

AI in education: blessing or curse?—Examining how AI assistance shapes academic skills and equity in Chinese middle & high schools

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Abstract. This study examines how Artificial Intelligence (AI) assistance affects the academic skills and educational equity of Chinese junior and senior high school students. Using a sequential mixed-methods design, the study combines a questionnaire survey of 233 students with semi-structured interviews with four students. The findings indicate that AI has a double-edged effect on academic development. Moderate use of AI, defined in this study as three to five times per week, is positively associated with basic academic skills ($r = 0.29, p < 0.05$), particularly by providing immediate explanations and support for knowledge consolidation. In contrast, high-frequency and uncontrolled use of AI, defined as more than one hour per day, is negatively associated with independent problem-solving ability ($r = -0.39, p < 0.01$). The study also identifies substantial inequalities in access to AI tools and school-based guidance: urban students report considerably more frequent use and fewer access barriers than rural students. Qualitative findings further suggest that unequal resources and teacher guidance can turn AI into an amplifier of existing educational inequalities. The study therefore argues that AI should be treated neither as an inherently beneficial nor harmful educational technology. Its effects depend on patterns of use, resource conditions, and professional guidance. The findings highlight the need for AI literacy education, equitable digital infrastructure, and clearer guidance on responsible AI use in schools.

Keywords: artificial intelligence, academic skills, educational equity, mixed methods, AI literacy

1. Introduction

In recent years, artificial intelligence technology has been widely used in the field of education. Various AI learning platforms and homework guidance tools have been deeply integrated into the daily learning process of junior and senior high school students. The Chinese government continues to promote the construction of digital education, hoping to use AI technology to break the regional barriers of educational resources, provide high-quality learning support for students in remote areas, and narrow the gap between urban and rural education [1, 2]. But at the same time of the popularity of AI, its educational impact has also caused widespread controversy: supporters believe that AI can achieve personalized counseling and make up for the learning weaknesses of students with weak foundation. Opponents worry that students' excessive dependence

on AI will weaken their ability to think independently, and the difference in digital resources between urban and rural areas is more likely to make AI the driving force of aggravating education inequality [3, 4].

Combining the existing relevant studies, it is found that the current research focuses on the research and development of AI technology functions or the formulation of macro education policies, and rarely explores the real experience and subjective feelings of students' use of AI from the perspective of students' subject. At the same time, some studies tend to fall into the wrong judgment of binary opposition, or regard AI as a "universal tool" for educational reform, or deny its educational value completely, failing to objectively and comprehensively reveal the actual impact of AI in the real educational scene [5, 6].

Based on this, this study, taking Chinese junior and senior high school students as the research object, explores the dual impact of AI assistance on students' academic skills and educational equity through empirical investigation, aiming to clarify the characteristics of students' AI use behavior, the mechanism of AI on students' core academic skills, and the impact of the difference in the use of AI between urban and rural areas and between schools on educational equity, and finally provides empirical reference and practical suggestions for the rational and effective application of AI in the field of basic education.

2. Literature review

Around the core topics of the study, this chapter systematically reviews the research on the application of AI in education, the impact of academic skills and educational equity at home and abroad. First, through CNKI, web of science, Scopus and other core academic databases, literature retrieval is carried out with "AI+education", "AI learning", "academic skills" and "educational equity" as the Chinese and English keywords, covering the core literature of nearly a decade to ensure timeliness. Then, the CRAAP evaluation standard was used to complete the literature screening and evaluation from the five dimensions of timeliness, relevance, authority, accuracy and research purpose, and eliminate the low quality, subject deviation and duplicate literature. On this basis, the paper reviews the four core dimensions of the mainstream view of global AI education application, the gap between China's local AI education policy and practice, the dual impact of AI on students' academic skills, and the controversy over the relationship between AI and education equity, and comprehensively sorts out the research status in the field. After combining, it is found that most of the existing studies focus on technical functions or macro policy analysis. There is insufficient empirical research on Chinese junior and senior high school students, and there are limitations of binary opposition judgment and the ignoring the real experience of students. At the same time, there is a lack of in-depth discussion on the appropriate use boundary of AI and the impact of urban-rural differences. This research gap and deficiency constitute the core entry point and research value of this study.

2.1. Literature search & evaluation

Before carrying out the empirical research, the researchers conducted a systematic literature search through CNKI, Web of Science, Scopus, and other Chinese and foreign academic databases with the keywords of "artificial intelligence", "educational application", "academic skills", and "educational equity".

In order to ensure the quality of literature and research relevance, the researchers used CRAAP evaluation criteria (currency, relevance, authority, accuracy, research purpose) to screen the search results, rejected the low-quality, outdated and low correlation with the research topic, and finally selected the core literature to build the theoretical basis of this study.

2.2. Global research

From the perspective of global research, AI is generally considered to be an important force to promote educational reform. On the one hand, AI can rely on big data analysis to achieve personalized learning guidance, accurately locate students' knowledge vulnerabilities and push targeted learning resources, becoming a "scaffolding tool" for students' learning, especially providing effective learning support for students with weak foundation and improving the overall learning efficiency [1]. The relevant report of the organization for Economic Cooperation (OECD) in 2021 also pointed out that reasonable application of AI education can enhance students' learning autonomy, which echoed the AI learning scaffolding theory proposed by [1], and jointly affirmed the core value of AI technology in personalized learning.

On the other hand, some scholars also warn about the educational application of AI [3]. believes that students' excessive dependence on AI will gradually lose the ability to think deeply and solve problems independently. At the same time, the human-computer interaction mode of AI will reduce the real emotional communication between teachers and students and ignore the humanistic nature of education. This concern has also become the core argument of subsequent AI education risk research, forming a clear academic dialogue with positive support research.

2.3. The AI application in China

Focusing on the context of Chinese education, the Ministry of education has repeatedly issued policies to encourage the application of AI in the field of basic education as an important means to narrow the gap between urban and rural education and promote the balanced development of education. This policy orientation is also consistent with the research trend of AI enabled education equity worldwide.

However, existing research shows that there is a significant gap between the policy vision and actual practice of AI education application [5]. found that urban schools are often equipped with high-quality AI teaching tools and professional technical guidance, while rural schools are limited by network infrastructure and equipment conditions, and students often use free AI tools with single function, which is difficult to fully enjoy the educational dividend of AI technology. This conclusion also confirms the applicability of the global digital divide theory in China's basic education scene, and is associated with Selwyn's view of technology application risk, highlighting the dual problems caused by uneven resources in the process of technology implementation.

2.4. How AI affects students' academic skills

As for the impact of AI on students' academic skills, the existing research has not yet formed a unified conclusion, and there is a direct academic confrontation between different views. Research with a positive view believes that AI can provide students with instant learning feedback, help them consolidate basic knowledge, and solve learning difficulties. Especially for students who lack family counseling, AI has become an important learning aid resource [6]. This view is in line with the AI learning support theory of [1] and further refines the role of AI in improving the basic academic ability of local students. Studies with negative views point out that high-frequency use of AI will make students form "thinking inertia", tend to obtain AI answers directly in the face of learning problems, and gradually lose their patience and ability to solve problems independently [4]. This conclusion not only echoes Selwyn's concern about AI weakening thinking ability, but also opposes Li & Wang's positive views, highlighting the different effects of the differences in AI use frequency and mode. At present, academia has not yet defined the boundary between "moderate use" and "excessive dependence", and also lacks empirical research verification for Chinese junior and senior high school students.

2.5. How AI affects education equity

In the research field of AI and education equity, scholars' views are also divergent, and all kinds of views are closely related to the previous research on technology application and resource allocation. Some scholars believe that free and open source AI education tools can provide high-quality learning support for students in areas with weak educational resources and become a "balancer" to promote educational equity. This view relies on the core logic of the inclusiveness of AI technology and is consistent with the policy guidance of global AI enabled education equity. However, more studies have confirmed that the application of AI in education will exacerbate the existing inequality in Education - the digital divide between urban and rural areas, the difference in resource allocation between schools, and the gap in AI guidance ability of teachers, so that the dominant students can get more improvement from the application of AI, while the disadvantaged students are unable to effectively use AI tools due to the lack of resources and guidance, which eventually leads to the further expansion of the education gap [5]. This conclusion not only integrates the previous research arguments of urban and rural resource differences and students' excessive dependence on AI, but also overturns the idealized view of AI inclusive and fair, and becomes an important theoretical basis for the core issue of this study.

2.6. Summary & research gap

To sum up, the existing literature has initially outlined the complex picture of the application of AI in education, but there are still limitations in the research perspective, and there is a lack of empirical research based on Chinese junior and senior high school students, combined with quantitative and qualitative data and balanced analysis of the dual impact of AI, which is also the core entry point and research value of this study.

3. Methodology

In order to comprehensively and deeply answer the research questions, this study uses the sequential interpretative hybrid research method, which combines the advantages of quantitative research and qualitative research.

First, the overall trend of students' AI use is mastered through the questionnaire survey, and then the deep reasons behind the phenomenon are explored with the help of semi-structured interviews, so as to realize the mutual confirmation of macro data and micro experience, and improve the reliability and explanatory power of the research conclusions.

In the quantitative research stage, the researcher designed a structured questionnaire for junior and senior high school students, covering AI use frequency, tool types, use scenarios, as well as students' perception of the impact of AI on academic skills and their perception of the fairness of AI use.

The questionnaire structure is clear and hierarchical design: Questions 1 to 5 mainly collect information on demographic characteristics, including students' grades, types of schools (urban/rural, key schools/ordinary schools), regions, types of daily smart devices, and home network conditions. Questions 6 to 10 focus on the core behaviors of students' AI use, including frequency of use, types of commonly used AI tools, main use scenarios, and duration of single use. Questions 11 to 18 are used to investigate the perception of the impact of AI on academic skills, covering the subjective evaluation of the dimensions of independent problem-solving ability, critical thinking, and mastery of basic knowledge points. Questions 19 to 23 focus on the cognition of education equity, including the difficulty of obtaining AI resources, school guidance, and perception of the gap between urban and rural use. Finally, questions 24 to 28 collect students' perceptions of the risks of AI use and suggestions for improvement.

This study uses the convenience sampling method, relying on the online questionnaire platform to carry out the distribution work, mainly through the class group, campus community, education online community three channels to push the questionnaire, the whole process uses anonymous filling mode, to avoid the response deviation caused by the exposure of identity information. At the same time, the research ethics statement was clearly marked at the beginning of the questionnaire, which explained in detail that this study was only used for academic topic analysis, and all the collected data were only used for overall statistics. No personal identity information, family information and answers were disclosed. There were no potential risks in the filling process. Students could choose whether to fill in or not voluntarily, and could terminate the filling at any time in the middle, so as to fully protect the participants' right to know and privacy.

The questionnaire was distributed to junior and senior high school students in various provinces and cities across the country, and 233 valid questionnaires were collected. Through the statistical analysis of the questionnaire data, this paper preliminarily combs the overall characteristics of students' AI use, and explores the correlation between AI use and academic skills.

In the qualitative research stage, the researcher selected 4 representative students to conduct semi-structured interviews according to the dimensions of AI use frequency, geographical background, school type and so on.

The core questions of the interview were set around the research theme, mainly including the following contents: 1 What specific scenarios do you usually use AI in your study? What problems do you usually use AI when encountering? 2. what specific effects do you think the long-term use of AI will have on your independent problem-solving ability and thinking habits? 3. what differences do you think exist in the way students use AI? Is there a significant gap in AI use between urban and rural students? 4. what AI guidance do you want schools and teachers to provide you with? 5. what learning risks do you think excessive dependence on AI will bring?

The interview focused on the students' specific use of AI, the changes in their learning behavior after using AI, their feelings about the differences in AI resources between urban and rural areas, and their concerns about using AI. The single interview lasted about 22 minutes, and the whole process was recorded and transcribed.

Before the interview, the researcher explained the purpose of the research and the scope of use of the interview content to the interviewed students again. He promised that all the recorded and transcribed texts would only be used for academic research, and would not disclose any personal information and school information of the interviewed students. He clearly told the interviewed students that they could refuse to answer any sensitive questions. After the interview, they could request to withdraw the relevant content at any time, fully respect the wishes of the interviewed students, and protect their privacy and rights.

Then the topic analysis method is used to code and analyze the interview text, extract the common experience and personalized problems of students' using AI, and provide visual support for the interpretation of quantitative data.

4. Results

Through the integrated analysis of the questionnaire data and the interview text, the researcher sorted out the overall characteristics of the use of AI by junior and senior high school students, as well as the specific impact of AI on academic skills and educational equity. The core findings are as follows:

First, there are significant differences in students' AI use behavior between urban and rural areas and between schools. In terms of the frequency of use, 62% of urban students said they would use AI every day for learning, while the daily AI use rate of rural students was only 24% (Figure 1).

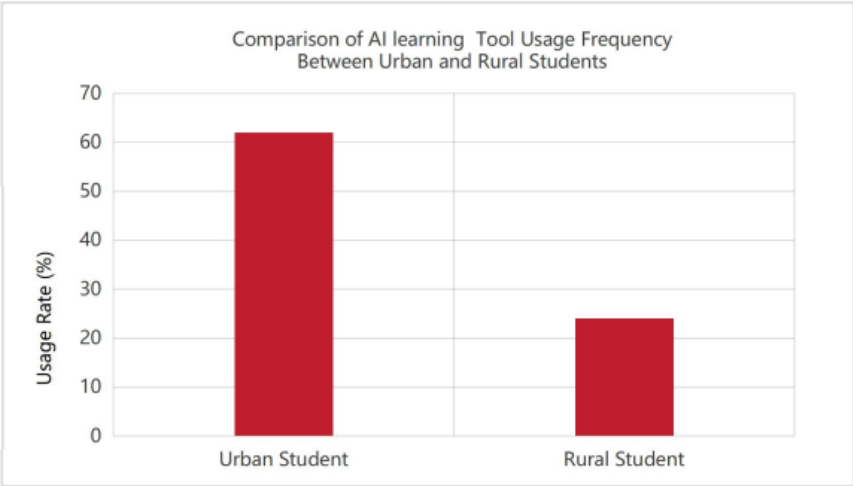


Figure 1. Comparison of AI learning tool usage frequency between urban and rural students

Source: primary research

From the perspective of tool selection, urban students often use fully functional paid AI learning platforms, which can provide personalized error analysis, intensive knowledge points, customized learning plans and other services, while rural students mainly rely on free basic AI tools, and their functions are mostly limited to answer query and simple knowledge point interpretation, which is difficult to meet the needs of in-depth learning. In addition, in terms of resource guarantee and guidance for AI use, 74% of rural students reported that there were barriers to use, such as unstable network signals, old smart devices, and limited functions, while the proportion of urban students was only 16% (Figure 2). The proportion of urban students receiving special AI use guidance from schools is 3.2 times that of rural students. Students from key schools can also get more AI use teaching and guidance than students from ordinary schools.

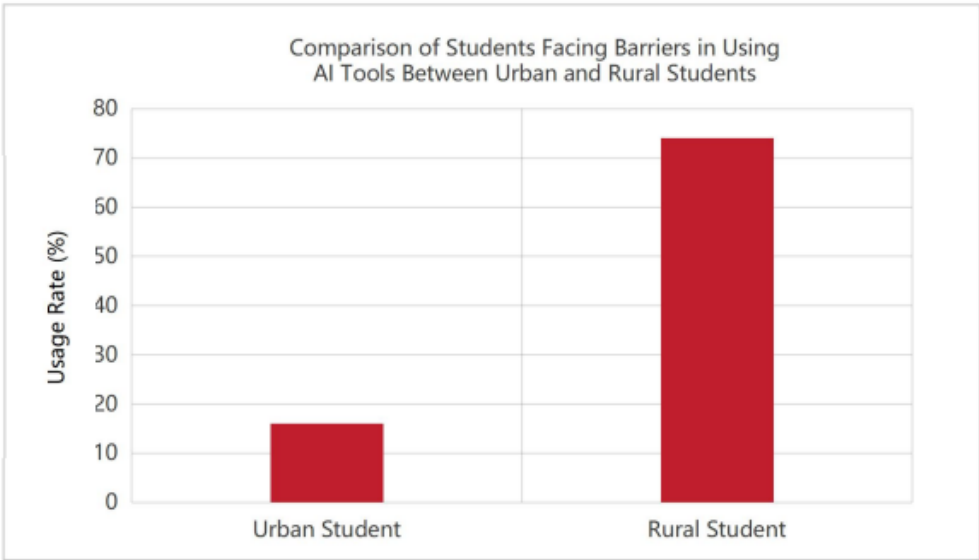


Figure 2. Comparison of students facing barriers in using AI tools usage between urban and rural students

Source: primary research

Second, AI has a significant "double-edged sword" effect on students' academic skills. Correlation analysis showed that moderate use of AI (3-5 times a week) was significantly positively correlated with the improvement of students' basic academic skills ($r = 0.29$, $p < 0.05$) (Figure 3 & Table 1). In the interview, most students said that the real-time explanation and repeated playback functions of AI can help them better understand the knowledge points they did not master in the classroom, especially in the consolidation of basic knowledge such as English vocabulary and mathematical formulas. For students who lack family guidance, AI has become an important learning supplement. However, the high frequency and uncontrolled use of AI (more than 1 hour per day) were negatively correlated with the decline of students' ability to solve problems independently ($r = -0.39$, $p < 0.01$) (Figure 3 & Table 1). Students who use AI frequently say that they are gradually used to obtaining answers or solving problems directly through AI. When facing learning problems, they are no longer willing to spend time thinking and trying to solve them independently, or even "without AI, they will not do problems". In the long run, their ability to solve complex problems independently is significantly weakened.

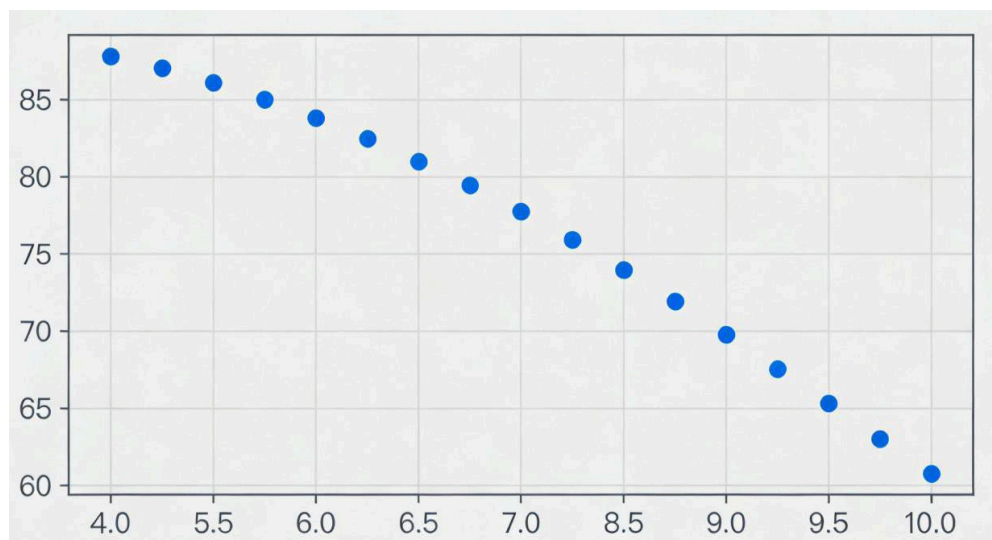


Figure 3. Scatter plot

Source: primary research

Table 1. Pearson correlation analysis

	students' basic academic skills
moderate use of AI (3-5 times a week)	0.29*
high frequency and uncontrolled use of AI (more than 1 hour per day)	-0.39**

Note. * $p < 0.05$, ** $p < 0.01$ (Sources: Primary research)

Third, the educational application of AI has not achieved the goal of promoting educational equity, but has exacerbated educational inequality to a certain extent. It is found in the interview that urban students can improve their learning efficiency, make up for knowledge loopholes, and improve their academic performance with the help of high-quality AI tools. However, due to the single function, limited use, and lack of professional guidance of AI tools, rural students find it difficult to obtain substantial learning improvement from AI applications. Some students even feel frustrated because they can not keep up with the learning

progress of urban students. At the school level, teachers in key schools will guide students to use AI as a learning aid to teach students how to critically use AI to generate content, while teachers in ordinary schools are mostly lack of relevant guidance consciousness and ability, and students mostly regard AI as "a shortcut to complete homework", which is only used for answering questions and queries, and fails to play its educational value. As a rural student said in the interview, "the AI used by urban students can explain the problem ideas and teaching methods. What I use can only find the answers, and the gap will only be larger and larger."

In addition, four core themes were extracted from the interview text to further deepen the understanding of the impact of AI Education. First, the function of AI is dual, which can not only improve learning efficiency and supplement learning resources, but also cause students' thinking inertia and weaken academic skills. Second, the uneven distribution of resources and guidance is the core reason why AI aggravates the inequity of education. The digital gap and guidance gap between urban and rural areas and between schools make AI a "tool for advantageous students". Third, the problem of students' excessive dependence on AI has objectively existed. High frequency use of AI will lead to the decline of students' critical thinking and information discrimination ability. Fourth, students have a strong need for AI use guidance, hoping that teachers can clarify the boundaries of AI use, teach correct use methods, and help themselves avoid the negative effects of AI use.

The subject coding and refining process follows a standardized qualitative research process. First, read through the transcripts of the four interviews line by line, get familiar with the overall content and mark the key sentences. Then open coding was carried out to preliminarily classify the content with similar meaning in the text, and a total of 32 initial codes were generated, such as "relying on AI and unwilling to think", "differences between urban and rural tools", and "lack of teacher guidance". Next, we will conduct axis coding, merge and integrate the initial codes with high correlation, eliminate repetitive and meaningless codes, and reduce them to 10 core secondary codes. Finally, selective coding is carried out. Around the core issues of this study, the secondary code is further refined and summarized into four core themes to ensure that each theme is supported by the corresponding interview text. After the coding process is completed independently by the researcher, the instructor is invited to review and verify to ensure the objectivity and accuracy of the coding results and avoid subjective bias.

5. Discussion

Dialogue analysis of the empirical results of this study and existing literature not only verifies some existing research conclusions, but also adds new empirical evidence based on the actual situation of Chinese junior and senior high school students, and provides targeted ideas for the practice of AI education application.

The empirical core results of this study can be briefly summarized as follows. First, there are significant differences between urban and rural areas and between schools in the use of AI among junior and senior high school students. The daily use rate of AI, the quality of tools used and the coverage rate of school specific guidance of urban students are far higher than those of rural students. Second, AI has a clear double-edged sword effect on students' academic skills. The moderate use of AI 3-5 times a week can effectively improve the basic academic ability. The unrestrained use of AI for more than 1 hour a day will significantly weaken students' ability of independent problem solving and independent thinking. Third, AI has not achieved the goal of narrowing the education gap in the existing education scene. On the contrary, the uneven distribution of resources and guidance has further exacerbated the education inequality between urban and rural areas and between schools, and the surveyed students generally lack professional guidance for the standardized use of AI. The problem of thinking inertia caused by excessive dependence is more prominent.

First, this study confirmed the dual effects of AI on students' academic skills, and defined the specific boundary between "moderate use" and "excessive dependence" of AI in the junior and senior high school students. Appropriate use of AI can become an effective learning support for students, help consolidate the foundation and solve difficulties, which is consistent with the affirmation of the value of AI education in the existing research. The high-frequency and unrestrained use of AI will weaken students' core academic skills such as independent problem solving and critical thinking, which also confirms the warnings of [3, 4] and other scholars on the risks of AI use. This study defines the appropriate use range of "3-5 times a week" through specific data, and provides a clear reference for students to regulate the use of AI.

Second, this study found that in the current education practice, AI did not achieve the policy vision of promoting education equity, but exacerbated the education inequality between urban and rural areas and between schools due to the digital divide, uneven distribution of resources, and differences in guidance ability, which is highly consistent with the research conclusion of [5] on the digital divide in the application of AI education. This finding also shows that technology itself cannot solve the problem of education equity. Without supporting resources and policy support, advanced education technology will instead become an "amplifier" of education inequality, sounding the alarm for education policy makers.

Third, this study highlights the key role of teacher guidance in the application of AI education. The empirical results show that whether there are teachers' professional guidance or not directly determines whether students can use AI tools reasonably: students with teachers' guidance can use AI as a learning aid to play its educational value. Students who lack teachers' guidance are prone to fall into the misunderstanding of relying too much on AI, and even use AI as a tool for copying homework. This discovery defines the role of teachers in the era of AI Education - teachers are not only imparters of knowledge, but also guides students' use of technology, and points out the direction for teachers' professional development in the basic education stage.

Based on the above research conclusions, this study puts forward the practical enlightenment of the application of AI education for different subjects: for educators, AI literacy education should be incorporated into daily teaching, not only to teach students the use of AI tools, but also to cultivate students' ability to critically evaluate and reasonably use AI generated content, clarify the boundaries of the use of AI, guide students to think independently and then with the help of AI, and avoid thinking inertia and technical dependence. For policy makers, we should increase investment in educational technology in rural areas and weak schools, improve network infrastructure, equip necessary intelligent devices, and provide fair and high-quality AI education resources for all students. At the same time, we should issue norms and guidelines for AI education applications, clarify the guiding responsibilities of schools and teachers, and promote the orderly development of AI education applications. For students and families, students should establish a correct concept of AI use, actively set a reasonable time limit for use, and give priority to the cultivation of autonomous learning and independent thinking ability. The family should cooperate with the school to guide and supervise, help the children develop the standard habit of using AI, and jointly avoid the negative impact of AI use.

6. Evaluation

This study explores the impact of AI on academic skills and educational equity of junior and senior high school students through mixed research methods, and has made a series of valuable research findings. However, limited by the research conditions, there are still some limitations: first, although the coverage of the research sample involves 12 provinces and cities, the sample size is relatively limited, and it does not cover all

types of schools and student groups. The universality of the research conclusion needs to be further verified. Second, this study mainly carried out the survey from the perspective of students, and did not include the views of teachers, parents, education policy makers and other stakeholders, so the analysis of the impact of AI education was not comprehensive. Third, this study uses cross-sectional data to carry out the research, which can only reflect the characteristics of students' AI use and impact at a specific time point, and can not track the long-term impact of AI use on students' academic skills and educational equity. Fourth, the research data mainly rely on students' self-report, which may have some subjective bias. For example, some students may hide their excessive dependence on AI due to concerns.

Despite the above limitations, this study still has certain academic value and practical significance: at the academic level, this study takes Chinese junior and senior high school students as the research subject, combines quantitative and qualitative data to balance the analysis of the dual impact of AI on education, breaks the binary narrative of "all good or all bad AI", and supplements the empirical research on the application of AI education in the stage of basic education. At the practical level, this study combs the real characteristics and core issues of students' AI use, and provides specific practical suggestions for educators, policy makers, families to standardize the application of AI education, avoid the use risk, and give full play to the value of AI education, which has strong practical significance.

7. Conclusion

This study takes Chinese junior and senior high school students as the research object, and systematically explores the actual impact of AI assistance on students' academic skills and educational equity through the hybrid research method of questionnaire survey and semi-structured interview. The core research conclusion is that the application of AI in the field of basic education is a typical "double-edged sword", and its educational value depends on the way of use, resource guarantee and professional guidance. When students use AI appropriately and normatively, and can obtain teachers' professional guidance, AI can effectively supplement learning resources and improve learning efficiency, and become a powerful auxiliary tool for students' academic improvement, especially to provide learning support for students in areas with weak resources. When students use AI excessively and without restraint, and there is a serious gap in AI resources and guidance between urban and rural areas and between schools, AI will weaken students' core academic skills such as independent thinking and problem solving, and further aggravate the phenomenon of educational inequality.

As a new educational technology, AI itself is not absolutely "good" or "bad". Whether it can become a positive force to promote educational development and promote educational equity depends on the concerted efforts of all parties. Only when educators do a good job in professional guidance, policy makers improve resource security and institutional norms, families do a good job in guidance and supervision, and students establish a correct concept of use, can AI be reasonably and effectively applied in the field of basic education, truly serve the all-round development of students, and promote the realization of educational equity.

References

- [1] Baker, R. S. (2020). AI-powered learning tools as adaptive scaffolds for student academic growth. *Journal of Educational Technology & Society*, 23(2), 112–128.
- [2] OECD. (2021). *AI in education: Policy and practice insights*. OECD Publishing.
- [3] Selwyn, N. (2019). What's the problem with AI in education? Critical reflections on technology and schooling. *Learning, Media and Technology*, 44(3), 287–301.

- [4] Popenici, S. A., & Kerr, C. J. (2017). Cognitive laziness in the digital age: The impact of instant technology on student problem-solving skills. *Journal of Educational Psychology*, 109(6), 812–825.
- [5] Chen, L. (2021). Digital divide and AI education application in rural and urban China. *Chinese Journal of Educational Technology*, 41(8), 39–46.
- [6] Li, Y., & Wang, H. (2022). The supportive role of AI tutoring for middle school students with limited family academic support. *Journal of Basic Education Research*, 19(4), 56–63.

Appendix 1. Questionnaire survey

Questionnaire on AI-Assisted Learning Among Chinese Middle and High School Students

Ethics Statement & Instructions

Dear Participant,

This questionnaire is designed for academic research only, aiming to explore the impact of AI-assisted learning on academic skills and educational equity among Chinese middle and high school students. All data collected will be used solely for overall statistical analysis and academic research, and your personal information, school identity, and specific answers will be strictly anonymized and confidential.

There are no potential risks in filling out this questionnaire, and you have the right to voluntarily participate or withdraw at any time. Please answer each question honestly based on your actual learning situation.

Thank you for your cooperation and support!

Section 1: Demographic Characteristics

This section is used to collect basic personal information, which will help us classify and analyze the research data.

1. Your current grade:
 - ☐ A. Grade 7 (Junior 1)
 - ☐ B. Grade 8 (Junior 2)
 - ☐ C. Grade 9 (Junior 3)
 - ☐ D. Grade 10 (Senior 1)
 - ☐ E. Grade 11 (Senior 2)
 - ☐ F. Grade 12 (Senior 3)
2. Type of your school:
 - ☐ A. Urban key school
 - ☐ B. Urban ordinary school
 - ☐ C. Rural key school
 - ☐ D. Rural ordinary school
3. Your residential area:
 - ☐ A. First-tier city
 - ☐ B. Second-tier city
 - ☐ C. Third-tier city or county
 - ☐ D. Rural township or village
4. Types of smart devices you can use for daily learning:
 - ☐ A. Smartphone only
 - ☐ B. Tablet only
 - ☐ C. Laptop/desktop computer
 - ☐ D. Multiple smart devices (smartphone + tablet + computer)
5. Your home network condition:
 - ☐ A. Stable and high-speed network, no lagging
 - ☐ B. Basically stable, occasional lagging
 - ☐ C. Unstable, often disconnected or lagging

- D. Poor network, hard to use online learning tools

Section 2: AI Usage Behavior

This section focuses on your actual usage habits of AI learning tools in daily study.

1. Frequency of using AI tools for learning:
 - A. Every day
 - B. 3-5 times a week
 - C. 1-2 times a week
 - D. Once a month or less
 - E. Never use
2. Types of AI learning tools you usually use (can select multiple):
 - A. Free basic AI tools (only answer searching, simple explanation)
 - B. Paid professional AI learning platforms (personalized tutoring, mistake analysis, study plan)
 - C. AI homework helper apps
 - D. AI oral English/grammar tools
 - E. Other AI learning tools
3. Main scenarios of using AI tools (can select multiple):
 - A. Search answers directly when encountering difficult problems
 - B. Check and verify answers after finishing homework independently
 - C. Learn and understand knowledge points not mastered in class
 - D. Sort out mistakes and make targeted review
 - E. Improve basic skills (vocabulary recitation, formula memory)
4. Average single usage time of AI learning tools:
 - A. Less than 30 minutes
 - B. 30 minutes - 1 hour
 - C. 1-2 hours
 - D. More than 2 hours
5. Have you received professional guidance on how to use AI tools for learning from school or teachers?
 - A. Yes, regular guidance and training
 - B. Yes, occasional brief guidance
 - C. No, never received any guidance

Section 3: Perception of AI's Impact on Academic Skills

Please rate your agreement with the following statements based on your real experience (1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree)

1. Using AI tools helps me improve basic academic skills (vocabulary, formulas, basic concepts).
2. Using AI tools improves my learning efficiency and saves study time.
3. I rely more on AI tools and become less willing to think independently when facing difficult problems.
4. My ability to solve complex problems independently has decreased after frequent use of AI tools.
5. AI tools help me make up for knowledge gaps that teachers cannot explain in detail.
6. I have lost patience in thinking and exploring problems slowly due to AI's instant answers.
7. My critical thinking ability (judging whether AI answers are correct) has not improved.
8. Moderate use of AI is a good supplement to classroom learning.

Section 4: Perception of Educational Equity (Questions 19-23)

1. Do you think it is easy for you to get access to high-quality AI learning resources?
 - A. Very easy

- B. Relatively easy
 - C. Difficult
 - D. Very difficult
2. Have you ever encountered obstacles when using AI learning tools?
- A. Never (stable network, suitable devices)
 - B. Occasionally (slight network lag)
 - C. Often (poor network, outdated devices, limited functions)
3. Do you think there is an obvious gap in AI tool usage between urban and rural students?
- A. Very obvious gap
 - B. Slight gap
 - C. No obvious gap
4. Do you think high-quality AI tools widen the academic gap between students?
- A. Definitely widen
 - B. Slightly widen
 - C. No impact
 - D. Narrow the gap
5. Students from disadvantaged backgrounds (rural, poor family education) can get effective learning support from AI tools.
- A. Strongly Disagree
 - B. Disagree
 - C. Neutral
 - D. Agree
 - E. Strongly Agree

Section 5: Opinions and Suggestions (Questions 24-28)

1. What do you think is the biggest disadvantage of using AI tools for learning? (can select multiple)
- A. Develop laziness and reduce independent thinking
 - B. Unreliable answers, easy to be misled
 - C. Widen the gap between urban and rural students
 - D. Waste time and affect learning focus
 - E. No obvious disadvantages
2. Do you support the standardized use of AI tools in middle and high school learning?
- A. Strongly support
 - B. Support
 - C. Neutral
 - D. Oppose
 - E. Strongly oppose
3. What kind of guidance on AI usage do you need most from teachers? (can select multiple)
- A. How to use AI moderately without dependence
 - B. How to judge the correctness of AI answers
 - C. How to use AI for targeted review and mistake sorting
 - D. How to use AI to make up for knowledge gaps
 - E. No guidance needed
4. In your opinion, what should schools do to make AI tools benefit more students?
5. Do you have any other opinions or suggestions on AI-assisted learning?

Appendix 2. Interview

Semi-Structured Interview Outline

Basic Interview Information

• Research Topic: AI in Education: Blessing or Curse? — Exploring How AI Assistance Shapes Academic Skills and Educational Equity Among Chinese Middle and High School Students

• Interview Subjects: 4 middle and high school students (selected by AI usage frequency, regional background, school type)

• Interview Duration: Approximately 22 minutes per interviewee

• Interview Method: Online one-to-one semi-structured interview

• Recording & Transcription: Full recording with consent, complete written transcription after interview

Part 1: Pre-Interview Ethics Statement & Brief Introduction (Mandatory)

(Read to interviewee word for word before starting the interview)

Hello! Thank you very much for taking time to participate in this academic research interview. All content of this interview is only used for the data analysis and thesis writing of this academic research, and we will strictly protect your privacy and personal information:

- 1. Your real name, school, class and other personal identification information will be completely anonymized in the research data and final thesis;
- 2. The interview recording and transcription text will only be used for this research, and will be permanently deleted after the research is completed;
- 3. You can refuse to answer any question you do not want to respond to during the interview, and you can terminate the interview at any time without any reason;
- 4. You can also request to withdraw the relevant interview content provided by you after the interview ends.

This interview mainly talks about your real experience and feelings of using AI tools in daily study, there are no standard answers, just answer according to your actual situation. Do you understand the above content and agree to participate in this interview?

Part 2: Core Interview Questions (Semi-Structured, Flexible Follow-Up Allowed)

Maintain a relaxed communication attitude, and conduct appropriate follow-up inquiries according to the interviewee's answers, such as "Could you explain this in more detail?" "Can you give a specific example?"

1. Basic Usage Scenario Question: Could you tell me about the specific scenarios where you use AI learning tools in your daily study? When do you usually choose to use AI tools for help with your studies?

2. Impact on Academic Ability Question: In your real experience, what specific impacts does long-term use of AI tools have on your independent problem-solving ability and thinking habits? Do you think you have become more or less willing to think independently after using AI?

3. Usage Gap & Equity Question: Have you noticed any differences in the way AI tools are used among your classmates? Do you think there is an obvious gap between urban and rural students in using AI learning tools, and what specific differences are they?

4. Guidance Demand Question: What kind of guidance or suggestions on using AI tools for study do you hope to get from teachers and schools? Do you think clear guidance on AI usage is necessary for students?

5. Risk & Concern Question: What do you think are the main learning risks or disadvantages caused by over-reliance on AI tools? Do you have any worries about using AI tools for study frequently?

6. Supplementary Question: Is there anything else you want to share about your experience of using AI-assisted learning that we haven't mentioned?

Part 3: Post-Interview Closing

Thank you very much for your sincere answers and valuable time! We will keep all your interview content confidential as promised before. If you have any questions about this research or need to withdraw your interview data later, you can contact us at any time. Thank you again for your support to this academic research!