

The Impact of Artificial Intelligence Tools on College Students' Academic Self-efficacy

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Abstract. With the continuous development of artificial intelligence technology, its impact on higher education teaching has attracted more and more attention. In particular, the question of whether there is a correlation between the use of artificial intelligence software and the academic self-efficacy of college students and what the related factors are is worthy of in-depth exploration in various fields. Based on the questionnaire survey, this study uses logistics regression analysis to analyze data, explore the influence mechanism and conduct attributional discussion. The study found that the use of artificial intelligence software at a certain frequency could improve the academic self-efficacy (ASE) of college students; the frequency of use has a significant impact on it, and the effect on the use and sense of identity is not significant. This study aims to clear the effects of artificial intelligence software on college students' academic self-efficacy and the mechanisms involved, and to provide directions for the innovative reform of higher education and research at the intersection of education and psychology.

Keywords: Artificial intelligence; academic self-efficacy of college students; questionnaire survey; interview; logical analysis.

1. Introduction

In the era of the prevalence of artificial intelligence software today, emerging artificial intelligence software such as ChatGPT and DeepSeek are establishing increasingly profound connections with people's lives, production works and other fields, especially the teaching mode of higher education and its educational philosophy and strategy. Globally, the number of users using artificial intelligence tools has increased on a large scale, and the number of college students has increased accordingly. Moreover, the updates and iterations of science and technology often drives the reform and development of traditional education models, which also has an indelible impact on the learning cognitive mode of college students and their learning efficiency and other related factors. Based on this, many educators and psychologists have launched a new discussion on the linkage mechanism between artificial intelligence tools and psychological factors related to the learning of college students.

By consulting relevant literature, this study found that most psychologists' research is mainly focusing on the study of the correlation and attribution of college students' academic self-efficacy and learning motivation, learning enthusiasm and other factors. For example, in the study of Professor Wang and Professor Miao on the relationship between academic self-efficacy, self-esteem and learning burnout of college students, 834 college students were surveyed using college students' academic self-efficacy questionnaires, self-esteem questionnaires and college students' learning burnout questionnaires. This study found that college students' academic self-efficacy and self-esteem have a predictive effect on learning burnout. The study puts forward the correlation between college students' academic self-efficacy and learning burnout, but does not point out the relationship between it and artificial intelligence [1]. In addition, the identification of the advantages and problems of artificial intelligence software such as ChatGPT and its impact on future educational development involved in the article of Zhong and other professors on the challenges of ChatGPT to education provides a new idea to improve learning efficiency by measuring and intervening students' academic

self-efficacy. However, the written talk only proposes an educational form that integrates human teachers and mechanical teachers (artificial intelligence tools), and does not clearly point out how the two are connected and what is the mediating mechanism [2]. Some researchers have also clearly proposed the challenges brought by ChatGPT intelligent tools to the development of higher education, such as educational ethics - whether the emergence of artificial intelligence will replace the role of teachers, teachers' professional literacy - teachers' skill anxiety and professional value, college students' learning - changes in independent learning ability, etc. This solution focuses on the improvement of artificial intelligent tools, the improvement of the network environment and the digital literacy of teachers and students rather than exploring the relationship between intelligent tools and the psychological factors of users and further research on how ChatGPT affects the development of education is missing [3]. It can be seen that the study on the interaction between various emerging artificial intelligence software and higher education is at the theoretical level, and there is still a certain gap in the in-depth study of the influencing mechanism and the exploration of the psychological factors involved.

In addition, Song and other researchers mentioned in the research literature on the improvement of the independent learning ability of college students majoring in finance and accounting under the technical support of generative artificial intelligence tools. The researchers designed a univariate questionnaire survey to explore whether generative artificial intelligence tools have an impact on the improvement of college students' independent learning ability, and jointly discuss the intrinsic factors such as college students' learning motivation with artificial intelligence tools. However, the experiment only conducts a 20-day self-study test for college students majoring in finance and accounting at the 23rd level of Southwest Nationalities University. The subjects usually spend more time using artificial intelligence tools than ordinary college students, and the research problems are biased towards solving the learning efficiency of online courses, and the additional variables during the period are difficult to control. Therefore, the universality of the study is relatively weak and the problems solved by the research are not comprehensive enough. However, it cannot be denied that it still reveals the positive impact of artificial intelligence tools on students' independent learning [4]. Many studies have proved that artificial intelligence does affect self-efficacy. For example, in a cross-culturally oriented study on the integration of artificial intelligence on employees' creative self-efficacy with the participation of 427 participants from professional fields, these participants analyzed the changes in their perception over time after alternating artificial intelligence integration and non-integration tasks. The results show that artificial intelligence has a positive interactive impact on creative self-efficacy, and this impact is particularly obvious among participants in collectivism culture [5]. And self-efficacy plays a role in influencing college students' behavioral operations in many different dimensions. For example, self-efficacy plays a key role in the rather critical career choice of university students. In a study with 647 Indonesian students in vocational education, using a post hoc research design and structured questionnaires, numerical competence and psychological well-being of the study participants were examined and data were collected from them through a holistic sampling. It was found that sense of efficacy is a key factor in improving career opportunities, and it is also associated with industry-related numerical competence and students' psychological well-being [6]. In addition, JiYoon Kim mentioned in his study that secondary school students with high self-efficacy scored higher than those with low self-efficacy in the areas of environmental awareness and achievement motivation in science activities, and suggested that self-efficacy should be improved in secondary school students [7]. In a study conducted by Prof. Yusong Liang, 455 college students from four universities in Wuhan were used as research subjects, and a self-administered academic self-efficacy scale was used to conduct a questionnaire survey to explore the characteristics of college students of different genders, different grades, different disciplines, and different origins in terms of achievement goal attribution and academic self-efficacy as well as the relationship between the three types of motivational factors. The results of the study showed that both academic self-efficacy and mastery goal-seeking attributions have a causal relationship. [8] Nowadays, it is obvious that AI tools are the key factors influencing college students' self-efficacy, and people should deeply explore the linkage mechanism and study how to utilize AI tools to enhance

college students' academic self-efficacy. However, only a small amount of foreign literature has mentioned the direct relationship between academic self-efficacy and AI tools, and has not pointed out the associated mechanism and its recommendations [9].

Thus, there is a gap in the research to explore more directly and deeply whether there is a certain correlation between college students' academic self-efficacy and artificial intelligence software and its influence mechanism. Moreover, the self-efficacy proposed by Bandura in 1977 [10] has pointed out that college students' academic self-efficacy directly affects their motivation, learning goals, self-esteem, self-confidence, and resistance to frustration, etc., which shows that it is necessary and important to explore the correlation between college students' academic self-efficacy and artificial intelligence tools in depth. Based on a questionnaire survey of college students, this study aims to explore the effects of artificial intelligence tools on college students' academic self-efficacy and the mechanisms involved, and to provide new ideas and directions for the innovative reform of teaching strategies in higher education and research at the intersection of education and psychology.

2. Subject

This study adopts the method of questionnaire survey interview, aiming to reach the research objectives. The questionnaire part of the survey selected several universities in mainland China with different majors and different sources of current college students as the object of the survey, and distributed the questionnaires in the form of questionnaire star. The total number of students surveyed was 103, and the valid questionnaires were 95. (Survey respondents who have never used AI software such as ChatGPT were selected as invalid questionnaires.) Among the college students surveyed in this study, the proportion of men and women is relatively balanced (53.4% of male students and 46.6% of female students), in which the population belongs to a wider distribution (covering a total of 14 cities in mainland China), so it can be assumed that the data obtained from the results of this study are more valuable at the level of college students in the country as a whole. Therefore, it can be assumed that the results of this study are more valuable at the national university level. The design of the questionnaires starts from collecting the basic information of the respondents to understanding the frequency of using AI software and analyzing the needs of the respondents, gradually connecting the use of AI software with the psychological factors of the respondents, and finally collecting the suggestions and outlooks of the respondents for the improvement of the AI software.

The self-administered questionnaire surveyed in this study contains a variety of question types such as single choice, multiple choice, and fill-in-the-blank questions. Different dimensions of questions based on the same nature of linkage are proposed in this questionnaire questions to improve the reliability and validity of the survey data. Since the dependent variables selected for this study are categorical variables, logistic regression model was established to analyze the data and the results are shown below:

Table 1. Variable assignment

	Variable name	Assignment
Dependents	Are you more confident in your learning ability after using ChatGPT?	0=No; 1=Yes
Independent variables	Use ChatGPT or similar software to learn	0=NO; 1=Yes
	Use ChatGPT or similar software for entertainment	0=No; 1=Yes
	Use ChatGPT or similar software to obtain information	0=No; 1=Yes
	Use ChatGPT or similar software to chat with AI	0=No; 1=Yes
	Frequency of using ChatGPT or similar software every week	1=once or less; 2=once to three times; 3=three to five times; 4=five times and above
	ChatGPT or similar software helps you learn	0=No; 1=Yes

This study uses logical regression to assign values to dependent variables and independent variables. Because Question 5 "What do you mainly use ChatGPT or similar software for" is a multiple-choice question, it is divided into 4 single-choice questions for assignment; the sixth question is a single-choice question, which is converted into dumb variables after assignment (as shown in the classification variable code), and then logical regression is used (see Table 1).

Table 2. Classification variable coding

		Frequency	Parameter coding		
			(1)	(2)	(3)
Frequency of use	Once and below	6	.000	.000	.000
	Once to three times	36	1.000	.000	.000
	Three to five times	37	.000	1.000	.000
	Five times or more	16	.000	.000	1.000

The dumb variable conversion of the four options is carried out, and the frequency of "once and below" is used as a reference indicator (see Table 2).

Horizontal axis “Predicted Prob”: indicates the prediction probability, ranging from 0 to 1. The prediction probability here refers to the probability that the sample belongs to the “yes” category.

The sequence of 0 and 1 (dependent variable) under “Group”: represents the category to which the sample actually belongs. 0 means “no” and 1 means “yes”.

Cut Value: 0.5, which is the threshold for judging the category to which the sample belongs. When the prediction probability is greater than or equal to 0.5, the sample is predicted as “yes” (1); when the prediction probability is less than 0.5, the sample is predicted as “no” (0).

Numbers and symbols in the figure: each symbol represents 2 samples, and the numbers directly represent the number of samples. It can be seen from the figure that in areas with low prediction probability (near 0), the actual category is mostly 0; in areas with high prediction probability (near 1), the actual category is mostly 1, but there are also some prediction errors, such as low prediction probability but the actual category is 1, or the prediction probability is high but the actual Samples of category 0 (see Figure 1).

Table 4. Classification table ^a

Actual testing		Prediction			
		Be more confident in learning		Correct percentage	
		No	Yes		
Step 1	Be more confident in learning	No	24	13	64.9
		Yes	14	44	75.9
Overall percentage					71.6

a. The boundary value is. 500

Based on the regression results, it can be obtained that the overall prediction rate of the model is 71.6%. That is, it indicates that the model correctly predicted 71.6% of the cases out of the total sample analyzed. Since the data set is relatively balanced, the accuracy rate obtained is high (see Table 4).

Combined with the specific data from the questionnaire survey, it can be seen that more than 95% of the students believed that the AI software was helpful to their learning, and 61.05% of them felt more confident in their learning ability after using the AI software. At the same time, 76.84% of the students believed that long-term use of AI software had an impact on their information retrieval ability, 61.05% believed that long-term use of AI software had an impact on their critical thinking, and 54.74% believed that long-term use of AI limited their creativity. It proves that even though the use of AI software does improve college students’ academic self-efficacy, it also tends to weaken some abilities to a certain extent. According to the results of logistic regression analysis, there is an association with the frequency of college students’ use of AI, and the optimal frequency of use is 1-3 times per week ($p=0.037<0.05$), while there is no correlation with the purpose of use. ($p>0.05$) (the prediction correctness rate for this finding is 71.6%).

Compared with previous studies, this study reveals more directly that the use of AI software does have a positive effect on college students’ academic self-efficacy, and by exploring the mechanism of this effect, it is found that changes in college students’ academic self-efficacy are most likely related to the frequency of the use of AI software. This may be due to the following reasons: the use of AI software can help them collect more information about their studies in a short time, and the use of AI software can help them complete their study tasks more efficiently and with higher quality. It is recommended that college students control the frequency of using AI software to one to three times a week and receive the information provided by AI critically. It should be noted that the mechanism of AI software’s influence on college students’ academic self-efficacy is very complex, and there are limitations in the manipulation of some variables in this study. The categorization of usage in this

study includes only four types of usage - entertainment, study, chatting, and information acquisition, which can be further subdivided, e.g., study usage can be categorized into reviewing and summarizing the literature, relying on AI to generate and complete homework exams. This study investigates only a few dimensions of college students' creativity, critical thinking, and independent problem-solving ability that may be influenced by AI software. This study only investigated a few dimensions that may be affected, such as creativity, critical thinking, independent problem-solving ability. In reality, there are more dimensions that can be included in the questionnaire, such as: frustration ability, self-esteem and self-confidence, and so on.

4. Conclusion

The questionnaire survey shows that the use of AI software with a frequency of 1–3 times a week can improve the academic self-efficacy of college students. Therefore, college students can control the frequency of use and use AI software to help themselves learn efficiently and with high quality. Colleges and universities can also combine AI software with classroom education innovation - use AI software to expand teaching resources, use AI to optimize classroom interaction and other activities, so as to improve college students' sense of academic self-efficacy and stimulate their learning drive.

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