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2025 Volume 3, Issue 8
Contemporary Education Frontiers
ISSN (Online): 3029-1860 ISSN (Print): 3029-1879

The Impact of Generative AI on College Students' Self-Efficacy

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Abstract: With the rapid development of AIGC (Artificial Intelligence Generated Content) technology in the field of education, its impact on students' learning experience and cognitive development has garnered increasing attention. This study adopts quantitative research methods such as questionnaire surveys, targeting college students as the research subjects. By constructing a structured questionnaire with a scale and collecting valid data, this study processes the data through methods such as correlation analysis after analyzing reliability and validity. The research results indicate that the application of AIGC in classroom teaching significantly enhances college students' self-efficacy. AIGC effectively boosts students' self-efficacy by providing personalized learning support, instant feedback, and an interactive learning environment.

Keywords: Artificial intelligence; AIGC; Self-efficacy

Online publication: September 26, 2025

1. Introduction

Since the first proposal of artificial intelligence in 1956, decades have passed, ushering in an explosive development of generative artificial intelligence driven by large-scale language models. This technological breakthrough marks a new stage in the field of artificial intelligence, shifting from perceiving and understanding the external world to autonomously generating and creating content [1]. As an important branch of artificial intelligence, Generative AI can generate various new contents through deep learning and pattern extraction of massive data. Although these contents have similarities with training data, they are not simply copied and pasted. From the stunning debut of ChatGPT to the continuous iteration and upgrading of multimodal models, generative AI is integrating into various industries with unprecedented depth and breadth [2]. While this technological wave brings great opportunities such as efficiency and convenience, and stimulates innovation potential, it has also sparked extensive discussions in society about the boundaries of academic integrity, technological dependence, and human subjectivity.

The popularization of generative AI has naturally had a profound impact on the learning of contemporary students. Today's college students are in an academic environment characterized by information explosion, fierce competition, and high digitization. The heavy workload runs through their learning careers, and each task demands extremely high requirements for information processing and knowledge integration abilities. In this context, generative AI, with its

powerful content generation and problem-solving abilities, has quickly become a “learning tool” for many students. But this convenience and efficiency have also given rise to a key psychological question: how will generative artificial intelligence affect college students’ self-efficacy? Self-efficacy, proposed by renowned psychologist Albert Bandura, is essentially an individual’s level of confidence and belief judgment about their ability to organize and perform certain tasks [3]. For college students, high self-efficacy means they firmly believe that they can overcome learning difficulties and achieve academic success through their own efforts. This inner belief is the core support that drives their learning motivation and resilience.

This article will deeply analyze the impact of generative artificial intelligence on college students’ self-efficacy, explore its influence on students in the classroom, clarify its dual role of “empowerment” and “weakening”, guide students to have a healthy psychology, make good use of technology, and enhance learning motivation.

2. Literature review

The researchers used AI technology to explore the current situation of mental health education for college students, and pointed out from a psychological perspective that AI technology can effectively improve the efficiency and coverage of student mental health services. Generative artificial intelligence significantly enhances the success experience of college students in learning scenarios by providing instant answers and efficient support, making them the “commanders” of tools. This process helps to enhance students’ confidence, sense of learning control, and autonomy, thereby improving their learning motivation and self-efficacy [4].

Jiang Hua, Wang Chunxiu, and Yang Shudong believe that the impact of artificial intelligence should not only be limited to promoting learning at the technical level, but also help students acquire the ability to explore independently to adapt to today’s rapidly developing era [5]. The breadth, depth, and complexity of the knowledge and information network that artificial intelligence possesses require the cultivation of students’ questioning ability, critical thinking, integration, and creativity. The quality of artificial intelligence answers directly depends on the accuracy of user questioning, and the phenomenon of “illusion”, which generates seemingly reasonable but actually incorrect content, also requires us to always remain clear headed, have critical thinking, be able to evaluate, integrate, and create the optimal solution. Not viewing AI as a dependency ‘crutch’, but continuously improving the ability to control AI, is the key to effectively enhancing self-efficacy [6].

The researchers believe that artificial Intelligence has solved the problem of traditional “one size fits all” teaching models being unable to adapt to individual differences among students through personalized teaching. Generative artificial intelligence can generate personalized teaching, improve efficiency, and to some extent promote educational equity, achieving “one-on-one” teaching support. Its profound value lies in reshaping students’ learning experience, that is, building a safe and sustainable learning environment, transforming “failure” into opportunities, and transforming “passive acceptance” into “active exploration”, thereby effectively enhancing learning motivation and self-efficacy [7].

Lin et al. explored the application effect of AI based chatbots in college students’ after-school review. The study showed that the application of AI chatbots significantly improved students’ academic performance, self-efficacy, learning attitude, and learning motivation, with moderate to large effect sizes. This confirms the effectiveness of AI chatbots in student-centered learning environments, providing empirical support for the application of AI technology in higher education.

(1) Technical characteristics and educational advantages

Generative AI has core technological features such as deep language understanding, contextual memory, real-time interaction, and personalized response, which make it demonstrate unique application value in the field of education. Research has shown that generative AI can provide customized learning support and guidance based on learners’ knowledge levels and learning needs, effectively promoting the development of knowledge construction and critical thinking [8].

(2) Application scenarios and effect

According to the latest research data, China has completed the filing and launch of over 100 generative artificial intelligence service models, with a significant proportion of applications in the education sector. In higher education, generative AI is widely used in various disciplines such as language learning, writing guidance, problem-solving, and programming teaching. In classroom teaching, generative AI is mainly applied in various aspects such as intelligent tutoring, personalized learning recommendations, automated homework grading, and enhanced classroom interaction [9].

(3) Theoretical basis

Self-efficacy, as the core concept of social learning theory, refers to an individual's speculation and judgment on whether they have the ability to complete a certain behavior, and plays a crucial role in the learning process of college students. In recent years, generative AI has been reshaping traditional teaching and learning methods with its powerful natural language processing capabilities, personalized learning support, and instant feedback mechanisms. More and more research is focusing on the impact mechanism of generative AI on college students' self-efficacy in the classroom environment [10].

From the research content of scholars, it can be seen that generative artificial intelligence has a huge impact on students' classroom performance and other practical applications, forming a linkage effect of "psychology technology teaching", which lays the foundation for exploring its relationship with college students' self-efficacy. In addition, there are many shortcomings in the existing research on the impact of artificial intelligence on college students' self-efficacy, and generative artificial intelligence will undoubtedly inject vitality into it, help it solve problems, and achieve further development.

3. Research methods and technical framework

3.1. Generative artificial intelligence

Generative artificial intelligence is a type of AI technology that can autonomously create new content such as text, images, audio, video, code, etc. It learns patterns from massive amounts of data, imitates human creativity, and generates original or highly simulated outputs. Mainly including text generation tools such as ChatGPT and DeepSeek, image generation models such as Doubao, and video generation technologies such as Sora and Pika. In addition, it also includes vertical domain applications such as audio generation (such as ElevenLabs) and code writing (such as GitHub Copilot). The subsequent content of this article will refer to generative AI as AIGC.

3.2. Generative artificial intelligence applied in the classroom

(1) Embedded AI

Using standardized AI tools as a carrier, embedded in various aspects of traditional teaching to improve process efficiency.

(2) Collaborative AI

Supported by a collaborative platform, teachers and students independently use AI tools to design learning activities, achieving "generative teaching design".

(3) Real agent development

Customize and develop AI systems based on teaching scenarios, achieve precise matching of teaching needs through custom standards and local computing power support.

3.3. Students utilize AI applications in the classroom

(1) Information processing

Utilize AI to assist in literature retrieval, generate mind maps, and enhance information screening and integration

capabilities.

(2) Personalized learning

Using adaptive systems to generate differentiated learning paths, such as pushing specialized training for weak knowledge points.

(3) Creative thinking cultivation

Through AI simulation, case analysis and other functions, stimulate critical thinking and innovation ability.

3.4. Students' self-efficacy

It refers to an individual's ability to judge whether they can complete a task, proposed by psychologist Bandura, and directly affects learning motivation, strategy selection, and academic achievement. Students with high self-efficacy tend to actively embrace challenges, have stronger persistence when facing difficulties, and can optimize the learning process through goal setting and metacognitive regulation.

This study takes college students' classroom learning as the scenario, with self-efficacy in college students' classroom learning as the core outcome variable. "College students' mastery of AI" and "the impact of AI on students in the classroom" are used as key antecedent variables. By exploring the specific manifestations and mechanisms of the first two, the comprehensive impact path of the former two on college students' self-efficacy is clarified, and the impact logic of the integration of generative artificial intelligence into classroom scenarios on students' self-efficacy is revealed. (**Figure 1**)

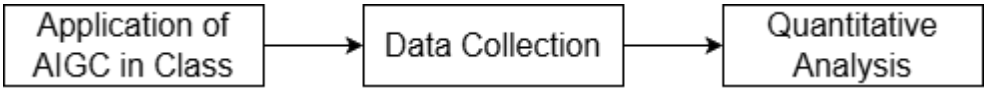

Figure 1. Framework.

4. Research process

4.1. Application process

In the classroom, students can use generative artificial intelligence to assist in the entire process of preview, in class, and review, while enhancing their self-efficacy through "controllable use and feedback reinforcement".

(1) Pre class preparation

Reduce the difficulty of entry and build learning confidence. The core of self-efficacy is' believing in oneself to complete tasks', which can help students quickly overcome initial obstacles and avoid withdrawal due to unfamiliarity. By using AIGC to break down knowledge points, overcome learning difficulties, provide tips and techniques through difficulties, and strengthen students' psychological construction.

(2) In class learning

Strengthen the sense of participation and accumulate the experience of 'I can do it'. Positive feedback in the classroom is the key to enhancing self-efficacy, serving as a tool to encourage students to actively participate rather than passively listening. Real time Q&A and thought completion, using AIGC to quickly generate popular explanations. Classroom task assisted output, group discussions, and pre class speeches can help students organize their thoughts, optimize their expressions, and generate content that can give them more confidence to participate in presentations and accumulate successful experiences.

(3) After class review

Accurately overcome weaknesses and strengthen self-control. By using AIGC to solve problems in a targeted manner, students can clearly see their progress, thereby enhancing their belief in 'I can learn well'. Personalized error review, using artificial intelligence to analyze errors and problem-solving strategies, generates AIGC final reports, allowing students to fill in gaps and weaknesses through practice and feel 'I can correct mistakes'.

Finally, the results are visualized and sorted out, and the learned content is transformed into output results (such as summaries and mind maps) through AIGC, enhancing the sense of control. The generated results will extract key information, which students can directly use for memorization or pre-exam review, seeing clear results that they have mastered the core content, and enhancing their learning confidence.

4.2. Research samples and implementation

The study selected a regular higher education institution in Jiangxi, China, and randomly sampled 88 students from two classes for teaching activities. The teaching process combines a large number of applications of generative artificial intelligence and fully reflects the differences from traditional classroom teaching. The teaching period is 2 months in total, and after the end, a questionnaire survey and interviews will be conducted with students to collect experimental data.

4.3. Data collection and analysis

After implementing teaching, data collection was conducted on experimental samples mainly through questionnaire surveys and interviews. The questionnaire survey is designed in the form of a Likert scale, with options divided into 5 levels. The survey is divided into three parts: Part A: Students' mastery of generative artificial intelligence; Part B: The impact of generative artificial intelligence on students in the classroom; Part C: Students' self-efficacy. Each section is designed with 6 questions, with a total of 18 questionnaire items and a sample size of 88, which can meet the statistical test results.

Based on the questionnaire survey, randomly select students for interviews and design structured questions for the three dimensions involved in the scale. To compensate for the limitations of questionnaire data, explore the deep relationship between generative artificial intelligence and changes in self-efficacy among college students, and further verify and supplement quantitative research conclusions through specific cases, making the study of the impact of generative artificial intelligence on college students' self-efficacy more profound and persuasive.

Data analysis is conducted through quantitative methods, combining reliability analysis and validity analysis. Including descriptive statistical analysis, reliability and validity testing, correlation analysis, and other methods. Being able to scientifically and effectively analyze data, verify hypotheses, deepen conclusions, and enhance research credibility, explore deep correlations between variables, and provide solid empirical support for research conclusions.

5. Research findings

5.1. Descriptive statistics

(1) Part A (Mastery of Generative AI)

This dimension mainly investigates students' actual application of AIGC products. The data results show that the mean of this dimension is 4.267, the standard deviation is 0.700, the minimum value of the average of each item is 4.216, and the maximum value of the average of each item is 4.341. Analyzing the overall mastery level indicates that students have a good grasp of the basic operations of AI and have a certain level of high-level functional application ability.

(2) Part B (Generative AI Classroom Impact)

This dimension includes items such as "improvement of learning efficiency", "deepening of knowledge understanding", and "changes in classroom participation", revealing the specific role and performance of AI in classroom scenarios. The mean of this dimension is 3.880, the standard deviation is 0.787, the minimum average value of each item is 3.477, and the maximum average value of each item is 4.102. AIGC has a more significant effect on improving classroom efficiency.

(3) Part C (College Students' Self Efficacy)

This dimension mainly focuses on students' self-perception and designs questions centered on self-efficacy. The

data results show that the mean value of this dimension is 4.058, the standard deviation is 0.779, the minimum average value of each item is 3.795, and the maximum average value of each item is 4.125, reflecting that college students have stronger confidence in classroom learning and can have a relatively good sense of self-efficacy.

5.2. Reliability and validity test results

5.2.1. Reliability analysis results

(1) Overall scale reliability

The Cronbach's alpha coefficient of the total scale in the questionnaire results is 0.952, which is greater than the standard of 0.8, indicating excellent overall internal consistency of the scale.

(2) Reliability of each dimension

Cronbach's alpha coefficients of each sub dimension are presented separately, where Part A: AIGC mastery, alpha coefficient is 0.912; Part B: The impact of AIGC on the classroom, with an alpha coefficient of 0.906; Part C: Student self-efficacy, with an alpha coefficient of 0.923. The standardized Cronbach's alpha coefficients of the three sub dimensions are all greater than 0.9, demonstrating excellent overall internal consistency of the scale.

5.2.2. Validity analysis results

The structural validity was evaluated through exploratory factor analysis (EFA): the reported KMO value was 0.888, and the Bartlett sphericity test results showed a significance p-value of less than 0.0001, indicating a significant level of correlation between variables. The factor analysis was effective and appropriate.

When the number of principal components in factor extraction is 3, the eigenvalue explained by the variable is less than 1, and the contribution rate explained by the variable reaches 73.347%, which is consistent with the preset dimension.

5.3. Core research hypothesis testing results

5.3.1. Verification of the relationship between generative AI mastery and self-efficacy

(1) Correlation analysis results

The Pearson correlation coefficient of the data results showed significant correlation ($p < 0.01$), with a significant positive correlation between "AI mastery level" and "use of AIGC in the classroom", and a significant positive correlation between "use of AIGC in the classroom" and "student self-efficacy", confirming the direction and strength of the association between the three.

(2) Regression analysis results

Self-efficacy as the dependent variable, AI mastery as factor one, and the use of AIGC in the classroom as factor two. The regression coefficient (0.656) and standard error (0.151) of the path between "AI mastery level" and "use of AIGC in the classroom" are significant; The regression coefficient (0.963) and standard error (0.11) of the path between the use of AIGC in the classroom and student self-efficacy are significant. The results indicate that the level of AI mastery and the use of AIGC in the classroom have a significant positive predictive effect on academic self-efficacy, verifying the predictive effect of AIGC on self-efficacy. The structural equation model is shown in **Figure 2**. The SEM path analysis results are shown in **Table 1**, and the model fit index is shown in **Table 2**.

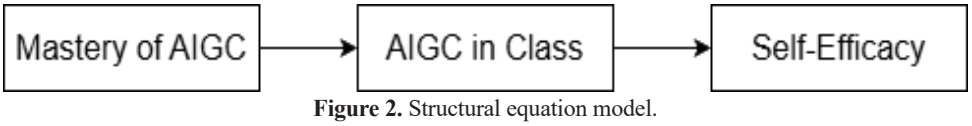

Figure 2. Structural equation model.

Table 1. Correlation analysis

Factor	Coefficient	Standard error	p
Part A → Part B	0.574	0.138	< 0.05
Part B → Part C	0.966	0.077	< 0.05

Table 2. Fit index

GFI	RMR	CFI	NFI
> 0.9	< 0.05	> 0.9	> 0.9
0.907	0.024	0.933	0.907

6. Summary

According to the research content, it can be concluded that current higher education can attach importance to cultivating students' mastery of generative AI, and through systematic AI literacy education, enhance students' understanding and application ability of AIGC technology, which will directly promote students to use AIGC tools more effectively in the classroom. At the same time, the application of AIGC should be moderately integrated in classroom teaching, which has a more prominent positive predictive effect on enhancing students' self-efficacy in learning. The reasonable integration and application of AIGC tools in the classroom have a significant positive predictive effect on students' self-efficacy in learning, providing a new theoretical perspective for understanding the motivational mechanisms of learning in the digital age.

The study also identified potential challenges in the application of technology. The data shows that as the frequency of using AIGC tools in teaching scenarios increases, students may develop an excessive dependence on technology, which is more pronounced in high self-efficacy groups. While promoting the application of AIGC in teaching, educators also need to be alert to potential technology dependency risks. Research has found that the increased use of AIGC in the classroom may lead to stronger dependence on AI tools among students, and this dependence relationship is more pronounced in student groups with improved self-efficacy. In educational practice, a balance mechanism should be established to fully leverage the advantages of AIGC technology while emphasizing the cultivation of students' independent thinking ability and critical thinking, avoiding excessive reliance on technological tools.

A structured AI literacy training system can effectively enhance students' cognitive depth and practical ability in generative technology, further transforming their ability to use AI technology into practical benefits in the learning process. According to the findings of this study, the academic community and educational practice need to conduct more in-depth and systematic exploration in multiple dimensions. Further refine the differential impact mechanisms of different types of AIGC tools on learning outcomes at the classroom construction level, construct more refined technology application models, and particularly conduct in-depth research on the role mechanism of generative AI in the development of core competencies such as knowledge content, innovative thinking, and self-reflection, providing a new technological framework for understanding the essence of learning in the digital age. Developing a more comprehensive AI literacy training system through practical innovation, designing layered teaching curriculum modules and knowledge content, helping students establish a systematic technical cognitive framework and learning ability, while exploring the pros and cons of technology applications. While fully leveraging the advantages of AI technology, it effectively protects and promotes the comprehensive development of students' independent thinking ability, innovative thinking, and humanistic literacy. The design of AIGC applications can adopt more diversified content to examine the long-term impact of AIGC technology on students' cognitive development. By combining mixed research methods with quantitative and qualitative

analysis, we aim to uncover the complex mechanisms underlying the application of technology.

Finally, this study provides important reference for educators to establish a balance mechanism in the process of technology application. Future research should also focus on the relationship between AI technology and educational equity, explore how to narrow the education gap through technological innovation, promote balanced distribution of educational resources, and conduct in-depth research on effective paths and implementation strategies for AI education, helping students establish correct concepts of technology use, value judgment abilities, and social responsibility. These multidimensional explorations will provide important theoretical support and policy basis for building a future education ecosystem that is collaborative, intelligent, efficient, and widely applicable. They will promote the development of higher education towards a more intelligent, open, and personalized direction, and cultivate high-quality innovative talents that meet the needs of the artificial intelligence era.

Disclosure statement

The authors declare no conflict of interest.

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