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"Does AI Make Us Smarter—or More Dependent?": Public Discourse on Knowledge Construction Across Cognitive, Behavioral, and Ethical Dimensions

"¿La inteligencia artificial nos hace más inteligentes o más dependientes?": El discurso público sobre la construcción del conocimiento a través de las dimensiones cognitiva, conductual y ética

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ABSTRACT

As artificial intelligence (AI) becomes increasingly embedded in educational ecosystems, its role in shaping how knowledge is acquired, interpreted, and applied raises new questions about human cognition, behavior, and ethics. Rather than reexamining AI's efficiency or acceptance, this study explores how the public constructs meanings, responsibilities, and governance expectations around AI as a learning partner. Framed within the broader context of digital education policy and ethical AI governance, this study develops a Cognition–Behavior–Ethics (CBE) × Three-Stage (Acquisition, Comprehension, Application) analytical model to examine how public discussions on Reddit (2013–2025, N=10,503 posts) reflect collective reactions and reflections toward AI-assisted learning as a social phenomenon. Topic Modeling reveals three recurrent dilemmas: ensuring informational reliability during knowledge acquisition, maintaining cognitive agency amid growing AI reliance, and reconciling ethical responsibility with institutional and policy constraints in application contexts. These findings demonstrate AI is simultaneously constructed as an intellectual partner, behavioral facilitator, and ethical interlocutor—roles that transform learning from a pedagogical to a socio-technological process of reflection and negotiation. The study contributes theoretically by extending AI acceptance research into a discourse-driven framework of knowledge construction and practically by highlighting the need for transparent, participatory, and stage-specific governance in educational AI systems. Sustainable AI integration requires not only technological innovation also ethical oversight, public deliberation, and adaptive policy mechanisms fostering accountable, human-centered learning environments.

RESUMEN

A medida que la inteligencia artificial (IA) se integra cada vez más en los ecosistemas educativos, su papel en la adquisición, interpretación y aplicación del conocimiento plantea nuevas preguntas sobre la cognición, el comportamiento y la ética humanas. En lugar de volver a analizar la eficiencia o aceptación de la IA, este estudio examina cómo el público construye significados, responsabilidades y expectativas de gobernanza en torno a la IA como compañera de aprendizaje. Enmarcado en las políticas de educación digital y la gobernanza ética de la IA, desarrolla un modelo Cognición–Comportamiento–Ética (CBE) × Tres Etapas (Adquisición, Comprensión, Aplicación) para analizar cómo las discusiones en Reddit (2013–2025, N=10.503 publicaciones) reflejan reacciones colectivas ante el aprendizaje asistido por IA como fenómeno social. El modelado temático biterminal identifica tres dilemas: garantizar la fiabilidad informativa durante la adquisición del conocimiento, mantener la agencia cognitiva frente a la creciente dependencia de la IA y reconciliar la responsabilidad ética con las limitaciones institucionales y políticas

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en los contextos de aplicación. Los hallazgos muestran que la IA se construye como socia intelectual, facilitadora conductual e interlocutora ética, transformando el aprendizaje de un proceso pedagógico a uno socio-tecnológico de reflexión y negociación. El estudio amplía teóricamente la investigación sobre la aceptación de la IA y destaca la necesidad práctica de una gobernanza transparente, participativa y adaptativa que promueva entornos de aprendizaje responsables y centrados en el ser humano.

KEYWORDS | PALABRAS CLAVE
Artificial Intelligence, Education, Cognition, Behavior, Ethics, Morality.
InteligenciaArtificial, Educación, Cognición, Comportamiento, Ética, Moralidad.

1. Introduction

With the widespread application of artificial intelligence (AI) in education, the process of knowledge construction has become distinctly technology-mediated. Education is not merely a venue for acquiring and applying knowledge; it also serves as a microcosm of digital society. As one of the most contentious domains surrounding AI, the integration of education and AI has sparked a series of contradictions and debates concerning efficiency versus overload, agency versus dependency, and innovation versus regulation. These conflicts fundamentally stem from a radical shift in the information paradigm. Unlike the industrial era, the digital age confronts individuals with the challenge of filtering, synthesizing, and applying knowledge amidst overwhelming information overload (Simon, 1996). The rise of AI has efficiently addressed knowledge retention and application, but while altering individual learning methods, it has reshaped the cultivation of humanity as a whole and profoundly influenced the structures of knowledge, meaning, and power across society. In other words, AI functions both as an information provider and as a participant in the process of meaning construction (Hirvonen et al., 2024).

Contemporary communication studies consistently view human-machine and human-technology interactions as communicative processes (Xu et al., 2023). Early research introduced the "Computers Are Social Actors" (CASA) paradigm, emphasizing that humans often unconsciously treat machines as social actors in their responses (Reeves & Nass, 1996). Human-Machine Communication (HMC) research further indicates that individuals adjust their expectations and evaluations of AI based on "machine heuristics" during interactions with machines (Lee, 2024). Recently, related studies have emphasized AI explainability—meaning AI algorithms must not only produce outputs but also enable users to comprehend and participate in the entire decision-making process. Explainable AI (XAI) emphasizes human agency, while algorithms themselves are increasingly embedded within more complex social contexts. In this sense, human-machine interaction constitutes an interactive and socialized process of collaborative communication, in which meaning is realized through human interpretation and application (Dogruel et al., 2022; Silva et al., 2024).

Against this backdrop, the educational domain emerges as one of the most illuminating and critical contexts for understanding human-machine interaction. In AI-assisted learning, technology must not only fulfill learners' needs for information and knowledge acquisition but also cultivate their cognitive agency, critical thinking, logical reasoning, and communication patterns (Fortunati et al., 2025). Yet, while a growing body of research has examined AI acceptance and learning outcomes (Ali et al., 2025; Hazaimeh & Al-Ansi, 2024), far less attention has been paid to how the public collectively interprets, discusses, and critically reflects on AI once its use as a learning tool has become a social norm. Understanding these discourses is essential, as they reveal how society reconsiders the boundaries between technological efficiency, human cognition, and moral responsibility. By viewing AI not merely as a pedagogical tool but as a social and communicative phenomenon, this study bridges the gap between individual-level acceptance research and collective-level meaning-making, shedding light on how humans rethink their cognitive agency and ethical engagement in the age of intelligent learning.

2. Accordingly, this study aims to explore how public discourse constructs and evaluates AI's role in knowledge construction across cognitive, behavioral, and ethical dimensions. Situated within the field of communication studies, it approaches education as a communicative arena where meanings of technology are publicly constructed and contested. By bridging perspectives from educational technology and digital ethics, this interdisciplinary lens illuminates not only what AI does for learning, but also what its societal meanings and moral implications are.

2. Literature Review

2.1. AI in Education as Knowledge Construction

In recent years, communication and educational research have increasingly converged in exploring how artificial intelligence (AI) reshapes learning and meaning-making practices (Vargas et al., 2024). Rather than viewing education as a closed pedagogical setting, this study situates AI-assisted learning within the public communication sphere, where meanings and values surrounding technology are continuously constructed and contested.

Knowledge construction, in this regard, is a dynamic and socially situated process through which individuals or communities actively engage in experience-based exploration to build new understandings,

and it is inherently a lifelong endeavor (Jarvis, 2009). Knowledge construction is not merely an instructional activity but a socio-technological and ethically charged process embedded in culture. Unlike exam-oriented education that evaluates students' performance in a summative manner, knowledge creation is personalized, collaborative, and practice-oriented (Bereiter & Scardamalia, 2014). It thus provides a lens for observing how public discourse frames the promises and risks of AI. Knowledge construction also involves ethical dilemmas concerning learner agency, moral education, academic integrity, and educational equity (Lee, 2003; Rawls, 1971). With AI's proliferation, these challenges gain new complexity through platform affordances and algorithmic visibility (Guzman & Lewis, 2020).

Applications of artificial intelligence in education (AIED) are often categorized into three paradigms: AI-directed, in which learners act as passive recipients; AI-supported, in which learners collaborate with AI; and AI-empowered, in which learners assume leadership roles with AI assistance (Ouyang & Jiao, 2021). Across these paradigms, the central concern has been the reassertion of learner agency. When situated within the context of lifelong and problem-driven knowledge construction, the significance of explainable AI (XAI) becomes especially evident (Jarvis, 2012). XAI is not merely a context-aware, real-time supporting system for enhancing cognitive information processing but also a communicative act. The form and content of explanations—whether through visualization, narrative framing, or dialogic interaction—shape how users perceive trust, responsibility, and human–machine relationships (Shin, 2020).

In digitally mediated learning environments, such explanations rarely remain confined to individual cognition. Instead, they circulate, are reinterpreted, and are debated within peer networks, platform-based communities, and broader public discourse (Yang & Sundar, 2024). This suggests that XAI is not simply a learning tool but a communicative node embedded in wider socio-technical networks. Recent studies show that discussions of generative AI in education increasingly occur within online platforms such as Twitter, where users collectively frame its potential and pitfalls (Li et al., 2024). Through these processes of circulation and re-contextualization, AI in education influences not only individual understanding but also the broader social framing of technology (Tuomi, 2024). Technology adoption, therefore, is not purely instrumental but also a process of meaning construction—sensitive to functional, relational, and moral dimensions of human–AI communication (Lee, 2024).

2.2. Three Stages of AI-Supported Knowledge Construction

Grounded in cognitive scaffolding theory (Perkins, 1993), there are three stages in the process of knowledge construction: acquisition, understanding, and application, as described by Anderson (2014) in relation to AI in education. Many studies have adopted the framework of knowledge construction to analyze how AI is applied in education, extending their discussions beyond cognitive mechanisms to include behavioral and ethical dimensions (Belle, 2023; Ouyang et al., 2023).

Particularly, in the acquisition stage, AI tools identify the scope and sequence of information through algorithmic ranking, interface design, and visibility mechanisms. This "gatekeeping" not only determines where learners begin their engagement but also shapes their early cognitive schemas (Perkins, 1993). Research further cautions that excessive system explanations may undermine learners' metacognitive capacities, highlighting the need to balance system guidance with learner autonomy (Mayer & Alexander, 2011). As for the comprehension stage, some AI explanations may take the form of causal chaining, analogical reasoning, or visual mapping, which influence how learners reconstruct ideas (Schäffer & Lieder, 2023). Learners at different levels exhibit distinct preferences: novices benefit from concrete or anthropomorphic explanations that lower comprehension thresholds, whereas advanced learners favor adjustable visualizations and open interfaces that enhance transparency and a sense of control (Guzman & Lewis, 2020; Khosravi et al., 2022). In the application stage, AI is used by individuals to make choices and produce tangible outcomes. These results extend into other learning and evaluative environments, where discussions of originality, the value of the intangible, and academic honesty come into play (van Aalst, 2009). At the same time, the involvement of generative and decision-making AI may blur the boundaries of individual contribution and responsibility, raising normative and ethical concerns (Riva et al., 2025).

When determining the optimal design for AI explanation mechanisms, it is important to assess how explanations will travel through multi-layered communication networks, how they may be amplified or distorted by algorithmic systems, and how they will shape public trust in AI (Knowles & Richards, 2021).

Research indicates that current XAI systems often underperform: they may fail to help users fully comprehend decision-making processes (Hassija et al., 2024), have limited impact on sustained trust (Huang & Wang, 2023), and offer suboptimal decision support (Liao et al., 2020). These shortcomings depend on users' literacy, cognitive levels, and task contexts, which constrain the uptake of explanations (Oeldorf-Hirsch & Neubaum, 2023). In educational contexts—sites of dense, repeated human–machine interaction—addressing these limitations is not only a technical imperative but also a communicative one: essential for sustaining interpretive agency, fostering trust, and enabling ethical deliberation within the open digital public sphere (Dieterle et al., 2024; Zhai et al., 2021). In Table A1, we have compiled keywords related to the three stages of knowledge construction from literature, forming the search term database for the methodology section.

2.3. Cognition-Behavior-Ethics and the Moral Dilemmas of AI

In addition to examining the three stages of knowledge construction, this study also adopts a multidimensional perspective that considers cognition, behavior, and ethics. This approach builds on prior research in educational technology, communication, and moral philosophy (Clark & Chalmers, 1998; Feenberg, 2012), which help us to argue that AI not only changes how people process and apply knowledge but also reshapes learning behaviors and ethical norms (Belle, 2023; Ouyang et al., 2023).

Cognitively, AI reshapes how learners allocate attention, manage cognitive load, and develop metacognitive capacities (Edwards et al., 2024). Particularly, retrieval systems enhance efficiency but risk "cognitive offloading" that reduces deeper engagement (Gerlich, 2025). In the comprehension phase, AI explanations can support conceptual internalization, yet over-reliance risks weakening critical reasoning skills (Melisa et al., 2025). In the application phase, generative AI can enhance productivity but blur boundaries of intellectual originality (Khosravi et al., 2022). From the behavioral dimension, scholars highlight how AI's affordance reshape interactions with both information and peers. In the acquisition stage, rapid retrieval can foster "copy-paste" forms of engagement (Tyndall et al., 2025). In the comprehension phase, structured presentation formats may improve efficiency but foster "fast-food learning" that prioritizes quick answers over systematic reasoning (Tang et al., 2025). In the application phase, AI-assisted writing and problem-solving redefine academic practice and fuel debates about originality and integrity (Kotsis, 2024).

From the ethical dimension, existing studies have shown that the values, biases, and design logic embedded in AI systems profoundly influence learners' moral reasoning and perceptions of fairness (Khreisat et al., 2024). Scholars have noted concerns over algorithmic transparency, data privacy, and academic integrity, highlighting how AI-mediated education can reproduce or even amplify social inequalities if not properly governed (Dixon-Román et al., 2020; Leon et al., 2025). These findings underscore the need to view ethical reflection as an integral part of AI-assisted learning, shaping how individuals balance efficiency, responsibility, and moral accountability in digital learning environments. In Table A2, we have compiled keywords related to the three dimensions of "Cognition–Behavior–Ethics" from literature, forming the search term database for the methodology section.

2.4. The Propose of Theoretical Framework

Despite extensive research on AI acceptance and adoption, most existing studies rely on surveys or experiments focused on individual attitudes (Morales Caluña et al., 2025; Vicente-Yagüe-Jara et al., 2023), with limited attention to how collective public discourse constructs shared meanings and moral reflections on AI in education. Yet as AI increasingly becomes a visible learning partner in everyday educational and professional contexts, public discussions about it have evolved into a broader social trend and an emerging arena of meaning-making. Online discussions, by contrast, provide a valuable lens to capture societal consensus and to understand how the roles, functions, and dilemmas of AI are defined, framed, and debated in open communication spaces. Examining such discourse is important because it reveals how people collectively interpret technological change, frame educational values, and articulate their expectations, anxieties, and moral boundaries in response to AI's growing presence.

Accordingly, this study explores major issues arising from the application of AI in education within cyberspace and examines how users engage with concepts such as "efficiency," "agency," and "regulation," as well as the communicative strategies and framework adjustments prompted by these discussions. Employing supervised thematic analysis and the CBE framework, it investigates public perceptions and reflections on

AI use across the three stages of knowledge construction—acquisition, comprehension, and application (Anderson, 2014)—thereby revealing how education serves as a microcosm of broader societal debates in the digital age (Oliver et al., 2024). By mapping these multilayered discussions, the study identifies where specific communicative strategies and value orientations emerge, highlighting how different learning contexts shape the public's understanding of AI as both a practical tool and a moral concern. Based on these considerations, the study proposes the following research questions:

RQ1. How are the stages of knowledge construction—acquisition, comprehension, and application—represented and debated in public discourse about AI in education?

RQ2. Within the perspective of cognition, behavior, and ethics, what concerns and tensions are emphasized in public discussions of AI-assisted knowledge construction?

RQ3. How do participants in open digital environments articulate communicative strategies to balance efficiency, agency, and ethical norms when discussing AI-supported learning?

3. Methodology

3.1. Research Design and Rationale

This study uses an interdisciplinary mixed-method design that integrates computational text mining and qualitative interpretation to analyze how public discourse constructs knowledge, values, and ethical dilemmas surrounding AI in education. Whereas most prior studies have approached AI adoption through experimental, survey-based, or classroom research (Dabis & Csáki, 2024; Dai et al., 2024), this study focuses on public discourse analysis to reveal how cognitive, behavioral, and ethical tensions are collectively established in open online environments.

Specifically, this study selects Reddit as the research site for analyzing public discourse on AI. Compared with other social media platforms such as X or TikTok, Reddit's thread-based discussion format allows users to reason, debate, and reflect more extensively, making it particularly suitable for examining collective sensemaking and ethical negotiation in AI-assisted learning. Its relative anonymity also encourages open discussions on issues such as academic integrity, algorithmic bias, and ethical issues, offering valuable insights into how the public constructs reasoning and forms values. To identify the salient themes in these discussions, the Biterm Topic Model (BTM) method was used rather than LDA or PLSA (Cheng et al., 2014)831E6D26}, since it is better suited for analyzing short social media texts. The process was done by using the bitermplus library to preprocess texts into bag-of-words vectors, get the term frequency matrix, and then obtain biterms.

3.2. Data Collection and Analysis

We collected posts and comments via Reddit's public API and a Python-based scraper from subreddits related to AI and education, including "r/ChatGPT, r/ArtificialIntelligence, r/Education, and r/AskAcademia". Reddit was chosen because of its thematic sub-communities, rich user-generated content, and relatively open environment for expressing diverse perspectives, making it especially suitable for examining evolving public discourse on AI (Boyd & Crawford, 2012). To ensure thematic relevance, 31 keyword phrases were applied (e.g., "ChatGPT and thinking," "academic integrity," "student responsibility") (Heersmink, 2015). Specifically, the 31 keyword phrases were categorized according to the three stages of knowledge construction (acquisition, comprehension, and application) and three dimensions (cognition, behavior, and ethics). Posts containing these keywords were grouped and analyzed separately within each stage–dimension subset. The collection period spanned from 9 April 2013 to 27 June 2025, resulting in a total of 20,174 posts. The raw text was preprocessed through several steps, including the removal of irrelevant symbols (such as *"@"*, *"#"* tags), lemmatization with spaCy, and filtering of stopwords, duplicates, advertisements, and non-English entries. After preprocessing, 10,503 valid posts remained for analysis.

We then employed BTM topic modeling to identify key topics in the corpora of each stage and each dimension of knowledge construction. Different numbers of potential topics were tested, and the model's performance was evaluated using coherence and perplexity metrics. The optimal number of topics was determined at the point where coherence reached its peak and perplexity began to rise. For example, in the acquisition-stage corpus, setting the topic number to seven produced a clear inflection point on the coherence curve; therefore, seven topics were selected as optimal for that subset. The final model was

trained for 30 iterations with parameters $\alpha = 50/12$ and $\beta = 0.01$ to ensure convergence (Blei et al., 2003).

The same procedure was applied to each stage and dimension of the corpus. As a result, seven topics were identified for the acquisition stage, five for the comprehension stage, and twelve for the application stage (see Table A3 for the 24 topics). Across dimensions, seven cognitive, eight behavioral, and five ethical themes emerged (see Table A4 for the 20 topics). For each trained model, the 20 most relevant keywords were extracted for every topic, and each post was assigned to its most representative topic based on the posterior probability distribution. These topic assignments provided the quantitative foundation for qualitative interpretation and cross-stage comparison. Building on these results, the analysis examined how discourse patterns evolved across the three stages of knowledge construction—acquisition, comprehension, and application—and three analytical dimensions: cognitive, behavioral, and ethical. Guided by theoretically grounded keyword sets and topic modeling outputs (see OSF repository), we identified key thematic clusters for each stage and dimension, which collectively form the empirical basis for interpreting how public discourse articulates the cognitive, behavioral, and ethical dilemmas of AI-assisted learning.

4. Results

4.1. Stage-Based Analysis of AI-Assisted Knowledge Construction

4.1.1. Acquisition Stage: Efficiency vs. Reliability

In the acquisition stage of knowledge construction, the discussions primarily reflected the tension between efficiency and reliability. Many participants emphasized that AI efficiently integrates and presents information from multiple sources, lowering operational barriers (Topic 3). Yet users worry that prolonged reliance weakens independent analytical ability (Topic 1). The instability of generated content, including factual errors, logical flaws, and even improper citations, has triggered widespread "credibility anxiety" (Topic 2), forcing users to invest additional time and effort in manual verification.

In addition, acquisition-stage discourse highlighted community-based collaboration (Topics 4, 5 and 6). Specifically, learners use community resources to supplement AI-related knowledge, such as tool usage experiences and resource sharing. Yet these collaborative practices were accompanied by concerns about copyright and the boundaries of AI assistance. The acquisition stage was framed by this tension between "dependence" and "skepticism", with efficiency gains constantly being questioned by demands for rigour, reliability and "increased verification needs".

4.1.2. Comprehension Stage: Outsourcing vs. Subjectivity

In the comprehension stage, discourse centered on the contest between outsourcing cognitive work and preserving human subjectivity. Users described AI as capable of transforming abstract theories, complex models or obscure concepts into more accessible and operational forms (Topics 7, 8 and 11), while simultaneously questioning the contextual validity, logical rigor, and validity of such outputs (Topic 11).

Meanwhile, users actively identify potential biases in AI output (Topic 9), dissect the assumptions and parameter limitations of models (Topic 10), and emphasized the need to clarify boundaries of AI conclusions. AI users also noted that after using AI to support comprehension, they deliberately disengaged and reconstructed knowledge frameworks independently (Topic 12). This reflects a cognitive stance where reliance and vigilance coexist: AI fills knowledge gaps but may erode independent reasoning. These discursive practices highlighted how reliance and vigilance coexisted, framing comprehension as a tension between collaborative understanding and independent reasoning.

4.1.3. Application Stage: Empowerment vs. Accountability

In the application stage of knowledge construction, discussions revealed a tension between technological empowerment and regulatory constraints. Many users described AI as a "practice accelerator", recognizing its ability to generate multiple solutions, provide cross-domain references, and reduce trial-and-error costs in problem-solving (Topics 13, 15, 16, and 19). This so-called "parallel solution" capability was primarily viewed as a way to minimize exploration costs and expand possible solution paths.

At the same time, issues such as plagiarism, intellectual property, and broader cultural and ethical considerations (Topics 14, 17, 18, 22, and 24) were also actively debated. Some participants argued that using AI-generated outputs—even for academic or artistic purposes—could constitute plagiarism. Others

warned that excessive reliance on AI might weaken human judgment and create blind spots in areas related to social responsibility and fairness.

Moreover, users emphasized the necessity of human oversight, especially at critical points of decision-making. Posts frequently stressed the importance of reaffirming human judgment to avoid errors caused by "black-box" systems or model limitations (Topics 16 and 20). Some discussions also mentioned peer consultation or additional verification of AI outputs to ensure reliability and accountability (Topics 21 and 23).

4.2. Dimension-Based Analysis of Dilemmas in AI-Assisted Education

4.2.1. Cognitive Dimension: Trust vs. Skepticism

From the cognitive dimension, discourse revealed an interplay between "anthropomorphic projection" and "rational skepticism". This process can be understood as a cognitive negotiation oscillating between the "machine heuristic" (Sundar & Kim, 2019) and "cognitive dissonance" (Dawson et al., 2025). Users often perceived AI as a "human-like partner," noting its fluent language and adaptive responses as evidence of competence (Topics 31). Some even described AI as understanding them better than peers, projecting emotional qualities onto the system (Topic 29). In certain contexts, AI was discussed as a reliable long-term learning collaborator in certain contexts (Topic 27).

However, when factual errors, logical contradictions, or hallucinatory content emerge in AI output, the trust established through heuristics clashes with prior knowledge or expectations, triggering discomfort and skepticism (Topic 25 and 26). This shift prompted recalibration through verification practices such as consulting prior knowledge, authoritative references (Topic 28), or peer discussions (for example, "Do you think AI's answer is correct?") (Topic 30). The discourse thus constructed a "trust–skepticism–recalibration" cycle, showing how AI's cognitive role was continuously positioned between reliance and doubt.

4.2.2. Behavioral Dimension: Tool Use vs. Community Collaboration

In the behavioral dimension, discourse framed AI use along a continuum from individual reliance to collective collaboration. Posts frequently depicted AI as a problem-solving tool for tasks such as debugging, information retrieval, or market research (Topic 32). At the same time, users articulated expectations that AI should withstand counterexamples, boundary conditions, and contextual variations, with discussions highlighting both its robustness and its limitations (Topics 35 and 39).

Beyond individual use, discussions emphasized community-oriented practices. Users described sharing prompts, reviewing processes, and comparing outputs, thereby constructing AI use as a collaborative activity embedded in verification networks (Topics 34, 36 and 37). The discourse also revealed negative attitudes: frustration, fatigue, and withdrawal were common when AI outputs diverged sharply from expectations (Topic 33 and 38). Yet other posts conveyed adaptive strategies, such as refining questioning styles or supplementing AI responses with alternative sources, illustrating how community discourse framed AI use as a dynamic interplay between individual effort and collective collaboration (Topics 36 to 38).

4.2.3. Ethical Dimension: Individual Morality vs. Societal Regulation

Discussions in the ethical dimension were centered on the conflict between technological innovation and existing regulatory systems. At the individual level, users expressed consistent moral stances, firmly opposing behaviors such as using AI to cheat, overrelying on AI-generated content, or misusing private data (Topic 42). Some posts even described concrete actions, such as reporting violations or discouraging misconduct in public discussions (Topic 43).

At the societal level, discussions shifted toward concerns about the fairness, transparency, and adaptability of regulatory systems. Posts questioned whether misconduct detection mechanisms were reliable, whether platforms provided clear procedures for addressing infringement, and whether data collection boundaries were properly defined (Topics 40, 43, and 44). These debates are not only related to the governance capacity of platforms and authorities but also directly influence learners' trust in AI applications and their willingness to use them.

The deeper tension emegered from what users desribed as "systemic rules lag behind technological innovation", known as "the Collingridge Dilemma" (Genus & Stirling, 2018). The pace of technological development far outstrips institutional updates, creating an inevitable "time gap" that leaves certain contexts

in a regulatory gray area. For example, posts noted that AI-assisted thesis revision, while improving efficiency, often blurred the boundaries of academic integrity (Topics 40 and 43). Ethical anxieties were amplified in high-stakes contexts such as job applications, where unclear standards heightened risks of unfair advantage (Topic 40). As AI becomes embedded in the process of knowledge construction, humans face constraints from two dimensions: the moral imperatives arising from their own conscience and the ethical restrictions imposed by external regulatory systems, producing persistent ethical uncertainty.

As summarized above, each stage and dimension reveals distinct yet interconnected tensions in how learners engage with AI. To synthesize these patterns, Table 5 presents a cross-sectional overview of the core tensions identified across the cognitive, behavioral, and ethical dimensions.

5. Discussion

5.1. Conclusion

This study employs a "Cognition–Behavior–Ethics (CBE) × Three-Stage (Acquisition, Comprehension, Application)" analytical framework to examine public discussions on AI in education across the Reddit platform from 2013 to 2025. The findings address three research questions. First, regarding RQ1, this study reveals that public concerns about AI usage vary significantly across different knowledge-construction stages. When using AI for information acquisition, users perceive its ability to effectively synthesize information and reduce operational complexity, yet express concerns about its reliability and potential to induce mental laziness. During the understanding stage, discussions center on the conflict between cognitive outsourcing and preserving agency. Users acknowledge AI's assistance in reasoning and knowledge organization but worry it undermines critical thinking. When applying knowledge with AI, public attention focuses on the conflict between technological empowerment and institutional constraints. Such discussions primarily revolve around academic integrity, copyright, and policy limitations.

Second, based on cognitive, behavioral, and ethical dimensions, the public exhibits differentiated concerns during the processes of understanding, using, and reflecting on AI. When discussing AI's impact on cognitive processes, users oscillate between trust and skepticism, continually adjusting their judgments about AI's role in learning assistance. Regarding specific AI usage methods, emphasis is placed on the importance of incorporating collective collaboration and experiential judgment. Ethical discussions reveal reflections on balancing individual responsibility with societal norms, touching on issues like fairness, bias, and accountability.

Finally, addressing RQ3, this study finds that users in digital spaces do not passively accept AI outcomes but actively employ communication strategies to balance efficiency, agency, and ethical demands. Numerous users reported selectively relying on AI while pursuing efficiency, simultaneously reducing uncertainty through verification, peer consultation, and collaborative sharing. They re-establish human agency in critical areas like originality and academic integrity. These iterative practices demonstrate that AI-assisted learning is not merely a technical process but an evolving ecosystem of human-machine interaction characterized by continuous adjustment and negotiation.

In conclusion, AI-assisted learning has expanded beyond pedagogy to become a communicative process through which people collectively explore the boundaries of cognition, autonomy, and ethics. This study thus shifts attention from how AI is used to how the public understands and redefines its meaning and legitimacy as a learning partner.

5.2. Discussion

Drawing from research on knowledge construction and extended cognition (Clark & Chalmers, 1998; Heersmink, 2015), this study introduces the CBE × Three-Stage model to trace how public understanding of AI in education evolves through discourse. Unlike prior studies that have focused on individual behavior or psychological mechanisms (Morales Caluña et al., 2025), this study emphasizes the social dimension of meaning-making—how the public reshapes AI's role and value in education through communication, debate, and reflection.

The findings show that public understanding of AI-assisted learning develops from an emphasis on efficiency, to a focus on collaboration, and ultimately to ethical reflection. This process is not a simple chronological sequence but a dynamic evolution tied to stages of knowledge construction. It aligns with human–computer interaction research suggesting that deep technological embeddedness reshapes social

cognition (Ferrario et al., 2020; Obrenovic et al., 2025). As AI becomes integrated into learning and teaching practices, public discourse moves beyond operational efficiency toward deeper concerns about agency, trust, and responsibility. This shift from functionality to reflection marks a central feature of AI's socialization in education.

In the efficiency-oriented phase, AI was primarily viewed as a productivity tool that enhanced feedback, assessment, and analytics. Early studies highlighted its capacity to improve learning accuracy and adaptability (Cope et al., 2021; Zouhaier, 2023) and described this period as an intelligent-assistance paradigm focused on expanding learners' operational capacities (Cantú-Ortiz et al., 2020). However, this study's corpus shows that when AI entered real educational settings, public notions of efficiency extended beyond performance to concerns about trust, risk, and control. Efficiency thus evolved from a technical measure into a social indicator of AI's reliability and transparency. In the collaboration-oriented phase, attention shifted to human-AI interactivity and complementarity. Research began emphasizing a social-constructionist logic that valued collaboration among learners, systems, and communities (Rienties et al., 2020). Improving AI literacy was found to enhance teachers' reflective learning and students' creative thinking (Du et al., 2024; Yan et al., 2024). Similarly, generative AI was shown to foster creativity alongside efficiency (Vicente-Yagüe-Jara et al., 2023). Public discourse reflects this turn: when AI is seen as a partner, discussions move from how to use AI toward how to learn with it. Collaboration emerges not only as a pedagogical phenomenon but also as a shared process of meaning-making.

In the ethical-reflection phase, both scholarship and public discourse increasingly addressed fairness, accountability, and moral responsibility. Studies warned of risks such as privacy breaches and bias while calling for stronger ethical governance (Bibi et al., 2024; Usher & Barak, 2024). Ouyang and Jiao (2021) further proposed evolving from intelligent support to ethical symbiosis. This study complements those perspectives, showing that ethical reflection often arises from direct experience rather than abstract reasoning. Users frequently describe anxiety or moral tension in AI interactions, suggesting that ethical awareness develops experientially before becoming normative. As such emotions circulate, they transform into collective reflections on justice and accountability in AI-based education.

Overall, public cognition of AI in education follows a multi-stage process of semantic reconstruction. As attention shifts from efficiency to collaboration and then to reflection, AI's social role is continuously redefined—progressing from a performance-enhancing tool to a cognitive co-creator and eventually to an ethical interlocutor. This evolution reflects a renewed public understanding of AI's functions and values and underscores education's dual role as both a site of technological practice and a crucial arena for societal reflection on technology. Building on this insight, we propose more targeted pathways for practical optimization by considering variations across learning stages and dimensions of public perception. These applications also resonate with the broader academic and industrial shift from technology-centric to human-centered approaches (Li & Gu, 2023; Topali et al., 2025).

During the knowledge acquisition stage, public attention centers on the reliability of information sources and the transparency of algorithmic processes. AI education systems should enhance explainability in data presentation, content filtering, and recommendation mechanisms to help users understand how information is generated and reduce uncertainty associated with the "black box effect" (Feldman-Maggor et al., 2025; Fiok et al., 2022). Developers can foster user trust in AI-driven learning resources by providing clear index structures, data source annotations, and robust fact-checking mechanisms.

At the comprehension stage, the public places greater emphasis on the quality of human-AI interaction and on maintaining cognitive control during learning. AI's role should therefore evolve from an information provider to a cognitive collaborator. Effective cooperation between educators and AI is essential: teachers can use AI-generated learning analytics reports to guide students in reflecting on their learning paths and cognitive biases, shifting the focus from obtaining answers to understanding processes and thereby deepening reflective learning (Kim et al., 2022). Classroom practices may also adopt a tripartite interaction model involving AI, students, and teachers, in which AI provides initial analyses, students engage in critical validation, and teachers facilitate discussions on values and ethics. This structure positions AI as an enabler of creativity and critical thinking rather than a substitute for human instruction.

In the application stage, ethical concerns and a sense of moral responsibility become more pronounced. AI educational products should integrate principles of co-creation and traceability, enhancing both system

transparency and learner reflection. Learning platforms can incorporate reflection prompts, contextual dialogues, and value-judgment modules to help learners develop independent reasoning and ethical awareness through AI interaction. Meanwhile, developers and operators should establish dynamic feedback mechanisms, using ongoing user data and learning analytics to refine AI guidance strategies and support sustained cognitive growth.

From a broader perspective of social communication and governance, educational institutions, media platforms, and technology companies should jointly assume responsibility for guiding public understanding of AI in education (Kousa & Niemi, 2023). Through open scientific communication and value-oriented public dialogue (e.g., Fütterer et al., 2023), the public can gain a more balanced understanding of AI's potential and limitations, cultivating a rational and self-aware learning culture. AI ethics governance should also extend beyond data protection to include algorithmic fairness, information reliability, and accountability mechanisms throughout the entire process. For example, third-party evaluation systems could continuously monitor educational AI tools to ensure alignment with institutional standards and ethical commitments, reducing learners' persistent uncertainty and self-doubt (Silva et al., 2024). Such measures not only safeguard academic integrity but also reinforce the theoretical value of the CBE framework by demonstrating how explainability must be addressed simultaneously at the levels of design, pedagogy, and governance.

Although this study offers contributions at both theoretical and practical levels, it also has several limitations. First, the data mainly comes from Reddit, an English-language community whose users share specific cultural, educational, and technological backgrounds. This may limit the applicability of the findings to non-English contexts or other users without reflective abilities. Second, the analysis focuses on identifying topical features across stages and dimensions, without examining their proportional distribution, conducting sentiment analysis, or applying time-series analysis. As a result, trends in topic prevalence, sentiment polarity, and dynamic evolution remain unexplored, and the life-cycle or emotional trajectories of topics in AI-assisted learning cannot be inferred. Future research could test this framework with cross-platform and cross-cultural data, and incorporate longitudinal, sentiment, and experimental analyses to further reveal the evolving dynamics of AI-assisted knowledge construction.

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