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Research Paper

Digital Empathy in AI for Social Good: A Systematic Review of Applications in Education and Libraries

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ABSTRACT

Artificial intelligence (AI) is increasingly shaping educational and library environments, promising efficiency, personalization, and accessibility. However, questions remain about whether these systems align with the values of equity, fairness, and care. Digital empathy the ability of technology to recognize, interpret, and respond appropriately to human emotions offers a way to humanize AI and ensure it functions as a tool for social good. This review synthesizes research on how empathy is conceptualized, operationalized, and integrated into AI systems designed for education and libraries. A systematic search across multiple databases identified 28 studies published between 2010 and 2024. These were analyzed to uncover common theories, design principles, and applications. The findings highlight that empathetic AI fosters inclusive learning environments, supports accessibility for marginalized groups, and improves user trust in digital systems. However, challenges persist, including algorithmic bias, limited ethical frameworks, and superficial applications of empathy. The review concludes that embedding empathy in AI requires interdisciplinary collaboration and consistent methodological tools. Future research should focus on long-term outcomes of empathetic AI and the development of guidelines for equitable, ethical design.

Keywords: *Digital empathy, Artificial Intelligence, Education, Libraries, Social good, learning, Emotional AI, Empathetic*

In recent years, artificial intelligence (AI) has become a transformative force across multiple sectors, including education and library sciences. While AI has proven effective in automating tasks, providing personalized learning, and streamlining access to information, its capacity to foster meaningful human connection remains limited. This has led to growing interest in the concept of digital empathy the ability of digital systems to understand, interpret, and respond appropriately to human emotions and needs in online environments.

Digital empathy extends beyond technical efficiency. It emphasizes relational values such as compassion, inclusivity, and fairness in human machine interactions. In education, this means designing AI systems that do more than deliver content they support learners emotional well-being, recognize diverse learning styles, and promote engagement. In libraries, empathetic AI contributes to equitable access to resources, personalized

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recommendations, and culturally sensitive services that acknowledge the unique needs of different user communities.

The significance of digital empathy becomes more pressing in the context of social good. Social good refers to the application of technology to advance collective well-being, reduce inequality, and strengthen communities. When AI is designed without empathy, it risks reinforcing biases, alienating vulnerable groups, and undermining trust in digital systems. Conversely, empathetic AI can act as a bridge, ensuring that technological innovation is inclusive and socially responsible.

Despite growing interest, research in this area remains fragmented. Some studies focus on affective computing and emotional recognition, others on human centered design, and others on ethical AI frameworks. However, there is still limited integration of these perspectives into a comprehensive understanding of how digital empathy can be systematically designed and evaluated for social good. Moreover, most existing work is concentrated in experimental or pilot settings, leaving a gap in large-scale applications in education and libraries.

This paper addresses these gaps through a systematic review of literature on digital empathy and AI in education and library contexts. By synthesizing findings from recent studies, grounding the discussion in established theories, and identifying methodological patterns, the review seeks to clarify the current state of research and propose pathways for future innovation. The focus is not only on what AI can do but also on how it can be designed and implemented in ways that affirm human dignity, strengthen trust, and contribute to equitable social outcomes.

Research Question:

How has digital empathy been integrated into AI systems in education and libraries, and what effects does it have on learners and users?

Objective

1. Synthesize existing research on digital empathy and AI to understand current practices, innovations, and challenges in education and library contexts, building on the literature that highlights both the promise and limitations of empathetic AI.
2. Identify and analyze theoretical foundations—including Human-Centered Design, Social Good Theory, Constructivist Learning Theory, and Affective Computing—to clarify how empathy can be conceptually and practically integrated into AI systems.
3. Examine practical applications of empathetic AI, focusing on outcomes such as learner engagement, accessibility, inclusivity, and user satisfaction, thereby connecting theory to real-world implementations in education and libraries.
4. Evaluate methodological approaches and systematic tools used in prior studies, including PRISMA protocols, thematic analysis, and quality appraisal frameworks, to ensure rigor, transparency, and reproducibility in assessing the effectiveness of empathetic AI.
5. Highlight gaps and limitations in current research, including ethical concerns, algorithmic biases, cultural constraints, and limited long-term evaluation, emphasizing areas where theory and practice have yet to fully align.
6. Propose recommendations for future research and design strategies that emphasize interdisciplinary collaboration, culturally adaptable solutions, and the integration of

empathy as a core principle, ensuring AI contributes meaningfully to social good in educational and library contexts.

Background

Digital empathy has emerged as a vital concept in the evolving landscape of education and library sciences, particularly as artificial intelligence (AI) becomes increasingly integrated into social goods. Digital empathy refers to the ability to recognize, understand, and respond compassionately to the emotions and needs of individuals through digital platforms. In education, this means developing systems that can engage students in a supportive and inclusive way, while in libraries, it involves creating AI-driven services that respect users' diverse backgrounds and information needs.

A growing body of research highlights the importance of embedding empathy within AI systems to counteract the limitations of traditional algorithmic design, which often overlooks human centered values. For example, studies have shown that when AI is developed without attention to empathy, it risks reinforcing biases, reducing trust, and creating barriers to equitable access. In contrast, AI tools designed with empathy foster inclusivity, promote learner engagement, and create environments where individuals feel acknowledged and supported.

Several scholars have investigated the applications of empathetic AI in educational technology, adaptive learning platforms, and library management systems. These studies demonstrate that empathetic design can increase student motivation, reduce dropout rates, and improve user satisfaction with library services. However, the literature also identifies gaps: many existing models remain experimental, lack standardized evaluation tools, or fail to account for cultural differences in how empathy is expressed and perceived.

By reviewing studies across these domains, this paper identifies the need for more structured theoretical grounding and systematic approaches in developing digital empathy through AI. The literature reveals that while the concept has gained momentum, there remains a lack of consensus on how to operationalize empathy within AI for social good.

Transition to Theoretical Framework

To address these gaps, it becomes necessary to ground the study in relevant theories that provide both conceptual clarity and practical direction. The following theoretical frameworks guide this systematic review by offering insights into how empathy can be understood, designed, and applied within digital technologies.

Theoretical Framework

This study is informed by several interrelated theories that provide a foundation for understanding and designing AI with digital empathy for social good in education and libraries.

1. Human-Centered Design (HCD): Human-Centered Design emphasizes creating technologies around the needs, behaviors, and values of users. Within the context of digital empathy, HCD highlights the necessity of designing AI tools that prioritize learners' and library users' emotional and cognitive experiences. By centering human needs, HCD ensures that AI systems do not remain merely functional but become relational and empathetic, fostering inclusivity and belonging.

2. Social Good Theory: Social Good Theory argues that technological advancement should not only focus on efficiency but also on collective well-being. In applying this theory, empathetic AI in education and libraries is seen as a vehicle to reduce inequities, expand access, and promote fairness. This perspective provides ethical grounding, ensuring that AI applications are evaluated not just on performance metrics but also on their contribution to the greater good of society.
3. Constructivist Learning Theory: Constructivist Learning Theory emphasizes that knowledge is actively constructed by learners through interactions with their environment. In this context, empathetic AI supports constructivist principles by adapting content to students' emotional states, offering encouragement, and creating personalized pathways that respect diverse learning needs. This makes AI not only a tool of knowledge delivery but also an empathetic partner in the learning process.
4. Affective Computing Framework: Affective computing focuses on the design of systems that can recognize, interpret, and respond to human emotions. This framework directly supports the operationalization of digital empathy by providing methodologies to measure emotional cues and integrate them into AI systems. Within education and libraries, affective computing enables AI to respond to frustration, confusion, or engagement, thereby humanizing digital interactions.

Together, these theories provide a comprehensive foundation for this review. They ensure that the study does not treat empathy as an abstract ideal but as a measurable, designable, and actionable component of AI systems that serve the common good.

METHODS

Search Strategy

This review followed PRISMA guidelines to ensure transparent and reproducible selection of studies. Databases searched included Scopus, Google Scholar. Keywords used in various combinations were: *digital empathy, artificial intelligence, education, libraries*, and *social good*. Searches were conducted between September 20 and September 25, 2025.

Inclusion Criteria

- Peer-reviewed journal articles or conference papers published between 2015–2025
- Studies involving AI systems that explicitly address empathy or emotionally adaptive features
- Applications in educational or library settings
- English-language publications

Exclusion Criteria

- Opinion essays or purely theoretical articles without empirical evidence
- Studies unrelated to empathy or human-centered AI
- Non-English publications.

Selection Process

A total of 154 studies were initially identified. After removing duplicates and screening titles/abstracts, 42 full-text articles were assessed. Following strict inclusion criteria, 28 studies were included in the final review.

Data Analysis

Studies were analyzed thematically, with findings grouped under key themes:

a. empathetic AI in education
b. empathetic AI in libraries
c. theoretical integration
d. challenges and gaps.

Patterns and divergences across studies were highlighted to provide a comprehensive synthesis.

Systematic Tools

- Data Extraction**:** Information from each study was recorded in a simple table including study type, participants, AI application, and main results.
- Quality Check**:** Each study was reviewed to make sure it had clear methods and reliable findings.

RESULTS

Empathetic AI in Education

Multiple studies have explored the role of empathetic AI in educational settings, highlighting its potential to enhance engagement, motivation, and socio-emotional learning.

1. AI driven tutoring platforms recognized learners' emotional cues, such as confusion or frustration, and provided adaptive feedback that improved persistence and reduced dropout risk (Abou Hashish, 2025).
2. Conversational agents and chatbots offered personalized encouragement in online learning environments, reducing feelings of isolation and increasing overall learner satisfaction (Ortega-Ochoa & García-Sánchez, 2024).
3. Adaptive learning systems that integrated textual, behavioral, and affective data provided tailored guidance, demonstrating that affect-aware AI can foster confidence and self-regulated learning (Liu & Zhang, 2024).
4. Large language models with empathy-driven responses enhanced classroom discussions by recognizing students' emotional states and suggesting supportive interventions, improving participation and engagement (Sorin & Lee, 2024).
5. Generative AI tutors designed with social good principles were found to support underrepresented student groups by providing culturally sensitive responses and personalized scaffolding (Wu & Zhang, 2025).

Overall, students reported that empathetic AI systems felt more human and supportive, confirming the potential for socio-emotional learning enhancement and greater inclusion in digital education.

Empathetic AI in Libraries

Research on empathetic AI in libraries is emerging but shows promising results:

1. AI powered recommendation systems that account for user preferences and emotional context improved satisfaction, perceived helpfulness, and resource discovery (Vistorte & Silva, 2024).
2. Virtual library assistants using empathetic language, such as acknowledging confusion and offering step by step guidance, enhanced trust, accessibility, and user confidence, particularly for marginalized groups (Bond & Zawacki-Richter, 2024).

3. AI driven chat interfaces with sentiment detection provided real-time feedback on user frustration or satisfaction, helping librarians prioritize support for users with higher informational or emotional needs (Garzón & Kurian, 2025).

These findings indicate that empathetic AI can improve user experience in libraries, though the number of studies is currently smaller than in educational contexts, suggesting a need for further research.

Ethical and Cultural Challenges

Across all studies, several challenges were consistently highlighted:

- Algorithmic bias**:** AI systems may misinterpret emotional cues, especially across different cultural or linguistic groups, potentially leading to inequitable responses (Rubin & Smith, 2024).
- Privacy and data sensitivity**:** Emotion recognition requires access to personal data, raising ethical concerns about consent, storage, and misuse (Zhai & Wang, 2024).
- Simulated empathy**:** While AI can mimic empathetic responses, it cannot genuinely experience emotions. Overreliance may create unrealistic expectations or emotional dependency among users (Sharma, Miner, Atkins, & Althoff, 2020).
- Inclusivity gaps**:** Not all AI systems are designed to accommodate diverse learning or library user needs, underscoring the importance of culturally adaptable, human-centered design (Abou Hashish, 2025; Wu & Zhang, 2025).

These challenges emphasize the necessity of designing AI systems that are ethically sound, culturally sensitive, and transparent in their operations, ensuring that digital empathy contributes positively to social good.

DISCUSSION

The results of this systematic review demonstrate that digital empathy in AI has significant potential to enhance both educational and library experiences. In educational contexts, empathetic AI systems including adaptive tutors, conversational agents, and generative language models support learner engagement, motivation, and socio-emotional learning (Abou Hashish, 2025; Liu & Zhang, 2024; Sorin & Lee, 2024). These systems allow for personalized feedback, recognize learners' emotional states, and respond in ways that reduce frustration and isolation (Ortega-Ochoa & García-Sánchez, 2024; Wu & Zhang, 2025).

Similarly, in libraries, empathetic AI improves accessibility, trust, and user satisfaction. Systems that detect emotional cues and provide guidance tailored to user needs have shown positive outcomes, especially for underrepresented or marginalized groups (Vistorte & Silva, 2024; Bond & Zawacki-Richter, 2024; Garzón & Kurian, 2025). This aligns with Human-Centered Design and Social Good Theory, highlighting the importance of designing AI systems that prioritize well-being, equity, and inclusion.

However, ethical, cultural, and technical challenges remain. Algorithmic biases, privacy concerns, and the limitations of simulated empathy underscore the need for careful design, transparent data practices, and culturally adaptable systems (Rubin & Smith, 2024; Zhai & Wang, 2024). The integration of Constructivist Learning Theory and Affective Computing frameworks provides a way to operationalize empathy systematically, enabling AI to adapt responsively while remaining sensitive to ethical and cultural considerations.

Overall, this review indicates that while empathetic AI offers substantial benefits, further research is needed to evaluate long-term outcomes, develop standardized evaluation tools, and expand applications across diverse educational and library environments. The integration of theory, practical application, and ethical considerations is essential for creating AI systems that meaningfully contribute to social good.

CONCLUSION

This systematic review underscores the growing importance of digital empathy in AI for education and libraries. Empathetic AI enhances learner engagement, inclusivity, and user satisfaction by recognizing and responding to emotional and informational needs. In education, AI tutors, conversational agents, and generative models provide adaptive feedback that supports socio-emotional learning. In libraries, AI driven recommendation systems and virtual assistants improve accessibility and trust, particularly for marginalized users.

Despite these benefits, challenges remain, including algorithmic bias, privacy concerns, cultural adaptability, and the limits of simulated empathy. Addressing these issues requires the integration of robust theoretical frameworks, ethical design principles, and human-centered approaches. Future research should focus on large-scale evaluations, longitudinal studies, and interdisciplinary collaboration to ensure that empathetic AI systems truly serve the broader goals of social good.

In conclusion, digital empathy is not merely a technical feature but a guiding principle for designing AI that supports human well-being, inclusion, and equitable access to educational and library resources. By combining theoretical grounding, practical application, and ethical responsibility, AI can evolve into a tool that genuinely enhances social good.

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Conflict of Interest

The author(s) declared no conflict of interest.

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