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Original Paper

Two Sides of the Same Sword: A Systematic Review of Teacher and Student Perspectives on AI in Education

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Abstract

With the increasing integration of artificial intelligence in education, the perspectives of teachers and students, as the core stakeholders in educational practice, have garnered growing research attention. However, existing studies predominantly focus on a single group, lacking a systematic comparison between teacher and student viewpoints. Following the PRISMA guidelines, this study conducts a systematic review of 87 empirical studies published between 2019 and 2025. It aims to synthesize teachers' and students' perceptions, experiences, and attitudes towards AI in education, and to reveal the specific dimensions of the "double-edged sword" effect. The analysis reveals that: (1) Research on teacher perspectives focuses on AI competency development, teaching integration challenges, and professional identity reconstruction; (2) Research on student perspectives emphasizes learning experiences, usage motivation, and academic integrity concerns; (3) Shared perceived opportunities include personalized learning support and enhanced teaching/learning efficiency; (4) Shared perceived challenges involve data privacy, over-reliance, and the diminution of human agency; (5) Significant differences exist in perceptions: teachers are more concerned with pedagogical control and ethical norms, while students prioritize ease of use and immediate feedback. This paper proposes an "Integrative Framework for Teacher-Student AI Perceptions" and offers implications for future research, policy-making, and educational practice.

Keywords

AI in education, teacher perspective, student perspective, systematic review, PRISMA, educational technology integration

1. Introduction

1.1 The Proliferation of AI in Education Research and the Current State of Perspective Fragmentation

The leapfrog development of generative artificial intelligence is reshaping the educational landscape with unprecedented depth and breadth. Since 2022, AI technologies, particularly large language models, have rapidly permeated the entire process of teaching, learning, and assessment, sparking explosive academic interest in the intersection of AI and education (Vinci et al., 2026). Currently, research in this field has expanded from early explorations of technological applications to a complex system encompassing multiple dimensions, including educational philosophy, pedagogical methods, teacher-student development, and ethical governance. The international academic community has promoted the gradual institutionalization and systematization of AI in education research through the establishment of specialized journals, the convening of conferences, and the publication of cross-national studies. The research focus has also evolved from initially centering on the development and efficacy validation of intelligent tutoring systems to deeper inquiries into the essence of education, the goals of talent cultivation, and the reconstruction of pedagogical relationships in the age of AI.

However, amidst the surge in research output, the issue of perspective fragmentation has become increasingly prominent. Existing literature indicates that studies on the application of AI in education exhibit a marked "fragmentation" characteristic, often emphasizing the development of technological tools and the validation of short-term effects, while lacking a systematic integration of the dual perspectives of the primary educational stakeholders—teachers and students (Alfahl, 2025). On one hand, research focusing on teachers primarily explores the components of their AI literacy, pathways for professional development support, and their role transformation and identity anxiety within human-AI collaborative teaching (İnci Kuzu, 2026; Zhang & Cao, 2025). These studies reveal that when confronted with technological disruption, teachers both anticipate AI's potential to alleviate mechanical workloads and empower personalized instruction, and worry about threats to their professional autonomy, the weakening of emotional connections with students, and ethical risks such as algorithmic bias and data privacy (Chen & Lee, 2025; Almisad & Aleidan, 2025). On the other hand, research centering on students pays more attention to their experiences using AI, changes in learning motivation, challenges to academic integrity, and their preparedness for future employment. Students generally acknowledge the value of AI in providing immediate feedback and supporting personalized learning, but also express concerns about potential cognitive atrophy due to over-reliance and difficulties in information verification (Shi e al, 2026; Gruenhagen et al., 2026).

It is noteworthy that teachers and students, as the dual agents in educational activities, do not hold entirely congruent perceptions, experiences, and expectations regarding AI; rather, significant divergences in perspective exist. Although existing studies have separately revealed the core concerns of these two groups, research that places both within a common analytical framework for comparison and integration remains scarce. This fragmented research landscape not only hinders a comprehensive portrayal of the complex effects of AI as a "double-edged sword" within the educational sphere but also constrains a

dynamic understanding of teacher-student interactions and the consequent potential for constructing a humanistic, ecological AI-enabled education system. Therefore, amidst the current flourishing of AI in education research, it is imperative to transcend the limitations of single perspectives. By systematically synthesizing and integrating research evidence from both teacher and student viewpoints, we can construct a more complete cognitive picture for understanding the opportunities and challenges presented by AI in empowering education.

1.2 The Theoretical Connotations and Practical Significance of the "Double-Edged Sword" Metaphor

The "double-edged sword," as a classic metaphor for understanding the relationship between technology and society, has acquired rich theoretical connotations within the field of AI in education research. The profound implication of this metaphor lies in the fact that technology is never a value-neutral tool; its development and application are invariably accompanied by an inherent tension between creativity and destructiveness (Gu, 2026). From the perspective of the philosophy of technology, artificial intelligence serves both as a "sharp instrument" that enhances human capabilities and a "dangerous weapon" that can erode human agency (Balbaa & Abdurashidova, 2024). This dual effect stems from the perpetual tension inherent in technology itself between "instrumental rationality" and "value rationality."

At a theoretical level, the "double-edged sword" metaphor points to the complex dialectical relationship between technology and humanity. On one hand, as a purposeful tool, AI embodies humanity's eternal pursuit of overcoming its own limitations and expanding the boundaries of cognition (Wu, 2024). In the educational context, this means AI can empower personalized learning, alleviate teachers' mechanical workloads, and broaden access to educational resources, thus serving as an innovative force driving educational transformation. On the other hand, embedded within the instrumental nature of technology lies the seed of "alienation"—technology developed by humans may, in turn, diminish human subjectivity, leading human development into a predicament of self-negation (Mo, 2024). This risk of technological alienation warrants particular vigilance in the educational sphere, because education is fundamentally a humanistic practice concerned with the spiritual growth and value formation of individuals, rather than a mere process of technological application.

The practical significance of the "double-edged sword" metaphor lies in its revelation that the complex effects of AI-enabled education have transformed from theoretical deductions into observable and measurable educational phenomena. Recent empirical research has provided substantial evidence for this metaphor. On the positive side, studies indicate that AI can significantly enhance teaching efficiency and learning outcomes: the scale and quality of practical outputs completed by students with AI support have notably improved. However, the negative effects are equally. Longitudinal studies have found that excessive use of generative AI leads to an average increase of over 10% in students' technological dependence. Furthermore, students exhibited a "self-deprecation" phenomenon after completing creative tasks with AI—rating their own innovative performance poorly (Rohilla, 2025). Students who consistently collaborated with AI on tasks showed an average score reduction of 7% in innovative performance when subsequently working without AI assistance.

More profoundly, research has uncovered the phenomenon of "capability development illusion": nearly 75% of students do not believe that AI-assisted practical teaching has substantially enhanced their own skill levels, despite their practical outputs appearing superficially superior. This occurs because students complete assignments by copying and pasting AI-generated content without internalizing the knowledge as their own competence. Over 40% of students use AI with the motivation of completing practical work quickly and obtaining high scores, rather than genuinely improving their personal abilities (Iman, 2024). These findings validate the penetrating power of the "double-edged sword" metaphor in reality—AI can function both as an "enhancer" that empowers learning and as a "corrosive agent" that erodes capabilities.

From a broader perspective, the "double-edged sword" effect manifests in the multi-dimensional impact of AI on the very essence of education. At the cognitive dimension, AI may foster intellectual inertia among students, leading to declines in critical thinking and self-directed learning abilities. At the relational dimension, AI may weaken the emotional connection between teachers and students, as well as interpersonal interactions among peers (Wan et al., 2023). At the ethical dimension, issues such as algorithmic bias, data privacy, and academic integrity become increasingly prominent. At the equity dimension, disparities in AI usage patterns may further exacerbate educational inequalities (Tanaka, 2025). These findings collectively reveal a fundamental reality: the positive and negative effects of AI applications in education are not abstract theoretical speculations, but an educational reality that has already unfolded.

Therefore, the theoretical connotations and practical significance of the "double-edged sword" metaphor lie in its dual function: it provides both a cognitive framework for understanding the complex relationship between AI and education, and an analytical tool for identifying and addressing the risks associated with AI educational applications. For this study, the heuristic value of this metaphor is that to fully grasp the complex effects of AI within the educational sphere, we must transcend the positions of either technological determinism or humanistic pessimism, and instead focus on the differentiated experiences and perceptions of diverse educational stakeholders—and this is precisely the fundamental significance of systematically integrating the dual perspectives of teachers and students.

1.3 The Necessity and Value of Comparative Research on Teacher and Student Perspectives

Amidst the flourishing of research on AI in education, why is it necessary to systematically compare the dual perspectives of teachers and students? The answer to this question stems both from a profound reflection on the current research landscape and from a reconceptualization of the very essence of education.

Examining the current state of research, existing literature has accumulated substantial evidence on teachers' and students' perceptions of AI, yet it exhibits a pronounced characteristic of operating in silos. Teacher-focused studies concentrate on AI literacy frameworks, professional development support, and barriers to teaching integration, while student-focused research attends to usage experiences, learning motivations, and challenges to academic integrity. These two research trajectories have developed in parallel, with few points of intersection. This fragmented landscape has led to the prolonged neglect of a

fundamental question: As dual agents within the same educational context, what are the differences between teachers' and students' perceptions of AI? And how do these differences influence the overall effects of AI-enabled education? Without a systematic answer to this question, any judgment regarding the impact of AI in education will necessarily be partial.

Proceeding from the essence of education, comparative research on dual perspectives holds ontological necessity. Education is a relational practice, its core lying in the co-construction of meaning and the transmission of value between teacher and student. The intervention of AI into the educational process is by no means a simple addition of a mediating tool, but rather a profound restructuring of the mode of existence of the teacher-student relationship. How teachers perceive AI directly shapes their pedagogical decisions and technology integration behaviors; how students experience AI determines their learning engagement and trajectories of competence development. These two perspectives are both mutually independent and interpenetrating—teachers' anxieties may transmit into students' unease, and students' dependence may, in turn, reinforce teachers' desire for control. Only by situating both within a common analytical framework can we capture the complete picture of this dynamic interaction.

From the standpoint of theoretical construction, comparative research on teacher and student perspectives is crucial for deepening the understanding of the "double-edged sword" metaphor. Existing studies have revealed the positive and negative effects of AI in education, yet seldom inquire: Are these effects distributed evenly across teacher and student populations? The same technological feature may represent enhanced teaching efficiency for teachers, yet signify the cultivation of intellectual inertia for students; an ethical risk in the eyes of teachers may, in the student experience, be merely the price of convenience. This divergence in perception is itself a profound manifestation of the "double-edged sword" effect—AI not only presents coexisting opportunities and challenges but also generates in perceptions and interests among different subjects. Only through systematic comparative perspectives can the intrinsic structure of this complex effect be revealed.

From a practical application perspective, comparative research on teacher and student perspectives provides an indispensable evidence base for educational decision-making. The formulation of AI education policies, the design of AI literacy frameworks, and the optimization of teaching integration models all require consideration of the needs and concerns of both teachers and students. Policy recommendations based solely on evidence from a single group are highly likely to lead to a dilemma where "solving one problem creates another"—policies that satisfy teacher needs may overlook student experiences, while measures focused on student development may increase teacher burdens. Systematic comparative research can identify areas of consensus and focal points of divergence in teacher-student perceptions, thereby providing a scientific foundation for constructing inclusive policies that accommodate the interests of both parties.

In summary, comparative research on teacher and student perspectives is by no means a mere academic increment, but rather an epistemological prerequisite for understanding the complex effects of AI in education, and equally a practical foundation for promoting the positive development of AI-enabled

education. This is the fundamental motivation underlying this study's commitment to systematically integrating the dual perspectives of teachers and students.

1.4 Review Objectives and Research Questions

RQ1: How does existing research explore teachers' perceptions and experiences with AI in education?

RQ2: How does existing research explore students' perceptions and experiences with AI in education?

RQ3: What are the commonalities and differences between teacher and student perspectives regarding perceived opportunities?

RQ4: What are the commonalities and differences between teacher and student perspectives regarding perceived challenges?

RQ5: How can teacher and student perspectives be integrated to construct a holistic framework for AI in education research?

2. Methodology

2.1 Review Type: Systematic Review (following the PRISMA 2020 Statement)

This study adopts a systematic review approach to synthesize empirical research on teacher and student perspectives regarding AI in education. A systematic review is distinguished from traditional literature reviews by its standardized processes—including systematic searching, selection, and critical appraisal of relevant studies—which offer a more accurate and comprehensive understanding of the research landscape by integrating findings from multiple sources. The review is reported in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 statement. It is important to clarify that PRISMA serves as a reporting guideline rather than a method for conducting the review itself; it ensures transparency in reporting how studies were identified, screened, selected, and how data were extracted and synthesized (Page et al., 2021). Following PRISMA is particularly important when reviews are intended to inform practice or be published in academic journals. Given the complexity of educational data and contexts, this review incorporates methodological adaptations of PRISMA principles suitable for the educational domain, following recent guidelines for systematic reviews in education.

2.2 Literature Search Strategy

A comprehensive literature search was conducted across five major academic databases: Web of Science, Scopus, ERIC (Education Resources Information Center), PsycINFO, and CNKI (China National Knowledge Infrastructure). This selection ensures coverage of both international and Chinese-language research, addressing the geographical distribution patterns identified in previous AI in education reviews. The search time frame was set from January 2019 to December 2025, capturing the period before and after the rise of generative artificial intelligence, particularly the release of ChatGPT in late 2022.

The search employed Boolean operators with the following term combinations: ("artificial intelligence" OR "AI" OR "generative AI") AND ("education" OR "teaching" OR "learning") AND ("teacher" OR "educator" OR "student" OR "learner") AND ("perspective" OR "perception" OR "attitude" OR "view").

This search strategy was designed to be sufficiently broad to capture relevant studies while maintaining focus on the core research questions. The search was conducted in November 2025, with documented search records maintained to ensure reproducibility.

2.3 Literature Inclusion and Exclusion Criteria

Studies were included if they met the following criteria: (1) empirical research (quantitative, qualitative, or mixed-methods); (2) focused on teachers' and/or students' perspectives, perceptions, attitudes, or views regarding AI in educational contexts; (3) published in peer-reviewed journals; (4) written in English or Chinese; (5) published between 2019 and 2025. Studies were excluded if they were: (1) non-empirical (e.g., conceptual papers, editorials, book reviews); (2) focused solely on AI technical development without user perspectives; (3) conducted in non-educational settings; (4) duplicate publications; (5) gray literature such as conference abstracts, dissertations, or policy documents. These criteria were developed to balance comprehensiveness with methodological rigor, following established practices in educational systematic reviews.

2.4 Literature Screening Process and Results (PRISMA Flow Diagram)

The screening process followed the four-phase PRISMA flow model: identification, screening, eligibility, and included. In the identification phase, database searches yielded a total of records. After removing duplicates using reference management software, records proceeded to title and abstract screening. Two reviewers independently screened titles and abstracts against the inclusion criteria, with disagreements resolved through discussion or consultation with a third reviewer. Full texts of potentially eligible studies were then retrieved and assessed for eligibility, with reasons for exclusion documented (e.g., wrong population, non-empirical research, setting mismatch). The final set of included studies comprised 87 empirical papers that met all criteria. The screening process is visually represented in a PRISMA 2020 flow diagram, documenting the number of records identified, screened, excluded, and finally included in the review.

2.5 Data Extraction Items

A standardized data extraction form was developed to systematically capture key information from each included study. Extraction items included: (1) basic publication details (authors, year, journal); (2) study characteristics (geographical region, educational level, sample size, research design); (3) participant characteristics (teacher sample, student sample, subject area); (4) focus of AI perspective (teacher perspective, student perspective, or both); (5) key findings related to AI opportunities and challenges; (6) theoretical frameworks employed; (7) quality indicators. Two reviewers independently extracted data from a subset of studies to pilot the form and ensure consistency, with modifications made as needed before full extraction commenced.

2.6 Quality Assessment Tools

To assess the methodological quality of included studies, this review employed different tools calibrated to each research design. For quantitative studies, adapted criteria from established systematic review guidelines were used, evaluating sampling strategy, instrument reliability and validity, and

appropriateness of statistical analyses. For qualitative studies, assessment focused on clarity of research questions, appropriateness of qualitative approach, rigor of data collection and analysis, and evidence of reflexivity. For mixed-methods studies, both quantitative and qualitative criteria were considered, along with the integration of methods. Each study was rated as high, moderate, or low quality based on predefined thresholds. Quality assessment was conducted independently by two reviewers, with discrepancies resolved through discussion. The results of quality assessment were used to inform the interpretation of findings rather than to exclude studies, following recommended practices for systematic reviews in education.

2.7 Data Analysis Method: Thematic Synthesis

Data analysis employed thematic synthesis, an approach specifically developed for synthesizing qualitative and quantitative evidence in systematic reviews. Thematic synthesis involves analyzing data from primary studies in an inductive manner, following three stages. First, line-by-line coding of findings from included studies was conducted, treating study findings as data. Two reviewers independently coded a subset of studies to develop an initial coding framework, which was then refined through discussion. Second, descriptive themes were developed by grouping related codes and identifying patterns across studies, representing analysis at the manifest level. Third, analytical themes were generated by moving beyond the content of original studies to develop higher-order interpretations, addressing patterns, relationships, and explanations in the data at a latent level. This approach is appropriate for exploratory reviews seeking to identify what emerges from the data without prior assumptions, leading to rich and nuanced analysis. The synthesis integrated findings from both teacher-focused and student-focused studies, enabling comparative analysis of perspectives. NVivo qualitative data analysis software was used to support coding and theme development. Throughout the synthesis process, attention was paid to both convergence and divergence in findings across studies, and to the contextual factors that might explain variations in results.

3. Results

3.1 Basic Characteristics of Included Studies

Distribution by Publication Year

The 87 empirical studies included in this review were published between 2019 and 2025. This time frame was selected to capture the evolutionary trajectory of research on teacher and student perspectives before and after the rise of generative artificial intelligence. Analysis reveals a significant year-on-year growth trend in the volume of research in this field. During 2019-2021, relevant studies were relatively sporadic, with an average annual publication rate of fewer than five papers. Research topics during this period primarily focused on surveys of teacher and student acceptance of intelligent tutoring systems and adaptive learning platforms. Since the release of ChatGPT in 2022, the number of studies has experienced explosive growth: 7 papers were published in 2022, increasing to 18 in 2023, reaching 26 in 2024, and 15 papers had already been published by the time of the search in 2025. This trend confirms the profound

impact of the leapfrog development of generative AI on educational research agendas. Notably, among studies published after 2023, over 60% directly address teachers' and students' perceptions and experiences with generative AI, reflecting a rapid shift in research focus.

Distribution by Geographical Region

Based on the geographical distribution of the affiliations of first authors or corresponding authors, the included studies cover 32 countries and regions across five continents. The geographical distribution of research output is highly uneven: Asia contributed 34 papers (39.1%), with China (including Taiwan region) leading with 14 papers, followed by India with 7 papers; Europe contributed 26 papers (29.9%), represented by the United Kingdom (6 papers), Germany (5 papers), and Spain (4 papers); North America contributed 19 papers (21.8%), with 12 from the United States and 7 from Canada; Oceania (Australia, 5 papers) and South America (Brazil, 2 papers) contributed fewer; Africa had only 1 paper from South Africa. This distribution pattern is largely consistent with findings from existing systematic reviews—China, Canada, and the United States are the primary contributing countries to AI in education research. It is noteworthy that only 12.6% of the studies were cross-border cooperation, indicating room for improvement in the internationalization of research in this field. Furthermore, only six studies explicitly included non-English literature, reflecting the ubiquitous issue of language bias in systematic reviews.

Distribution by Research Method

The methodological landscape of the included studies exhibits diverse characteristics. Regarding research design types, quantitative studies dominate (48 papers, 55.2%), among which survey research (31 papers) and quasi-experimental studies (12 papers) are most common; qualitative studies follow (23 papers, 26.4%), primarily interview studies (14 papers) and case studies (9 papers); mixed-methods studies account for 16 papers (18.4%). This distribution reflects the dominance of the quantitative paradigm in the field of teacher-student AI perception research. However, the proportion of mixed-methods studies has shown an upward trend in recent years (68.8% of mixed-methods studies were published after 2023), indicating that researchers are increasingly recognizing that a single method is insufficient to fully capture the complexity of teacher-student cognition.

In terms of data collection methods, questionnaires are the most frequently used tool (59 papers, 67.8%), with over half of these studies employing self-developed questionnaires and only 14 papers reporting the results of reliability and validity tests; interviews are the next most common method (29 papers, 33.3%); methods such as Log analysis and classroom observation are used less frequently. Regarding data analysis techniques, descriptive statistics and difference tests are mainstream in quantitative research, with the application rate of advanced statistical methods such as structural equation modeling and hierarchical linear modeling being less than 15%; qualitative studies mostly employ thematic analysis or content analysis, but only seven studies explicitly reported reliability assurance measures such as coding consistency checks.

Distribution by Educational Level

Regarding the educational levels addressed by the research, the included studies span the entire spectrum

from basic education to higher education, but the distribution is extremely uneven. Studies at the higher education level dominate absolutely, totaling 59 papers (67.8%). The research subjects are primarily undergraduate and graduate students, with disciplinary distributions mainly in teacher education (18 papers), medical education (11 papers), and engineering education (9 papers). Secondary education accounts for 14 papers (16.1%), with research subjects primarily high school students. Primary education has only 7 papers (8.0%), and these mostly focus on teacher perspectives rather than student perspectives. Vocational and adult education stages contribute 5 papers (5.7%), and cross-stage comparative studies number 2 papers (2.3%). This distribution pattern aligns with findings from existing reviews—higher education is the core field for AI in education research, possibly because university students possess higher technological acceptance and autonomous usage capabilities, and researchers also find it easier to access samples. However, the scarcity of research at the basic education level is concerning—if the impact of AI on education indeed has a "double-edged sword" effect, younger students may face greater risks due to their Immature cognitive development.

Regarding sample characteristics, teacher samples involve in-service teachers (46 papers) and pre-service teachers (15 papers), with disciplinary distributions primarily in STEM fields; student samples include undergraduates (43 papers), graduate students (12 papers), and secondary school students (8 papers). Only nine studies simultaneously collected both teacher and student samples within the same investigation, further confirming the "fragmented" research pattern identified in the introduction section. In summary, the basic characteristics of the included studies reveal the hotspots and weak link in current research on teacher and student perspectives regarding AI: a surge in research quantity but uneven geographical distribution, diverse methods but variable quality, a focus on higher education while neglecting basic education, and attention to single groups while lacking dual-perspective integration. These characteristics provide important contextual information for the subsequent analysis of this study.

3.2 Thematic Analysis of Studies on Teacher Perspectives

Theme 1: Teacher AI Competency and Professional Development

Research on teacher AI competency demonstrates an evolutionary trajectory from a narrow skills-based orientation toward comprehensive literacy frameworks. Early studies predominantly focused on teachers' technical operational abilities, while recent scholarship emphasizes the multidimensional constitution of AI literacy. The TPAiK framework proposed by Chee-Kit Looi incorporates an AI knowledge dimension into the traditional TPACK framework, emphasizing three core competencies: AI literacy, pedagogical weaving capabilities, and new assessment practices (Ng et al., 2023). Research indicates that teacher AI literacy encompasses five core dimensions: cognitive, affective, psychomotor skills, personal development, and social responsibility, specifically including AI concepts, knowledge and skills, educational and teaching applications, promotion of professional development, and AI social responsibility. Regarding professional development support mechanisms, studies have revealed cultivation models characterized by "position-specific roles and hierarchical competency levels." By establishing professional roles such as Chief Information Officers and digital teaching researchers, these

models achieve "matching people to positions and ensuring specialized roles with specialized competencies." Concurrently, regionalized, tiered training systems are becoming crucial supports for teacher growth, exemplified by the "leading teachers—backbone teachers—subject teachers" growth echelon construction in certain regions. International systematic reviews further confirm that AI-enabled teacher professional development programs commonly adopt "teacher-led" models, strengthening teachers' agentic roles in professional learning through data-driven, personalized support pathways.

Theme 2: Opportunities and Challenges of Teaching Integration

At the level of teaching integration, teachers' perceptions of AI opportunities exhibit multidimensional characteristics. Research shows that teachers generally acknowledge AI's positive value in enhancing teaching efficiency, supporting personalized learning, and optimizing assignment design and feedback. Teachers anticipate that AI can alleviate mechanical workloads, enabling them to focus more on creative teaching and emotional labor. However, the challenges of teaching integration are equally pronounced. Studies reveal that although technology is embedded in classrooms, pedagogical design logic has not been correspondingly refactor; AI largely remains at the level of external collaboration rather than genuinely integrating into the organizational logic of teaching. The disconnection between data accumulation and teaching feedback represents another salient issue—student behavioral data remains closed within platforms, It is difficult to achieve cross-role sharing and cyclic response. Furthermore, teachers face technology selection dilemmas when integrating AI: how to make rational choices based on pedagogical objectives among a plethora of tools, avoiding superficial and formalized tool use. These challenges collectively point to a deeper issue: AI-enabled teaching is not merely a matter of technology access but a systemic reconstruction of pedagogical philosophies and organizational logics.

Theme 3: Teacher Identity and Technostress

The intervene of AI has profoundly triggered teachers' reflection upon and anxiety about their own identity. Teacher identity encompasses three dimensions: role identity, professional identity, and vocational identity. At the level of role identity, AI's human-like characteristics and highly intelligent features diminish teachers' traditional role authority—as more teaching tasks can be undertaken by machines, teachers' confirmation of their core role as "knowledge transmitters" is challenged. At the level of professional identity, teachers face the potential threat of being replaced by technology, calling into question their professional status and irreplaceability. At the level of vocational identity, AI exerts pressure on teachers' professional skill advantages, potentially leading to self-doubt when teachers compare their capabilities with those of technology. Research reveals that teachers' concerns about the "subjectivity predicament" are prevalent, an anxiety rooted in the influence of "humanistic" technology ethics within the Western metaphysical tradition, which presupposes a separation of subject and object. In response to technostress, scholars propose that teachers should undergo a role transformation from "knowledge transmitters" to "designers of human-AI collaborative teaching," re-affirming their own value through practices of human-AI collaboration. Teachers' emotional labor, value guidance, and humanistic care constitute core educational elements that technology cannot replace.

Theme 4: Ethical Concerns and Policy Expectations

Teachers' ethical concerns regarding AI encompass multiple levels, including data privacy, algorithmic bias, academic integrity, and technological dependence. Research indicates that teachers wide spread concern the security and privacy protection of student data, beware algorithmic bias that may lead to educational inequity, and follow the potential cognitive atrophy resulting from students' excessive use of AI. At the level of academic integrity, teachers experience confusion regarding the boundary definition between AI-assisted writing and assignment completion, urgently needing clarification of the distinction between "assistance" and "ghostwriting." Ethical competence has been incorporated into the core dimensions of teacher AI literacy, encompassing safety ethics (ensuring student data and psychological security), equity ethics (preventing technology from exacerbating educational disparities), and benefit ethics (preventing technology misuse and excessive intervention). Regarding policy expectations, the Guidelines for Teacher Application of Generative AI issued by the Ministry of Education in 2025 marks an institutionalized response at the national level to teacher AI application. The Guidelines articulate the fundamental principle of "teacher-led, AI-assisted," emphasizing that teachers' agentic roles must be upheld in key educational processes such as values education and student psychological support. Teachers expect policies to provide more systematic training mechanisms, more detailed student usage specifications, clearer data security provisions, and more operational academic integrity safeguards. This institutional expectation reflects teachers' deep-seated demand for a transition from "spontaneous exploration" to "compliant innovation."

In summary, research on teacher perspectives reveals a multidimensional landscape of teacher development in the AI era: competency frameworks evolving from unitary to comprehensive, teaching integration presenting coexisting opportunities and challenges, identity undergoing profound reconstruction, and ethical concerns intertwining with policy expectations. These themes collectively point to a core question—how to seek balance between technological empowerment and the hold fast of humanistic values, enabling AI to genuinely become a collaborator that supports rather than replaces teachers' professional agency.

3.3 Thematic Analysis of Studies on Student Perspectives

Theme 1: AI Usage Experience and Learning Outcomes

Students' experience with the use of artificial intelligence exhibits a dual characteristic of positivity and caution. Research indicates that students generally recognize the positive value of artificial intelligence in enhancing learning efficiency, deepening knowledge understanding, and broadening learning horizons. In project-based teaching scenarios, most students believe that AIGC technology can improve learning outcomes, and they have clear expectations for the intelligence, comprehensiveness, and precision of the tools. Students categorize the application scenarios of AI tools into four types: serving as an "inspiration spark" to stimulate creativity, acting as an all-weather "personal tutor", enhancing efficiency as a "time saver", and being used as a "tinker" to explore unknown areas. They utilize AI for brainstorming, generating practice questions, checking grammar, debugging code, and even handling what they consider

to be "repetitive" or "routine" assignments.

However, there are individual differences in students' satisfaction with the effectiveness of AI tools, with some students expressing dissatisfaction with the performance of AIGC tools. In complex task scenarios, approximately 45% of respondents noted that ChatGPT should be used with caution due to its lack of accuracy in handling complex tasks. Students' views on AI exhibit a complex "double-edged sword" mentality: they recognize that AI can significantly enhance learning efficiency and problem-solving abilities (the "sharp" side), but also worry that excessive reliance may weaken critical thinking and innovation capabilities, and even lead to accessing inaccurate information (the "blunt" side). It is worth noting that research shows that course level has no significant impact on students' perception, while gender only affects prior knowledge of ChatGPT, but not satisfaction or usability perception; there is the strongest correlation between response quality and overall satisfaction. These findings suggest that regardless of their prior familiarity with AI, most students are able to effectively use AI, demonstrate critical thinking in its use, and are willing to adopt it as a supplementary learning tool.

Theme 2: Academic Integrity and Dependency Risks

Academic integrity is one of the core concerns in student-centered research. The study reveals that generative artificial intelligence affects the intrinsic mechanism of academic integrity among college students through three core pathways: "black box" algorithm masking, capability substitution effect, and normative cognitive bias, leading to practical challenges such as the concealment of academic misconduct and the weakening of original creative ability. Large-scale survey data indicates that generative AI has had profound and diverse impacts on the learning of college students, with particularly alarming potential negative effects, especially the decline in autonomous learning ability and learning quality caused by technology dependence.

The risk of academic integrity has shifted from a potential concern to a real dilemma. Surveys show that 85.5% of the interviewed college students express concerns about academic misconduct issues (such as content plagiarism, data falsification, etc.) that may arise from the improper use of generative AI. Only 14.6% of the students have a low level of concern. More seriously, about two-thirds (65.9%) of the interviewed college students are directly or indirectly facing the risk of AI-related academic disputes. Among them, 42.0% of the interviewed students have personally experienced academic disputes caused by AI-generated content, such as plagiarism judgments and reduced grades on assignments. Even in the case of explicit prohibition by institutions, 51% of the students still indicate that they will continue to use generative AI tools, while 48% of the students have at least tried an AI writing tool once. This data indicates that simply prohibiting it is difficult to effectively address the practical needs of students in using AI, and there is an urgent need to seek a balance between regulatory guidance and innovative application.

Observing from the perspective of student behavior, students are spontaneously constructing their own ethical boundaries for AI usage, but this spontaneous exploration lacks systematic guidance. The study calls for combining the new regulations of the "Academic Degrees Law of the People's Republic of

China" with university governance practices, and constructing an educational guidance system that adapts to the requirements of the new era from four dimensions: institutional norms, literacy cultivation, technical support, and cultural leadership. The aim is to help universities find a balance between technological empowerment and integrity adherence, and cultivate outstanding talents who possess both innovative capabilities and adhere to academic integrity.

Theme 3: Privacy Awareness and Trust Issues

The widespread application of artificial intelligence (AI) systems among young digital citizens has raised significant privacy concerns. Research on the use of AI systems among adolescents indicates that privacy issues have become a growing focus among student groups. Through a comparative analysis of parents/educators and AI professionals, the study examined five confirmatory constructs: data ownership and control, parental data sharing, perceived risks and benefits, transparency and trust, and education and awareness. The results showed that education and awareness significantly influence data ownership perception and risk assessment, while data ownership and control have a strong impact on transparency and trust.

Research indicates that young users may not fully realize the data privacy risks associated with the use of AI systems. Therefore, it is crucial to understand the privacy perspectives of young digital citizens, while also examining the views of other stakeholders. The study emphasizes the need for user-centered privacy control mechanisms, tailored transparency strategies, and targeted educational initiatives. Integrating the perspectives of multiple stakeholders can provide actionable insights for ethical AI design and governance, striking a balance between innovation and robust privacy protection to promote trust building in the digital era.

In terms of trust, students' trust in AI systems is founded on transparency and interpretability. Studies have found that transparency and trust exert minimal influence on parental data sharing behavior, indicating that other factors may play a more significant role. This suggests to educators and policymakers that merely enhancing transparency may not directly alter privacy-related behaviors; it is necessary to combine educational guidance with institutional norms.

Theme 4: Future Employability and AI Literacy

In the context of artificial intelligence rapidly reshaping the job market, students' preparation for future employability has become a research hotspot. Studies have shown that AI has differentiated impacts on employment across different majors, necessitating the construction of a competency framework tailored to the demands of the AI era. Innovative research proposes the "AI-Q" (Artificial Intelligence Quotient) competency framework, encompassing three core dimensions: technology application, human-machine collaboration, and ethical awareness. This framework aims to construct a "technology-position-competency" three-dimensional model through big data analysis (mining job postings and industry reports) and empirical research (interviews with universities, enterprises, and graduates), revealing the differentiated impacts of AI on employment. It also designs dynamic educational programs, including the construction of micro-major clusters and "AI+X" curriculum systems.

From a policy perspective, the "Guidelines for Artificial Intelligence Application in Vocational Colleges" systematically elaborates on the requirements and evaluation system for students' artificial intelligence literacy. The guidelines follow the concept of progressive stratification from secondary vocational education to higher vocational education and professional undergraduate education, covering three core components: "general literacy, professional skills, and industry competencies", and incorporating safety and ethics education. They clarify the artificial intelligence knowledge, skills, and professional qualities that students must possess at different stages. Specifically, secondary vocational students should be able to understand the basic concepts and daily applications of artificial intelligence, and use AI tools to complete basic tasks; higher vocational students should understand typical applications of AI in professional fields and be able to independently design AI-assisted solutions in work scenarios; professional undergraduate students should systematically grasp the innovative models of combining AI with their majors and be able to construct innovative business solutions empowered by AI.

The evaluation of students' artificial intelligence (AI) literacy is evolving towards a more systematic and dynamic approach. Research suggests developing an AI literacy evaluation system based on a dynamic capability map, with gradient assessment tools tailored for different levels. Evaluations should be conducted across dimensions such as general literacy, professional skills, industry competencies, and ethical and security awareness. Vocational colleges should regularly conduct AI literacy assessments for students, incorporating the results into their comprehensive quality profiles. This approach enhances the employment-oriented nature of the evaluation, helping students better adapt to future workplace demands. The ultimate goal is to cultivate highly skilled talents who are not only proficient in AI technology but also capable of flexible application and innovation in complex professional scenarios, possessing abilities such as good human-machine collaboration, professional norms, and lifelong learning.

In summary, the student perspective study reveals a multidimensional landscape of learner development in the era of artificial intelligence: the user experience exhibits a dual characteristic of positivity and caution, academic integrity and dependency risks have become real dilemmas, privacy awareness and trust issues are increasingly prominent, and the cultivation of employability and artificial intelligence literacy is becoming increasingly urgent. These themes collectively point to a core issue - how to strike a balance between empowering learning and preventing risks, so that artificial intelligence can truly become a collaborator that promotes student growth rather than replacing students' thinking.

3.4 Comparative Analysis of Teacher and Student Perspectives

3.4.1 Comparison of Perceived Opportunities

Consensus areas: personalized learning, instant feedback, resource acquisition

There is a significant consensus among teachers and students regarding the perception of opportunities presented by the application of artificial intelligence in education. At the level of personalized learning, both parties acknowledge that AI can provide adaptive learning paths and customized content based on learners' characteristics. Research has shown that AI can analyze students' learning performance data and deliver learning resources tailored to individual needs in real time, thereby transforming personalized

education from a concept to practice. Teachers view this as technical support for individualized instruction, while students perceive it as a possibility to experience a "private tutor"-like learning environment. In terms of immediate feedback, AI systems can provide real-time and accurate responses and evaluations, meeting the mutual expectations of both teachers and students for teaching efficiency. Studies indicate that students particularly value the immediate problem-solving assistance and learning feedback provided by AI, believing that it significantly enhances learning efficiency. Teachers also recognize the value of AI in reducing the burden of mechanical question-answering and accelerating the feedback cycle. At the resource acquisition level, AI expands the channels through which teachers and students can access high-quality educational resources, lowering the threshold for knowledge acquisition. Teachers can utilize AI to enrich their teaching content design, while students can leverage AI to explore knowledge areas beyond the boundaries of textbooks. These three consensuses form the basis of the shared expectations of teachers and students regarding AI-empowered education.

Differential area: teaching efficiency vs. learning autonomy

However, there exists a profound divide between teachers and students in terms of their core perceptions of opportunities, which is primarily reflected in the differing value orientations towards "teaching efficiency" and "learning autonomy". From the perspective of teachers, they place greater emphasis on the role of artificial intelligence (AI) in enhancing teaching efficiency—anticipating that AI can alleviate the burden of mechanical tasks, optimize teaching processes, and support differentiated teaching designs, thereby allowing them to focus more on creative teaching and emotional labor. This orientation positions AI as a "teaching enhancer", with the core aspiration of improving the efficiency of the educational supply side. On the other hand, students' perspective is more focused on AI's empowerment of learning autonomy—cherishing the autonomous learning space brought by AI, exploring possibilities, and feeling the freedom from the constraints of teacher authority. Students tend to view AI as a cognitive partner that enables them to "learn at my pace" and "explore in my way", with the core aspiration of enhancing the experience of learning subjectivity. Research indicates that the "judgment-free environment" created by AI enables students to freely ask questions and repeatedly make mistakes without fear of being evaluated, a learning experience that is difficult to obtain in traditional classrooms. This cognitive divide reveals the differentiated expectations of teachers and students towards the value of AI: teachers, starting from the logic of "teaching", anticipate AI to become a more efficient teaching tool; students, starting from the experience of "learning", anticipate AI to become a cognitive partner that expands their autonomy. These two expectations are not opposed, but constitute an important dimension in understanding the complexity of the "double-edged sword" effect—the same technology is endowed with differentiated meanings and values by different subjects within the same educational field.

3.4.2 Comparison of Perceived Challenges

Consensus areas: data privacy, over-reliance, fairness issues

There is a broad consensus among teachers and students regarding their perception of challenges posed by the application of artificial intelligence (AI) in education. On the aspect of data privacy, both parties

share concerns about the security of the collection, storage, and use of students' personal information and learning behavior data. Research indicates that the widespread application of AI systems in educational settings poses potential risks of student data leakage and abuse. Both teachers and students express unease about the data flow and usage permissions within "black box" algorithms. On the aspect of over-reliance, both parties unanimously worry that AI may erode students' autonomous learning abilities and critical thinking skills. Studies show that when students become accustomed to obtaining ready-made answers through AI rather than engaging in independent exploration, their problem-solving abilities and creative thinking may gradually deteriorate. On the aspect of fairness issues, both parties are wary that AI may exacerbate existing educational inequalities. Differences in access to technological equipment, potential educational opportunity disparities caused by algorithmic bias, and the gap in AI literacy among different groups have become topics of common concern for teachers and students. These three consensuses constitute the shared cognitive foundation for teachers and students regarding the risks of AI in education.

Differences in areas: attribution of responsibility for academic integrity, changes in teacher authority

In terms of academic integrity, there is a fundamental disagreement between teachers and students regarding the attribution of responsibility in AI-assisted learning. Research indicates that responsibility attribution is one of the core dimensions of ethical challenges posed by artificial intelligence. Teachers tend to attribute academic integrity issues to students' subjective choices, believing that students should bear the responsibility of adhering to academic norms when using AI to complete assignments. When students submit content generated by AI, teachers often label it as academic misconduct, expecting students to consciously resist the temptation to "take shortcuts". In stark contrast, from the perspective of students, the attribution of responsibility for academic integrity exhibits a tendency towards externalization. More than two-thirds of students attribute the risk of AI-related academic disputes to the ambiguity of institutional norms and the lack of guidance, rather than their own choices (McIntire, Calvert and Ashcraft, 2024). Students believe that, in the absence of clear institutional policies and inadequate teacher guidance, using AI to assist in completing academic tasks has a certain "rationality". This cognitive dissonance in responsibility attribution has led teachers and students to fall into a dilemma of mutual expectations on academic integrity issues - teachers expect students to be self-disciplined, while students expect teachers to clarify rules.

In terms of teacher authority, for teachers, artificial intelligence poses a challenge to traditional role authority. As more and more teaching functions can be undertaken by machines, teachers' recognition of their core role as "knowledge transmitters" is challenged. Teachers are concerned that their authority status in the classroom will be weakened by technology, and their professional value will be questioned. However, students' experience of AI from their perspective is just the opposite - students cherish the "judgment-free environment" created by AI. This learning space, free from direct evaluation by teachers, gives them an unprecedented sense of autonomy. Students regard AI as a cognitive partner that can "learn at my pace" and "explore in my way", rather than a substitute for authority. In other words, teachers feel a weakening of authority, while students experience an enhancement of autonomy. This divergence in

perception reveals how the same technological change can differently shape the power experiences of different subjects: teachers perceive a loss of power from the "teaching" position, while students experience empowerment and enhancement from the "learning" position. These two perceptions are not opposed to each other, but constitute an important dimension in understanding the complexity of how artificial intelligence reshapes teacher-student relationships.

3.4.3 Potential Factors Influencing Perceptual Differences

The emergence of cognitive differences between teachers and students is the result of the intertwined effects of multiple factors. At the level of role positioning, teachers, as the organizers of teaching and bearers of responsibility, naturally tend to examine the value of technology from the logic of "teaching", focusing on overall efficiency and controllability; students, as the participants in learning and the constructors of meaning, pursue individual autonomy and immediate satisfaction from the perspective of "learning" experience. This innate difference in role identity constitutes the deep foundation of cognitive divide. At the level of power relations, teachers feel the dissolution of traditional authority due to technological intervention, while students experience the expansion of autonomous space brought by technological empowerment - the same technological change shapes the power experience of teachers and students differently, exacerbating the cognitive alienation between them. At the level of intergenerational characteristics, students, as "digital natives", have a higher acceptance and lower risk sensitivity towards new technologies, while teachers, as "digital immigrants", often adopt a more cautious or even vigilant attitude. In addition, differences in AI literacy, ambiguity in institutional norms, and the lack of communication mechanisms between teachers and students jointly constitute the realistic soil for the expansion of cognitive differences. These factors overlap, leading to a profound divide in teachers' and students' perception of AI.

4. Discussion

4.1 Theoretical Interpretation of Main Findings

The multidimensional manifestations of the "double-edged sword" effect: teaching dimension, relationship dimension, and ethical dimension.

This study finds that the "double-edged sword" effect of AI in the educational field is not a single-dimensional phenomenon, but rather manifests as a complex form across three dimensions: teaching, relationship, and ethics. In the teaching dimension, AI not only enhances teaching effectiveness through personalized learning support and immediate feedback mechanisms, but also potentially leads to cognitive laziness and hinders deep learning due to students' over-reliance—efficiency improvement and ability weakening constitute the inherent tension in this dimension. In the relationship dimension, AI not only expands the channels for teachers and students to access resources and creates a "judgment-free" learning space, but also weakens the traditional knowledge-power structure and emotional connection between teachers and students—empowerment and empowerment enhancement alongside authority dissolution constitute the core contradiction in this dimension. In the ethical dimension, AI not only

promotes the optimization of educational resource allocation but also triggers systemic risks such as data privacy leakage, algorithm bias entrenchment, and academic integrity ambiguity—innovation empowerment and ethical misconduct constitute the fundamental paradox in this dimension (Smith et al., 2024). These three dimensions are intertwined, jointly shaping the complex effect map of AI's application in education.

The generation mechanism of cognitive differences between teachers and students: role differences, power relations, and intergenerational characteristics

The cognitive differences between teachers and students regarding AI stem from the intertwined effects of a triple mechanism. From the perspective of role differences, teachers, as the ultimate bearers of educational responsibility, naturally embed their cognitive framework in concerns about teaching order and overall effectiveness; students, as active constructors of learning meaning, focus their cognitive orientation on gaining individual experience and autonomy. This ontological difference between "teaching" and "learning" constitutes the deep foundation of cognitive divide. From the perspective of power relations, the intervention of AI has reconfigured the power distribution in the classroom field - teachers feel threatened by the dissolution of traditional knowledge authority by technology, while students experience a sense of liberation from a single evaluation system. The differentiated shaping of power experiences by the same technological change for different subjects exacerbates cognitive alienation. From the perspective of intergenerational characteristics, students, as "digital natives," have a higher acceptance and lower risk threshold for new technologies, while teachers, as "digital immigrants," adopt a more cautious or even vigilant attitude. The intergenerational differences in the process of technological socialization further widen the cognitive gap.

From binary opposition to dialectical integration

Moving beyond the binary oppositional thinking of "opportunity vs challenge" and "empowerment vs risk" to a dialectically integrated epistemological stance is the theoretical premise for understanding the complex effects of AI education. This study reveals that the consensus and differences in cognition between teachers and students, as well as the multidimensional manifestations of the "double-edged sword" effect, all point to a fundamental fact: AI is not a neutral tool external to educational practice, but rather an active force deeply embedded in the educational relationship network, participating in the reconstruction of educational intersubjectivity. Therefore, grasping the effects of AI in education requires moving beyond the linear thinking of a single subject, single dimension, and single effect, and instead focusing on perceptual interactions among multiple subjects, tension balance across multiple dimensions, and the dynamic evolution between short-term effects and long-term impacts. This dialectically integrated perspective provides an epistemological foundation for the subsequent construction of a framework for integrating teachers' and students' cognition of AI—only by seeking consensus in differences and grasping unity in opposites can we truly understand and harness the complex landscape of AI empowering education.

4.2 Implications for Educational Policy and Practice

Develop an inclusive framework for teachers and students' AI literacy

This study finds significant differences in teachers' and students' cognition of AI, necessitating the development of a literacy framework that takes into account both perspectives. Existing literacy frameworks often focus on a single subject, making it difficult to respond to the differentiated needs of teachers and students in AI education applications. Future policy formulation should advocate for an inclusive design concept and construct an AI literacy framework that integrates the perspectives of both teachers and students. In terms of content, the framework needs to cover consensus areas and divergent issues - including ethical awareness, privacy protection, and critical thinking that are of common concern to both parties, as well as responding to teachers' expectations for teaching integration capabilities and students' literacy needs for autonomous learning. In terms of structure, the hierarchical design concept of "basic literacy - professional literacy - developmental literacy" can be referenced to develop gradient and operable literacy standards tailored to the characteristics of teachers and students at different educational stages and in different subject areas. It is particularly important for the framework to clarify the respective role positioning and responsibility boundaries of teachers and students under the principle of "teacher-led, AI-assisted", integrate ethical education throughout the entire process of literacy cultivation, and achieve unity between technological empowerment and humanistic adherence at the level of the literacy framework.

Establish an AI education governance mechanism involving both teachers and students

The existence of cognitive differences between teachers and students highlights the limitations of the single-subject decision-making model. AI education governance needs to shift from top-down one-way regulation to collaborative governance involving multiple stakeholders. Firstly, an AI application deliberation mechanism involving joint participation by teachers and students should be established at the school level. Through regular dialogue platforms, both parties can reach a common understanding of technical boundaries, usage norms, and responsibility attribution, resolving cognitive dissonance in areas such as academic integrity. Secondly, in the policy-making process, representatives of teachers and students should be involved through hearings, pilot consultations, and other means to ensure that policies can respond to teachers' concerns about teaching order and ethical boundaries, while also respecting students' demands for learning autonomy and user experience. Thirdly, the governance mechanism should have dynamic adaptability, incorporating feedback from teachers and students to update rules in a timely manner as technology evolves and experience is accumulated. Finally, collaboration among families, schools, and communities should be promoted to extend the consensus between teachers and students to a broader educational ecosystem, forming a multi-level, three-dimensional governance network for AI education applications.

Reconstruction of educational ecology to promote human-machine collaboration

The profound significance of AI's involvement in education lies not in replacing teachers with technology, but in promoting the systematic reconstruction of the educational ecosystem. Policy formulation should

transcend the limitations of "technological instrumentalism" and prioritize human-machine collaboration as the core vision, reshaping the relationship between teaching and learning. At the level of resource allocation, priority should be given to supporting research and pilot projects on human-machine collaborative teaching models, exploring how AI can expand students' space for autonomous learning while alleviating teachers' mechanical burdens. At the level of evaluation reform, talent evaluation standards compatible with the AI era need to be established to avoid students being disadvantaged in traditional evaluation systems due to the use of AI-assisted learning. At the level of teacher development, human-machine collaborative capabilities should be incorporated into the core content of teacher professional development, supporting teachers in completing their role transformation from "knowledge transmitters" to "learning designers". At the level of student growth, students should be cultivated to develop the ability to collaborate with AI to solve complex problems through curriculum integration and project practice. The ultimate goal is to build a new educational ecosystem where teachers, students, and AI can each play to their strengths and coexist in synergy - where teachers play an irreplaceable role in value guidance and emotional care, students achieve autonomous growth through technology empowerment, and AI serves as a collaborator that enhances human capabilities, rather than a competitor that replaces human subjects.

4.3 Limitations

This study has several limitations that need to be taken into account when interpreting the research findings.

Limitations on literature coverage. Due to language limitations, only papers published in Chinese and English were included, potentially excluding important research findings published in other languages. Furthermore, the exclusion of grey literature may have resulted in the omission of some practical-level evidence related to teacher-student cognition from the analysis. The uneven geographical distribution, with Asia, Europe, and North America dominating and Africa and South America making limited contributions, may also imprint the study findings with specific cultural contexts, affecting the global applicability of the conclusions.

Publication bias may exist. A large number of unpublished studies, such as those with non-significant results, negative findings, or reports on small-scale practices, have been excluded from the analysis. This may result in a certain degree of positive bias in the presentation of teachers' and students' cognition towards artificial intelligence in this study, and an incomplete capture of the complex landscape of challenges and risks. Future research should attempt to include more grey literature to obtain a more comprehensive cognitive landscape.

Complexity of meta-analysis. Some of the original studies have inconsistent operational definitions of key concepts and insufficient reporting on questionnaire reliability and validity, which may affect the reliability of theme induction. The identification of cognitive differences between teachers and students relies on the depth of analysis in the original studies, yet most studies only present descriptive findings without in-depth exploration of the mechanisms underlying these differences. Furthermore, due to the

predominantly cross-sectional design adopted in the included studies, this research struggles to capture the dynamic evolutionary trajectory of teacher-student cognition, necessitating caution in drawing inferences about influencing factors. In the future, longitudinal studies and meta-analysis should be incorporated to further test the robustness of the findings in this research.

5. Conclusion

5.1 Summary of Research Question Answers

This study comprehensively addresses five research questions through a systematic review of 87 empirical studies. Existing research on the teacher's perspective focuses on the composition of AI literacy, challenges of teaching integration, and identity anxiety; while attention to the student's perspective is concentrated on usage experience, academic integrity, and employability preparation. There is a consensus (personalized learning, immediate feedback, resource access) and a divergence (teachers emphasize teaching efficiency, students emphasize learning autonomy) in teachers' and students' perception of opportunities; there is also a consensus (data privacy, over-reliance, fairness issues) and differences (teachers' accountability for academic integrity, students' expectation for clear systems; teachers' feeling of diminished authority, students' enhanced experience of autonomy) in their perception of challenges. The cognitive differences between teachers and students are rooted in the interaction of role positioning, power relations, and generational characteristics. Integrating both perspectives requires transcending binary oppositions and constructing a dialectically unified analytical framework.

5.2 Theoretical Contribution: Teacher-student AI Cognitive Integration Framework

This study proposes a "Framework for Cognitive Integration of Teacher-Student Artificial Intelligence", which comprises three core layers: the Consensus Foundation Layer encompasses issues of mutual concern, such as personalized learning and data privacy; the Differential Tension Layer reveals cognitive divides in teaching efficiency and learning autonomy, responsibility attribution, and authority changes; and the Dynamic Interaction Layer emphasizes the mutual influence and collaborative evolution of teacher-student cognition in technological iteration and practical use. This framework transcends the limitations of single-group research, providing an integrated analytical tool for understanding the complex effects of artificial intelligence as a "double-edged sword" in the educational field, and laying a theoretical foundation for subsequent empirical research.

5.3 Future Research Directions

Future research should focus on advancing the following directions: Longitudinal tracking studies need to examine the evolutionary trajectory of teachers' and students' AI literacy, usage behavior, and risk perception, identify key turning points and influencing factors, and move beyond the static descriptions of cross-sectional studies. Cross-cultural comparative studies should incorporate diverse cultural contexts to reveal how educational traditions, technological infrastructure, and values shape the differentiated cognitive landscapes of teachers and students, and test the boundary conditions of existing findings. Interventional studies need to design and validate the effectiveness of intervention programs such as AI

literacy courses and human-machine collaboration teaching models, providing evidence-based support for educational practice. Multi-stakeholder participation in research should be expanded to include diverse stakeholders such as parents, education administrators, and technology developers, constructing a more complete analytical framework for the AI education ecosystem, and promoting the evolution of research from a dual perspective of teachers and students to multi-stakeholder collaborative governance.

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