Teachers' Perceptions of AI-Enhanced Data-Driven Decision-Making (DDDM) in Schools: A Systematic Review

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תפיסותיהם של מורים את תהליכי קבלת החלטות מבוססת נתונים (DDDM) הנתמכים בבינה מלאכותית בבתי הספר: סקירה שיטתית של הספרות

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Abstract

This systematic review examines teachers' perceptions of data-driven decision-making (DDDM) supported by artificial intelligence (AI) in K-12 schools. Guided by PRISMA standards, it synthesizes 25 empirical studies published between 2020 and 2025, identified through major databases and hand searches of leading journals. The analysis reveals both convergence and variation in how teachers interpret the role of AI in evidence-based practice. Positive perceptions highlight efficiency, personalization, and support for inclusive pedagogy when AI tools align with curricular goals, while negative perceptions focus on transparency, reliability, and threats to professional autonomy, reflecting ongoing ambivalence toward AI adoption. Teachers' experiences are shaped by systemic barriers, such as insufficient training, excessive workload, and infrastructural limitations, alongside enabling factors, including professional development, institutional support, and curricular integration. Ethical and emotional concerns, particularly around privacy, fairness, and professional identity, emerge as cross-cutting influences shaping trust and adoption. Contextual variations across geography, educational levels, and disciplines indicate that perceptions are deeply situated within local policies and cultures. Overall, teachers' perceptions of AI-enhanced DDDM are multifaceted and context dependent, shaped by trust, ethics, and professional values. The review consolidates current evidence, notes quality and geographic limitations, and offers guidance for teacher-centered integration of AI into DDDM in schools.

Keywords: Artificial Intelligence, Data-Driven Decision-Making, DDDM, Perceptions, Systematic Review, Teachers.

Introduction and Literature Review

Over the past decade, education systems have been shaped by two interrelated developments: the growing reliance on data-driven decision-making (DDDM) and the rapid advancement of artificial intelligence (AI) technologies. Both movements share a vision of improving instructional quality and organizational learning, yet they differ in how data are produced, interpreted, and acted upon. DDDM has long been promoted as a cornerstone of evidence-based reform, emphasizing teachers' capacity to collect, analyze, and apply data to improve teaching and learning (Mandinach & Schildkamp, 2021). AI, by contrast, introduces new modes of data generation and interpretation through algorithms capable of predicting, modeling, and even generating content (Holmes et al., 2022; Luckin, 2018). Together, these trends are reshaping the ways in which educators understand and exercise professional judgment (Sajja et al., 2025).

Data-Driven Decision-Making (DDDM)

Research on DDDM in education highlights both promise and persistent challenges. When teachers engage meaningfully with student data, they can identify learning needs, tailor interventions, and monitor progress (Mandinach & Gummer, 2016). However, studies consistently show that data use is constrained by limited time, data literacy, and systemic pressures emphasizing accountability over pedagogical improvement (Mandinach & Schildkamp, 2021). Teachers often find data practices burdensome or disconnected from classroom realities. The effectiveness of DDDM, therefore, depends not only on access to information but also on professional cultures that value inquiry, trust, and collaboration (Marsh & Farrell, 2014). School leaders play a crucial role in creating such conditions by providing structures for shared data interpretation and professional learning.

Artificial Intelligence (AI) in Education

Parallel to this evolution, AI has entered educational settings in diverse forms, from intelligent tutoring systems and learning analytics to generative AI tools such as ChatGPT. These technologies promise to reduce workload, reveal data patterns, and support personalization (Zawacki-Richter et al., 2019). Yet teachers' responses remain ambivalent. While many appreciate AI's potential to enhance efficiency and student engagement, they also express concerns about transparency, fairness, and professional autonomy (Williamson & Eynon, 2020). Because AI systems often operate as "black boxes," offering recommendations without clear explanations, teachers may struggle to trust them or to integrate algorithmic outputs into professional reasoning. Ethical issues such as algorithmic bias, privacy, and the risk of deskilling further complicate perceptions (Arantes, 2023; Lee & See, 2004). Ultimately, the educational value of AI hinges on teachers' trust that the algorithmic insights enhance, rather than override, their professional judgment and capacity for evidence-based decision-making (Holmes et al., 2022).

The Intersection of AI and DDDM

The intersection of AI and DDDM represents an emerging yet underexplored area of inquiry. Traditional DDDM required teachers to manually interpret datasets, whereas AI now automates aspects of analysis and prediction, shifting the balance between human and machine judgment. This convergence raises new questions about how teachers interpret and evaluate AI-generated educational data used for decision-making. Do teachers view AI as a partner that supports data interpretation and evidence-based instructional decisions, or as a system that constrains their professional autonomy? How do emotional and ethical factors affect teachers' trust in and use of AI-generated data for decision-making? Despite the growing presence of AI in educational data systems, systematic synthesis of research on teachers' perceptions at this intersection remains limited (Romero & Ventura, 2020; Williamson & Eynon, 2020).

Existing reviews on DDDM emphasize teacher capacity, beliefs, and organizational conditions but rarely consider AI-generated data as a distinct evidentiary source in classroom decision-making (Datnow & Hubbard, 2016; Hoogland et al., 2016). Likewise, reviews of learning analytics and educational data mining focus on methodological and technical dimensions rather than on teachers' interpretive experiences (Romero & Ventura, 2020). Sociocultural approaches further highlight that data use is embedded in professional norms and institutional contexts (Biesta, 2015). Teachers' perceptions of AI-enhanced DDDM therefore reflect not only cognitive evaluations of tools but also broader negotiations of identity, ethics, and control.

Purpose and Research Question

Building on these perspectives, the current review seeks to clarify how teachers perceive the integration of AI into DDDM in schools. It aims to synthesize empirical evidence on both opportunities and challenges as reported across diverse contexts, while identifying underrepresented educational levels and regions. In doing so, the review bridges fragmented research strands and provides insights into responsible, teacher-centered adoption of AI in education. The review explored the following **research question**: What are K-12 teachers' reported perceptions (attitudes, beliefs, emotions, trust, and experiences) related to AI-enhanced DDDM in schools? Sub-questions:

a) What benefits and drawbacks do teachers attribute to AI-DDDM?
b) What barriers and enablers shape these perceptions and use?
c) Which contextual moderators are reported?
d) What ethical considerations influence teachers' trust and adoption?

Methodology

The review followed PRISMA-guided systematic procedures, ensuring transparent, replicable screening and synthesis of studies, minimizing bias, and establishing a reliable evidence base.

Search Strategy and Eligibility Criteria

The search was conducted in ERIC, Scopus, and Web of Science, with supplementary screening in Google Scholar and leading journals in educational technology, AI, and DDDM. Search terms combined four key components: K-12 teachers, DDDM, AI, and school education, using Boolean operators to capture variations in terminology across disciplines. The search process was refined through pilot testing and completed in August 2025. Duplicates and non- eligible articles were removed.

Inclusion criteria focused on empirical studies in K-12 contexts examining teachers' perceptions of AI-enhanced DDDM. Theoretical, conceptual, or higher-education studies were excluded. This systematic and transparent process ensured comprehensive coverage and yielded a final dataset of 83 studies for screening and analysis.

Screening and Data Extraction

The screening followed a structured two-phase procedure. In the 1st phase, 83 records were reviewed by title, abstract, and keywords to assess relevance to K-12, empirical design, and AI-supported DDDM. Studies meeting predefined thematic criteria were retained, resulting in 52 eligible articles and 13 marked for re-evaluation. In the 2nd phase, full-text screening verified eligibility, yielding 25 empirical studies that fully met the inclusion criteria. For each included study, a structured data extraction table captured key information to support cross-study synthesis and comparison. The

table contained: context, methodology, AI tools, focus of DDDM, teachers' perceptions, barriers, enablers, and theoretical frameworks.

Data Analysis and Synthesis

Findings were thematically analyzed through an iterative analysis process to identify patterns, divergences, including usefulness, reliability, barriers, enablers, and ethical concerns. This structured, PRISMA-guided process enabled an integrated synthesis of evidence and is summarized in Figure 1.

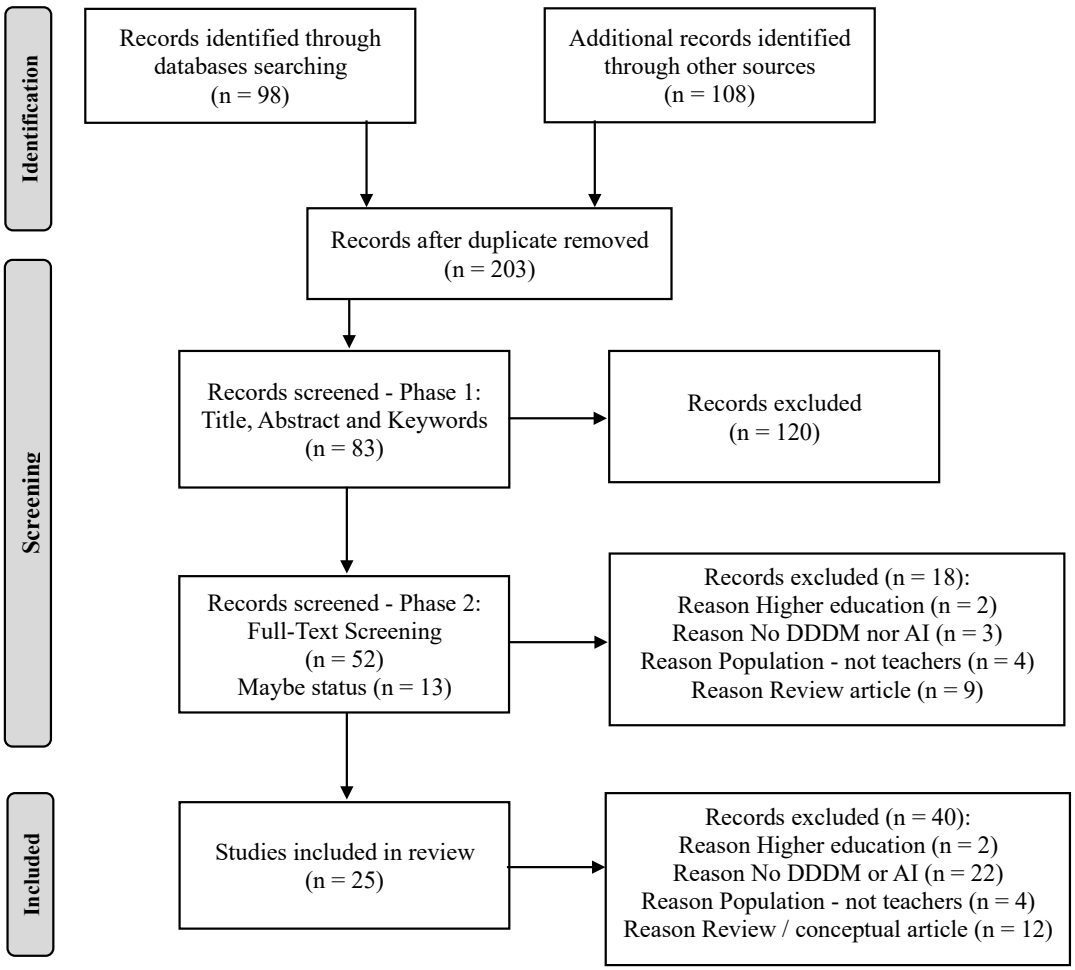

Figure 1. PRISMA Flow Diagram.

Results

The synthesis of 25 studies revealed a picture of teachers' perceptions of AI-enhanced DDDM. Findings are presented thematically, highlighting convergences and divergences in usefulness, reliability, barriers, enablers, ethical and contextual variations (see Table 1).

Table 1. Summary of Findings on Teachers' Perceptions of AI-Enhanced DDDM

Question	Category	Number of Studies	Example References
How did the studies conceptualize teachers' perceptions of AI-enhanced DDDM?	Positive perceptions	15	Cheah & Kim, 2025
	Negative perceptions and skepticism	12	Kim, 2024
What barriers were identified across the studies?	Insufficient training and data literacy	11	Nazaretsky et al., 2023
	Technological and infrastructural constraints	9	Alsudairy & Eltantawy, 2024
	Workload concerns	6	Liu et al., 2023
	Trust and accuracy issues	7	Kim, 2024
What enablers and facilitators supported AI adoption?	Professional development and training	14	Cheah & Kim, 2025
	Institutional support and resources	10	Alsudairy & Eltantawy, 2024
	Curricular and pedagogical alignment	8	Alsudairy & Eltantawy, 2024
	Transparency and explainability	6	Cheah & Kim, 2025
What ethical and emotional considerations emerged?	Data privacy and security	10	Nazaretsky et al., 2023
	Algorithmic bias and fairness	9	Nazaretsky et al., 2023
	Emotional ambivalence	7	Kim, 2024
What research designs and contexts characterized these studies?	Quantitative survey studies	11	Alsudairy & Eltantawy, 2024
	Qualitative case studies	7	Kim, 2024
	Mixed-methods studies	7	Cheah & Kim, 2025

Note to Table.

1. Numbers indicate how many of the 25 reviewed studies reported in each category. Example references are illustrative and not exhaustive.

Teachers' Perceptions of AI-Enhanced DDDM

Across the corpus, teachers' perceptions of AI-enhanced DDDM were diverse, ranging from enthusiasm to skepticism. Positive views, reported in 15 of the 25 studies, emphasized AI's contribution to instructional efficiency, personalization, and inclusive pedagogy. Teachers valued AI tools that automated assessment, offered predictive insights, or supported differentiated instruction aligned with curricular goals (Alsudairy & Eltantawy, 2024; Cheah & Kim, 2025). STEM and special education teachers described AI as a resource for creativity and individualized support. Across the studies, the most frequently used tools included learning analytics dashboards, intelligent tutoring systems, and generative AI applications such as ChatGPT, each offering distinct benefits and challenges in supporting data-informed teaching (Cheah & Kim, 2025; Nazaretsky et al., 2023).

Conversely, 12 studies documented negative or cautious perceptions. Teachers voiced concerns about the opacity of algorithmic recommendations, potential bias, and the erosion of professional autonomy (Kim, 2024; Liu et al., 2023). Several participants described AI-generated advice as conflicting with their professional judgment, leading to partial or selective adoption.

Teachers' trust in the usefulness and reliability of AI tools varied across contexts. Dashboards and tutoring systems were praised for visualizing student progress, but also criticized for data overload and limited transparency. Generative AI tools, such as ChatGPT, added new layers of ambivalence: teachers valued their creative support yet questioned their accuracy and ethics. Overall, perceptions were shaped by the degree to which AI aligned with teachers' professional values and school environments.

Barriers and Enablers of Adoption

Eighteen studies reported systemic barriers to implementing AI-enhanced DDDM. The most frequent included insufficient training and data literacy (11 studies), technological and infrastructural limitations (9), increased workload (6), and distrust in AI accuracy (7). Teachers frequently described feeling unprepared to interpret AI-generated data or to integrate insights meaningfully into classroom practice (Nazaretsky et al., 2023).

At the same time, 20 studies identified enablers that fostered adoption. Professional development was the most influential facilitator, with teachers gaining confidence through mentoring, workshops, and collaborative learning communities (Cheah & Kim, 2025). Institutional support, such as dedicated technical assistance, leadership vision, and structured time for experimentation, also emerged as critical, particularly when school leaders aligned AI initiatives with curricular and assessment priorities (Alsudairy & Eltantawy, 2024). When AI systems were clearly connected to curricular goals and assessment needs, teachers demonstrated higher levels of engagement. Explainable AI models that clarified how recommendations were produced significantly improved trust and sustained use (Nazaretsky et al., 2023).

Ethical and Emotional Considerations

Ethical and emotional dimensions appeared in nearly all studies, with 22 explicitly addressing these themes. The most prevalent issues concerned data privacy and security (10 studies), followed by algorithmic bias and fairness (9), and emotional ambivalence (7). Teachers worried about the misuse of student information and the lack of clear regulatory frameworks, particularly in developing regions (Nazaretsky et al., 2023). Concerns about algorithmic bias were pronounced in STEM-related contexts, where teachers questioned the neutrality of predictive models (Liu et al., 2023).

Emotionally, teachers expressed both excitement and apprehension. Many viewed AI as an innovative tool with transformative potential but simultaneously feared loss of control or professional identity (Kim, 2024). This duality highlights that adoption is not merely technical but deeply tied to educators' sense of agency, ethics, and trust.

Research Contexts, Designs, and Trends

Studies spanned K-12 levels, primarily secondary education, with limited focus on elementary and special education. Most research originated from educational technology and AI in education, with a smaller number addressing STEM or disciplinary teaching.

Geographically, the distribution was uneven (see Figure 2). The United States represented the largest share (5 studies), followed by China (3), Germany (2), Taiwan (2), and Estonia (2). Additional single-country studies emerged from Saudi Arabia, South Korea, Nigeria, and Finland, alongside multi-country European collaborations. This concentration in Western and East Asian contexts underscores the need for greater cultural diversity in future research.

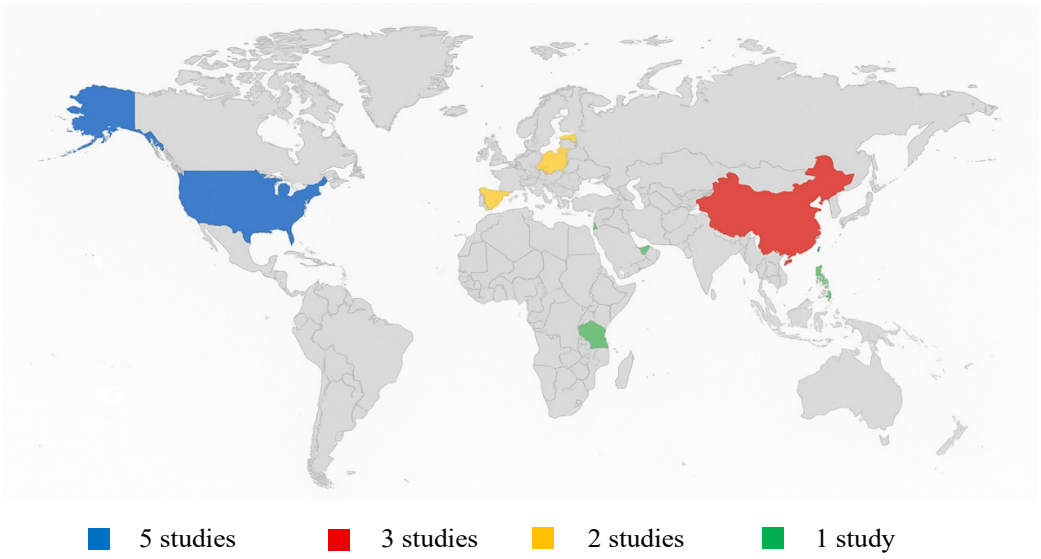

Figure 2. Global Distribution of Studies on AI-Enhanced DDDM in Education.

The 25 reviewed studies employed varied methodologies: 11 used quantitative surveys (e.g., Alsudairy & Eltantawy, 2024), 7 qualitative case studies (e.g., Kim, 2024), and 7 mixed methods (e.g., Cheah & Kim, 2025). Sample sizes varied widely, ranging from small design-based case studies with 8-30 (e.g., Thompson et al., 2025) teachers to large-scale quantitative surveys involving over 1,000 participants (e.g., Michos et al., 2023). Qualitative studies most frequently employed semi-structured interviews, classroom observations, and co-design workshops.

Temporally, publication trends (see Figure 3) indicate a sharp increase from 2023 onward, coinciding with the spread of generative AI. Earlier studies (2020-2022) focused on learning analytics and dashboards, whereas recent work explored generative AI's ethical and pedagogical implications.

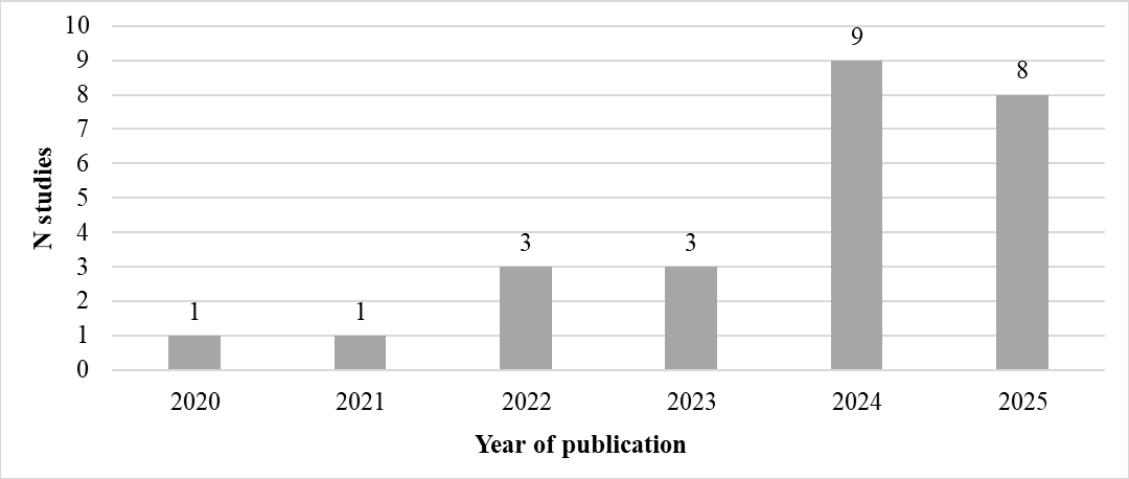

Figure 3. Distribution of the 25 included studies by year of publication.

Cross-analysis revealed contextual influences on teachers' perceptions. In highly regulated systems (e.g., the U.S., China), ethical concerns about privacy and fairness predominated (Liu et al., 2023; Nazaretsky et al., 2023). In contrast, studies from developing regions emphasized AI's pedagogical promise for inclusion and resource optimization (Alsudairy & Eltantawy, 2024). Secondary teachers often cited workload and autonomy concerns, while primary and special education teachers emphasized training needs. These patterns suggest that geography, educational level, and discipline collectively shape how teachers interpret AI's role in DDDM.

Discussion

This review examined current research on teachers' perceptions of AI-enhanced DDDM in schools. Teachers' perceptions are central to determining whether data-informed innovation leads to meaningful pedagogical change, as their trust, agency, and ethical reasoning mediate AI integration into professional practice. Teachers' perceptions show duality: enthusiasm for AI's benefits and skepticism about trust and autonomy. This ambivalence reflects broader patterns in educational innovation, where technological optimism coexists with professional caution (Ertmer & Ottenbreit-Leftwich, 2010; Mandinach & Schildkamp, 2021). Within DDDM, the key tension lies in how AI redistributes authority between human judgment and algorithmic insight.

Perceptions of usefulness and reliability vary by tool. Learning analytics dashboards are informative yet overwhelming (Schildkamp et al., 2017). Intelligent Tutoring Systems are valued for personalization but criticized for opacity (Holmes et al., 2022). Generative AI evokes both enthusiasm and concern about bias and accuracy (Luckin, 2023). Reliability depends less on technical performance and more on teachers' data literacy, institutional support, and confidence in interpreting algorithmic outputs.

Persistent barriers, including limited training, workload, and infrastructure, echo familiar challenges in DDDM. Yet, meaningful change depends on whether schools frame AI not as a technical skill but as part of a broader culture of inquiry. Professional learning communities and leadership support can build ethical awareness and organizational capacity for AI-informed decision-making (Ertmer, 1999; Mandinach & Gummer, 2016).

Ethical and emotional dimensions remain central to teachers' acceptance of AI (Holmes et al., 2022). Concerns about privacy, fairness, and bias are intertwined with feelings of excitement and anxiety. Many teachers advocate "intelligence augmentation" rather than automation, emphasizing the importance of keeping human expertise and trust at the core of AI-enhanced DDDM (Luckin, 2018; Zawacki-Richter et al., 2019).

Findings suggest that context matters. Studies from the U.S. and China emphasize ethical and regulatory issues, while those from Saudi Arabia and Nigeria highlight pedagogical opportunities (Zawacki-Richter et al., 2019). Secondary teachers emphasize autonomy and workload, whereas primary and special education teachers highlight training needs. Leadership practices that foster dialogue and modeling (Marsh & Farrell, 2014) are crucial but must be adopted when AI mediates decision-making. Teachers' engagement with AI is shaped by cultural, institutional, and disciplinary conditions. Across studies, a unifying tension emerges as teachers balance enthusiasm for data-informed improvement with preservation of autonomy and trust. They act not as passive adopters but as interpreters mediating between algorithmic insights and pedagogical values. This perspective bridges AI and DDDM research, positioning teachers' perceptions as the key determinant of whether AI-generated data lead to pedagogical impact.

Limitations include the small, uneven corpus of 25 studies and the geographic concentration. Future research should include underrepresented regions, employ longitudinal methods, and explore intersections of ethics, emotion, and discipline. Strengthening professional development and institutional ecosystems remains essential for responsible, teacher-centered integration of AI into DDDM.

Conclusions

This systematic review concludes that the success of AI-enhanced data-driven decision-making (DDDM) depends less on technological sophistication and more on teachers' professional judgment, trust, and ethical engagement. Strengthening collaborative inquiry, data literacy, and reflective professional development can transform AI-supported DDDM from a technical innovation into a sustainable, teacher-centered practice that empowers evidence-informed decision-making in schools.

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