

Research on the Impact Mechanism of Generative Artificial Intelligence on College Students' Learning Motivation—Analysis Based on Self-Determination Theory

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ABSTRACT

Generative artificial intelligence (AIGC) is profoundly influencing the higher education ecosystem, particularly exerting complex bidirectional effects on the learning motivation of college students. This study is based on self-determination theory and constructs an analytical framework for the impact of AIGC on learning motivation by satisfying or thwarting the three psychological needs of autonomy, competence, and belonging. Research has found that AIGC can enhance motivation through personalized support and immediate feedback, as well as suppress deep motivation through dependency formation and emotional alienation. To this end, universities should systematically guide from three aspects: restructuring teaching objectives, optimizing teaching design, and improving academic standards, in order to maximize the educational benefits of AIGC. This study can provide theoretical basis and practical path for the transformation of higher education in the era of artificial intelligence.

KEYWORDS

Generative artificial intelligence; Learning motivation; Self-determination theory; Basic psychological needs

1 Introduction

With the rapid development of generative AI tools such as ChatGPT and ERNIE Bot, AIGC has been deeply integrated into the field of higher education, significantly changing the learning style of college students. At present, it is commonplace for college students to use AIGC tools to assist with academic tasks, especially in using AIGC for the conception and integration of graduation thesis materials. The technological intervention of AIGC has not only changed the way of learning, but also had a complex impact on deep learning motivation. The self-determination theory points out that the essence of learning motivation lies in the degree of satisfaction of the three basic psychological needs of autonomy, competence, and belonging, and AIGC precisely interacts with these needs through its technical characteristics in multiple dimensions. Current research shows polarization, with one emphasizing the positive value of AIGC, such as enhancing learning interest and providing emotional support; The other party warns of potential risks, such as weakening metacognitive abilities and leading to academic integrity crises. However, these studies mostly focus on describing phenomena and lack a theoretical framework for analyzing the mechanisms of influence from the perspective of motivational psychology. This study is based on self-determination theory and focuses on analyzing the process of learning motivation changes in college students' psychological needs satisfaction or frustration caused by the use of AIGC. The aim is to systematically analyze the bidirectional impact mechanism of AIGC on learning motivation and propose corresponding educational guidance strategies.

2 AIGC and learning motivation from the perspective of self determination theory

2.1 The core connotation of self-determination theory

Self determination theory is a motivational process theory about human self-determination behavior. This theory breaks through the binary division of traditional motivation research and proposes that motivation is a continuous lineage from non motivation to intrinsic motivation, and its evolution depends on the degree of satisfaction of three basic psychological needs. Autonomy needs refer to the individual's subjective choice and sense of control over behavior, manifested in the educational context as students' self-determination of learning content, methods, and pace. Competency needs refer to the need for individuals to feel effective and proficient in activities, and students need to confirm their abilities through challenges and feedback in order to maintain learning confidence. The need for belonging refers to the individual's need to establish connections and a sense of belonging with others. Learning is not an isolated activity, but a process of constructing meaning through interaction within an academic community. These three needs have universality and intrinsic correlation, collectively forming the psychological foundation of learning motivation.

2.2 The coupling relationship between AIGC and basic psychological needs

There is a natural coupling between the technical characteristics of AIGC and basic psychological needs, which constitutes a potential pathway that affects learning motivation. The real-time feedback function of AIGC can enhance the sense of competence, personalized interaction can enhance the sense of autonomy, and social simulation function can provide relationship support. When students use ChatGPT for exploratory learning, their satisfaction with autonomous needs is significantly higher than in traditional teaching environments. However, at the same time, the answer generation efficiency of AIGC may lead to a gradual loss of autonomy, the authority of information may weaken critical thinking, and the advantages of human-computer interaction may replace interpersonal interaction. Network analysis research shows that in AI learning environments, intrinsic regulation rather than intrinsic motivation becomes the core of the motivation system. This dual correlation makes AIGC a key environmental factor affecting learning motivation, and its ultimate effect depends on the synergy between technology application methods and educational guidance strategies. Table 1 shows the correlation between AIGC characteristics and basic psychological needs.

Table 1 Correlation between AIGC characteristics and basic psychological needs

Basic Needs	AIGC Support Features	Potential Satisfaction	Potential Frustration
Autonomy	Personalized resource generation, multimodal interaction	Autonomous selection of learning content and pace	Decision dependency, algorithm-driven choices
Competence	Immediate feedback, error correction, knowledge integration	Enhanced sense of efficacy, overcoming obstacles	Weakening of critical thinking, degradation of metacognitive abilities
Relatedness	Intelligent dialogue, emotional simulation, collaborative support	Non-judgmental support, reduced academic loneliness	Reduced interpersonal interaction, diluted emotional connection

3 The bidirectional influence mechanism of AIGC on learning motivation

The penetration of Generative Artificial Intelligence (AIGC) in the field of education is profoundly reshaping the learning experience of college students and having complex bidirectional effects on their learning motivation. This influence is not simply promoted or suppressed, but rather formed through the intervention of the three basic psychological needs of autonomy, competence, and belonging revealed by self-determination theory, forming a refined mechanism of action. Its essence is a double-edged sword effect: while AIGC satisfies specific needs to stimulate motivation, it may also defeat the same needs at another level, potentially weakening deep motivation.

3.1 Autonomous demand manifests as the coexistence of empowerment and dependence

AIGC, with its powerful content generation and personalized interaction capabilities, provides unprecedented learning control and choice space for college students. Students can use AIGC tools to explore interdisciplinary knowledge, generate personalized learning materials (such as concept maps, literature reviews), and customize learning paths based on their own interests and pace. This 'self-centered' 'exploratory learning experience can significantly enhance students' sense of autonomy, meet their self-determination needs, and effectively stimulate intrinsic motivation - learning behavior is more rooted in curiosity and interest itself.

However, behind the autonomy empowered by this technology lies the risk of dependence. The efficient output and "easy access to answers" feature of AIGC may cause students to gradually give up independent thinking and fearless exploration processes. From the current reality, some students have an excessive reliance on AIGC to complete their thesis outline design, which can easily lead to a decline in independent ideation ability. The more profound impact lies in the "black box" nature of algorithms and potential recommendation mechanisms, which may make students appear to be free to choose, but in reality, they are invisibly guided, forming a kind of "illusion of autonomy". When the decision-making power of learning is transferred from students themselves to algorithms, their true autonomous needs are actually suppressed, leading to the alienation of learning motivation from the internal "I want to learn" to the external "AI makes me learn" or "I need to use it to complete assignments".

3.2 The demand for competence presents a coexistence of efficiency and disability

At the level of competency requirements, the core advantage of AIGC lies in its powerful performance enhancement effect. It helps students quickly overcome learning barriers and gain an immediate sense of achievement and efficacy through instant Q&A, knowledge integration, and skill coaching. This 'high-efficiency illusion' is particularly attractive to students who lack confidence in learning, making them more willing to try challenging tasks. However, this improvement in surface efficiency may come at the cost of degradation in deep capabilities. When AIGC excessively shoulders the cognitive load that should have been borne by students, their critical thinking, metacognitive abilities, and sustained focus are at risk of decline. What is even more alarming is that the satisfaction of competency needs may shift from "mastering knowledge" to "utilitarian goals" - students are more concerned with how to use AIGC to obtain high scores or quickly complete tasks, rather than pursuing a true understanding and deep internalization of knowledge, which will formalize learning motivation.

3.3 The need for belonging is reflected in the coexistence of connectivity and alienation

AIGC has created a new model of academic relationships. As an 'never tired learning companion', AIGC tools can provide non judgmental, low-risk immediate responses, which can alleviate students' academic loneliness to some extent, especially for introverted or hesitant students who dare not ask questions in class. In addition, AIGC, as a collaborative intermediary, can facilitate group collaboration in optimizing generated content, conducting human-machine debates, and providing a tool based relationship support. However, instrumental relationships are difficult to replace the rich emotional connections and ideological collisions in real interpersonal interactions. Overreliance on human-computer interaction may lead to the degradation of students' academic social skills such as debate, collaboration, and empathy, and weaken their sense of belonging in the learning community. Based on teaching considerations, it can be seen that students who frequently use AIGC have reduced offline academic interactions and emotional connections with teachers. When the emotional motivation and spiritual interaction necessary for deep learning are partially replaced by the command response mode of "human machine", the satisfaction of belongingness needs may be superficial, and there may even be a risk of emotional alienation, which is not conducive to maintaining sustained intrinsic motivation.

In summary, AIGC profoundly influences the learning motivation of college students by satisfying and thwarting the three basic psychological needs of autonomy, competence, and belonging. Its impact is two-sided. Recognizing this duality is crucial for educators to properly guide the use of AIGC, maximize its positive impact, and mitigate its potential risks.

4 Guiding strategies to stimulate deep learning motivation

4.1 Refactoring teaching objectives, focusing on cultivating abilities and qualities

The deep integration of AIGC requires universities to fundamentally reconstruct teaching objectives and achieve a transformation from knowledge transmission to literacy cultivation. The traditional education model emphasizes the memorization and repetition of knowledge, while AIGC's ability to quickly generate answers makes this goal orientation outdated and inefficient. The teaching objectives of the new era should be based on core competencies, focusing on cultivating students' key abilities to adapt to future society, including critical thinking, innovation, self-learning, and human-machine collaboration. This means that educators need to rethink what is worth learning, shifting the focus from simple acquisition of knowledge to deep understanding, critical application, and creative generation of knowledge. Therefore, the restructured teaching objectives should highlight the following three directions:

Firstly, adhere to critical thinking. In the context where AIGC can easily provide answers, teaching evaluation must design tasks and standards that are "irreplaceable by AI". This requires more use of process evaluation, reflective writing, and oral debates and defenses. For example, students can be required to submit a detailed process report on the use of AIGC assisted writing, explaining how they utilize AI, how they assess the reliability of their output information, and how they integrate their own thinking to evaluate their ability to discern and integrate information, rather than the perfection of the final text.

Secondly, strengthen the cultivation of AI literacy. The teaching objectives should clearly include artificial intelligence literacy as an essential skill for students in the new era. This includes but is not limited to prompt word engineering, algorithmic thinking, information critical literacy, and AI ethics and responsibility. Universities should systematically incorporate this into their curriculum system, rather than just providing sporadic lectures. Universities both domestically and internationally have established modules such as 'Collaborative Writing with AI', aimed at teaching students how to iteratively optimize prompt words and cross validate the authenticity of AI output through multi-source information, thereby transforming AIGC from an 'answerer' to a 'thinking partner'.

Thirdly, clarify humanism. Education must adhere to a people-centered approach. The teaching objectives should clearly emphasize and cultivate the unique advantages of humans that AI cannot replace, such as empathy, creativity, value judgment, and social responsibility. Guide students to recognize that AIGC is a tool for enhancing human intelligence, rather than a substitute for human thinking. The cultivation of all literacy should ultimately be directed towards the comprehensive growth and development of students, enabling them to become more intelligent, warm, and responsible individuals empowered by technology.

4.2 Optimize teaching design and promote human-machine collaborative learning

To effectively address the dual impact of AIGC on learning motivation, instructional design needs to break through traditional models and build a new learning ecosystem that is student-centered and human-machine collaborative. The core of this ecosystem lies in clarifying the roles of "human" and "machine" - teachers as learning guides, students as active constructors, and AIGC as cognitive tools, forming a deep collaborative partnership among the three, as shown in Figure 1.

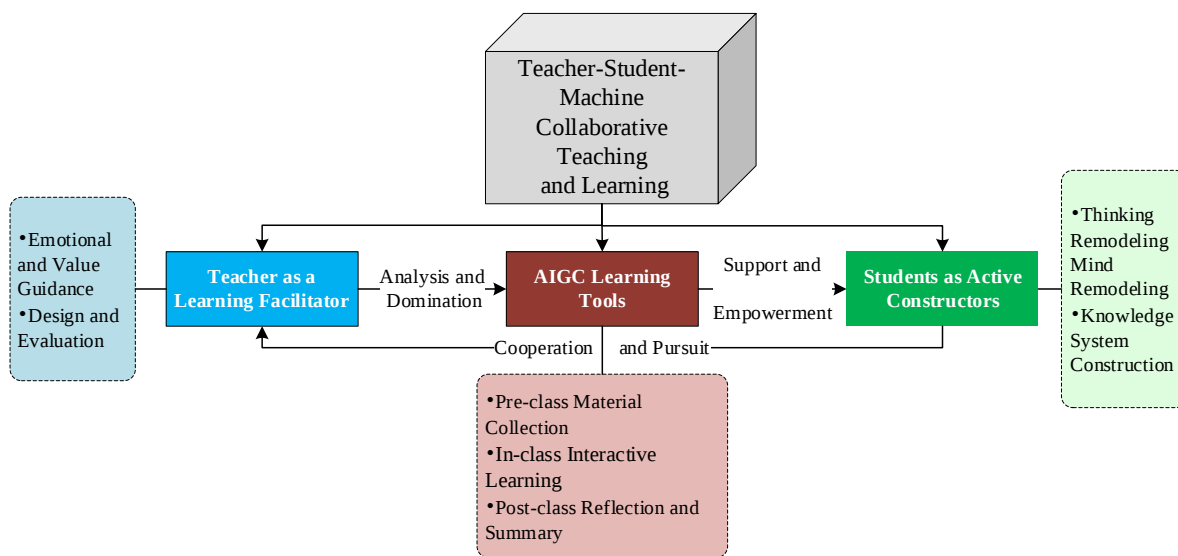


Figure 1 Teacher student AIGC collaborative partnership

Firstly, design differentiated hierarchical tasks. Teaching design should be tailored to the different application levels of AIGC, and a gradient task system should be constructed to balance the consolidation of basic abilities and the cultivation of higher-order thinking. The basic layer tasks allow and encourage students to use AIGC to complete low cognitive load tasks such as information retrieval, knowledge sorting, and architecture reshaping. The purpose is to liberate students from tedious basic labor and enable them to focus more on deep thinking. Advanced level tasks require students to dominate in areas of human advantage such as innovation, critical thinking, and emotional expression. For example, students are required to provide in-depth commentary and rebuttal based on reports generated by AIGC, or design original solutions and explain their superiority over AI solutions. During this process, AIGC primarily serves as a 'critical thinking partner' rather than an answer provider, used to inspire inspiration, validate ideas, or provide diverse perspectives.

Secondly, innovative blended learning activities. The deep integration of AIGC's interactive mode can reshape the classroom form and promote deep learning. On the one hand, it is necessary to conduct AI enhanced debates within universities. Both sides should first use AIGC to quickly generate arguments and supporting materials, and then conduct on-site debates in the classroom, focusing on evaluating the effectiveness of AI generated content, criticizing logical loopholes, and making value judgments. This activity aims to train students' ability to discern information, respond quickly, and think critically. On the other hand, to strengthen the research on human-machine comparative analysis, students are required to submit human solutions and AIGC generated solutions separately for the same problem, and write comparative analysis reports, detailing their respective advantages and disadvantages, applicable scenarios, and underlying logic. This requires students to have a deep understanding of the essence of the problem, rather than staying at the surface level of the answer. In addition, it is necessary to strengthen students' metacognitive training, incorporate "how to effectively interact with AI" into teaching objectives, and train students to design precise prompt words through systematic training, cultivating their ability to decompose, abstract, and express complex problems.

Thirdly, achieve the transformation of the teacher's role in the era. In the human-computer collaborative classroom, the

role of teachers needs to shift from authoritative knowledge transmitters to motivational guides and emotional value enablers for learning. Firstly, teachers should publicly demonstrate how to use AIGC responsibly and efficiently for lesson preparation, research, and creative work, rather than simply prohibiting or avoiding it. Through demonstration, guide students to see more possibilities for human-machine collaboration. Secondly, the central task of teachers has shifted to designing learning situations and challenging tasks that can stimulate students' intrinsic motivation, and providing emotional support and personalized guidance when students encounter setbacks. This is precisely the unique value of human teachers that AIGC cannot replace - encouragement based on empathy and life guidance based on rich experience. Finally, by utilizing the learning situation data analysis report provided by AIGC, teachers can more accurately grasp the cognitive status and emotional changes of both the overall class and individual students, and adjust teaching strategies in a timely manner, achieving an organic combination of large-scale education and personalized training.

4.3 Establish sound academic standards and cultivate a culture of healthy use

Establishing sound academic standards and cultivating a healthy usage culture are institutional guarantees for addressing the challenges of generative artificial intelligence. Its core lies in building a multi-level and operable normative system, and internalizing it as a conscious behavior of the academic community through educational guidance, ultimately forming a healthy cultural atmosphere that takes pride in adhering to academic ethics and shame in violating academic ethics.

Firstly, establish clear usage boundaries and disciplinary norms. Universities and academic institutions need to issue a hierarchical classification of AIGC usage guidelines, clearly delineating the boundaries of "encouraged, allowed, and prohibited". For example, it is allowed to be used for auxiliary work such as literature search and grammar proofreading, but it is strictly prohibited to directly generate application materials, falsify data, or substitute original thinking. It is even more forbidden to use generative artificial intelligence to directly generate project application materials. When using the generated content, it is necessary to clearly label and explain the generation process. For violations, a "zero tolerance" punishment mechanism should be established, and based on the severity of the situation, measures such as criticism, revocation of projects, cancellation of promotion qualifications, and dismissal should be taken. An academic ethics veto system should also be implemented to ensure the deterrent effect of the system.

Secondly, establish a disclosure and review mechanism for the entire process. Transparency is the core of responsible use of AIGC. Journals and academic institutions should implement a mandatory AI usage declaration system, requiring authors to disclose in detail the specific steps, tool names, and proportion of generated content when using AIGC in their research, and provide traceable processing records for verification. At the same time, strengthen the "human responsibility" and clarify that AIGC cannot be the author of the paper, and researchers must take full responsibility for the authenticity and accuracy of the content generated by AI. In the publishing process, the review process should be improved, and the use of technical tools to detect AI generated content should be explored to effectively control the export of academic achievements.

Finally, strengthen educational guidance and value orientation. Institutional constraints need to be combined with educational guidance in order to internalize norms into value pursuits and externalize them into conscious actions. Academic norms and AI ethics education should be incorporated into the pre service training for teachers and the compulsory curriculum system for students. The harm of academic misconduct should be analyzed through case studies, and students should be clearly informed of the ethical red lines for using AIGC. In addition, it is necessary to vigorously promote and commend exemplary figures who abide by academic ethics, play a role as role models, and guide teachers and students to adhere to academic integrity and consciously resist bad practices through warning education on academic misconduct.

5 Conclusion

Overall, it can be seen that generative artificial intelligence has a complex impact on college students' learning motivation. This article also proposes that AIGC deeply participates in the construction process of learning motivation by intervening in the three major psychological needs of autonomy, competence, and belonging. It may become a motivation enhancer through personalized support, effectiveness improvement, and academic connection, or a motivation suppressor through dependency formation, ability degradation, and emotional alienation. This double-edged sword effect warns educators that the value of technological applications depends on the guidance of educational concepts and the wisdom of institutional design.

Therefore, in order to maximize the educational value of AIGC, universities need to promote systematic changes and adhere to the humanistic core - AIGC can only be a tool for expanding human abilities, rather than a substitute for human thinking. Future research needs to further track long-term impact mechanisms, explore differentiated strategies across

different disciplines and cultural backgrounds, and provide sustained insights for the educational transformation in the era of artificial intelligence.

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