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Application, Risks, and Prospects of Generative Artificial Intelligence in Education: A Case Study of DeepSeek

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Abstract. The generative AI (GAI) technology represented by DeepSeek is developing rapidly and gradually entering the field of education. However, systematic examination of its applicability in education remains limited. Drawing on risk theory and human-computer collaboration theory, this study conducts a systematic review of the literature on DeepSeek's current educational applications. It analyzes the positive effects of DeepSeek in three dimensions: students, teachers, and classrooms, including supporting cognitive training, reducing teachers' repetitive workload, and facilitating contextualized knowledge construction. At the same time, its application entails potential risks such as educational data leakage, misinformation caused by algorithmic hallucination, the digital divide, threats to academic integrity, and weakened teacher roles. The study concludes that DeepSeek should be positioned as an auxiliary cognitive tool in education rather than a replacement for human teaching. Accordingly, recommendations are proposed at three levels: institutional data governance and privacy protection, technical improvement of algorithmic transparency, and educational evaluation reform and critical digital literacy cultivation.

Keywords: DeepSeek, Generative Artificial Intelligence, Educational Application, Risks, Human-Computer Collaboration

1. Introduction

In recent years, Artificial Intelligence (AI) tools such as DeepSeek have developed rapidly and are now widely used in daily tasks, including information retrieval, knowledge summarization, and content creation. According to public data, from January 11, 2025 to January 31, 2025, the daily active users of DeepSeek on all platforms (Web + App) increased from 1.24 million to a peak of 45.41 million, a 36.6-fold increase, making it the world's second largest AI application by daily active users across all platforms. This rapid growth reflects the increasing presence of AI as an intelligent assistant in many people's work and study.

In the field of education, the application of AI has also generated widespread discussion. Some scholars have studied ChatGPT and other generative AI models. For example, Jiang Hua et al. analyzed the positive potential of ChatGPT in empowering students, assisting teachers, and reshaping the educational environment, while also pointing out the risks of technology abuse and educational alienation [1]. Pu Qingping and Xiang Wang discussed the profound changes brought about by ChatGPT from four perspectives, namely production methods, scientific research

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paradigms, educational forms, and lifestyles, and identified legal, ideological, and social risks [2]. Lu Yu et al., based on four core capabilities of ChatGPT, namely inspirational content generation, contextual dialogue understanding, sequential task execution, and programming language parsing, identified its potential applications in teaching, learning, evaluation, and tutoring, and validated the functions of exercise generation, automatic problem solving, and assisted grading through experiments [3].

Existing studies mostly focus on the educational applications of generative AI, few studies have systematically examined newer models such as DeepSeek, especially regarding their practical effects, potential risks, and long-term implications. This paper draws on risk theory and human-computer collaboration theory to develop a risk perception framework and examines both the possible benefits and risks of DeepSeek in education, with the aim of offering guidance for the responsible integration of generative AI into educational practice.

2. Theoretical framework

2.1. Risk theory

Risk theory holds that many risks in modern society are not naturally occurring but arise from human technologies and social activities, carrying uncertainty and potentially negative consequences. In education, existing studies on the ethical risks of educational AI have identified problems such as data security, algorithm bias, technology dependence, and emotional deficiency. Scholars have proposed a classification framework that distinguishes four types of ethical risks in educational AI: educational data risk, machine learning risk, technological ontology risk, and intelligent application risk [4, 5]. This framework provides a basis for analyzing the possible risks associated with DeepSeek in education.

2.2. Human-computer collaboration theory

Human-computer collaboration theory was first proposed by Joseph Licklider. Licklider argued that humans and computers should form a complementary and cooperative relationship rather than one of simple replacement. The core idea is that humans contribute creativity, value judgment, emotion, and ethical decision-making, while machines contribute computing power, data processing, pattern recognition, and automated execution. Their collaboration can produce intelligence enhancement. In educational contexts, human-computer collaboration theory positions AI as an auxiliary tool that works with teachers and students to build a new learning ecology, rather than as a substitute for human teaching [4]. This perspective offers a theoretical basis for understanding how DeepSeek can support and reshape teaching and learning.

3. Three-dimensional analysis of DeepSeek integration into teaching and learning

3.1. Student dimension: role shift from passive reception to active inquiry

In traditional teaching, teachers play the dominant role, and students mostly remain passive recipients. When studying independently, students often lack a dialogue partner who can keep asking questions and help them clarify their thinking. As a dialogue model, DeepSeek can pose follow-up questions based on students' responses and prompt them to articulate their reasoning in a complete and logical manner. This repeated questioning itself serves as effective cognitive training, more conducive to developing thinking skills than simply obtaining ready-made answers. DeepSeek

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can also provide targeted explanations and exercises according to individual foundations and learning progress, partly compensating for the difficulty of accommodating individual differences in whole-class instruction. When students face difficulties after class, DeepSeek can give hints or ask follow-up questions about the specific step they are stuck on, helping them continue working through the problem instead of waiting for the next class [1].

3.2. Teacher dimension: reducing repetitive burden and returning to professional duties

In the traditional teaching model, teachers mainly rely on homework and exams to infer students' learning levels and difficulties, which makes it hard to precisely track their mastery of the subject. Dialogue logs between students and AI can now serve as reference material that reflects their thinking processes. From these records, teachers can identify common cognitive misconceptions across the class, thus gaining an additional channel for understanding students' learning and making previously unobservable cognitive difficulties more analyzable. At the same time, DeepSeek can automate repetitive tasks such as question generation, homework grading, and lesson plan organization, allowing teachers to devote more attention to students' emotional guidance, classroom interaction design, and personalized instruction [1].

3.3. Classroom dimension: knowledge construction in real problem situations

The difficulty in learning abstract knowledge largely comes from its isolated presentation detached from the context in which it is produced. Situated cognition theory points out that knowledge detached from context easily becomes inert knowledge. Unlike traditional cognitive psychology that regards learning as pure mental representation, situated cognition regards learning as a shift from how representations are processed to how representations are created and given meaning. Learning truly happens through the interaction between individuals and the environment [6]. Individual participation in practical activities and interaction with the environment are the fundamental mechanisms for learning to occur [7].

Multimedia teaching aids are now common in many subjects, but abstract ideas such as theorems and formulas remain difficult for students to grasp, and they often memorize them for exams without understanding their practical meaning. DeepSeek can quickly generate explanations, stories, dialogues, and visual suggestions based on the subject content. These materials place abstract concepts in concrete contexts, making them easier to understand. For example, in mathematics or history teaching, teachers can use DeepSeek to generate background text about the origin of geometry, such as how ancient Egyptians developed geometry through land surveying along the Nile. By placing abstract symbols in a concrete historical context, this approach reduces cognitive load and helps students understand why the knowledge matters. Such use of DeepSeek encourages learners to take an active part in meaning construction and can also strengthen their motivation to learn. Through dialogues, stories, and simulated scenarios, DeepSeek can present abstract concepts more intuitively and enrich learning in areas such as oral practice and interdisciplinary inquiry [1].

4. Risk examination of DeepSeek's application in education

Although generative AI has brought positive changes to education, its potential risks and challenges should not be ignored. From the perspective of risk theory, the use of DeepSeek in education also raises a range of ethical, technical, and social problems.

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4.1. Educational data risk

4.1.1. Leakage of students' personal learning data and family information

When using DeepSeek, students need to provide learning data, including homework content and knowledge weaknesses, and their data may even include sensitive information such as family details. If these data are improperly collected, stored, or misused by the platform, such practices seriously violate personal privacy. Minor students, in particular, often have limited awareness and ability to protect their personal information. More concerning, these data may also be used for commercial purposes, which deviates from the public welfare nature of education [1, 4].

4.1.2. Retention and abuse of teachers' teaching materials

Similar to the data risks faced by students, teachers may upload teaching materials, student grade analyses, class management information, and other content when using DeepSeek for lesson preparation and planning. Retention or leakage of these materials not only infringes teachers' intellectual property rights, but may also indirectly expose students' academic information, creating a secondary privacy risk

4.1.3. Dilemma of data governance

DeepSeek generates a large amount of educational data during its operation, but the ownership, usage, and management rights of these data remain unclear. The lack of effective data governance may not only lead to the privacy problems mentioned above, but may also result in educational data being used for non-educational purposes, thereby undermining the healthy educational ecology [1, 4].

4.2. Machine learning risk

4.2.1. Cognitive bias caused by misinformation

Generative AI is still at an early stage of development and often produces content that appears reasonable but is actually incorrect or unfounded, a phenomenon known as hallucination [3]. Because students may lack the ability to discriminate information, they may internalize such incorrect information as correct knowledge, which negatively affects learning outcomes. This problem is especially evident in factual learning: students may memorize wrong concepts and formulas generated by AI as standard answers, resulting in cognitive biases that are difficult to correct.

4.2.2. Marginalization of specific groups by algorithm biass

Some studies have pointed out that the training data of AI models contain biases, and model outputs can also be influenced by how users phrase their questions. This can lead to discrimination against or marginalization of certain groups or viewpoints in content understanding and generation, thereby subtly transmitting and reinforcing unfair values [4]. For example, the model may differ in its understanding of expressions from different dialects and cultural backgrounds, causing some students to receive lower-quality service during use.

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4.3. Technology ontology risk

4.3.1. Digital divide and educational equity

Due to the current unequal distribution of educational resources, significant differences exist in technological equipment and network conditions across different regions, schools, and families. There are also considerable differences in access to generative AI and in how students are guided to use it. In practice, differences in students' proficiency may further widen the gap [1, 2].

4.3.2. Technology dependence

From the students' perspective, if they develop the habit of turning to AI whenever they encounter a problem, they may gradually lose the motivation for independent thinking and self-inquiry, thereby developing a path dependence on AI [2, 4]. When the thinking process is replaced by technology, students may gradually lose the ability to engage in independent inquiry and critical thinking, which runs counter to the fundamental goal of education to cultivate well-rounded individuals [1, 2]. From the teachers' perspective, if they rely too heavily on AI for repetitive work such as lesson preparation, question design, and grading, they may gradually weaken their instructional design abilities and their sensitivity to individual differences among students [1]. This two-way technology dependence essentially reflects a weakening of the human position in the human-computer collaboration relationship.

4.4. Intelligent application risk

4.4.1. Academic integrity and weakening of students' subjectivity

DeepSeek is capable of generating texts, integrating content, and producing answers. Students can use it to complete homework, papers, and other learning tasks quickly. If students rely too heavily on AI-generated content and submit it directly as their own work, they may not only weaken their awareness of academic integrity, but also reduce their opportunities for independent thinking, knowledge construction, and problem solving. This, in turn, can undermine their subjectivity in learning [2, 4].

4.4.2. Decline in the effectiveness of teaching evaluation

When students can use AI to complete most of their written assignments, traditional homework and exams can hardly reflect their actual mastery of knowledge and thinking abilities. If teachers continue to rely on outdated evaluation methods, they may misjudge students' learning conditions, making teaching feedback and interventions less targeted. This problem poses a direct threat to educational quality assurance.

4.4.3. Weakening of teacher role boundaries

Human-computer collaboration theory emphasizes that the core value of teachers lies in emotional care, value guidance, and educational judgment, which cannot be replaced by AI [1]. Once teachers are reduced to mere reviewers of AI output, the warmth and depth of education will be greatly diminished, and a crisis of educational alienation may even be triggered [1, 2]. The boundaries of the teacher's role need to be redefined. Questions such as how to integrate AI into different stages of

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teaching to improve efficiency and how to position the teacher's role in this new context require careful consideration by every educator.

5. Positioning and path regulation of DeepSeek's application in education

5.1. Educational role positioning of DeepSeek

From the perspective of human-computer collaboration, technology intervention should aim at enhancing human subjective abilities. The proper role of DeepSeek in education should be that of an intelligent assistant rather than a replacement for human teachers [3]. The advantages of AI lie in efficient information retrieval, content generation, and automated processing of repetitive tasks, but the inspiration of thinking, emotional communication, and the shaping of values remain the responsibility of teachers. The classroom is not only a place for knowledge transmission, but also a social space for teacher-student interaction, peer collaboration, and personality development. These functions are far beyond the capability of technology [1, 2]. Therefore, DeepSeek should serve as an auxiliary cognitive tool in education. True understanding and internalization of knowledge still require students' own thinking and practice. Teachers can use it to improve work efficiency and enrich teaching methods, but the core of instructional design and the responsibility of educational judgment must remain with teachers themselves [1, 3].

5.2. Practical implications

To ensure that DeepSeek supports education without creating new problems, students, teachers, schools, and parents need to establish and follow shared usage norms.

5.2.1. Institutional level: data governance and privacy protection

Schools should clarify data rights and responsibilities with technology service providers and establish clear rules for information security. When choosing AI tools, schools should also give priority to platforms with stronger data protection capabilities. In addition, users need to avoid entering real names, ID numbers, home addresses, or other directly identifiable personal information in conversations with AI [1, 4]. Parents can support this process by paying attention to how and how often their children use AI, providing reasonable guidance instead of outright prohibition, and helping them develop responsible technology use habits [1, 2]

5.2.2. Technical level: algorithm transparency and critical use

Generative AI models such as DeepSeek operate with a degree of opacity, which is particularly risky in educational settings [3]. Platform providers therefore have a responsibility to make their outputs more transparent, for example by attaching reasoning steps or indicating information sources when generating answers. They should also improve the quality of sources and set clear limits on the collection of personal information. At the same time, since full algorithmic transparency is not yet achievable, users' critical thinking becomes especially important. When using AI, teachers and students should cross-check factual content against textbooks, academic literature, or other authoritative sources, and remain alert to the reasoning process. If AI gives overly confident or oversimplified conclusions, users should question whether the logic holds [1, 4].

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5.2.3. Educational practice level: evaluation reform and role definition

Schools should formulate clear AI usage norms and ethical guidelines, specifying the situations in which AI may or may not be used, and strengthen digital literacy education for both teachers and students. Teachers should also re-examine and reinforce their unique role in emotional communication, value guidance, and personalized care. When designing homework and assessment tasks, they need to account for the presence of AI and rely more on process evaluation, project-based learning, and other methods that better reflect students' comprehensive abilities [1, 3].

6. Conclusion

This paper takes DeepSeek as an example, combines risk theory and human-computer collaboration theory, and systematically explores the application prospects and potential risks of generative AI in education. In the three dimensions of students, teachers, and classrooms, DeepSeek shows positive potential in assisting cognitive training, reducing teachers' burdens, and promoting contextualized knowledge construction. At the same time, its application also faces multiple risks, such as educational data leakage, algorithmic hallucination and misinformation, the widening digital divide, threats to academic integrity, failure of teaching evaluation, and weakening of teacher roles. Based on the theoretical position of human-computer collaboration, this paper argues that the proper role of DeepSeek in education should be an intelligent assistant rather than a replacement, and puts forward suggestions for standardized use at three levels: data governance, algorithm transparency, and evaluation reform.

This study is primarily a theoretical and literature-based analysis, and its findings are not yet supported by empirical evidence from classroom practice. Future work could look at its actual use in teaching over time, compare it with other generative AI tools, and consider how results vary across subjects and student groups.

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