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Harnessing Artificial Intelligence in Generative Content for Enhancing Motivation in Learning

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Introduction

Artificial Intelligence in Generative Content (AIGC)

Artificial intelligence (AI) has emerged as a transformative force in various fields, with education being no exception (Kasneci et al., 2023; Kavitha & Joshith, 2024). A critical aspect of this transformation is AI-generated content (AIGC), which refers to the automatic creation of diverse forms of content, such as text, images, audio, and video, using AI technologies (Wang et al., 2023).

AIGC represents a paradigm shift from traditional AI systems, which rely on predetermined rules or intents (Fui-Hoon Nah et al., 2023). AIGC offers advanced personalized learning and content generation capabilities, gaining significant attention in fields such as news reporting, social media, and educational materials (Gill & Kaur, 2023). In education, AIGC is primarily used to generate textbooks and courseware, creating high-quality educational resources and learning materials (Chen et al., 2024).

The potential of AIGC in education extends beyond mere content creation (Kavitha & Joshith, 2024). AIGC-powered virtual tutors and learning assistants can interact intelligently with students, answering queries and enhancing academic abilities (Chen et al., 2024). For instance, text-based interactions are powered by systems like ChatGPT (OpenAI, 2024a) and Replika (Luka, 2024), allowing for natural language conversations and explanations. Visual aids can be generated on-demand using image creation tools such as DALL-E (OpenAI, 2024b) and MidJourney (MidJourney, 2024), enhancing understanding of complex concepts. For more immersive experiences, video production technologies like Synthesia (Synthesia, 2024) and DeepBrain (DeepBrain, 2024) can create personalized video lessons.

Another key strength of AIGC lies in its emphasis on interaction and dialogue, which fosters creativity and engagement among learners (Abdelghani et al., 2023). This provides a dynamic and engaging educational environment, potentially revolutionizing how students interact with educational content (Hwang & Chen, 2023).

Significance and Timeliness of Researching AIGC's Role in Student Motivation

The development of education is driven by advancements in technology and our understanding of how learning occurs (Chen et al., 2024). At the heart of this evolution is the

concept of learning itself—a complex, multifaceted process that involves cognitive, emotional, and social dimensions (Jarvis, 2006). Effective learning is not merely about the transmission of information; it encompasses the acquisition of knowledge, skills, and attitudes that enable individuals to adapt and thrive in various contexts (Illeris, 2016).

The application of AIGC in education is rapidly expanding and holds both promises and challenges for supporting individual learning (Chen et al., 2024). For example, ChatGPT surpassed one million users in just five days and now boasts over 180 million users, demonstrating AIGC's immense potential in education (Duarte, 2024). AIGC has revolutionized traditional learning methods, creating new opportunities to enhance student learning (Chen et al., 2024).

Central to the learning process is the role of motivation (Pintrich, 2003; Ryan & Vansteenkiste, 2023). In educational settings, motivation refers to the *internal processes* that give behavior its energy, direction, and persistence (Reeve, 2024). Motivation has been identified as a key factor influencing students' learning methods, engagement, persistence, cognitive processes, and learning styles (Ryan & Deci, 2017; Ryan et al., 2023). Students' motivation can vary significantly due to individual differences and environmental factors (Ryan & Vansteenkiste, 2023), presenting a challenge for educators striving to create effective learning environments.

Traditional teaching methods, however, often struggle to maintain student interest and motivation due to the lack of interaction and the monotonous content (Omolaf & Ize, 2022). AIGC and the various available tools offer a promising solution by providing personalized and interactive learning experiences that can significantly boost student motivation (Dai et al., 2023; Lu et al., 2024). Multiple studies have demonstrated that AIGC-enabled features promote student motivation, leading to increased satisfaction, enthusiasm, and initiative (Ebadi & Amini, 2024; Huang et al., 2024; Ma & Lei, 2024).

As AIGC continues to evolve, its applications in education are likely to expand, making it imperative to comprehend its effects on student motivation and learning (Hsu & Ching, 2023; Huang et al., 2024). By understanding these impacts, we can provide valuable guidance for the design and deployment of generative AI technologies in education settings. This understanding will enable educators and policymakers to leverage these technological

tools effectively, transforming traditional teaching methods into more interactive and personalized learning experiences (Zhu et al., 2023), thereby enhancing student engagement and learning outcomes (Lai et al., 2023). Moreover, an examination of AIGC can also help mitigate its potential ethical risks, such as privacy concerns and potential biases in AI-generated content (Hsu & Ching, 2023; Li et al., 2024), thus improving the overall quality and outcomes of education in the AI era (Hmoud et al., 2024). Therefore, this editorial aims to explore the influence of AIGC on student motivation in educational environments and its impact on students' learning experiences and outcomes. It starts with a review of the current applications of AIGC in education and provides the theoretical rationale and potential benefits in enhancing motivation supported by empirical examples, followed by a call for action for researchers to address existing knowledge gaps and a conclusion.

Current State of AIGC in Education

Overview of AIGC Technologies

AIGC is rapidly evolving in the field of education, providing a diverse array of powerful tools and functionalities (Chen et al., 2024). To analyze, comprehend, and generate content that authentically emulates human-generated results, AIGC needs to simulate human systems, thereby acquiring the capability to achieve predetermined goals (Fui-Hoon Nah et al., 2023). From a technical standpoint, AIGC relies on three key technologies: information processing, content generation, and data processing (Wu et al., 2023).

In information processing, AIGC employs advanced algorithm models to deeply understand and analyze input data, producing human-like responses (Fuchs, 2023). It utilizes Natural Language Processing (NLP) for text comprehension and error correction (Al Shloul et al., 2024), computer vision and deep learning for image analysis and creation (Temsah et al., 2024), and video analysis and generation technologies for content examination and creation (Joseph, 2023). Moreover, AIGC demonstrates the ability to understand information across different cultural contexts, such as language usage patterns and communication styles, enabling it to analyze and capture characteristics specific to particular cultural backgrounds (Zhao & Qiu, 2024). This capability enhances the relevance of educational content to diverse linguistic environments (Berger & Packard, 2022).

In content generation, AIGC leverages fine-tuned large language models to generate a wide spectrum of educational materials, such as lesson plans, quizzes, exercises, and explanatory videos (Chen et al., 2024). It assists teachers in creating personalized learning plans and generating diverse teaching content (Zhao et al., 2023), while enabling students to develop various creative projects, thereby enhancing their learning experience and fostering creative abilities (Abas et al., 2023).

AIGC's data processing capabilities allow for personalized learning experiences (Zhu et al., 2023). Through advanced algorithms and robust data memory, AIGC can provide tailored feedback and support to students (Alshahrani, 2023). It adapts to individual learning progress, automatically adjusting the content difficulty (Abas et al., 2023) and continuously refining its responses through interactions with students (Grassini, 2023). This adaptive approach enables AIGC to provide increasingly precise and effective support and guidance, optimizing each student's learning journey (Zhou et al., 2024).

Examples of Current Applications in Classrooms

The emergence and development of AIGC have opened up a range of possibilities for education (Hwang & Chen, 2023; Stone, 2023). The application of AIGC in real educational environments has already made significant progress (Chen et al., 2024), which can be seen in three main areas: personalized support, interactive learning environments, and real-time feedback systems.

Personalized Support

Personalized Tutoring. AIGC has become a key driver of educational innovation by providing personalized learning experiences (Abas et al., 2023; Grassini, 2023). It can identify and respond to specific student needs, generating targeted learning materials based on individual interests and abilities (Bahrami et al., 2023). This includes creating personalized textbooks, educational videos, exercises, and other resources, which enhance the relevance and appeal of learning materials (Grassini, 2023).

For instance, when a student struggles with mathematics, AIGC tools can generate exercises and explanatory content tailored to the student's level, gradually increasing in

difficulty to help solidify foundational knowledge and promote advancement (Eager & Brunton, 2023). Additionally, AIGC can recommend related learning resources based on the student's learning needs and interests (Abas et al., 2023). When students provide their learning goals or topics, AIGC can utilize its pre-trained models and knowledge base to recommend suitable learning materials, textbooks, and courses, helping students access more valuable learning resources (Zawacki-Richter, 2019).

Personalized Learning Plans. AIGC can provide personalized plans that consider various factors such as their abilities and performance levels (Abas et al., 2023). These plans can help students better manage their study time and tasks and learn at an optimal pace, including daily learning objectives, review times, and quiz schedules (Zawacki-Richter, 2019). When students need to adjust their study schedules, AIGC can offer appropriate suggestions and strategies to help them formulate reasonable plans and enhance their learning outcomes (Zawacki-Richter, 2019).

Interactive Learning Environment

Role-Playing Training. Conversational AIGC, such as ChatGPT, has a significant role in creating interactive learning environments (Eager & Brunton, 2023). These tools simulate natural conversations, providing a realistic language exchange environment for learners to practice their speaking, listening, and reading skills (Kostka & Toncelli, 2023; Niyozov et al., 2023). AIGC provides immediate feedback and improvement suggestions based on students' responses and offers customized advice on improving vocabulary, phrases, and pronunciation (Gill & Kaur, 2023). This interactive approach creates a safe environment for students to practice their communication skills, promoting inclusivity and reducing learning barriers (Skjuve et al., 2024). By involving users in interactive exchanges, AIGC connects the theoretical aspects of language learning with practical application, helping students develop their language abilities more comprehensively (Qu & Wu, 2024).

Virtual Classroom Interaction: In classroom teaching, AIGC offers possibilities for interactive instruction in classroom teaching (Caratiquit & Caratiquit, 2023). Teachers utilize interactive AIGC-generated interactive Q&A sessions, case analyses, and discussion topics to enrich classroom content and enhance student engagement (Zawacki-Richter, 2019). For

example, in medical courses, teachers use AIGC to reconstruct and interpret CT images for student discussions (Shao et al., 2024). Art courses benefit from AIGC's ability to recreate original artistic styles and generate art creation materials for analysis and imitation (Pavlik & Pavlik, 2024). Science courses utilize AIGC to simulate experimental processes and results, enabling virtual experiments and observations even without laboratory conditions (Reginald, 2023). These applications make AIGC a powerful auxiliary tool for education, providing innovative supplements to traditional teaching methods (Grassini, 2023).

Feedback System Support

Instant Assignment Feedback. AIGC has also been widely applied in providing instant feedback on student assignments (Abas et al., 2023; Lo, 2023). With advanced assessment capabilities, AIGC identifies errors, recognizes weak areas, and provides specific improvement suggestions (Lee et al., 2022; Zawacki-Richter, 2019). For example, after submitting an assignment, students can quickly receive instant feedback from ChatGPT, which promptly points out grammatical errors, logical issues, and content inconsistencies, and offers tailored improvement suggestions (Foroughi et al., 2023; Qu & Wu, 2024). This principle can be employed across the entire range of educational settings, including pre-school, primary, secondary, and tertiary education and extending towards lifelong learning (Ali et al., 2024; Wang et al., 2024).

Progressive Feedback. As a dynamic educational tool, AIGC excels in providing progressive feedback throughout the learning process (Qu & Wu, 2024). It can continuously monitor students' learning performance, conduct data analysis, and provide precise skill assessments (Bahrami et al., 2023). AIGC interacts with students and accumulates dialogues to identify misunderstandings and knowledge gaps, offering targeted guidance and supplementation (Eager & Brunton, 2023). By periodically analyzing students' assignments, quizzes, and exam answers, AIGC pinpoints strengths and weaknesses in their learning and generates personalized learning reports (Chen et al., 2024). These reports detail students' progress, helping them to identify their next learning focus and develop corresponding study plans, ensuring optimization and improvement throughout the learning process (Zawacki-Richter, 2019).

AI Literacy Development

An essential aspect of AIGC's application in education is its role in fostering students' AI literacy (Gill & Kaur, 2023). By interacting with AIGC, students can explore and grasp the fundamental principles of AI technology and its diverse applications within real-world learning environments. This includes gaining an understanding not only of AI models and algorithms but also of practical examples of AI use across various industries. Additionally, In AI ethics education, AIGC can generate simulated scenarios and case studies that play a crucial role in helping students navigate and discuss the ethical issues associated with AI technologies, such as privacy concerns, algorithmic bias, and data security (Dong et al., 2024). It allows students to identify and address these ethical challenges in realistic contexts, thereby enhancing their ability to make informed and responsible decisions in an AI-driven world (Dong et al., 2024). Through this approach, AIGC not only improves students' technical proficiency but also deepens their critical understanding and moral reasoning regarding AI (Ruiz-Rojas et al., 2024). As a result, students will be better equipped to use and develop AI technologies responsibly in their future careers (Johnston et al., 2024).

Potential Benefits of AIGC in Enhancing Motivation

Theoretical Frameworks Linking AIGC to Student Motivation

Applying AIGC in education can be understood through various theoretical frameworks to comprehend its potential impact on student motivation. These frameworks include the Expectancy-Value Theory (EVT), the Achievement Goal Theory, the Social Cognitive Theory (SCT), the Distributed Cognition Theory, and the Self-Determination Theory (SDT), all of which have been extensively used to understand human motivation, in particular across different learning contexts.

The Expectancy-Value Theory

The expectancy-value theory also provides a robust framework for explaining the potential impact of AIGC on student motivation in education. Expectancy-value theory posits that an individual's motivation is determined by their expectations of success (expectancy) and the value they place on the success outcome (value) (Wigfield & Eccles, 2000, 2024).

Expectancy refers to a student's belief about their likelihood of success in an upcoming task (Rosenzweig et al., 2019). AI-generated content, which provides immediate feedback, personalized suggestions, and efficient learning resources, makes tasks seem more manageable to students, enhancing their confidence and increasing their expectations of success (Hmoud et al., 2024). When students realize, through AIGC tools, that they have the opportunity to understand more complex concepts or achieve better grades (Javaid et al., 2023), their level of motivation is likely to increase. Value refers to a student's perception of the potential costs and benefits that are associated with completing that task (Wigfield & Eccles, 2000, 2024). AIGC can enhance these perceptions by offering engaging and relevant learning materials or interactively presenting knowledge (Hmoud et al., 2024), which makes the learning process more vivid and interesting, thereby increasing students' perceived value of the tasks. This enhanced value perception can boost students' interest and active participation, making them more motivated to learn (Rosenzweig et al., 2019).

The Achievement Goal Theory

The achievement goal theory offers another valuable perspective for exploring the potential impact of AIGC on student motivation. This theory suggests that an individual's motivation is influenced by the type and nature of the achievement goals they set (Elliot & McGregor, 2001; Elliot & Sommet, 2023). AIGC has the potential to shape students' mastery goals, thereby enhancing their motivation. It offers tailored learning content and suggestions based on students' personal needs and learning progress (Chen et al., 2024). By continually adjusting the difficulty and content of learning materials, AIGC helps students set mastery goals, maintain interest and challenge, and encourage them to explore and learn new knowledge and skills continuously. This aligns with the mastery-approach goal orientation, where students focus on developing competence and mastering tasks (Elliot & McGregor, 2001).

Additionally, the self-assessment and immediate feedback provided by AIGC allows students to understand their performance and progress, focusing more on developing their abilities rather than competition (Lai et al., 2023). Students potentially become accustomed to comparing their current performance with their past performance rather than with other

students (Elliot & McGregor, 2001). This shift can lead to deeper engagement with learning materials and a greater focus on personal growth, shifting them away from performance-approach or performance-avoidance goals towards more adaptive mastery-oriented goals, thereby enhancing intrinsic motivation (Elliot & Sommet, 2023).

The Social Cognitive Theory

The Social Cognitive Theory developed by (Bandura, 1986; Bandura & Cervone, 2023) provides another valuable perspective on how AIGC can influence student motivation, which emphasizes the dynamic interplay between personal factors, behavior, and environmental influences (Bandura, 2001; Schunk & DiBenedetto, 2020). When applied to the context of AIGC in education, this theory helps elucidate how such technology can enhance or hinder student motivation through three key components: self-efficacy, outcome expectations, and reciprocal determinism.

Self-efficacy refers to an individual's belief in their ability to succeed in specific situations or accomplish a task (Bandura, 1997; Schunk, 2023). AIGC can enhance self-efficacy by providing tailored learning experiences reducing students' perceived difficulty and fear of learning tasks, and boosting their confidence, thereby leading to increased motivation to tackle more challenging tasks (Grassini, 2023; Schunk & DiBenedetto, 2020).

Outcome expectations refer to a person's beliefs about the likely consequences of performing a behavior (Bandura, 2001). AIGC can influence these expectations by clearly demonstrating the links between learning activities and desired outcomes. For instance, by demonstrating the potential practical applications and future prospects of the learning content, AIGC can enhance students' perception of the value of educational results, thereby increasing students' motivation to engage with the learning activities (Schunk & DiBenedetto, 2020).

Reciprocal determinism, which refers to the concept that personal factors, behavior, and the environment interact and influence each other (Bandura, 1978), suggests that AIGC can create adaptive learning environments based on students' interactions (Chen et al., 2024). For instance, it enhances learning experiences and intrinsic motivation by providing virtual classrooms, online discussion forums, and collaborative projects, thereby fostering a more responsive and supportive educational environment (Chan & Hu, 2023).

Distributed Cognition Theory

AIGC reflects the principles of distributed cognition theory as articulated by Pea (1993) and Hutchins (2000). This theory posits that cognitive processes are not isolated within an individual but are distributed across tools, artifacts, and individuals within an environment (Hutchins, 2020). By highlighting the collaborative nature of cognition, distributed cognition theory offers a framework for understanding the dynamic interplay between humans and AI tools (Hollan & Hutchins, 2009).

AIGC promotes motivation by leveraging this distributed cognitive dynamic (Hutchins, 2020). As students interact with AIGC tools, these tools become extensions of their cognitive processes, assisting them in offloading complex tasks and providing real-time, personalized feedback (Abas et al., 2023). This interaction creates a more engaging learning environment where the cognitive load is shared between the learner and the AI, making learning tasks more manageable and less intimidating (Hutchins, 2020). This reduction in cognitive strain could boost students' confidence and willingness to engage with challenging material (Yin et al., 2024).

The adaptive nature of AIGC allows it to tailor content to individual learners' needs and progress, fostering a sense of accomplishment and motivating learners to continue engaging with the material (Bahrami et al., 2023). This personalization aligns with the distributed cognition framework by adapting the learning environment to each student's cognitive strengths and preferences. By distributing cognitive tasks and creating a collaborative learning experience, AIGC enhances students' motivation, making learning more effective and enjoyable (Hollan & Hutchins, 2009).

The Self-Determination Theory (SDT)

Applying AIGC in education can be effectively understood through psychological theoretical frameworks, particularly Self-Determination Theory (SDT) (Ryan & Deci, 2017; Ryan & Vansteenkiste, 2023), to comprehend its potential impact on student motivation. SDT is well-suited to articulate the impact of AIGC on student motivation due to its comprehensive focus on three fundamental psychological needs: autonomy, competence, and relatedness (Ryan et al., 2023). These needs are essential for fostering intrinsic motivation,

which is crucial for sustained engagement and effective learning (Ryan & Vansteenkiste, 2023). AIGC can facilitate the satisfaction of the three basic psychological needs, thereby promoting student motivation (Chiu et al., 2023; Ryan et al., 2021).

Autonomy. Autonomy, which refers to the ability of individuals to engage in activities or perform behaviors according to their own will (Ryan & Deci, 2017; Ryan et al., 2023), is significantly enhanced by AIGC in educational settings. AIGC provides personalized teaching content and automated learning support, offering students ample autonomous choices and the freedom to manage their learning (Abas et al., 2023). With continuous online services provided by AIGC, students can access the necessary academic support at any time, aligning with their diverse learning needs and flexible schedules (Abas et al., 2023). This flexibility not only increases learning efficiency but also enhances students' sense of control and autonomy over the learning process (Abas et al., 2023). Furthermore, students can develop study plans and schemes based on their own needs and characteristics, ask questions, and receive answers, thereby enhancing autonomy over the learning process (Chiu et al., 2023). As autonomous learners, students can receive tailored learning support and teaching services based on their progress and abilities, thus gaining support for their autonomy (Zhao et al., 2023). This further strengthens their intrinsic motivation to set goals, engage in learning, and explore answers, promoting the development of self-awareness, self-regulation, and independent learning abilities (Zhao et al., 2023).

Relatedness. Relatedness, which refers to the need to connect with others, such as caring for others or being cared for, and a sense of belonging (Ryan & Vansteenkiste, 2023), is also supported by AIGC in educational contexts. Through its advanced interactive functions, AIGC enhances students' relatedness experiences during the learning process (Lai et al., 2023). For instance, AI chatbots embedded with empathy dimensions can simulate real conversation scenarios, providing an experience similar to talking with humans (Chiu et al., 2023). This experience not only offers students timely and relevant academic support but also fosters emotional connections by encouraging understanding, active participation, and curiosity (Niyozov et al., 2023). This emotional experience closely aligns with the relatedness need in SDT, as it makes students feel cared for and supported, thereby enhancing their sense of belonging (Ryan & Deci, 2017; Slemp et al., 2024).

Although the companionship and guidance provided by AIGC may not fully replace social interaction with human instructors, it offers continuous, student-centered support during the learning process (Abas et al., 2023). This environment promotes immediate learning, motivates students to engage more in their studies, and helps them invest more time and effort (Abas et al., 2023). Through AI-powered platforms, students can participate in interactive and adaptive learning spaces that foster meaningful interactions and knowledge sharing among peers (Chen et al., 2024). For example, in AI-enhanced collaborative learning, students engage with AI entities that actively contribute suggestions, insights, and content, enriching their learning experience by combining their creativity with machine intelligence (Niyozov et al., 2023). By using AIGC, such as personalized learning materials and interactive simulations, students can engage deeply with the subject matter and with each other, thereby promoting a strong sense of community and belonging (Lai et al., 2023). Therefore, students can experience a sense of mutual connection and social bonding, fulfilling their need for relatedness (Ryan et al., 2023).

Competence. Competence, which refers to an individual's subjective sense of their ability to process information and solve problems effectively (Ryan & Deci, 2017; Ryan et al., 2023), is significantly supported by AIGC in educational settings. With powerful data analysis and processing capabilities, AIGC provides a platform for students to enhance their sense of competence and learning achievement (Abas et al., 2023). Specifically, AIGC can provide immediate feedback on students' performance in tasks such as essay writing, completing assignments, or implementing projects, helping them identify and overcome learning blind spots and difficulties (Chiu et al., 2023). This instant feedback not only improves students' self-reflection and problem-solving abilities but also offers non-judgmental support, reducing the potential embarrassment and stress associated with receiving criticism (Lai et al., 2023). Through this support, students can clearly see their progress, experience their growth and development in the academic field, and become more proactive and confident in their learning process (Abas et al., 2023). Additionally, the open educational materials and autonomous exploration environment provided by AIGC further enhance students' sense of competence (Zhao et al., 2023). As students independently solve problems, they not only acquire knowledge and skills but also develop confidence and belief

in their abilities, which are crucial to students' intrinsic motivation, stimulating a positive attitude and determination to overcome academic challenges (Caratiquit & Caratiquit, 2023). This support for competence is fundamental in fostering a deep and sustained engagement with learning materials and academic pursuits (Ryan & Vansteenkiste, 2023).

In conclusion, these theoretical frameworks provide complementary perspectives for understanding the multifaceted ways in which AIGC can influence student motivation. While these theoretical perspectives offer valuable insights, it is crucial to examine how they translate into real-world educational settings. The following section reviews existing empirical studies that have investigated the relationship between AIGC use in education and student motivation.

Review of Existing Empirical Studies

The increasing prevalence and adoption of AIGC in the educational field have sparked academic exploration. Empirical studies have already investigated the relationship between the use of AIGC in education and student motivation (Lai et al., 2023; Lee et al., 2022; Wu et al., 2024; Yin et al., 2021). These studies often focus on AI chatbots, such as ChatGPT, and their impact on learning experiences and outcomes (Lai et al., 2023). Current research indicates that AIGC is a valuable technology for promoting learning and effectively enhancing student motivation (Chen et al., 2024; Zhao et al., 2023).

Several studies have demonstrated the positive impact of AIGC on learning motivation and self-efficacy. Yin et al. (2021) conducted a controlled experiment and found that learners who interacted with an AI chatbot exhibited higher learning motivation compared to those using traditional learning methods. Lee et al. (2022) demonstrated that using AI chatbots during review sessions could enhance students' self-efficacy towards learning tasks (also see Chang et al. (2022). In the context of language learning, Kim (2018) found that Korean university students who used AI chatbots to learn English showed higher learning interest than those who did not use AI chatbots. Similarly, Liu et al. (2022) observed that AI chatbots enhanced elementary school students' interest in extensive reading. Wu et al. (2024) further supported these findings, indicating that ChatGPT-based intelligent learning assistance can boost intrinsic motivation by providing additional support.

AIGC has also been found to positively impact student motivation across different disciplines. In foreign language learning, Ebadi and Amini (2024) found that interacting with a chatbot that fosters a positive social experience effectively converts learning content into message fragments for skill practice, thereby enhancing students' motivation to learn English. Similarly, Silitonga et al. (2023) highlighted that the use of chatbots enhanced students' motivation to learn English writing. In computer science, Yilmaz and Karaoglan Yilmaz (2023) discovered through experimental research that students who used ChatGPT for programming training had higher levels of computational thinking skills and motivation compared to those who did not use it. These students also demonstrated superior performance in critical thinking and creativity (Yilmaz & Karaoglan Yilmaz, 2023).

Beyond learning motivation, numerous studies have shown that AIGC can help students become more active in their learning process and have positive effects on various aspects such as learning engagement, satisfaction, and academic performance (Al Shloul et al., 2024; Chiu et al., 2023; Lee et al., 2022; Skjuve et al., 2024). Wu et al. (2024) found that the use of the ChatGPT-Based Intelligent Learning Aid (CILA) not only boosted their self-efficacy but also enhanced students' cognitive, behavioural, and emotional engagement. In an experimental study, Lee et al. (2022) discovered that interacting with an AI chatbot for review improved students' learning attitudes, ultimately resulting in higher academic performance compared to students who reviewed through traditional methods. Essel et al. (2022) further found that increasing students' interactions with chatbots could enhance their enjoyment of learning, boost their confidence in understanding and completing courses, and result in better academic performance compared to students who interacted only with teachers.

Qualitative research has also provided valuable insights into students' experiences with AIGC. Acosta-Enriquez et al. (2024) conducted interviews with college students and found that ChatGPT could provide engaging and enjoyable learning experiences. Students reported that the materials generated and provided by ChatGPT offered essential help in solving tasks, increasing their confidence and satisfaction in completing assignments (Acosta-Enriquez et al., 2024). As a beneficial supplement to student learning, the additional interesting content provided by ChatGPT sparked students' curiosity and interest in tasks, prompting them to seek more information and enhancing their motivation to complete

assignments (Hmoud et al., 2024). Similarly, Yilmaz and Karaoglan Yilmaz (2023) found in student interviews that the use of ChatGPT could boost their confidence and thinking abilities.

Gaps in Current Literature

Despite the progress made in researching AIGC's impact on motivation in the educational field, there are still gaps and areas requiring further exploration regarding its specific effects on student motivation (Alshahrani, 2023).

Narrow Scope and Population Biases

The existing research on AIGC in education is characterized by a relatively homogeneous focus, both in terms of the technologies studied and the populations examined. Most studies on AIGC have focused on ChatGPT, with fewer studies examining the use of other AIGC tools (Acosta-Enriquez et al., 2024; Strzelecki, 2023). This narrow focus limits the understanding of the broader spectrum of AIGC technologies and their unique impacts on student motivation. Additionally, the research predominantly centers on university students in well-resourced higher education settings, often overlooking vulnerable groups such as students with disabilities, minorities, those from economically disadvantaged backgrounds, and those in rural or remote areas (O. Ajlouni et al., 2023). This bias in subject selection could lead to limited generalizability of results, as the findings may not accurately represent students in under-resourced settings (Acosta-Enriquez et al., 2024). Furthermore, there is also a lack of research on the influence of AIGC on motivation across different academic disciplines and educational levels, which may restrict the applicability of findings to diverse populations or educational contexts (Hmoud et al., 2024; Zawacki-Richter, 2019).

Methodological Limitations

Current research methods employed in current studies present several limitations. Most studies rely heavily on surveys, often lacking scales specifically designed for AIGC contexts (Acosta-Enriquez et al., 2024). Researchers frequently modify existing questionnaire items from previous studies, which, despite being validated for reliability and pre-tested, may still introduce response biases (Acosta-Enriquez et al., 2024). There is also a notable scarcity of qualitative methods, such as interviews, which hampers the consideration of diverse

student needs and individual differences, leading to results that may not comprehensively capture the experiences and perceptions of students (Hmoud et al., 2024). Another issue is that many studies are conducted under laboratory conditions, where students unfamiliar with AIGC are asked to use it based on the measurement needs (Yusfi & Asmara, 2023). This artificial setting may not accurately reflect the real-world use of AIGC in educational environments (Zawacki-Richter, 2019). Furthermore, current research tends to capture students' immediate perceptions and experiences with AIGC, often overlooking the long-term effects and how perceptions may change over time (Zawacki-Richter, 2019). Therefore, further exploration with longitudinal designs is needed to investigate the sustained impact of AIGC in long-term learning processes, which would provide valuable insights into the benefits and potential drawbacks of integrating AIGC into educational practices (Kurtz et al., 2024; Zawacki-Richter, 2019).

Ethical Considerations

Current research lacks exploration into the impact of ethical issues surrounding AIGC on student learning motivation (Foroughi et al., 2023). AIGC-generated content cannot always guarantee the authenticity and accuracy of the data (Lai et al., 2023). Time limitations in AI databases can result in outdated or inaccurate information, particularly in rapidly evolving fields or those with limited online resources (Shoufan, 2023). AI-generated responses may contain biases inherited from their training data (Lund & Wang, 2023; Mao et al., 2024). This can lead to student anxiety regarding the usability and accuracy of generated content, potentially impacting their trust in AIGC-generated materials and, consequently, impacting their learning experience and motivation (Lai et al., 2023).

Moreover, the use of AIGC may expose students to risks related to transparency and response bias (Lai et al., 2023). The difficulty in identifying sources of AIGC-generated content raises issues of AI plagiarism and copyright or privacy infringement (Eke, 2023). Students may worry about being accused of cheating, increasing psychological stress and potentially affecting their learning motivation (Cotton et al., 2024; Grassini, 2023). Additionally, students' over-reliance on AIGC may lead to misuse, raising concerns about the fundamental integrity of the educational process (Wang et al., 2023). This over-reliance can potentially decrease engagement with the material, leading to a superficial understanding of

complex concepts (Grassini, 2023). This shift from mastering concepts to merely completing tasks may undermine the depth and quality of the learning experience, hindering their ability to learn effectively (Fuchs, 2023). Excessive reliance on AIGC may also weaken students' critical thinking and independent problem-solving skills, potentially impacting their self-efficacy and motivation (Kostka & Toncelli, 2023). The potential ethical issues and their impact on student learning motivation have not been thoroughly explored in existing research.

Call to Action for Research

Given the existing gaps, there is an urgent need for empirical studies to understand the efficacy and mechanisms of AIGC in enhancing student motivation, guided by robust theoretical frameworks. Such research, guided by robust theoretical frameworks like Self-Determination Theory (SDT), can explore how AIGC fulfills students' needs for autonomy, competence, and relatedness, thereby enhancing intrinsic motivation (Ryan & Deci, 2017). Through rigorous empirical methodologies, researchers can provide evidence-based insights into the most effective ways to integrate AIGC into educational practices.

To effectively evaluate AIGC's impact on student motivation, research should encompass diverse student populations and educational settings, spanning various geographical locations, educational stages, and disciplines (Alshahrani, 2023). Besides, future research should extend across different fields of study, including language learning, STEM subjects, and social sciences, to explore how the motivational influences of AIGC may vary by subject matter (Alshahrani, 2023). Strengthening cross-disciplinary collaboration from education, psychology, computer science, and related fields is crucial for developing comprehensive frameworks that elucidate the complex interplay between AIGC, student motivation, and learning outcomes (Zawacki-Richter, 2019).

The diversity of research methods is equally important in advancing our understanding of AIGC's impact on student motivation. Long-term experimental designs, longitudinal studies, and mixed-methods research will help to understand how AIGC affects student learning motivation from various angles (Lai et al., 2023; Zawacki-Richter, 2019). Qualitative research can explore the personalization and diversity of student experiences,

while quantitative research should develop and validate scales designed the impact of AIGC on motivation (Acosta-Enriquez et al., 2024). Furthermore, research should transition from laboratory settings to real educational environments, enabling direct observe and record its impact on student motivation, thereby assessing the effectiveness of AIGC in real-world educational contexts (Yusfi & Asmara, 2023).

Ethical considerations are integral to responsible AIGC implementation in education (Cotton et al., 2024). There is a need to focus on AIGC's measures for handling personal data and protecting privacy (Rawas, 2024). Especially in academic research, it is recommended that all research projects undergo ethical review to ensure that data processing and usage during the research process comply with ethical standards and legal regulations (Wang et al., 2023), and adhere to appropriate guidelines for academic integrity in the AIGC era (Grassini, 2023). Additionally, assessing long-term impacts on students' learning motivation and mental health is essential (Kurtz et al., 2024). By integrating these methodological and ethical considerations, the effective application of AIGC in education can be enhanced, ultimately improving student motivation and learning outcomes substantially (Alshahrani, 2023).

The scope of the journal *Learning and Individual Differences* is highly relevant to this call for research on AIGC's role in student motivation. The journal focuses on original empirical studies that make substantial scientific contributions to our understanding of individual differences in learning within educational contexts. This alignment provides an excellent opportunity to explore how AIGC intersects with core aspects of learning and individual differences.

The interdisciplinary nature of this research also aligns well with the journal's welcoming of contributions from psychology, educational sciences, and learning sciences. Specifically, we are looking at studies that:

1. Investigate the impact of AIGC on student motivation in learning based on solid psychological frameworks.
2. Explore how individual differences (e.g., digital literacy, learning styles, prior knowledge) influence the effectiveness of AIGC in enhancing learning motivation.
3. Assess the long-term effects of AIGC-enhanced learning environments on student motivation and academic performance, considering various individual and contextual

factors.

4. Study how the integration of AIGC tools by teachers influences student motivation.
5. Investigate how AIGC influences student motivation in specific learning domains, with a particular focus on AI literacy and ethics.

By focusing on these areas, researchers can contribute to a nuanced understanding of how AIGC technologies can be optimally designed and implemented to enhance motivation and learning outcomes while accounting for individual differences. This research has the potential to shape evidence-based practices in the rapidly evolving field of AI-enhanced education, aligning closely with the journal's mission to advance our knowledge of individual differences in diverse learning contexts.

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