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Article

Explore Parents' Views and Acceptance of Large Language Models Applied to Education

Xiujuan Wan [1,*], Qien Liu [1] and Adebayo Saheed Adewale [2]

[1] College of Life and Environmental Sciences, Wenzhou University, Wenzhou 325035, China
[2] College of Education, Wenzhou-Kean University, Wenzhou 325060, China
* Correspondence: lisaxu@wzu.edu.cn

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Abstract: This study investigates Chinese parents' perceptions and acceptance of artificial intelligence (AI) in secondary education through a large-scale survey of 313 respondents across Mainland China. Utilizing a structured questionnaire, the research examines the relationships between demographic factors—such as income, education level, and child age—and parents' attitudes toward AI-assisted learning tools. Descriptive and inferential statistical analyses, conducted via SPSS, reveal that while 78.27% of parents are aware of AI in education, their understanding is often shaped by informal channels such as social media and personal networks. Recognition of specific tools like Deepseek and Kimi correlates with perceived accessibility and visibility. Despite general optimism regarding AI's benefits—such as increased learning efficiency and support for educational planning—concerns persist around data privacy, over-reliance, and potential bias. Educational attainment significantly predicts both perceived knowledge and acceptance levels, suggesting the presence of a digital cognitive divide. The findings underscore the need for transparent, trustworthy, and inclusive AI policies that address ethical concerns and bridge communication gaps between schools and families. The study offers practical recommendations for co-creation models, regulation, and digital literacy interventions to promote equitable AI adoption in education.

Keywords: artificial intelligence; education; parental perception; digital divide; technology acceptance

1. Introduction

With the rapid advancement of Artificial Intelligence (AI) technologies, their application in education has become a critical focus of global educational reform. AI is transforming traditional teaching models through diverse applications, and its value in promoting educational equity and quality has been recognized by international organizations and national governments alike (Holmes et al., 2019, 2022).

However, the rapid deployment of AI in primary and secondary education has not been fully embraced by parents. Despite the increasing adoption of AI tools in classroom settings, parents exhibit varying levels of awareness and acceptance. In China, where parents play a critical role in educational decision-making and resource allocation, their attitudes directly influence students' usage of AI tools and, consequently, shape the developmental trajectory of AI in education. Therefore, it is both theoretically significant and practically necessary to examine parents' cognitive perceptions, risk assessments, and behavioral intentions toward educational AI.

Existing research has largely focused on teachers and students. Some studies have explored the impact of AI tools on students' academic performance and motivation (Lee et al., 2022), while others have examined teachers' adaptation and attitudes toward AI technologies (Zawacki-Richter et al., 2019). In contrast, research on parents remains relatively sparse, lacking systematic frameworks and empirical validation. Preliminary findings suggest

that parents display highly polarized views—some highlight the convenience and efficiency of AI, while others express concerns over its implications for children's privacy, well-being, and creativity (Karran et al., 2024).

To address this research gap, this study adopts the Technology Acceptance Model (TAM) as its theoretical foundation. TAM posits that perceived usefulness (PU) and perceived ease of use (PEOU) are core predictors of an individual's intention to adopt new technology. While TAM has been widely applied to examine user behaviors in educational technologies (Tan & Tang, 2025), its application in the parental context—particularly within K–12 education and AI settings—remains limited (Lin et al., 2024). Moreover, the original TAM primarily emphasizes functional perceptions of technology, overlooking more complex sociotechnical dimensions such as ethics, data security, and educational equity. Therefore, this study integrates the "AI Ethics Trust Crisis" framework (Porayska-Pomsta, et al., 2023) and cultural dimensions (e.g., Hofstede's cultural model (Eckhardt, 2002)) into an extended TAM model to better interpret parental acceptance of educational AI tools.

The objectives of this study are: to build upon TAM and employ a quantitative questionnaire to systematically analyze Chinese parents' cognitive frameworks, risk evaluations, and acceptance pathways regarding AI in education. Specifically, the study addresses the following research questions:

(1) What is the current level of parental awareness regarding various AI educational tools, and what are their primary information sources?
(2) How do parents weigh perceived benefits against perceived risks in the decision to allow AI use in education?
(3) Which demographic and experiential factors significantly influence parental acceptance of AI educational tools?
(4) Are existing educational communication mechanisms effective in fostering parental understanding and trust in AI?

This research contributes to the literature in several ways. First, in terms of research subject, it focuses on the often-overlooked perspective of parents of junior and senior high school students in China, thereby addressing the gap in the literature that has largely centered on teachers and students. Second, from a theoretical perspective, it extends the applicability of the TAM by incorporating variables such as privacy concerns, technological anxiety, and cultural values, thereby constructing a more multidimensional acceptance model. Third, on a practical level, the study proposes concrete policy suggestions and tool design optimizations aimed at promoting the sustainable development of AI in education.

That said, this study has certain limitations. The sample is primarily drawn from urban areas, limiting the generalizability of the findings to rural or marginalized populations. Additionally, as a cross-sectional study, it cannot capture the dynamic evolution of parental attitudes over time. Finally, given the rapid pace of AI development, heterogeneity among AI tools may also affect the external validity of the results. Future research should expand geographic coverage, adopt longitudinal designs, and further explore how cultural, cognitive, and institutional factors shape parental behaviors toward technology acceptance.

In summary, this study is situated in the Chinese context and builds upon an extended TAM framework to explore parents' roles and attitudes during the AI-driven transformation of education. It aims to provide theoretical insights and practical guidance for constructing a more inclusive and ethically oriented AI ecosystem in education.

2. Literature Review

2.1. Applications of Artificial Intelligence in Education

The application of Artificial Intelligence (AI) in education has evolved from being a theoretical concept to a practical and impactful reality. In recent years, AI technologies have been deployed across various dimensions of teaching and learning, including intelligent assessment, personalized learning pathways, automated grading, data-driven feedback, and intelligent tutoring systems (Holmes et al., 2019; Luckin & Holmes, 2016). The emergence of large language models (LLMs), such as ChatGPT, Claude, and DeepSeek, has expanded the use of AI in natural language processing tasks like writing evaluation, summarization, question generation, and adaptive feedback delivery. These innovations are not merely augmentative but are becoming foundational in transforming pedagogy, curriculum design, and educational accessibility.

Research has shown that AI can enhance learning outcomes by tailoring educational content to individual students' needs, identifying knowledge gaps in real time, and enabling continuous formative assessment (Zawacki-Richter et al., 2019). AI systems are also credited with reducing teachers' workload by automating repetitive tasks such as grading and test preparation, thereby allowing educators to focus on higher-order instructional strategies. Furthermore, AI has shown promise in promoting educational equity by providing students in under-resourced environments with access to high-quality digital learning materials and intelligent guidance (Holmes et al., 2022).

On the policy level, AI is highlighted as instrumental to achieving the Sustainable Development Goals (SDGs), particularly SDG 4: inclusive and equitable quality education. It encourages member states to integrate AI into educational policy frameworks with an emphasis on human-centric, ethical, and inclusive principles. In alignment with this global agenda, China has enacted the *New Generation Artificial Intelligence Development Plan* (2017) and the *Education Informatization 2.0 Action Plan* (2018), setting the direction for "Smart Education" that includes AI-enhanced classrooms, teacher professional development, and AI-based learning analytics systems. Local governments have further implemented pilot programs to integrate AI into school curricula and classroom practice, particularly in subjects like math, English, and science.

However, despite the impressive progress, concerns remain regarding the overuse or inappropriate use of AI in school settings. Questions have been raised about the reduction of human interaction in learning processes, algorithmic bias, and over-dependence on automation. These issues suggest the need to balance innovation with ethical and pedagogical considerations, particularly in K-12 settings where students are still in critical stages of cognitive and emotional development.

2.2. The Role of Parents in Educational Technology Adoption

Parents are central actors in students' educational journeys, especially in compulsory education. Their role becomes even more crucial when new technologies such as AI are introduced into schools. Dias et al. (2016) highlight that parents often function as gatekeepers, controlling children's access to digital tools, or as scaffolders, actively supporting their technology use (Dias et al., 2016). This parental influence extends into the formation of students' digital attitudes and behaviors, with research showing that parents often play a more significant role than teachers in shaping children's tech engagement (Gür & Türel, 2022).

Existing literature has identified several key parental factors that influence technology adoption: technological literacy, information access, privacy concerns, socio-economic status, and attitudes toward innovation (Li et al., 2024; Livingstone & Helsper, 2007). For example, parents who are digitally literate and actively use AI in their workplaces or homes are more likely to view educational AI tools favorably. Conversely, parents with limited exposure to AI often experience uncertainty and even fear regarding its long-term implications on children's development (Ma et al., 2025).

Moreover, the ways in which parents gather information about educational AI play a significant role in shaping their perceptions. Many Chinese parents learn about AI tools through platforms such as WeChat, Douyin, or Xiaohongshu, which may not always offer accurate or evidence-based information. As a result, perceptions are often shaped by anecdotal experiences or media-driven narratives, leading to either overestimation of AI's capabilities or exaggerated fears regarding its potential harm (Qin et al., 2020).

Research also shows that parents' educational background and income level significantly correlate with their acceptance of AI in education (Hou et al., 2024; Miah, 2024). Higher-income and more educated parents are typically more receptive to emerging technologies, while lower-income families may view AI tools as unproven or potentially exclusionary due to digital divides. This raises equity concerns, as unequal parental acceptance may reinforce existing educational disparities, rather than mitigate them.

2.3. Technology Acceptance Model (TAM) and Its Extension in Education

The Technology Acceptance Model (TAM) has become a foundational framework for understanding users' decisions to adopt or reject new technologies. The core constructs—perceived usefulness (PU) and perceived ease of use (PEOU)—are posited to influence users' attitude toward the technology and ultimately their behavioral intention to use it. Over the years, TAM has been applied extensively in education to explore technology adoption by teachers (Selim et al., 2020), students (Teo, 2011), and administrators.

While the original TAM provides a parsimonious model, scholars emphasize the need to extend it to capture complex factors such as social influence, facilitating conditions, and experience (Viberg et al., 2024). In educational settings, extensions consistently integrate perceived risk, trust, and social norms—especially critical when technologies involve sensitive data like student performance or behavior (Mutimukwe et al., 2021; Sulasmi & Dalle, 2022).

In the domain of AI in education, the relevance of TAM is evident but requires thoughtful adaptation. The AI Ethics Trust Crisis Framework suggests that trust-related variables—such as algorithm transparency, data privacy, and ethical alignment—have become critical determinants of acceptance. Particularly for parents, who may not be direct users but are responsible for authorizing or resisting their child's use of AI tools, ethical concerns may outweigh considerations of usability or functionality (An et al., 2024; Ho et al., 2025).

Cultural factors must also be taken into account. Hofstede's cultural dimensions theory (Tang et al., 2026) has been employed to understand variations in technology acceptance across countries. In China, a society characterized by high uncertainty avoidance, collectivism, and power distance, the perception of AI's risk to social harmony or to traditional educational values may influence parents' acceptance. For example, some parents may fear that AI undermines teacher authority or disrupts established classroom norms, particularly if AI systems offer contradictory recommendations to those of human teachers.

2.4. Parents' Perception and Acceptance of AI Educational Tools

Early empirical studies on Chinese parents' attitudes toward AI in education reveal a dual narrative. On one hand, many parents express optimism about AI's ability to enhance learning efficiency, provide personalized instruction, and help students stay competitive in a rapidly digitizing society. Tools such as Squirrel AI or 17ZuoYe are often praised for their real-time feedback and data visualization dashboards that offer insights into students' learning progress (Wang et al., 2023).

On the other hand, concerns are widespread. Researchers have noted the risk of cognitive dependency on AI for essay writing and problem-solving, potentially impairing students' independent thinking, creativity, and deep learning (Melisa et al., 2025). Privacy scholars also alert to the vulnerability of students' sensitive data—ranging from learning preferences to personal identifiers—when processed by commercial AI platforms (Yan et al., 2024). Lastly, critiques stress that AI tools, despite their efficiencies, inherently lack the empathy, common sense, and contextual awareness that human educators provide, making parents uneasy about delegating educational authority to machines (Kucirkova & Leaton Gray, 2023).

Another important theme is the uneven acceptance of different AI functionalities. Structured applications like automated grading, error correction, and factual Q&A are generally well received, as they align with existing pedagogical models and are easy to understand. However, more generative or autonomous AI tools—such as those that provide essay writing assistance or simulate human conversation—are met with greater skepticism, as their outputs are often less predictable and more difficult to evaluate (Han et al., 2024).

Demographic variables also moderate these perceptions. Urban parents, especially those in first-tier cities like Beijing and Shanghai, are more likely to support AI adoption than rural parents, partly due to better access to technology and exposure to digital innovations. Similarly, mothers and fathers may differ in their evaluation of AI, with some studies suggesting that mothers are more sensitive to emotional and developmental risks (Li, 2025; Xing et al., 2017).

Despite these insights, current research on parental perception of AI tools remains fragmented. Many studies rely on small-scale qualitative interviews or exploratory surveys that lack generalizability. Moreover, few employ structured models like TAM to systematically analyze the determinants of parental acceptance. This limits our understanding of how multiple factors—technological, psychological, ethical, and cultural—interact to shape parents' attitudes and behaviors.

Therefore, there is an urgent need for a more comprehensive, theoretically grounded model that reflects the complex interplay of functional, ethical, and cultural factors in shaping parental acceptance of AI in education. Such a model should integrate constructs from TAM with additional variables such as risk perception, trust in AI, media influence, and cultural moderation, providing a more nuanced explanation of the diverse and sometimes contradictory parental attitudes observed in practice.

3. Methods

This study utilizes a structured questionnaire to examine parents' perceptions and acceptance of artificial intelligence (AI) in educational contexts. Given that AI in education is still an emerging and rapidly evolving domain, a survey approach is particularly well-suited for capturing large-scale attitudinal data toward unfamiliar or novel technologies. The use of a questionnaire enables systematic and efficient data collection, allowing for the exploration of key trends and associations—such as the potential link between household income and the acceptance of AI-based educational tools. Furthermore, statistical analyses are conducted using SPSS to ensure rigor in data interpretation, providing empirical insights that contribute to understanding the factors shaping parental attitudes toward AI integration in education.

3.1. Sample and Sampling

Convenience and simple random sampling methods were used in this study. A total of 313 participants were recruited online from parents of children aged 12 to 18 years across Mainland China. Table 1 presents the demographic distribution of the respondents. Participants' ages ranged from 30 to over 50 years, with 34.8% aged

30–39 years, 41.9% aged 40–49 years, and 23.3% aged over 50 years. The sample included slightly more male parents (50.8%) than female parents (49.2%). Regarding the age of the children, 55.3% were between 12 and 14 years old, while 44.7% were between 14 and 18 years old. In terms of educational background, 23.6% of parents had a high school education or below, 25.2% held junior college degrees, 19.5% had undergraduate degrees, 21.4% held postgraduate degrees, and 10.2% held doctoral degrees or above. Regarding average annual household income, 11.8% reported less than RMB 50,000, 38.7% reported between RMB 50,000 and 100,000, 21.4% between RMB 100,000 and 150,000, 18.2% between RMB 150,000 and 200,000, and 9.9% reported more than RMB 200,000.

Specific demographic information of the participants is shown in Table 1.

Table 1. Presents the demographic variables of the survey respondents.

Parental Age		Parent Gender		Child Age		Parental Education		Average Annual Household Income (CNY)	
Variable	**Percentage**	**Variable**	**Percentage**	**Variable**	**Percentage**	**Variable**	**Percentage**	**Variable**	**Percentage**
30~39 years	34.82	Man	50.80	12~14 years	55.27	High school and below	23.64	1,470–7,350	11.82
40~49 years	41.85	Woman	49.20	14~18 years	44.73	Junior college	25.24	7,350-14,700	38.66
more than 50 years	23.32					Undergraduate	19.49	14,700–22,050	21.41
						Postgraduate	21.41	22,050–29,400	18.21
						Phd or above	10.22	More than 29,400	9.90

3.2. Research Instruments

This study utilizes a questionnaire comprising four standardized instruments, each addressing a different aspect of the research focus. The first section collects background information, including demographic details such as students' gender, grade level, and city of residence, which helps to describe the sample characteristics and supports subgroup analysis.

The second section assesses participants' knowledge and awareness of AI in education through eight items. It covers whether they have heard of AI applications in education, sources of information, recognition of AI tools, self-rated understanding, awareness of school AI programs, and perceptions of AI's practical impact, such as cost savings, information comprehension, and response reliability. The items use a mix of binary and Likert-scale responses to provide a comprehensive measure of baseline AI knowledge, supporting analysis of its relationship with AI acceptance.

The third section explores perceived benefits and risks of AI integration with ten Likert-scale items. Benefits include AI's support in education planning, increased learning time, error reduction, and accessibility for low-income families. Risks cover data privacy concerns, impact on parent-child relationships, potential over-reliance on AI, increased screen time, and bias or unfair decisions by AI systems. This section also captures overall evaluations of whether benefits outweigh risks, helping to understand how perceptions influence acceptance intentions.

Finally, the measures acceptance of AI in education through seven Likert-scale items, covering understanding of AI, trust in its positive potential, encouragement of children's use, and restrictions due to concerns. It also assesses participants' interaction with AI, its educational support, and specific uses such as enhancing language learning. As the key dependent variable, this section evaluates behavioral intentions, attitudes, and willingness to use AI.

3.3. Data Collection

The questionnaire was launched on the Questionnaire Star online platform on 19 March 2025, with data collection conducted over a two-week period ending on 2 April 2025. During this time, the research team monitored the response rate to ensure timely and sufficient participation. All collected data were securely stored on the platform's protected server, adhering to relevant data protection regulations. After screening for completeness and consistency, a total of 313 valid responses were retained out of 315 submissions, ensuring the overall quality of the dataset for subsequent analysis.

3.4. Data Analysis

Before conducting the analysis, the quantitative data collected were first subjected to data cleaning procedures to ensure the validity and reliability of the dataset. This involved identifying and removing duplicate

responses, excluding incomplete or inconsistent entries, and checking for outliers that could potentially bias the results. Following these steps, the cleaned dataset was prepared for analysis using SPSS version 27.0.

Descriptive statistics were employed to calculate means and frequency distributions, providing an overview of the general trends in parents' awareness of artificial intelligence (AI). Subsequently, inferential statistics including correlation and regression analyses were conducted to examine the relationships between demographic variables, such as income and education level, and parents' acceptance of AI. The measurement instruments demonstrated high internal consistency, with a reliability coefficient of 0.934, supporting the robustness of the findings.

This comprehensive analytical approach ensured that the data were both accurate and meaningful, facilitating deeper insights into the factors influencing parental attitudes towards AI in education.

3.5. Ethical Consideration

This study strictly adhered to ethical guidelines to protect the rights and confidentiality of participants. As the participants were minors, informed consent was obtained from both the students and their parents or legal guardians prior to data collection. The purpose of the study, voluntary participation, and the right to withdraw at any time without penalty were clearly communicated to all participants. The online questionnaire was designed to ensure anonymity, with no personally identifiable information collected. All data were securely stored and accessible only to the research team to maintain privacy and confidentiality. Furthermore, ethical standards were followed in the handling and reporting of data, ensuring that the findings are used solely for academic and research purposes. This study was approved by the Institutional Review Board of the first author's institution, approval number 2024.0701.

4. Results

4.1. Descriptive Analysis

A total of 315 completed questionnaires were collected, of which 313 were deemed valid after rigorous data screening. Prior to formal analysis, the dataset underwent cleaning and coding procedures.

Of the valid respondents, 78.27% reported a basic understanding of AI applications in education, with notable disparities in information acquisition channels. Social media (53.99%) and personal networks (52.72%) were the dominant sources, far surpassing schools and formal institutions (37.38%) (see Table 2). This distribution is consistent with the assertion regarding the predominance of informal dissemination channels in technological diffusion and aligns with Perrotta & Selwyn's (2020) observations on the characteristics of communication strategies employed by educational institutions.

Table 2. Parental Understanding of AI Applications in Education.

Questions	Variable	Percentage
1. Have you heard of Artificial Intelligence (AI) being used in education?	Yes	78.27
	No	21.73
2. How did you first learn about AI in education?	News	30.67
	Social Media	53.99
	School	37.38
	Friends/Family	52.72
	Others	23.64
3. Can you name any AI tools or applications that are used in educational settings?	Deepseek	53.35
	DouBao	35.14
	Kimi	46.01
	ChatGPT	35.46
	Others	26.52

Interview data from parents included the comment: '*Schools rarely introduce AI tools; instead, we mostly encounter them accidentally through short videos or parent chat groups*'. This comment is consistent with the survey findings regarding the limited role of formal institutions in disseminating information about AI in education.

Awareness of Specific AI Tools and Self-Perceived Knowledge Gaps

In terms of specific tools, recognition rates were highest for Deepseek (53.35%) and Kimi (46.01%), while DouBao (35.14%) and ChatGPT (35.46%) lagged behind. Statistical analysis indicated significant positive

correlations ($p < 0.05$) between parents' familiarity with these tools and two variables: market visibility (e.g., advertising intensity, brand presence) and functional accessibility (e.g., localization, ease of use), consistent with conclusions on perceived utility and user acceptance (Yu et al., 2017).

In terms of self-perceived AI knowledge, 28.12% of parents believed they were well-informed, 48.56% acknowledged insufficient understanding, and 23.32% expressed neutrality. A one-way ANOVA revealed a statistically significant association between educational attainment and self-assessed knowledge ($F = 5.23$, $p = 0.002$). Among parents with a bachelor's degree or higher, 40.1% considered themselves "competent," compared to 18.9% of those with a high school education or below.

Figure 1 illustrates parents' information sources. Figure 2 summarizes responses regarding perceived AI utility: nearly half of the respondents were uncertain about school-level AI adoption, over 48% were unsure whether AI reduces educational costs, 31.18% found AI-generated learning content easily comprehensible, 42% expressed negative views, nearly 50% were uncertain about content accuracy, and 39% found the content inaccurate. These data indicate a prevalence of skepticism among parents regarding AI's effectiveness in education.

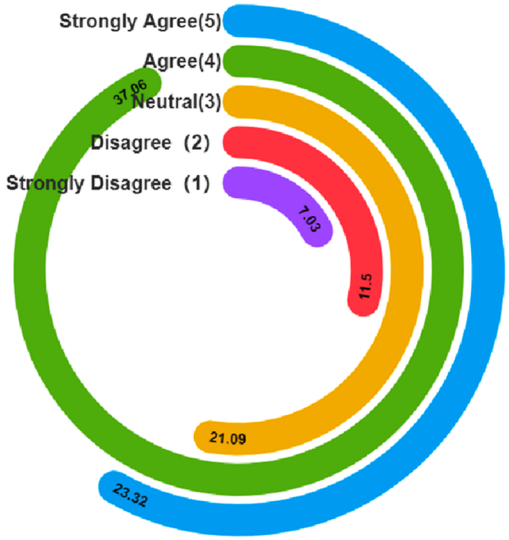

Figure 1. Distribution of Information Sources for Parental Awareness of AI in Education.

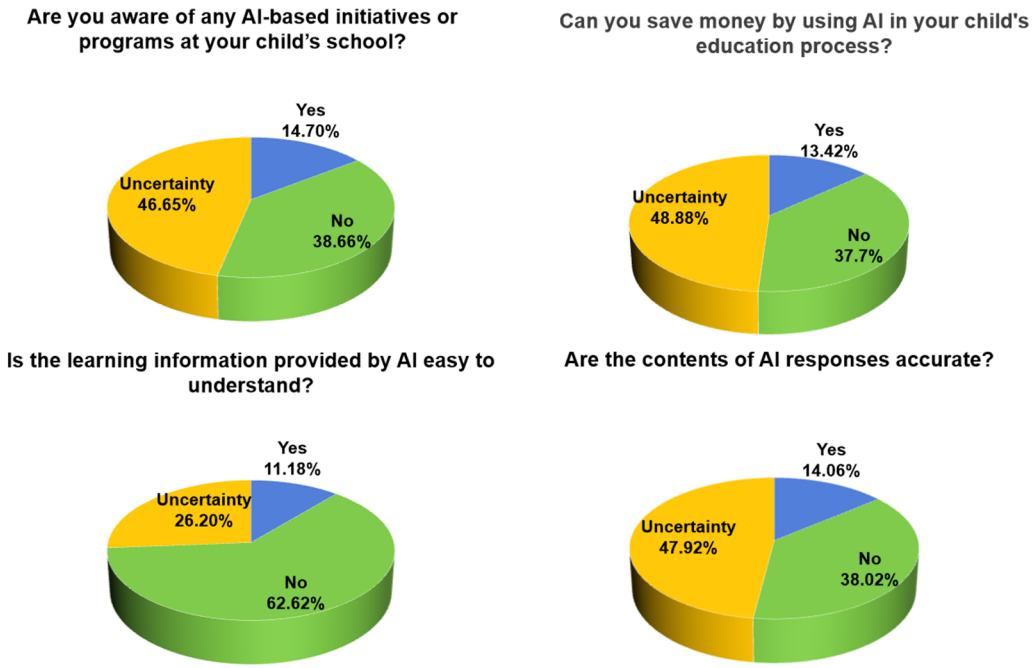

Figure 2. Survey of parents' recognition of the application of AI in the education scenario of junior and senior high school students**.**

4.2. Parents' Risk–Benefit Tradeoffs Regarding AI in Education

Parents held divergent views on the perceived benefits and risks of AI in education, with a statistically significant difference ($F = 6.82$, $p < 0.01$).

Regarding perceived benefits of AI integration in education, 47.0% of respondents recognized its potential to mitigate urban–rural disparities, 45.2% acknowledged its capacity to enhance instructional efficiency (e.g., automated grading, personalized learning pathways), and 38.7% appreciated its role in reducing the need for intensive at-home tutoring.

Regarding potential risks, 39.0% cited health-related issues (e.g., prolonged screen exposure, reduced attention spans), 44.7% highlighted concerns over fairness (e.g., algorithmic bias, unequal access to AI resources), 47.6% voiced apprehensions about violations of children's privacy, and 67.3% reported a general lack of trust in the data governance practices of AI platforms. These findings are consistent with the emerging discourse on the "AI Ethics Trust Crisis" and reflect the ethical and governance challenges associated with technological integration in education.

As Figure 3 shows, 38.7% of parents believed the benefits of AI outweigh the risks, 21.7% disagreed, and 39.6% were undecided. A logistic regression analysis revealed that higher educational attainment significantly predicted a more favorable attitude toward AI (OR = 1.52, $p = 0.013$). Conversely, parents who had experienced data breaches were more likely to hold negative views (OR = 0.68, $p = 0.028$), highlighting the pivotal role of trust in technology acceptance.

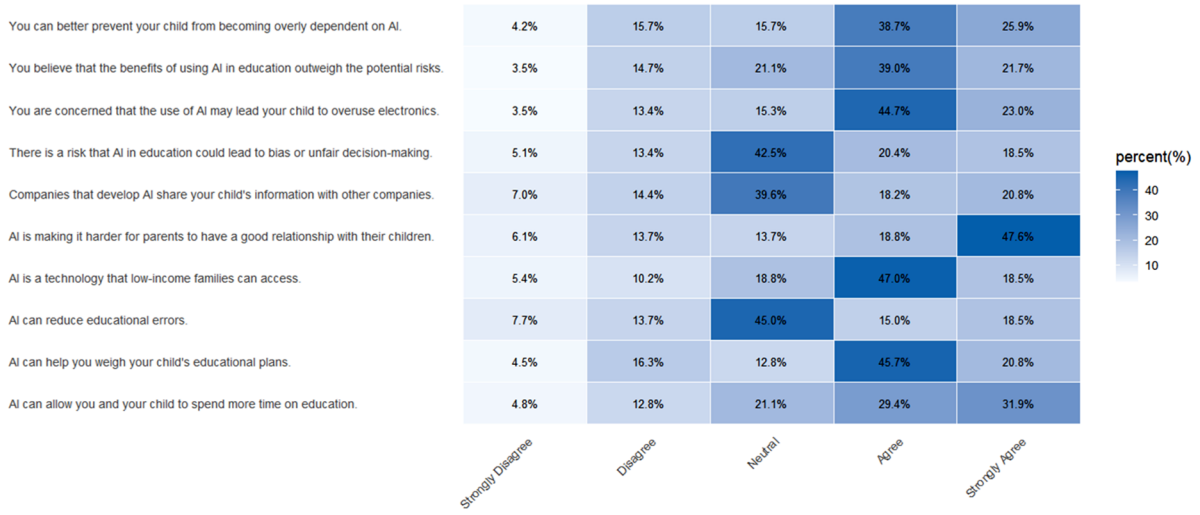

Figure 3. Parents' thoughts on the benefits and risks of AI in education**.**

4.3. Parental Acceptance of AI Educational Tools

Statistical analysis revealed that parental acceptance of AI educational tools varied significantly depending on the application context ($\chi^2 = 15.3$, $p < 0.05$). As Figure 4 shows, 42.8% of respondents expressed support for AI implementation in structured academic domains, such as vocabulary acquisition and mathematics problem-solving. One parent reflected this view, stating that "AI helps my child remember words more efficiently than traditional methods".

In contrast, only 33.9% of parents were comfortable with the use of AI in open-ended or creative learning tasks (e.g., essay composition or artistic design). A significant portion of these respondents voiced concerns about diminished originality and cognitive dependency—findings that are consistent with prior observations on overreliance and reduced independent thinking in students (Liang et al., 2024). As one parent remarked, "AI-generated essays lack originality and compromise children's independent thinking".

Moreover, a proactive attitude was observed among some parents: 35.1% indicated a willingness to guide their children in navigating AI tools effectively. An additional 24.3% recognized the value of AI for providing feedback through error analysis and learning progress tracking, suggesting growing interest in AI as a complementary home learning assistant.

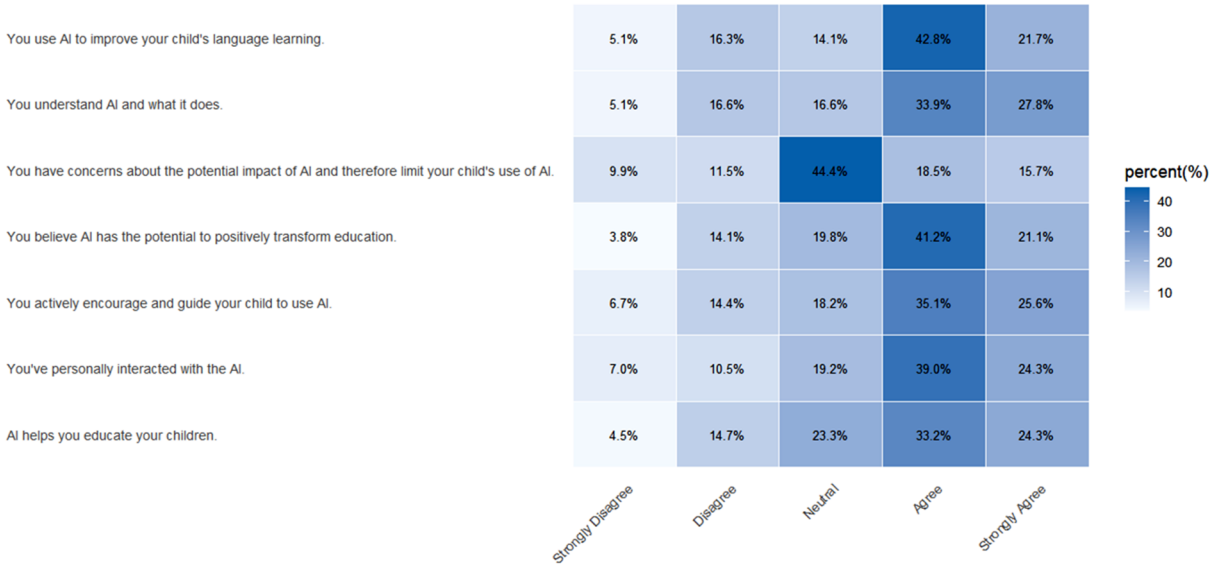

Figure 4. measures parents' overall acceptance of AI as a tool for their children's education.

Analysis of attitudinal trends revealed three distinct profiles among parents regarding the adoption of AI tools in education. The largest group, classified as Early Adopters (42.8%), primarily consisted of well-educated, higher-income individuals who emphasized the efficiency and academic advantages of AI technologies. In contrast, Cautious Moderates (33.9%) expressed a preference for bounded and controlled usage, underscoring concerns over potential misuse, data risks, and developmental impact. A third group, identified as Proactive Innovators (35.1%), was predominantly composed of younger parents who demonstrated openness to AI integration, provided it is accompanied by appropriate guidance and supervision.

Gender-based differences also emerged as statistically and substantively meaningful. A higher proportion of mothers (52.1%) voiced concerns over data privacy compared to fathers (43.8%), suggesting heightened sensitivity among female guardians to ethical and security-related issues. Conversely, more fathers (51.6%) than mothers (42.9%) recognized the potential of AI to promote educational inclusion, particularly in addressing learning disparities. These findings highlight the nuanced ways in which demographic factors such as gender and age intersect with technology acceptance and risk perception in the educational AI context.

4.4. Comprehensive Analysis

The scale's reliability and validity were confirmed via confirmatory factor analysis (CFA: $\chi^2/df = 4.47$, RMSEA = 0.074, CFI = 0.951). The sample featured a balanced gender ratio and represented a diverse range of family education stages. Employing ANOVA and logistic regression, several mechanisms were identified:

4.4.1. Disconnection Between Awareness and Institutional Communication

Despite relatively high awareness of AI in education, most parents relied on informal information sources, with schools primarily using unidirectional communication models (e.g., static notifications, under-attended parent meetings).

4.4.2. Synergistic Influence of Tool Visibility and Functionality

Tools with high market visibility (e.g., Deepseek 2.1.9) had higher recognition rates, and Kimi (2.7.6)'s Parent-Teacher Co-Testing Program—which iteratively improves design based on user feedback—achieved an 82.9% retention rate.

4.4.3. Balancing Risks and Benefits: Policy Recommendations

Parents' concerns regarding AI in education spanned student health, educational equity, and data privacy. There was an association between health concerns and prolonged digital exposure, between equity concerns and algorithmic bias, and between privacy concerns and data governance practices for minors. These observations point to the multifaceted nature of parental concerns about AI in education.

4.4.4. Context-Dependent Acceptance and the Role of Explainability

Parents are generally more receptive to structured AI applications but hesitant about open-ended uses. Incorporating explainability features—such as logic paths, reference sources, and decision rationales—can improve transparency and trust. For instance, essay-generation tools could display their reasoning process, helping parents better understand AI operations.

5. Discussion

This study provides a comprehensive examination of parental perceptions, knowledge, and acceptance of AI in education, with a particular focus on secondary school contexts in China. The findings contribute to the growing body of literature on educational technology adoption by shedding light on a stakeholder group often overlooked in AI discourse—parents. More importantly, this study advances the Technology Acceptance Model (TAM) through empirical validation and extension: by testing the model in the under-explored parental context of K–12 education, we identify key boundary conditions (e.g., sociodemographic differences, risk perceptions) that influence TAM's core constructs (perceived usefulness, perceived ease of use) and their relationship with behavioral intention. Specifically, our empirical data confirm that integrating AI ethics and cultural factors into TAM enhances the model's explanatory power for parental acceptance, addressing the gap in existing research that merely applies TAM without contextual adaptation. This empirical contribution not only validates TAM's applicability in educational AI contexts but also provides actionable insights for refining the model to better capture the sociotechnical complexities of parental technology acceptance.

5.1. Fragmented Awareness and the Role of Informal Channels

The results reveal that while 78.27% of parents possess a basic understanding of AI in education, this knowledge is primarily acquired through informal sources such as social media and peer networks—confirming Veraksa's (2020) assertion that informal, decentralized channels dominate technological diffusion in educational contexts. The limited role of formal institutions echoes Perrotta and Selwyn's (2020) critique of top-down, unidirectional school communication, which fails to meet parental informational needs. This disconnection suggests an urgent need to rethink parent-school communication models, shifting from sporadic, passive interactions to dynamic, digital-first engagement strategies (Zhang et al., 2025).

5.2. Digital Cognitive Divide and Its Educational Implications

The study demonstrates significant disparities in AI-related self-efficacy based on parental educational attainment, with highly educated parents reporting greater confidence and understanding. These findings empirically validate Wei et al.'s (2011) framework, which conceptualizes the digital divide as rooted in social-cognitive factors (capabilities and motivations) that drive uneven technology adoption. Such disparities may amplify educational inequality, as parents with higher digital capital are better able to guide their children's AI usage. Future interventions should target under-resourced families through community-based training and simplified AI literacy content for broader accessibility.

5.3. Risk–Benefit Tradeoffs and the Ethics of AI in Education

Parents' evaluations of AI reflect a nuanced balance of merits and risks: while many recognize AI's potential for educational equity and efficiency, concerns about health, algorithmic fairness, and data privacy remain prominent—aligning with the "AI Ethics Trust Crisis" framework and indicating skepticism toward corporate data governance. Regression results link negative attitudes to prior data breach experiences, underscoring trust as a key determinant of parental acceptance. To bridge this gap, AI developers and educational institutions must prioritize transparency, establish robust data governance, and involve parents in ethical dialogues about AI adoption.

5.4. Conditional Acceptance: Structured Use vs. Creative Autonomy

Parental acceptance of AI is context-dependent: structured applications (e.g., vocabulary practice, math drills) receive stronger endorsement than open-ended, creative tasks (e.g., writing, artistic expression). This dichotomy reflects concerns about cognitive dependency and loss of student agency (Liang et al., 2024). While structured AI tools can complement traditional pedagogies, excessive reliance—especially in unbounded tasks—may compromise critical thinking and creativity. Educators and designers should position AI as a supportive scaffold, not a substitute for human judgment, to preserve student autonomy.

5.5. Sociodemographic Differentiation in AI Attitudes

Sociodemographic differences shape parental attitudes: mothers are more sensitive to privacy concerns, while fathers prioritize AI's inclusive potential—echoing research on digital parenting and gendered risk perceptions. Younger and higher-income parents adopt a more proactive approach to AI integration, suggesting targeted messaging and support should account for these distinctions to improve adoption equity.

5.6. Implications for Policy and Practice

Multi-level, cross-sectoral interventions are needed to responsibly integrate AI into K–12 education. Policy-wise, health concerns demand screen-time regulations and ergonomic features (e.g., blue-light filtering, rest prompts) in educational AI platforms to mitigate physical and cognitive strain on young learners. For educational equity, systematic algorithmic audits and open-source models trained on inclusive datasets are essential to reduce bias and ensure equitable access.

Privacy protection requires transparent data governance, including regular disclosure reports, robust parental consent, and adherence to regulations like GDPR and China's PIPL—particularly critical for minors' digital identities. Practically, schools should adopt co-creation models involving parents in AI curriculum and application development; initiatives like Kimi's "Parent-Teacher Co-Testing" program exemplify participatory design that enhances tool effectiveness, parental trust, and long-term engagement.

5.7. Limitations and Future Research

This study has limitations: it relies on self-reported data (prone to social desirability or recall biases), focuses on urban/peri-urban samples (underrepresenting rural parents), and centers on the Chinese context (cross-cultural comparisons could reveal sociocultural influences). Future research should use longitudinal designs to track attitude changes, experimental studies to test tool design impacts (e.g., explainability features on trust), and qualitative investigations to explore underlying psychological mechanisms (e.g., techno-anxiety, control beliefs) in parental decision-making.

6. Conclusions

This study offers a comprehensive examination of Chinese parents' perceptions, knowledge, and acceptance of artificial intelligence (AI) applications within secondary education. Through a mixed-methods approach—drawing on 313 valid survey responses and semi-structured interviews—the research presents a nuanced and empirically grounded understanding of parental engagement with educational AI. The findings reveal a highly fragmented cognitive landscape: while a majority of parents report baseline familiarity with AI tools, their understanding is predominantly shaped by informal channels such as social media, peer discussions, and online forums. This reliance on decentralized sources highlights a key shortcoming in current school–parent communication practices and underscores the limitations of traditional, top-down information dissemination models in addressing complex technological topics.

One of the central contributions of this study lies in its documentation of the "digital cognitive divide" among parents. Specifically, higher levels of educational attainment and socioeconomic status were found to be strongly associated with greater confidence in navigating AI tools, higher levels of trust, and more favorable attitudes toward their integration in learning environments. This finding echoes and extends existing digital divide frameworks by emphasizing the importance of cognitive dimensions—such as self-efficacy, perceived utility, and digital literacy—in shaping parental readiness to engage with educational technologies. Parents from lower-income or less-educated backgrounds were significantly more likely to express skepticism, confusion, or ambivalence, which may, in turn, limit their capacity to support their children's interaction with AI-enhanced learning systems. Addressing these disparities requires targeted interventions, including localized AI literacy campaigns and culturally responsive resources designed to increase accessibility and reduce cognitive entry barriers.

At the same time, the study uncovers a complex set of risk–benefit tradeoffs that shape parental attitudes toward AI in schools. On the one hand, many respondents expressed optimism regarding AI's potential to enhance educational equity, improve instructional efficiency, and alleviate the burden of at-home tutoring. These perceived advantages were especially salient among younger parents and those with prior exposure to digital tools. On the other hand, deep-seated concerns were voiced regarding algorithmic fairness, excessive screen time, and data privacy—particularly in relation to children's personal information and prior negative experiences with data

breaches. The interplay between these benefits and risks suggests that parental acceptance of AI is not binary but conditional, highly context-dependent, and mediated by individual, technological, and institutional trust factors.

Notably, parents demonstrated higher acceptance of AI tools when they were applied to structured, narrowly defined educational tasks—such as vocabulary acquisition or mathematical problem-solving—where the perceived pedagogical value was clear and controllable. In contrast, applications involving open-ended, creative, or evaluative tasks—such as essay writing or artistic design—elicited more resistance. These results indicate that parents are cautious about the possibility of AI compromising students' critical thinking, creativity, and independence. Consequently, a key recommendation emerging from this study is that AI should be designed and implemented not as a replacement for human judgment or teacher interaction, but as a scaffolding mechanism that supports, rather than substitutes, learner autonomy.

Beyond empirical insights, the study contributes to the broader discourse on educational innovation by foregrounding the role of parents as critical stakeholders in the digital transformation of schooling. As AI tools become more prevalent in classrooms, the voices and concerns of families must be actively integrated into design, governance, and implementation processes. Educational institutions are therefore urged to evolve from episodic and reactive forms of communication toward continuous, two-way digital engagement strategies. Co-creation models, such as participatory curriculum design or feedback-driven tool deployment, may help bridge the trust gap and foster a shared sense of ownership over educational technology decisions.

From a policy standpoint, the findings point to the necessity of multidimensional strategies that extend beyond infrastructure and access. These include promoting transparent algorithm auditing for equity, ensuring compliance with international and national data protection regulations (e.g., GDPR, China's PIPL), and funding AI literacy initiatives tailored to diverse family profiles. Moreover, sustained investment in school–home collaboration platforms—especially those that allow for iterative feedback, usage monitoring, and trust-building—will be essential in creating inclusive, ethical, and effective AI-integrated educational ecosystems.

Despite its contributions, this study acknowledges several limitations. The cross-sectional design restricts causal interpretations, and the sample, while demographically varied, is primarily drawn from urban and peri-urban areas, limiting generalizability to rural populations. Future research would benefit from longitudinal methodologies to track evolving parental attitudes over time, especially as AI tools become more deeply embedded in formal curricula. Comparative international studies may also yield valuable insights into how cultural, regulatory, and institutional contexts mediate parental responses to AI in education.

In sum, this research reaffirms that while Chinese parents are cautiously optimistic about AI's role in educational settings, meaningful integration demands more than technical efficacy. It requires a robust ecosystem of institutional accountability, ethical governance, inclusive design, and culturally attuned communication practices. Only through such holistic efforts can AI become a trusted and equitable partner in the future of learning.

Author Contributions

X.W. conceived the study and led the framework design, conducted the data collection and manuscript writing, provided methodological guidance, quantitative analyses, data interpretation supervision. Q.L. performed the literature review and data collection, and manuscript writing, contributed to data formatting. A.S.A. provided data processing guidelines. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data provided in this study cannot be made public due to the privacy concerns of the participants. However, they can be made available upon reasonable request by the first author.

Conflicts of Interest

The authors declare no conflict of interest.

Use of AI and AI-Assisted Technologies

During the preparation of this work, the authors used Deepseek 2.1.9 to polish this article. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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