic motivation into two dimensions: intrinsic motivation, and extrinsic motivation.

Intrinsic motivation: according to Zeng Zhihong (2013), intrinsic motivation is the inner drive that makes people seek novelty, challenge, and extend and use their personal abilities to explore and learn. Koyuncuoglu, Ö. (2021) believed that intrinsic motivation is the desire to undertake a task out of personal interest or pure pleasure.

Extrinsic motivation: extrinsic motivation is the motivation to learn caused by inducements other than learning activities (Yu Qian, Liu Jinlan, & Zhao Yuan, 2018). There are many factors that influence academic motivation. Chen Minyu and Feng Zhen (2022) empirically confirmed that college students' motivation is influenced by a combination of factors, such as beliefs, arbitrary standards, and notions of behavioral control, with different degrees of influence. Wu Yongyuan and Li Shuhao (2019) conducted an empirical study on the academic achievement of students in the "top-notch program" and showed that the impact of intrinsic motivation on academic achievement was significantly higher than that of extrinsic motivation.

2 Learning engagement

Peng Jie, et al. (2022) proposed that learning engagement is a contextualized and diversified structure, which means that learners not only pay attention to “quantitative input” but also “qualitative input” in learning activities. Learning engagement was split into three dimensions by Zhang Qi and Wang Hongmei (2019): behavioral engagement, emotional engagement, and cognitive engagement, and it is her three-dimensional division that was used in this study.

Behavioral engagement: it speaks about the time, work, and energy that people devote to educational pursuits, which are observable outward behaviors and are important factors influencing learning performance (Wang Hongmei, Zhang Qi, & Huang Zhinan, 2019). Currently, studies related to behavioral engagement input focus on the following: theoretical models, e.g., behavioral engagement theory was used by Ma Zhiqiang, et al. (2017) to create a model of online learning behavior; evaluation indicators, e.g., based on the education cloud platform, Zhang Qi, et al. (2018) developed a paradigm for assessing behavioral engagement in a blended learning environment; related status, e.g. Lin C. C., et al. (2012) based on the WeShare social bookmarking application, tracked learners’ behaviors and recorded them as log data, and explored behavioral engagement patterns using clustering; impact on learning outcomes, e.g., Liu Zheyu, et al. (2017) explored the internal mechanism of behavioral engagement affecting deep learning in a virtual reality environment.

Emotional engagement: it also goes by the name of psychological engagement. It speaks of joyful emotional reactions to academic work or other people (such as teachers and peers) as well as a feeling of community at school (Liu Fanhua, & Yi Xitian, 2021). Wang Jian and Yan Zhaocun (2023) demonstrated that emotional engagement, as one of the main dimensions of learning engagement, performs a crucial function in hybrid collaborative learning and that positive emotional engagement serves a crucial function in improving academic performance. However, in the previous studies on the dimensions of learning engagement, most of them centered on the more explicit behavioral engagement and fewer studies on emotional engagement.

Cognitive engagement: it is a form of mental exercise that demands a high level of involvement with the learning processes and mental tools that students employ (Sheng Kai, 2022). Zhou Yuan, et al. (2018) explored cognitive engagement in terms of students’ mastery of knowledge, and their study showed that learners with high levels of mastery tend to have a stronger desire to learn and are able to revisit and sort out ideas. Learners with low cognitive engagement are shallowly engaged at the cognitive level, remaining only at the level of memorization of knowledge. Ma Dongmei (2022) argued that behavioral engagement is more significantly related to academic achievement than the affective and cognitive dimensions.

3 Academic achievement

The United States has increasingly conducted study on college students’ academic achievement since 1960s. Bloom thought about incorporating information, beliefs, and behaviors that are appropriate (Park, S. Y., et al., 2014). Cai Wenbo and Cao Xu (2019) believed that academic achievement comprises all areas of a student’s knowledge, skill, and accomplishment growth in addition to their academic performance in school. This study divides college students’ academic achievements into two parts, one is application skills, the other is self-improvement.

4 IPO Theory

In order to discuss team performance, McGrath initially suggested the input-process-output theoretical framework model (Input-Process-Outcome: IPO) in 1964 (Wei Xiaoyu, 2018). Input, refers to the variables that affect how team members interact. Processes are interactions among team members that guarantee a task is finished. Processes are essential to the model because they explain how the team's inputs result in results. Team performance and members' emotional reactions are examples of outcomes. This study regards higher education as a project, independent variable "academic motivation" as the input variable (I), intermediate variable "learning engagement" as the process variable (P), dependent variable "academic achievement" as the output variable (O).

5 Previous studies

Yu Qian, Liu Jinlan, et al. (2018) studied 400 undergraduates of Tianjin university and found that cognitive engagement had a direct and substantial beneficial effect on academic achievement. Luo Jinhua, Shi Wenwen, et al. (2019) conducted empirical research on sports students, a special group, and concluded that student engagement had a mediating effect and was significantly correlated with academic performance. Medical students from a university were used as research subjects by Sun Song, Liu Xiaochuan, et al. (2020) to examine the connection between academic motivation, learning engagement, and academic achievement. It is discovered that learning engagement has a partly mediation role in the influence of academic motivation on academic achievement and has a positive predictive effect on academic achievement.

Literature review above reveals that only by combining academic motivation and learning engagement can they better explain and predict college students' academic achievement. Therefore, it is essential to carry out this research.

3. Research Methodology

1 Population and sample

The survey covers college students enrolled in provincial comprehensive, engineering, medical, teacher training and other types of universities. A sample size of 400 was calculated according to the Yamane formula (Yamane, 1973). The data was collected through the Chinese online data collection platform "Questionnaire Star". There were 430 questionnaires distributed in total, 400 of which were valid, and 93% of them were actually answered.

According to the descriptive statistics of demographic variables, male respondents were the majority (64%) in this survey, which was related to the number of science and engineering majors in the surveyed universities. There are about equal numbers of freshmen, sophomores, and juniors according to grade distribution, and the number of seniors is the least (17.3%), which is consistent with the current situation that seniors go out for internship or are busy with employment and graduate school. In terms of the distribution of majors, the highest proportion of science and technology (77%); the percentage of parents with education at high school or below is as high as 79.5%, which is comparable to the percentage of rural students (65.8%). Finally, 38% of the respondents are class leaders of students.

2 Questionnaire design and measurement

The measurement tools employed in this investigation were developed from earlier research and have been validated. There are two sections to the questionnaire. The

demographic data of the respondents are in the first section, such as gender, profession, etc. All constructs in the conceptual framework are tested in the second section. This section's items are all scored using a five-point Likert scale (1 means "strongly disagree" and 5 means "strongly agree"). Academic motivation scale and learning engagement scale for college students were used as developed by Yu Qian et al. (2018). Academic achievement scale was adopted from the one developed by Xu Changyong (2000).

3 Reliability and validity analysis

The test of reliability is generally expressed by Cronbach's coefficient. The reliability of the relevant variables is examined using SPSS 25.0 and Amos 22.0, and the Cronbach's alpha for the three scales of academic motivation, learning engagement, and academic achievement were 0.864, 0.955, and 0.898, respectively, all of which are greater than 0.8, which indicated that the measurement scales have high reliability.

The validity analysis mainly analyzed the content validity, convergent validity and discriminant validity of the scales. In terms of content validity, the scales of the variables have good content validity because they are based on maturity scales. All observed variables' factor loads that relate to latent variables fall between 0.6 and 0.9. As demonstrated by the table below, the CR of every dimension is greater than 0.7, Each construct's square root of AVE is bigger than the standardized correlation coefficient off the diagonal, and the AVE is greater than 0.5. This demonstrates the high validity of all scales.

Table 2 Convergent Validity of Variables

	CR	AVE
Intrinsic motivation	0.905	0.545
Extrinsic motivation	0.786	0.555
Behavioral engagement	0.922	0.628
Emotional engagement	0.944	0.709
Cognitive engagement	0.926	0.758
Academic achievement	0.919	0.587

Table 3 Discriminant Validity Test Results

	IM	EM	BE	EE	CE	AA
Intrinsic motivation	0.738					
Extrinsic motivation	0.678	0.745				
Behavioral engagement	0.666	0.626	0.792			
Emotional engagement	0.668	0.590	0.784	0.842		
Cognitive engagement	0.722	0.555	0.754	0.815	0.871	
Academic achievement	0.716	0.588	0.664	0.638	0.710	0.766

4. Results

1 Model fit results

In this study, Maximum Likelihood Estimation is used to determine how well the theoretical structural model fits the actual data obtained. A better fit means that the model is closer to the sample (Zhai Hongkun, Li Qiang, & Wei Xiaowei, 2022). The fit metrics of the model

are analyzed and are shown in the following table. As every indication falls inside the permitted range, the model fits nicely.

Table 4 Model Fit Results

	X ² /df	RMSEA	GFI	AGFI	CFI	IFI	TLI
Default Model	2.825	0.068	0.901	0.912	0.910	0.910	0.901
Standard	(1,3)	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9

2 Hypothesis testing results

1) Path coefficients and significance. The table below displays the outcomes of the path test between the latent variables.

Table 5 Paths Test Results between Latent Variables

	Paths	Estimate	S.E.	T-Value	P	Results
H1a	IM --->AA	0.354	0.084	4.195	***	Accepted
H1b	EM --->AA	0.022	0.048	0.459	0.647	Rejected
H2a	IM --->BE	0.044	0.102	0.454	0.666	Rejected
H2b	IM --->EE	-0.085	0.096	-0.869	0.376	Rejected
H2c	IM --->CE	0.959	0.083	11.593	***	Accepted
H2d	EM --->BE	0.162	0.059	2.568	***	Accepted
H2e	EM --->EE	0.199	0.053	3.865	***	Accepted
H2f	EM --->CE	-0.042	0.061	-0.69	0.490	Rejected
H3a	BE --->AA	0.129	0.058	2.232	**	Accepted
H3b	EE --->AA	0.029	0.068	0.387	0.655	Rejected
H3c	CE --->AA	0.166	0.075	2.222	**	Accepted

*p<0.1, **p<0.05, ***p<0.01

Since IM positively affects AA, H1a and H1 are established. IM positively affects CE, EM positively affects BE and EE, so H2, H2c, H2d and H2e are all accepted. BE positively affects AA, and CE positively affects AA, so H3, H3a and H3c are accepted. However, H1b, H2a, H2b, H2f and H3b are all rejected.

2) The mediating effect test of learning engagement.

The mediating effect test of learning engagement are reported. If the p-value is less than 0.1, the test is considered successful because the null hypothesis is accepted at a 10% level.

Table 6 Intermediary Effect Test

Path	Estimate	Product of Coefficients		Bootstrapping				P
				Bias-corrected 95% CI		Percentile 95% CI		
		S.E.	Z	Lower	Upper	Lower	Upper	
Total: IM→AA	0.518	0.112	4.625	0.333	0.701	0.337	0.704	0.000
IM→BE→AA	0.006	0.015	0.400	-0.011	0.043	-0.017	0.032	0.442
IM→EE→AA	-0.002	0.015	-0.133	-0.042	0.010	-0.030	0.016	0.599
IM→CE→AA	0.160	0.093	1.720	0.004	0.313	0.013	0.323	0.091
Total: EM→AA	0.040	0.023	1.765	0.019	0.145	0.019	0.146	0.047
EM→BE→AA	0.021	0.016	1.250	0.003	0.060	0.001	0.052	0.030
EM→EE→AA	0.005	0.023	0.217	-0.018	0.061	-0.023	0.050	0.639
EM→CE→AA	-0.007	0.016	-0.438	-0.042	0.011	-0.033	0.017	0.414

The table above shows that IM→AA has a cumulative effect, the confidence interval [0.337, 0.704] does not include 0, $P < 0.1$, indicating that the total effect is valid. In the indirect effect of IM→BE→AA, the confidence interval [-0.017, 0.032] contains 0, indicating that the indirect effect is not valid, so H4a is rejected. In the indirect effect of IM→EE→AA, the confidence interval [-0.030, 0.016] contains 0, indicating that the indirect effect is not valid, so H4c is rejected. In the indirect effect of IM→CE→AA, the confidence interval [0.013, 0.323] does not include 0, $P < 0.1$, indicating that the indirect effect is valid, that is, the mediation effect exists, and the direct effect of IM → AA is significant. Therefore, the path IM→ CE→ AA passes the test, that is, IM affects AA through CE, so H4e is accepted, and CE is a partial intermediary role.

In the total effect of EM→AA, the confidence interval [0.019, 0.146] does not include 0, and $P < 0.1$ indicates that the total effect is valid. In the indirect effect of EM→BE→AA, the confidence interval [0.001, 0.052] does not include 0, $P < 0.1$, indicating that the indirect effect is valid, that is, the mediation effect exists, but the direct effect of EM→AA is not significant, therefore, the path EM→BE→AA passes the test, so H4b is accepted, and BE is a complete intermediary role. In the indirect effect of EM→EE→AA, the confidence interval [-0.023, 0.050] contains 0, indicating that the indirect effect is not valid, so H4d is rejected. In the indirect effect of EM→CE→AA, the confidence interval [-0.033, 0.017] contains 0, indicating that the indirect effect is not valid, so H4f is rejected.

To sum up, H4b and H4e are accepted, while H4a, H4c, H4d and H4f are rejected. The path AM→LE→AA passes the test, so H4 is accepted.

5. Discussion

1. Academic motivation significantly improves academic achievement. In terms of dimensions, academic achievement is significantly impacted favorably by intrinsic motivation, as contrast to extrinsic motivation.

Students with higher intrinsic motivation, their motivation for learning comes from the recognition of learning value and interest in learning, have full learning enthusiasm, a strong desire for knowledge, tenacious learning will and a high degree of learning consciousness, so that their academic achievements, especially good academic achievement. In contrast, those students with low intrinsic motivation lack understanding and recognition of learning value, lack interest in learning, lack of internal motivation to study seriously, always try to escape academic challenges and difficulties, lack of persistence and self-control in the learning process, so they will gradually lag behind those students with high intrinsic motivation. The findings of this study support opinions of Liang Yanying (2020), Zhang Yuping (2021), Zhao Min and Li Yongfen (2022).

Therefore, in order to raise the academic achievement of college students, we cannot ignore the important influence of academic motivation.

2 Academic motivations significantly improve learning engagement. It is essentially in line with the findings of pertinent domestic and international studies. Dong Guangxin (2021) conducted an empirical study on freshman students, and the results showed that some academic motivation factors have a strong inverse relationship with learning engagement.

The outcomes of this research demonstrate that intrinsic academic motivation has a favorable and significant impact on cognitive engagement with regard to the many characteristics of learning engagement, but has no significant influence on behavioral and emotional engagement. Extrinsic academic motivation has strong and favorable effects on behavioral and emotional engagement, but not on cognitive engagement. This is because respondents with strong external academic motivation have stronger action motivation than those with strong intrinsic motivation. In the absence of clear utilitarian goals, intrinsic motivation is not easy to form emotional and behavioral actual engagement but can only form active participation in cognitive learning. The findings of this investigation are congruent with those of Yu Qian, et al. (2018), who believed that extrinsic motivation is the academic motivation generated for some incentive, rather than the will and will of students themselves. Therefore, extrinsic motivation can only have a limited impact on students' engagement as shown in their outward conduct and emotions but cannot make students have inner cognition of learning activities.

Therefore, only by internalizing extrinsic motivation of students and transforming it into the intrinsic motivation of students' self-identification, can students be promoted to participate deeply in learning activities.

3 Learning engagement significantly improves academic achievement. This conclusion has been confirmed in previous studies. Academic achievement was positively correlated with learning engagement, as demonstrated by Sun Song, Liu Xiaochuan, et al. (2020).

Specific to different dimensions of learning engagement, behavioral engagement and cognitive engagement have a positive and significant impact on academic achievement, although emotional engagement has no discernible effect on academic achievement. The possible reasons are that, in the first place, respondents with stronger behavioral engagement are usually hardworking, and their motivation for action directly affects their academic achievement. Secondly, respondents with stronger cognitive engagement tend to have stronger behavioral engagement. As discussed above, their good intrinsic learning habits and action drive enable them to achieve better academic results. Finally, for respondents with only strong emotional involvement, they often lack executive power, so that such engagement cannot be directly reflected in academic achievement.

Therefore, schools and teachers ought to focus more on college students' learning engagement because it contributes to the promotion of academic achievement.

4 According to the mediating effect test, it is found that learning engagement mediates the relationship between academic motivation and academic achievement. The mediating effect of learning engagement has been proved by previous studies. Zhang Xia (2018) showed that academic motivation, mediated by effort, indirectly affects students' academic performance. By examining medical students at universities, according to Sun Song, et al. (2020), learning engagement played a factor in mediating the relationship between academic aspiration and academic success.

Specifically, behavioral engagement and cognitive engagement have mediating effects, that is to say, academic motivation can improve academic achievement by improving behavioral engagement and cognitive engagement, because behavioral engagement and cognitive engagement can respectively represent learning action motivation and behavioral habits, which will be reflected in academic achievement from short and long-term perspectives. However, there is no mediating effect of emotional engagement, that is, academic motivation does not affect academic achievement through emotional engagement.

6. Conclusion

Based on the conclusions of the previous section, this study will put forward countermeasures and suggestions for comprehensively improving college students' academic achievements. College students should make reasonable plans and goals, face up to individual differences; actively cultivate professional interests; refine solid professional skills; participate in practical activities inside and outside the classroom, and improve their overall personal quality.

Parents should face up to the differences in family cultural capital, and actively urge college students to develop their studies; actively construct new parent-child relationship, keep modest expectations for their children in the future; attaches high value to the family's investment in college students' education and fosters family cultural capital; strengthen the communication with the school coordination, forms the parent-school education resultant force.

Colleges and universities should take student development as the center to create a good education environment; adhere to the student-oriented, comprehensive strengthening of the academic style construction; deepen the connotation of quality construction and innovate talent cultivation mode; grasp the needs of social development, reasonable setting of professional adjustment; actively dock with enterprises and improve the academic guidance and employment guidance system.

The government should allocate public resources scientifically to balance the disparity between urban and rural education; optimize top-level design, while maintaining the importance of initiatives aimed at advancing education; high priority should be given to undergraduate education and the educational requirements of undergraduate programs in the new era.

7. Suggestion

This study has the following limitations. There is room for improvement in the scale design; the cross-sectional data of college students were taken, and there is a lack of long-term tracking of this survey group. In terms of sample selection, the coverage is not large enough, and the sample is not evenly distributed in terms of majors and the gender ratio is disparate. The research method is relatively single and narrow-minded. The questionnaire method has limitations and is vulnerable to the influence of the sample of subjects.

To address the above deficiencies, the following aspects will be refined and improved in the future study. First, the measurement of the variables should be precise in order to reduce the measurement error. Second, study input longitudinal research data will be used to obtain more valuable research results through long-term follow-up surveys. Third, the scope of the sample and observed variables will be expanded, while the study population will be categorized, and group-specific studies will be conducted to further improve the generalization value of this study.

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