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A study on the current situation, impacts, and guidance strategies of college students' dependence on generative Artificial Intelligence in the digital era: a case study of X University

Yuanyuan Li

Qinghai Normal University, Qinghai, China

2413706758@qq.com

Abstract. Against the backdrop of the continued advancement of educational digitalization, generative Artificial Intelligence (AI) has rapidly become integrated into university students' course learning, information retrieval, assignment completion, and everyday information processing. Based on 342 undergraduate survey responses from X University, supplemented by unstructured interviews, this study employs literature review, questionnaire survey, and descriptive statistical analysis to investigate the current use of generative AI among university students, the manifestations of AI dependence, its consequences, and corresponding guidance strategies. The findings reveal that generative AI has become a high-frequency learning tool for undergraduates at X University. Students primarily use AI for after-class learning, information retrieval, routine question answering, and assignment assistance. Their dependence on generative AI is mainly manifested in three dimensions: functional dependence, cognitive dependence, and judgmental dependence. Although generative AI contributes positively to improving learning efficiency, broadening access to information, and facilitating the organization and expression of ideas, it may also weaken students' capacity for independent thinking, encourage shortcut-oriented learning behaviors, and diminish their awareness of academic norms. To achieve a balance between technological empowerment and students' autonomous development, universities should establish a coordinated guidance framework encompassing the cultivation of student agency, improved assignment design and process-based assessment by instructors, institutional regulations, and AI literacy support.

Keywords: generative artificial intelligence, undergraduate students, AI dependence, educational digitalization, academic integrity, guidance strategies

1. Introduction

Against the backdrop of the nation's vigorous promotion of educational digitalization, generative artificial intelligence, leveraging advances in machine learning, natural language processing, and multimodal content generation, is becoming deeply integrated into teaching, learning, and assessment in higher education.

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University students are increasingly using a wide range of AI tools in activities such as course learning, assignment completion, information retrieval, academic writing, and everyday information processing. While these technologies improve learning efficiency, expand access to information, and lower the barriers to completing academic tasks, they also give rise to new educational challenges. Among these, the growing tendency of students to develop functional, cognitive, and judgmental dependence on generative AI has attracted particular attention. Since the emergence of AI applications such as ChatGPT, generative artificial intelligence has entered the educational sector at an extraordinary pace and has gradually become a common tool in university students' academic and daily lives. From text generation, language refinement, and knowledge-based question answering to programming assistance, information organization, and learning planning, generative AI now supports virtually every major aspect of students' routine learning activities. Compared with conventional search engines, generative AI not only provides access to information but also generates content directly in response to students' needs, thereby fundamentally transforming the ways in which they acquire knowledge and complete academic tasks.

2. Problem statement and literature review

2.1. Problem statement

For university students, the appeal of generative artificial intelligence lies primarily in its speed, convenience, and low threshold for use. When confronted with coursework, classroom presentations, term papers, or job application materials, AI tools can rapidly generate well-structured text, extract key information from source materials, and even provide complete answers. This combination of high efficiency and immediate feedback has enabled generative AI to gain widespread acceptance among university students within a remarkably short period. While these tools provide technological support for efficient knowledge acquisition and academic research, excessive reliance on AI may undermine students' capacities for independent thinking, sustained learning, and problem-solving, while also giving rise to new forms of academic misconduct risk [1]. Current debates on the educational application of generative AI center on the tension between technological empowerment and tool dependence. On the one hand, AI can reduce the cost of information retrieval, improve learning efficiency, and expand students' cognitive horizons. On the other hand, when students begin to treat AI as a substitute for thinking and judgment, their agency as active learners may gradually diminish. Against this backdrop, the present study focuses on university students as the primary population of interest and takes X University as its research setting to examine the manifestations, consequences, and guidance strategies related to students' dependence on generative artificial intelligence.

2.2. Literature review

Existing research has generated a substantial body of scholarship on the educational applications of generative artificial intelligence. Feng Yuhuan argues that content-generating AI products such as ChatGPT offer significant educational benefits, including enhanced practical creativity, increased cognitive initiative, and improved learning efficiency through reduced workload. At the same time, they introduce multiple ethical challenges involving individual agency, interpersonal relationships, algorithms, and educational resources [2]. Among these concerns, the loss of independent thinking resulting from AI dependence has been explicitly identified as a major risk in educational practice. This perspective suggests that AI dependence extends beyond the frequency of technology use and is fundamentally related to the development of learners' cognitive capabilities.

With respect to actual usage among university students, Li Yan et al., based on a survey conducted at Zhejiang University, found that generative AI has already achieved widespread adoption. Course learning, scientific research, daily life, further education, and job seeking have all become major application scenarios [3]. These findings indicate that generative AI is no longer a peripheral technology but has become deeply embedded in students' everyday learning practices, underscoring the practical significance of investigating AI dependence.

Regarding the effects of technology use, Ma Yinqi et al. examined the influence of AI-Generated Content (AIGC) on graduate students' research innovation and proposed that AIGC may produce two contrasting outcomes: technological empowerment and tool dependence [4]. When used appropriately, AI can function as a valuable instrument for fostering innovation; when used inappropriately, it may diminish learners' autonomy and creativity. Although their research focuses primarily on graduate students, the analytical framework highlighting the coexistence of empowerment and dependence also provides valuable insights into AI use among undergraduates.

From the perspective of educational risks, Xiao Haiping and Wang Jun argue that the integration of artificial intelligence into education may lead to superficial conceptual understanding, degraded thinking ability, narrowed practical engagement, and weakened responsibility in the cultivation of scientific literacy [5]. Their analysis suggests that the consequences of AI dependence extend beyond the operational use of technological tools and may affect deeper educational objectives, including knowledge comprehension, inquiry-based learning, and the development of responsibility. For university students, long-term reliance on AI to complete cognitively demanding tasks may gradually erode their problem awareness, critical questioning, and reflective thinking.

In addition, Lan Guoshuai and colleagues, drawing upon the *UNESCO Guidance for Generative AI in Education and Research*, argue that the current educational application of generative AI continues to face challenges such as insufficient top-level policy design, inadequate implementation guidelines, and lagging regulatory frameworks [6]. From the perspectives of policy and governance, their study highlights that students' dependence on AI should not be viewed solely as an individual behavioral issue but is also closely associated with the absence of clearly defined institutional boundaries, curricular support, and governance mechanisms within higher education institutions.

Overall, existing studies provide a solid theoretical foundation for understanding both the educational value and the potential risks of generative artificial intelligence. Nevertheless, two major gaps remain. First, much of the current literature emphasizes macro-level ethical discussions or policy analysis while paying relatively limited attention to the specific manifestations of AI dependence among students in particular institutional contexts. Second, previous research has focused predominantly on graduate students' research activities or on the overall educational effects of AI, offering relatively little detailed analysis of AI dependence in undergraduate learning contexts. Accordingly, this study centers on undergraduate students at a single university to investigate the manifestations, consequences, and guidance strategies of dependence on generative artificial intelligence. By doing so, it addresses the contextual limitations of existing research while providing a more practical case-based reference for higher education institutions.

3. Research design and survey implementation

3.1. Research methods and participants

This study primarily employs three research methods: literature review, questionnaire survey, and statistical analysis. The literature review was conducted to synthesize existing research and identify the core issues and

analytical dimensions of university students' dependence on artificial intelligence. A questionnaire survey was then used to collect first-hand data on the use of and dependence on generative AI among undergraduate students at X University. Finally, statistical analysis was performed to summarize students' frequency of AI use, major application scenarios, manifestations of dependence, and perceptions of AI's impact, while also comparing differences in AI dependence across students from different academic years and disciplinary backgrounds. The study focuses on undergraduate students at X University. Data were collected through an online questionnaire, with the sample covering students from different year levels and academic disciplines.

3.2. Questionnaire structure and key dimensions

Based on the objectives of this study and informed by the existing literature, a questionnaire entitled "*Survey on University Students' Use of Generative Artificial Intelligence*" was developed. The questionnaire consisted of four sections. The first section collected respondents' demographic and background information, including gender, academic year, field of study, duration of AI use, frequency of use, and the AI tools most commonly employed. The second section examined AI use and dependence, focusing on whether students habitually regarded AI as their first choice for completing learning tasks, whether they tended to consult AI-generated answers before engaging in independent thinking, and whether they placed a high degree of trust in AI-generated outputs when making judgments. The third section assessed students' perceptions of the impacts of AI dependence, including its effects on learning efficiency, the potential weakening of independent thinking, the simplification of learning processes, and risks associated with academic norms. The fourth section explored students' perceptions of institutional governance, investigating their expectations regarding curriculum development, instructor guidance, and institutional regulations governing the use of AI.

3.3. Data processing

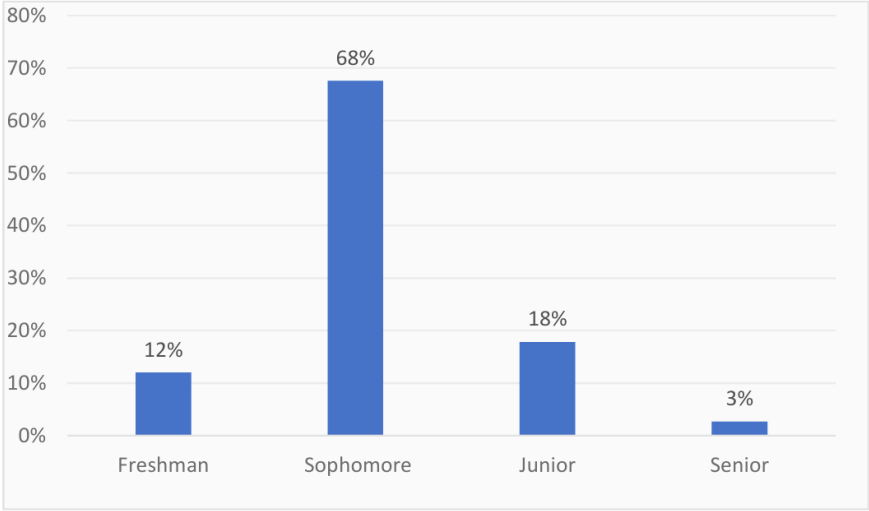

Figure 1. Distribution of questionnaire respondents by academic year

A total of 342 valid questionnaires were collected through the online survey platform Wenjuanxing. As shown in Figure 1, first-year students accounted for 12% of the sample, second-year students for 68%, third-year students for 18%, and fourth-year students for 3%. Regarding the duration of AI use, Figure 2 shows that 21% of respondents had used AI for less than six months, 33% for six months to one year, 30% for one to two years, and 15% for more than two years. The collected data were analyzed using SPSS 23.0. The analysis

focused primarily on descriptive statistics concerning students' frequency of AI use, principal application scenarios, and manifestations of AI dependence.

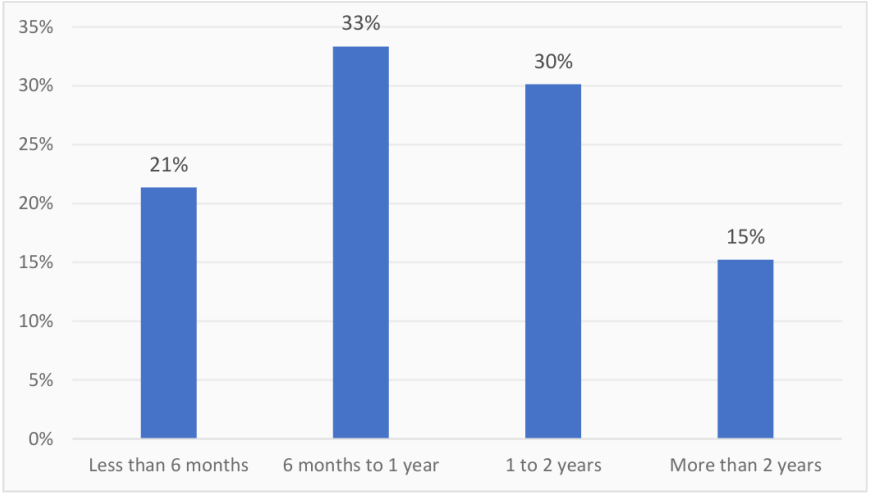

Figure 2. Distribution of respondents by duration of AI use

4. Current status of university students' dependence on generative Artificial Intelligence

4.1. The growing popularization of generative AI use

Overall, the use of generative artificial intelligence among undergraduate students at X University has reached a high level of adoption. As shown in Figure 3, 72% of respondents reported using AI tools at least once a week. Specifically, 29% used AI one to three times per week, 13% used it four or more times per week, and another 29% reported using AI almost every day. These findings indicate that generative AI is evolving from a novel technology into an everyday learning tool. Its influence is no longer confined to a small group of technologically inclined students but has gradually expanded to the broader undergraduate population.

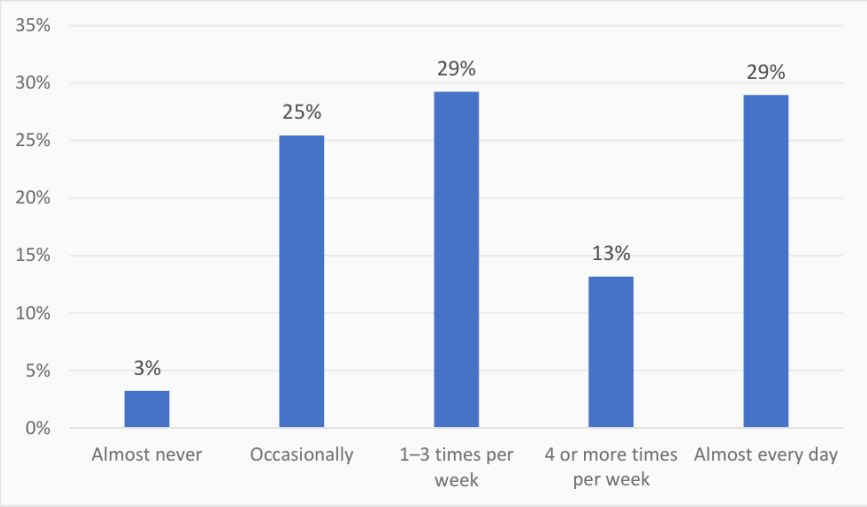

Figure 3. Frequency of AI tool use among undergraduate students at X University

With respect to the AI tools most frequently used, students' preferences are generally shaped by factors such as accessibility, Chinese language capability, response speed, and campus-wide diffusion. As shown in Figure 4, Doubao is the most commonly used AI tool among undergraduates at X University, with a usage rate of 87%, followed by DeepSeek at 59%. In addition, students also reported using Kimi, ERNIE Bot, and various other generative AI tools.

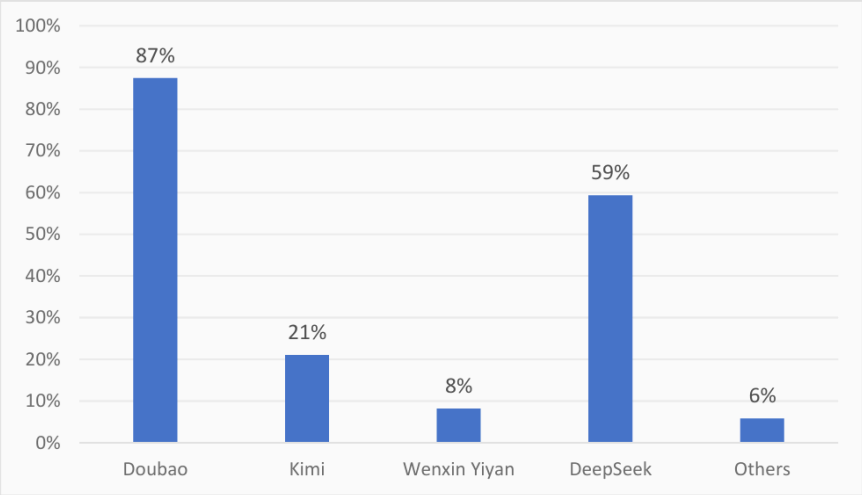

Figure 4. Most frequently used AI tools among undergraduate students at X University

These findings suggest that AI tools characterized by low barriers to entry, rapid response times, and strong compatibility with course assignments are more likely to gain popularity among university students. Students' choices of AI tools are therefore influenced less by the underlying technological architecture than by task convenience and overall user experience.

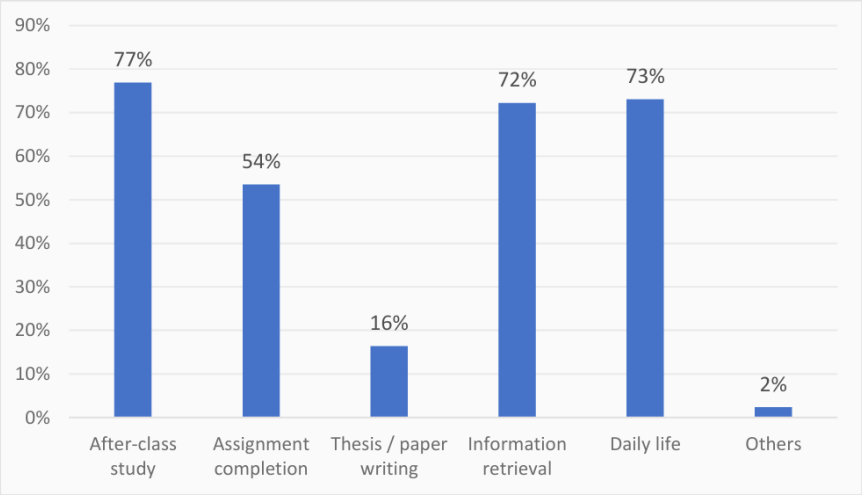

Figure 5. Major application scenarios of AI tools among undergraduate students at X University

In terms of application scenarios, course learning, assignment completion, academic writing, information retrieval, and everyday problem solving constitute the primary contexts in which students use generative AI. As shown in Figure 5, 77% of respondents reported using AI tools for after-class learning, 73% for resolving everyday questions, 72% for information retrieval, and 54% for assignment assistance. Overall, course

learning, information retrieval, and daily life represent the most common contexts of AI use, indicating that generative AI has become deeply embedded in both students' formal learning activities and their routine information-processing practices.

The rapid integration of generative AI into students' learning processes can largely be attributed to its ability to meet several practical needs. First, it satisfies the demand for greater efficiency in completing academic tasks. Second, it provides explanations for complex knowledge that students may find difficult to understand independently. Third, it offers timely assistance under conditions of heavy academic workloads and time pressure. Because generative AI aligns closely with students' actual learning needs, its use has continued to expand and has gradually become an integral part of everyday academic life.

4.2. Major manifestations of dependence on generative AI

Drawing on the questionnaire design and students' actual patterns of AI use, dependence on generative artificial intelligence among undergraduates at X University can be classified into three interrelated forms: functional dependence, cognitive dependence, and judgmental dependence. These three forms represent a progressive continuum, moving from *using AI as a tool* to *allowing AI to substitute for thinking* and ultimately to *relying on AI in making judgments*, thereby constituting the fundamental logic of AI dependence among university students.

First, functional dependence refers to students' habitual tendency to turn to AI as their first option when faced with academic tasks, delegating activities such as information collection, material organization, and even portions of written content to AI systems. As shown in Figure 6, 81% of respondents selected "neutral" or above for the statement "*I have developed a habitual reliance on AI tools when organizing research materials*", while 24% explicitly chose "agree" or "strongly agree". These findings suggest that task-oriented dependence on AI has become increasingly evident, although strong dependence has not yet become the dominant pattern.

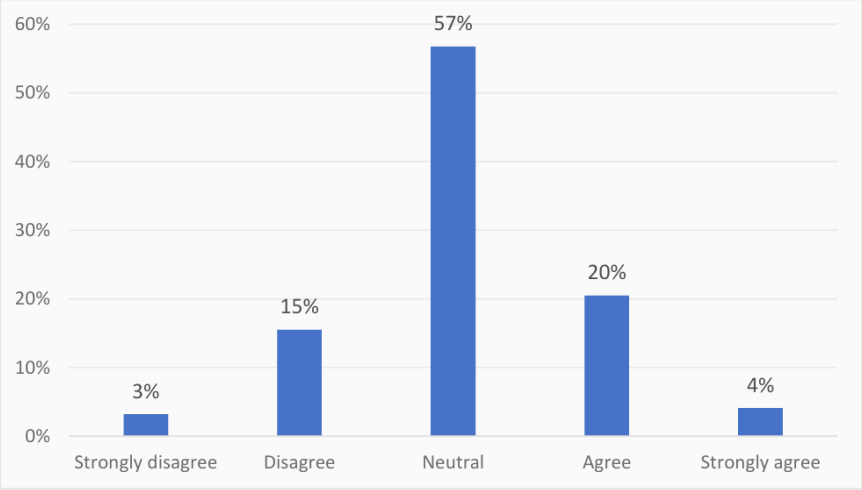

Figure 6. Undergraduate students' agreement with habitual dependence on AI when organizing research materials

A direct consequence of functional dependence is the development of task-related reliance on AI. Once deprived of AI assistance, some students experience a noticeable decline in work efficiency and may even feel uncertain about how to begin writing. Because functional dependence is typically associated with improved efficiency, it is the most readily accepted form of AI dependence and, consequently, the easiest to overlook.

Second, cognitive dependence is manifested when students confronted with complex problems no longer engage in independent thinking as their initial response. Instead, they first consult AI-generated answers, ideas, or organizational frameworks and then make only limited modifications. As shown in Figure 7, 81% of respondents selected "neutral" or above for the statement "*When encountering complex problems, I tend to consult AI-generated answers before thinking independently*", while 34% chose "agree" or "strongly agree". This finding indicates that AI has, to some extent, altered the sequence in which students approach problem solving.

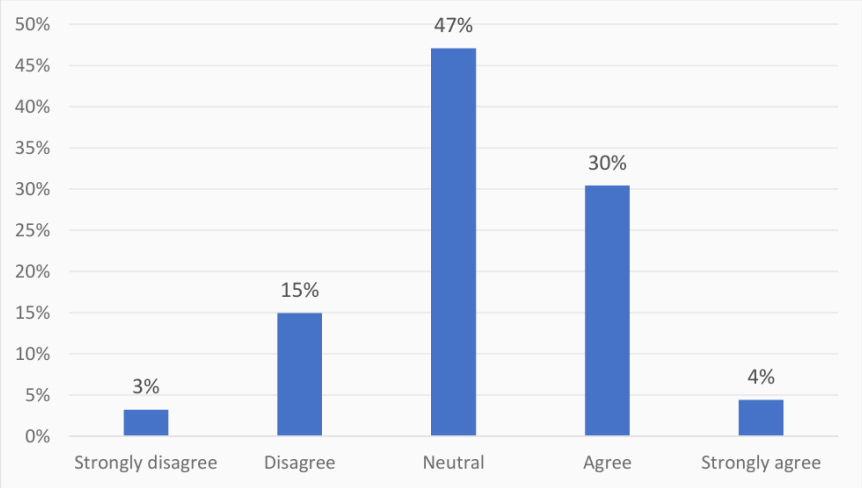

Figure 7. Undergraduate students' agreement with consulting AI before independent thinking when encountering complex problems

Although this behavior appears to improve efficiency, it substantially reduces opportunities for independent analysis and reasoning. Instead of actively constructing knowledge, students become more inclined to accept ready-made frameworks. Over time, cognitive dependence may weaken their patience in dealing with complex problems, diminish their reasoning abilities, and reduce their capacity for autonomous knowledge construction.

Third, judgmental dependence refers to the tendency of some students to accept AI-generated content without sufficient verification. Because AI-generated responses often appear comprehensive and well organized, students may readily assume that they are accurate. As AI increasingly becomes a trusted source of answers, students may become less rigorous in evaluating the authenticity of information, assessing the soundness of logical arguments, and verifying the credibility of supporting evidence.

Overall, functional dependence is the form most easily rationalized because of its immediate efficiency gains, whereas cognitive dependence and judgmental dependence are more subtle and therefore more difficult to detect. Although these latter forms may not produce immediate negative consequences, they can gradually reshape students' patterns of thinking and learning. Without appropriate guidance from instructors, students may gradually shift from using AI as a supportive tool to allowing it to replace their own intellectual agency.

5. Impacts and underlying causes of dependence on generative Artificial Intelligence

5.1. Positive impacts: enhanced efficiency and learning support

First, generative artificial intelligence can significantly improve university students' efficiency in completing academic tasks. When faced with extensive reading, information screening, and idea organization, AI can help students quickly establish an initial framework, thereby shortening the transition from *not knowing where to begin* to actively engaging in writing. For students coping with fast-paced academic schedules and heavy workloads, this efficiency advantage is highly attractive and constitutes one of the primary reasons for their continued use of AI. Second, generative AI broadens students' access to learning resources. In traditional learning environments, students typically rely on textbooks, classroom instruction, and search engines to acquire knowledge. By contrast, AI can integrate fragmented information into coherent and comprehensive responses, providing a more interactive gateway to knowledge. For students with relatively weak academic foundations, limited expressive abilities, or unfamiliarity with a particular topic, AI-generated explanations and examples can reduce learning anxiety and enhance confidence. Third, generative AI improves students' efficiency in organizing ideas, summarizing information, and structuring written expression. In tasks such as preparing presentation outlines, drafting initial manuscripts, refining language, and integrating information from multiple sources, AI can rapidly generate well-structured text. Provided that students retain independent judgment and use AI as an assistive rather than a substitutive tool, generative AI can effectively serve as a form of instructional scaffolding that supports the learning process.

5.2. Negative impacts: weakened thinking and risks to academic integrity

While generative AI offers substantial convenience, its use also entails risks that should not be overlooked. First, the most immediate concern is the potential erosion of students' capacity for independent thinking. The ability to obtain instant AI-generated answers may lead some students to abandon active inquiry in favor of passively accepting AI-produced content. Over time, this pattern may gradually weaken their ability to analyze complex problems while fostering dependence on the rapid acquisition of ready-made answers. Second, dependence on AI may encourage shortcut-oriented approaches to learning. Academic tasks that are intended to involve the complete learning process—including information gathering, conceptual development, argument construction, and written expression—may instead be reduced to copying, editing, and assembling AI-generated content. As a result, instructional assessment may become distorted, creating situations in which the final product appears satisfactory while students' underlying competencies fail to develop accordingly. Third, AI dependence may weaken university students' awareness of academic integrity. Although AI-generated content is often linguistically polished and logically organized, it may contain factual inaccuracies, fabricated citations, or unverified claims. Without sufficient critical awareness and a strong commitment to academic standards, students may overlook responsibilities related to proper citation, source verification, and the maintenance of originality. These risks are particularly pronounced in course papers and other forms of academic writing. Overall, excessive reliance on generative AI may undermine students' agency in learning. When students remain in a passive position with respect to knowledge evaluation, argument construction, and value judgment over an extended period, their capacities for independent thinking and autonomous judgment may gradually diminish, thereby deviating from the fundamental objectives of higher education, namely the cultivation of critical thinking and innovation.

5.3. Underlying causes of dependence on generative AI

The development of university students' dependence on generative AI is first closely related to the intrinsic characteristics of the technology itself. Generative AI provides immediate feedback, requires minimal operational effort, communicates in natural language, and produces outputs that can often be used directly. These characteristics align closely with university students' desire for efficiency and rapid problem solving. Compared with conventional information retrieval, AI eliminates much of the effort involved in searching, evaluating, and synthesizing information, delivering the desired "answer" directly. Consequently, it readily fosters habitual reliance. Second, the learning environment in which university students operate also contributes to the formation of AI dependence. Contemporary higher education is characterized by intensive academic demands, with students simultaneously managing coursework, examinations, competitions, professional certification, internships, and job preparation. Under such pressures, students naturally gravitate toward tools that maximize efficiency. When available time becomes increasingly limited, the priority of completing tasks quickly may easily outweigh the educational value of engaging fully in the learning process. Within this context, AI has come to function as a practical means of saving both time and effort. Third, instructional assessment methods and course design may unintentionally reinforce students' dependence on AI when they place excessive emphasis on final products while paying insufficient attention to the learning process itself. If course evaluations focus primarily on the quality of submitted reports, essays, or presentations, with relatively little consideration given to information sources, reasoning processes, revision history, and students' personal reflection, students are more likely to regard AI as a convenient shortcut for producing acceptable academic outcomes.

6. Guidance strategies for university students' dependence on generative Artificial Intelligence

6.1. Strengthening student agency and reflective capacity

University students should first recognize that generative artificial intelligence is fundamentally a tool rather than a substitute for human thinking. AI can be effectively used for preliminary information screening, concept clarification, and language refinement, but it should never replace students' independent judgment. Particularly in tasks such as course papers, reading reports, case analyses, and inquiry-based learning, students should adhere to the principle of "think first, consult AI second, and verify afterward". AI should serve a supporting role rather than a dominant one in the learning process.

Students should also actively cultivate their ability to evaluate information critically and engage in reflective thinking. AI-generated content should not be accepted as accurate merely because it is well written or logically organized. Instead, students should develop the habit of verifying data, checking sources, comparing multiple perspectives, and documenting their own revision process. Only by incorporating AI-generated information into their own reasoning can students genuinely use AI to enhance learning rather than become guided by it.

In addition, students should develop a strong sense of self-regulation. When completing reading-based, analytical, or reflective assignments, they should consciously establish clear boundaries for AI use and avoid directly reproducing AI-generated passages. In tasks requiring personal viewpoints or original analysis, students should formulate their own understanding before using AI for supplementation or proofreading. Ultimately, the critical issue is not whether students are capable of using AI, but whether they can preserve their intellectual agency while doing so.

6.2. Optimizing assignment design and process-oriented assessment

Faculty members play a pivotal role in guiding the appropriate use of AI by students. First, instructors should clearly specify, at the beginning of a course or when assigning coursework, the permissible scope of AI use, the boundaries of unacceptable use, and the disclosure requirements for AI assistance. For example, students may be allowed to use AI for information organization, language polishing, or outline development, while being required to disclose whether AI was used, identify the stages at which it was employed, and explain how AI-generated content was subsequently revised and verified. Second, instructors should appropriately redesign assignments and assessment methods to reduce students' incentives to rely excessively on AI as a result-oriented shortcut. For course papers, case studies, and project-based assignments, greater emphasis can be placed on the learning process by requiring students to submit materials such as topic proposals, literature sources, outline revisions, revision records, and classroom presentations. Strengthening process-oriented assessment enables instructors to better evaluate students' genuine learning engagement while limiting opportunities for AI to complete academic tasks in a single step. Third, AI literacy education should be integrated into classroom teaching to help students understand both the strengths and limitations of generative AI. For instance, instructors may demonstrate examples of AI-generated logical inconsistencies, factual inaccuracies, or fabricated references, thereby illustrating that AI is not an authoritative source of knowledge but rather a tool requiring careful evaluation and responsible use. Such instructional practices transform abstract principles of academic integrity into concrete learning experiences that students can readily appreciate.

6.3. Establishing institutional regulations and AI literacy support

At the institutional level, universities should establish governance frameworks that reflect the realities of generative AI in higher education. On the one hand, institutions should formulate clear guidelines governing AI use by specifying permissible and prohibited applications across different types of courses, assignments, and academic papers, while also defining disclosure requirements and academic responsibilities. On the other hand, universities should avoid adopting a simplistic prohibition-based approach and instead promote responsible AI use through well-designed regulations and capacity building.

Universities should also strengthen AI literacy education through dedicated courses and specialized training programs. Lectures or credit-bearing courses covering topics such as AI tools and academic integrity, digital literacy and information evaluation, and the ethics of generative AI in education can help students learn how to formulate effective prompts, verify information, disclose AI-assisted work appropriately, and recognize potential technological biases and misinformation. Only by integrating AI governance with AI literacy education can institutional policies become genuinely effective rather than remaining merely formal regulations.

Furthermore, universities can foster a more mature AI ecosystem through teaching support platforms, academic writing centers, and faculty development programs. For example, institutions can provide instructors with repositories of AI-assisted teaching cases and assignment redesign strategies, offer students writing support and information verification resources, and establish consultation services to address questions regarding AI use within individual departments. Through collaboration among students, faculty, and institutional administrators, universities can shift AI governance from reactive restriction toward proactive guidance.

7. Conclusion

Generative artificial intelligence is fundamentally transforming the ways in which university students acquire knowledge, organize ideas, and accomplish academic tasks. Among undergraduate students at X University, AI has evolved into a routine learning tool whose influence encompasses both substantial benefits and significant risks. This study argues that the central issue surrounding students' dependence on AI is not whether the technology should be used, but whether students can maintain independent thinking, adherence to academic integrity, and agency in learning while using it.

As this research is based on data collected from a single university, its generalizability and precision remain subject to certain limitations. Future studies could expand the sample by incorporating more extensive interview data and longitudinal evidence, enabling comparisons across different universities, academic disciplines, and educational contexts while exploring more targeted governance strategies for AI dependence. Nevertheless, the present case study provides valuable empirical insights into the emerging phenomenon of university students' dependence on generative artificial intelligence and contributes to a deeper understanding of the challenges and opportunities associated with AI integration in higher education.

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