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A Review of the Impact of Generative Artificial Intelligence on Students' Learning Motivation

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Abstract. The application of generative artificial intelligence (GenAI) in higher education has expanded rapidly, exerting a significant influence on multiple core dimensions of university students' learning. Based on the core framework of Self-Determination Theory (SDT), this study systematically reviews existing literature on the impact of GenAI on students' learning motivation. The findings suggest that GenAI can, to a certain extent, satisfy university students' basic psychological needs for autonomy and competence by providing personalized learning support, immediate feedback, and autonomous learning choices. It also promotes interaction among students and between students and learning content, thereby enhancing learning motivation. However, GenAI may also lead to excessive student dependence, the dissemination of inaccurate information, and a weakening of students' independent thinking abilities, thereby undermining their autonomy and perceived competence, and thus negatively affecting learning motivation. The study further highlights the need for scientific guidance and regulation regarding the use of GenAI in educational contexts.

Keywords: generative artificial intelligence, Self-Determination Theory, learning motivation, basic psychological needs

1. Introduction

Generative artificial intelligence (GenAI) has attracted widespread attention across educational domains, thanks to its ability to provide personalized, contextualized, and interactive feedback. Its application is expanding rapidly, with increasing penetration into students' learning contexts, thereby exerting a significant influence on learning processes. Self-Determination Theory, as an important theoretical framework for explaining the development of human motivation, provides a valuable perspective for analyzing the impact of GenAI on learning motivation.

Self-Determination Theory (SDT) offers an especially appropriate analytical framework for this purpose. Ryan and Deci propose that the satisfaction of three basic psychological needs—autonomy, competence, and relatedness—is essential for fostering intrinsic motivation, enhancing well-being, and achieving optimal functioning [1]. This theory further clarifies the pathway from psychological need satisfaction to motivational internalization. Although existing studies have examined motivational changes when students use GenAI tools, a systematic theoretical integration is still lacking.

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Therefore, this study aims to synthesize existing empirical research regarding how GenAI affects university students' learning motivation within the unified framework of SDT. It analyzes how the use of GenAI influences intrinsic or extrinsic motivation by satisfying or hindering the three basic psychological needs of autonomy, competence, and relatedness. By clarifying the interaction mechanism between GenAI and learners' basic psychological needs, this study seeks to provide both a theoretical reference and practical guidance for the appropriate application of GenAI in educational settings.

2. Theoretical foundation

2.1. Self-Determination Theory

Self-Determination Theory (SDT) finds extensive utility in fields like language education [1]. At its core lies the basic psychological needs theory, which contends that humans are endowed with three fundamental needs—autonomy, competence, and relatedness. Once these are gratified, people tend to exhibit intrinsic motivation and willingly get involved in tasks because of the inherent delight and contentment they bring [1, 2].

Autonomy is defined as the need for experiencing one's actions as volitional and self-endorsed. In educational contexts, this may be reflected in learners' ability to choose learning activities or to perceive the alignment between learning goals and individual values. The notion of competence entails a dual requirement: experiencing effectiveness in environmental interactions, along with having access to outlets for demonstrating and enhancing one's skills. In learning contexts, this manifests as self-efficacy or the successful completion of challenging tasks. Relatedness refers to the requirement for feeling attached to peers, attaining a sense of belonging, and participating in mutual care. Within educational contexts, such fulfillment is achieved by constructive engagement with teachers and fellow students, or by involvement in broader learning communities [1].

Thus, the satisfaction of autonomy, competence, and relatedness serves as a key psychological mediator for understanding how external technological tools are transformed into intrinsic learning motivation. This paper organizes its analysis of GenAI's impact on learning motivation around these three dimensions.

2.2. Types of motivation

Learning motivation can be divided into extrinsic and intrinsic motivation [3]. Extrinsic motivation refers to engaging in activities due to external factors such as rewards or punishments. In contrast, intrinsic motivation refers to engaging in activities out of personal interest or volition. Research suggests that the principle of self-determination is rooted in intrinsic motivation [3].

Students with intrinsic motivation typically derive enjoyment from tasks and show a spontaneous preference for learning activities. By satisfying the three basic psychological needs, learners are more likely to autonomously regulate and monitor their learning processes. In other words, intrinsic motivation can be enhanced, thereby facilitating the achievement of learning goals [3].

2.3. Research progress of SDT in education

SDT has been successfully applied in education and provides insights into factors influencing students' motivational states. Research conducted by Noels and colleagues verified that instructional strategies prioritizing learner autonomy correlate positively with stronger internal motivation as well

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as externally regulated motivation shaped by personal volition in second-language student populations [4]. Alamer's subsequent research revealed that fulfilling basic psychological needs is positively associated with autonomous motivation and academic outcomes in English as a foreign language [5]. Fryer and Oga-Baldwin's research on Japanese junior high school students stressed the critical role played by intrinsic motivation in L2 learning, and also identified competence along with psychological need gratification as major predictors for learner engagement and performance [6].

Scholars likewise adopt SDT to analyze how diverse digital learning tools and online platforms impact learners' motivational levels. Alm put forward the viewpoint that web-supported language learning settings can effectively stimulate learning enthusiasm, largely because such digital spaces satisfy fundamental psychological demands. His research further illustrated that Web 2.0 tools facilitate interpersonal connection, sense of capability and independent learning awareness by means of peer communication, joint composition tasks and customized learning modules [7]. Jeon investigated usage patterns of an autonomous learning app in informal EFL learning and found that continued users reported significantly higher satisfaction of competence and relatedness needs than discontinued users [8]. Zeng and Fisher pointed out that gamified language learning mobile software represented by Duolingo can meet learners' demands for autonomy and competence, which greatly facilitates the formation of internal learning motivation during foreign language acquisition [9]. They additionally advanced the idea of transfer of motivation, in which motivation derived from app-based learning gets transferred to broader educational settings for language study [9]. These studies provide a conceptual foundation for examining next-generation GenAI technologies.

3. Positive impacts

Existing research generally confirms that when used effectively, GenAI can satisfy students' basic psychological needs and thereby enhance learning motivation.

3.1. Autonomy

Multiple studies have demonstrated that GenAI significantly enhances students' perceived autonomy in learning. By tailoring learning plans to individual preferences and requirements, GenAI gives learners a sense of ownership and agency over their activities, which in turn empowers them to autonomously detect and remedy their own learning gaps and to venture beyond the originally anticipated scope [10].

Du and Alm, studying 24 international students employing ChatGPT to learn languages, found that GenAI significantly enhances learner autonomy, enabling independent task completion and skill improvement [10]. This confirms that when autonomy needs are satisfied, students perceive learning as self-initiated rather than externally imposed, thereby increasing intrinsic motivation.

Hidayat-ur-Rehman et al., using PLS-SEM with 387 university students in Saudi Arabia, examined the relationships among AI literacy, chatbot use, perceived autonomy, and informal digital learning engagement. Results showed that chatbot use significantly predicted perceived autonomy ($\beta = 0.244$, $t = 4.870$, $p < 0.001$), and autonomy further predicted engagement ($\beta = 0.238$, $t = 6.679$, $p < 0.001$), explaining 59.2% of variance in engagement ($R^2 = 0.592$) [11].

In classroom settings, Hsia conducted a comparative experiment in physical education that used AI-assisted peer learning. The AI-assisted group achieved higher adjusted mean scores (2.33 vs. 2.13; $\eta^2 = 0.08$), and higher intrinsic motivation (4.03 vs. 3.63; $\eta^2 = 0.05$), with no significant difference in extrinsic motivation ($p = 0.08$). This suggests that AI activates intrinsic motivation rather than external incentives [12].

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Overall, GenAI enables students to control how they use tools and express learning preferences, aligning learning with individual styles and needs. This sense of autonomy is central to enhancing intrinsic motivation.

3.2. Competence

Research has confirmed that AI has a significant impact on competence. Jinming and Maeng's interview studies show that ChatGPT enhances learners' self-efficacy and confidence through personalized feedback, error correction, and context-specific examples. Students' writing quality improves, and encouraging feedback strengthens confidence in their progress [10, 13].

Mohamed's cross-sectional study similarly found that AI enhances students' critical thinking and problem-solving abilities [14].

In educational practice, AI can be used for personalized instruction. Mohammad conducted a mixed-methods 2×2 factorial experiment examining GenAI-supported personalized grammar tasks. Results showed that AI enabled teachers to accurately identify learners' proficiency levels and to generate appropriately challenging tasks, significantly satisfying needs for competence ($\eta^2 = 0.32$). Competence satisfaction was further confirmed as a driver of intrinsic motivation [15].

These findings suggest that GenAI can create adaptive tasks tailored to learners' needs, such as identifying weaknesses and providing customized practice to enhance competence.

3.3. Potential promotion of relatedness

Compared with autonomy and competence, the positive effects of GenAI on relatedness remain relatively underexplored. Its influence is mainly reflected in providing a sense of companionship and guidance.

Studies indicate that GenAI's instant responses and unlimited patience create a low-anxiety interaction environment where learners feel free from judgment when seeking feedback, generating a sense of being accompanied and reducing learning anxiety [10, 13]. This psychological safety partially satisfies emotional needs and helps sustain engagement. However, research gaps remain regarding its mechanisms of influence.

4. Negative impacts

4.1. Overreliance and decision substitution

Although GenAI enhances perceived autonomy, this autonomy may be undermined by overreliance. Scholars have raised concerns that excessive dependence on AI-generated content may weaken students' independent and critical thinking skills and raise ethical issues, such as plagiarism.

When learners outsource cognitive tasks to AI and accept outputs uncritically, their autonomous decision-making ability may decline [10, 15]. Overreliance reduces active information processing and weakens autonomy satisfaction. In addition, complex AI outputs may confuse learners and reduce engagement [13].

4.2. Output limitations and frustration

GenAI also has limitations in handling complex tasks and ensuring accuracy, which may reduce learners' competence perceptions [10]. Maeng's interviews with English teachers revealed that AI lacks contextual appropriateness in ESP writing, increasing learner anxiety [13].

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Differences in students' AI literacy (e.g., prompt-writing skills) may also lead to frustration [10]. Unequal AI competence further weakens motivation [11]. However, findings remain inconsistent. Surachmi found no significant effect of ability on engagement, possibly due to user-friendly system design features such as adaptive interfaces and automatic correction [16]. Individual differences also play a role, as reflected in variance patterns reported by Mohamed [14].

4.3. Parasocial interaction and social alienation

Although GenAI can provide companionship, such relationships are essentially parasocial and cannot replace real interpersonal connections. Overuse may reduce real-world social interactions and weaken students' sense of belonging.

Peer pressure may further undermine relatedness when students feel anxious about falling behind in AI usage [17]. Compared with AI feedback, teacher feedback remains irreplaceable due to its contextual depth, credibility, and emphasis on meaning and task intentions [13]. This highlights the importance of meaningful human interaction in AI-assisted learning.

5. Discussion

5.1. Findings

GenAI has a "double-edged sword" effect on learning motivation. For autonomy, it enhances perceived control but may weaken long-term autonomy through overreliance. For competence, personalized feedback improves self-efficacy, while inaccuracies and skill disparities may undermine confidence. For relatedness, AI reduces anxiety through non-judgmental support but cannot replace real social interaction. These effects depend heavily on usage patterns and instructional design.

5.2. Practical implications

The rapid development of GenAI requires new competencies from educators. Teachers should engage in professional development and AI training to enhance their ability to integrate GenAI into teaching. Schools should provide opportunities for AI-related exchange and collaboration. Teachers should carefully integrate chatbots into instructional design, such as peer-assisted learning and personalized tasks. Students should be encouraged to critically evaluate AI outputs and engage in metacognitive reflection. Additionally, collaborative learning activities and peer discussion forums can enhance both AI literacy and relatedness by enabling students to share experiences and strategies.

6. Conclusion

This review systematically examines the mechanisms and boundaries of GenAI's impact on learner motivation through the lens of Self-Determination Theory. GenAI influences motivation primarily by satisfying basic psychological needs.

In terms of autonomy, GenAI enhances perceived control and reduces anxiety but may lead to overreliance. In terms of competence, personalized feedback supports confidence, but accuracy issues and skill disparities create divergence. In terms of relatedness, GenAI provides non-judgmental support but may weaken social bonds if overused.

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However, this study is based on a literature review and lacks empirical quantitative validation. Future research should adopt mixed-methods and longitudinal designs to further examine the mechanisms underlying GenAI's impact on learning motivation.

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