

The Double-edged Effect of AI Technology Application on College Students' Innovative Behavior

Xinyi Zhang*, Yi He

Zhejiang Normal University, Jinhua, Zhejiang 321000, China

Abstract: Based on the Learning Requirements-Resources Model, this study explores the “double-edged sword” effect of AI technology application on college students' innovative behaviors by constructing a structural equation model and a moderated mediation effect model.

Keywords: AI Technology Application; College Students' Innovative Behavior; Learning Requirement-Resource model

1. Introduction

Innovative thinking refers to people breaking through the traditional, conventional thinking habits or logic^[1]. The innovative thinking of college students in China lacks practice opportunities and professional guidance, which causes the lack of innovative ability and inhibits the innovation of behavior^[2]. Therefore, it is of great significance to study the relationship between college students' innovative behavior and the application of AI technology to cultivate innovative thinking.

2. Rationale and research hypotheses

The theoretical basis of this study is the Learning Requirements-Resources model derived from the Job Requirements-Resources (JD-R) model. According to Cheng Xuejiao's study^[3], her research verifies the applicability of the JD-R model in the learning domain. Therefore, the JD-R model can be generalized to the learning requirements-resources model. The Learning Requirements-Resources Model divides learning characteristics into two dimensions: learning requirements are the factors that require physical and mental costs in learning; learning resources are the factors that reduce physical and mental costs in learning. The Learning Requirements-Resources Model emphasizes the dual-path hypothesis that learning is both a gain in learning resources and a loss in learning requirements for the individual. And these are the research hypotheses:

2.1 Via learning the path of attrition of insecurity

Learning insecurity refers to an individual's anxiety about learning when he or she feels frustration or fear during the learning process^[4]. Learning insecurity belongs to the negative emotional perception brought about by learning requirements. The application of AI technology may lead to students questioning their learning ability, worrying that it is difficult to meet the needs of the job market, and increasing the sense of learning insecurity. Thus, this paper proposes the following hypothesis.

H₁: AI technology adoption is positively associated with learning insecurity

The level of psychological security affects an individual's learning behavior, innovative behavior, etc^[5]. Learning requirements as an external stimulus will continuously consume individuals' physical and mental or learning resources in the learning situation, which will trigger negative learning behaviors and responses and reduce innovative behaviors. Therefore, this paper proposes the following hypotheses.

H₂: AI technology applications negatively affect college students' innovative behavior through learning insecurity.

2.2 Gaining Pathways via Perceived Autonomy of Learning

Perceived autonomy of learning refers to the ability of learners to take responsibility for their own learning process, including the ability to set their own learning goals, control the progress of learning content, and make rational use of learning resources. Perceived autonomy of learning is a typical learning resource as a manifestation of learning skills, and AI technology can provide personalized learning resources and feedback, which enhances students' active participation in the learning process and strengthens their perceived autonomy of learning. As a result, this paper proposes the following hypotheses.

H₃: AI technology adoption positively correlates with perceived learning autonomy

Perceived learning autonomy implies that college students are able to actively grasp relevant learning resources and opportunities, acquire and transfer new knowledge, skills and ideas, and actively carry out exploratory practices to stimulate innovative behaviors. In the AI

application scenario, college students with a strong perception of learning autonomy will develop innovative behaviors through AI support for personalized learning and practice opportunities.

H₄: AI technology applications positively influence university students' innovative behavior through perceived learning autonomy.

2.3 The moderating role of learning motivation

Learning motivation is the psychological state that stimulates and maintains learning activities and drives behavior toward certain learning goals. Individuals with high motivation to learn are more able to actively face difficult learning tasks, take control of the process and results of using AI technology, quickly adapt to the learning requirements and work environment in AI scenarios, reduce anxiety about being replaced by AI, and reduce learning insecurity. The opposite is true for individuals with low learning motivation. As a result, this paper proposes the following hypothesis.

H₅: Learning motivation negatively moderates the relationship between AI technology adoption and learning insecurity.

In conjunction with H₁ and H₂, the hypothesis of a moderated mediating role is further proposed.

H₆: Learning Motivation Moderates the Indirect Effect of AI Technology Adoption in Suppressing College Students' Innovative Behavior through Learning Insecurity.

The higher the learning motivation adopted by an individual, the more autonomous he/she is in terms of learning, the deeper the knowledge of the current AI technology application environment, and the more active he/she is in utilizing new knowledge and learning resources. As a result, this paper proposes the following hypotheses.

H₇: Learning motivation strength positively moderates the relationship between AI technology adoption and perceived learning autonomy.

Combining H₃ and H₄, this study proposes the hypothesis that there is a moderated mediating role.

H₈: Learning motivation plays a moderating role in the indirect effect of AI technology applications to stimulate university students' innovative behavior through perceived learning autonomy.

3. Research methods

In this study, the university students were selected as the research object, and 358 valid questionnaires were recovered through the questionnaire method, and each variable in the questionnaire was measured by Likert-5 point scale.

4. Results

4.1 Reliability analysis

The factor loadings of each question item of the variables exceeded 0.5, the Cronbach's α coefficients were greater than 0.7, the combined reliability of each variable was higher than 0.7, and the mean variance extracted of each variable was higher than 0.5, which indicates that the variables involved in this study performed well in terms of reliability and convergent validity.

Meanwhile, a validated factor analysis using AMOS 23.0 showed that the square root of the mean extracted variance value of each variable was greater than the correlation coefficient of that variable with the other variables, and the overall discriminant validity was satisfactory.

4.2 Descriptive statistics and correlation analysis

The mean values of the variables ranged from 3.149-3.542, the standard deviations ranged from 0.915-1.074, indicating that the variables had a high level of average agreement, and that there were no outliers or systematic errors in the research data.

Using Pearson's correlation analysis, it was found that every two variables showed a significant correlation with each other. However, the correlation analysis could not exclude the interference of other potential influences, and it was necessary to use structural equation modeling analysis.

5. Hypothesis testing

5.1 Structural equation modeling

In this reaseac, AMOS 23.0 was used to analyze the structural equation modeling of the sample data, to verify some of the research hypotheses and to analyze the effects between the variables. The results of fit fitting: $X^2/Df=1.306<5$, $RMSEA=0.029<0.08$, $CFI=0.991>0.9$, $IFI=0.991>0.9$, the overall reliability of the model is high and the fit is good, and the standardized path coefficients are plotted as shown in Figure 1:

There is a significant positive effect of AI technology application on learning insecurity ($\beta=0.143$, $p<0.05$), hypothesizing that H₁ is proved; and there is a significant positive effect of AI technology application on perceived learning autonomy ($\beta=0.257$, $p<0.05$), hypothesizing that H₃ is proved.

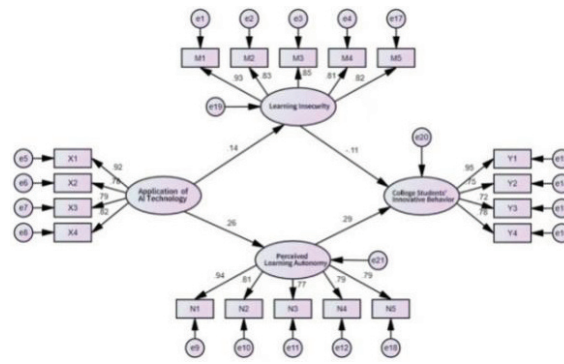


Figure 1. Path diagram of the structural equation model

The bootstrap method was used to test the mediating effect, and the results showed that the indirect effect of AI technology application→learning insecurity→college students' innovative behavior was -0.0194, H₂ proved; the indirect effect of AI technology application→perceived learning autonomy→college students' innovative behavior was 0.0595, H₄ proved.

5.2 Moderating effect test

To test the moderating effect of learning motivation, the moderating effect was plotted as shown in Figures 2 and 3:

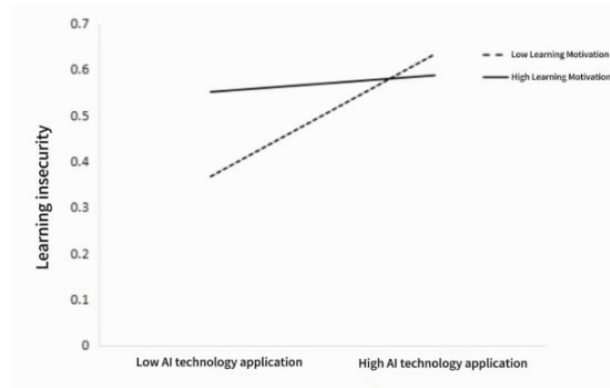


Figure 2. Plot of the moderating effect of learning motivation between AI technology adoption and learning learning insecurity

According to Figure 2, the positive effect of AI technology adoption on learning insecurity is weaker in high learning motivation compared to low learning motivation, H₅ proved.

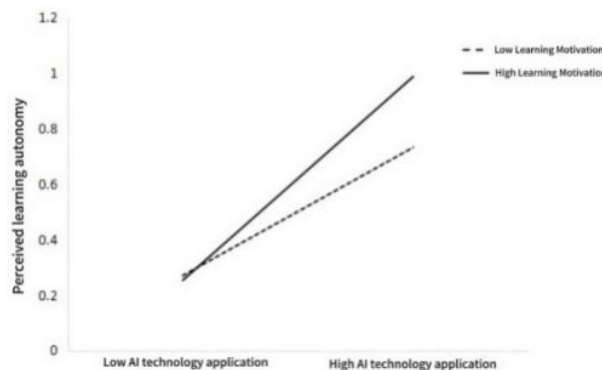


Figure 3. Plot of the moderating effect of learning motivation between AI technology adoption and perceived learning autonomy

According to Figure 3, the positive effect of AI technology application on learning autonomy is stronger in high learning motivation compared to low learning motivation, H₇ proved.

5.3 Moderated mediation effects test

This research used model 7 of PROCESS to conduct a moderated mediation effect test:

Using learning insecurity as a mediating variable, for subjects with high motivation to learn, the value of the effect of AI technology application on learning insecurity becomes subsequently smaller as motivation to learn increases (-0.0325→-0.0023), H₆ proved.

Using the perception of learning autonomy as a mediating variable, for highly motivated subjects(M+1SD), the effect value of the AI technology application on the perception of learning autonomy becomes larger as the motivation to learn increases (0.0221→0.0862), H8 proved.

6. Conclusion

AI technology applications as learning requirements can weaken college students' innovative behavior by enhancing learning insecurity; at the same time, AI technology applications as learning resources can promote college students' innovative behavior by enhancing the perception of learning autonomy. Among them, the enhancement of learning motivation will weaken the negative effect of AI technology application and strengthen the positive effect of AI technology application.

References

- [1] Xin Xin. Research on the Cultivation of Innovative Thinking Ability of College Students in the New Era[J]. Education Modernization, 2020, 7(29):34-37.
- [2] Xu Xujun et al. On the Cultivation of Innovative Thinking Ability of College Students [J]. Light Industry Science and Technology, 2020(4).
- [3] Cheng Xuejiao. Research on the relationship between learning burnout and teaching environment [D]. Central China Normal University, 2016.
- [4] Grout, D.R. Psychological security-insecurity of Illinois central college students. Creativity, 1969, (37), 1-130
- [5] Zheng Yaqian. Mechanisms of learning motivation's influence on college students' innovative behavior-the mediating role of extracurricular activity participation[J]. Fudan Education Forum, 2023, 21(05):63-71.

Funded Project: Provincial Undergraduate Training Program on Innovation and Entrepreneurship(Number:S202410345027)