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Augmented, Not Automated: Teachers as the Bridge to Inclusive AI-Enabled Learning — A Conceptual Review

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Abstract

AI (and generative AI more specifically) is coming into the classroom at a pace that is outpacing the number of teachers equipped to use it. Public debate about this has a strong focus on substitution – what tasks in education can be done by machines? This conceptual review contends that a more important question involves mediation: who is mediating the path by which AI gets to learners and under what conditions? The review incorporates four themes from 29 peer reviewed papers and policy documents published between 2006 and 2026, comprising of systematic and meta-reviews on the role of AI in education, teacher–AI collaboration, AI literacy and ethics, and evidence on the digital divide in India. First, AI-driven research in education is still technology-centered and scarcely focuses on teachers. Second, empirical research continues to reveal that AI is most useful when it is used in conjunction with teachers' judgment. Third, the ethical issues of AI, such as bias, surveillance and over-reliance, most severely impact learners in vulnerable groups. Fourth, access gaps have evolved from connectivity to devices, skills and support. Drawing from this synthesis, the paper proposes a new framework, called the Teacher-as-Bridge framework, where teachers are involved in four mediating roles (pedagogical orchestrator, ethical gatekeeper, trust calibrator and equity broker) and three enabling conditions (AI literacy, institutional policy and infrastructure). A set of four propositions is proposed for empirical testing. Based on our analysis of the presented evidence, the paper proposes that adopting AI in education without having teacher agency at its core is likely to exacerbate educational inequalities.

Keywords: Artificial intelligence in education; Generative AI; Teacher agency; Teacher–AI collaboration; Digital inclusion; AI literacy; NEP 2020

1. Introduction

Generative AI has been one of the fastest-growing technologies to gain traction from the research lab to the classroom. Soon after the widespread availability of LLM, students were using it to create assignments, teachers to create lessons, and institutions were creating policies for both (Chan, 2023; Kasneci et al., 2023). This rapid rate of change has created two counter-narratives. One views AI as a solution to age-old challenges of scale, a personal tutor for each learner, and a reprieve for overburdened teachers. The other regards it as a breach of academic integrity, of the teaching profession and of human relationships which are central to the learning process (Lim et al., 2023). Research is lagging behind: 1 study on teachers' use of generative AI was conducted in 2023, 11 in 2024 and 58 in 2025 (Cincioğlu et al., 2026).

Both the narratives make an unspoken assumption that the question that matters is not what AI can do rather than teachers but what AI can do instead of teachers. This paper asserts that this assumption is incorrect. The results of the 20 years of study and research on AI in education (AIEd) indicate that rather than the technology itself, the effectiveness of AI education tools hinges upon the mediation of these tools, including who selects the tools, how they are used in teaching, how their output is interpreted, and who is excluded in the use of these tools (Holmes & Tuomi, 2022; Zawacki-Richter et al., 2019). In the majority of education contexts, the mediating actor is the teacher.

Mediation is a relevant issue when it comes to inclusion. AI tools are frequently touted as a way to provide personalised learning to students who do not have access to quality teachers. However, the advantages of digital technology have always been for those who already possess devices, skills and support (van Deursen & van Dijk, 2019). The concerns about the widening, or shrinking, of the gap created by AI in India are not a distant possibility, given that the National Education Policy 2020 (NEP 2020) promises technology-enabled and equitable education (Ministry of Human Resource Development [MHRD], 2020), and the transition to online learning during COVID-19 revealed significant gaps in connectivity and devices (Dhawan, 2020).

In this context three questions are raised: What insights do studies provide into the role of teachers in the context of AI-supported learning? (2) What are the ethical and access risks of AI in the context of education and educational inclusion? (3) What concepts can be used to understand how to make AI adoption inclusive for teachers? The paper contributes to the

answering of them in two ways. It combines the scattered literature on the collaboration between teacher and AI, AI ethics, and digital inclusion, often treated as compartmentalized topics. It also introduces the Teacher-as-Bridge paradigm and a list of propositions that can be tested to place teachers at the active centre of the relationship between the capability of AI and inclusive learning outcomes.

2. Review Approach

This paper is a conceptual review paper. It is not an exhaustive systematic review, but rather some literature is selected and integrated in the process of creating an argument and a framework. Searches were conducted using combinations of the following terms on Google Scholar, on the publisher databases and the institutional repositories (IRs): teacher–AI collaboration, generative AI, AI literacy, ethics of AI in education, digital divide, and artificial intelligence in education.

Three criteria were used for selecting. Peer-reviewed systematic reviews and meta-reviews were prioritised as they summarise large bodies of evidence. Secondly, empirical and conceptual studies were also included that directly related to the role, ethics or access of the teacher. Third, major policy documents were introduced, such as UNESCO's guidance on generative AI (Miao & Holmes, 2023) and NEP 2020 (MHRD, 2020) to anchor the research in the policy landscape where institutions are embedded in India. The bibliographic information and the DOI for each source was checked with the publisher or an institutional repository. The last set contains 29 sources published from 2006 to 2026, a few of which are recent systematic reviews on generative AI and Indian studies (2025-2026). The literature was analysed in a thematic manner and the four themes of Section 3 were identified through reading across the literature.

3. Thematic Synthesis

3.1 A Technology-Led Field with Teachers at the Margins

The first theme is related to the shape of the research field itself. Zawacki-Richter et al. (2019) in a highly influential systematic review (146 studies in the field of AI in higher education from 2007-2018) found four major application areas of AI namely profiling, prediction, assessment/evaluation, adaptive systems/personalisation and intelligent tutoring systems. The title, Where are the teachers? highlighted two main findings, the first being that the research

lacked critical reflection on the dangers of AI, and the second was that it was only superficially linked to pedagogical theory.

Subsequent reviews reveal a rapid growth of the field and an ongoing disparity. Crompton and Burke (2023) conducted a literature review of 138 articles published from 2016-2022, and determined that 72% of the studies targeted students as the users, while 17% targeted instructors. They also noted little research from low income countries. In the meantime, a meta-review by Bond et al. (2024) of the synthesis of 66 evidence-based syntheses showed that the most prominent applications were adaptive systems and personalisation, and explicitly recommended an increased attention for ethical, methodological and contextual considerations as well as more interdisciplinary collaboration.

Holmes and Tuomi (2022) provide an explanation for this pattern. They say that teachers' expectations of AI in education are often unrealistic due to misconceptions about what capabilities AI has and a limited definition of what education is about. If learning is seen as the effective delivery of content, the teacher seems like an expense item to be maximised. If education is seen to be a social, developmental and ethical activity, then the teacher is irreplaceable. Similar trends are seen in the recent literature on generative AI. Alfarwan (2025) carried out a K-12 education study of 30 studies, which are uncommonly studied in-service teachers and the absence of rural contexts and students with special needs. Based on a review of 105 studies on teachers and generative AI, the evidence was found to be centered in high resource contexts like China, Turkey, the United States, and Spain (Ayubian et al., 2026). All these reviews imply that AI in education has been largely researched for learners, but not with teachers.

3.2 Complementarity over Substitution

The second theme is that when looking at teachers as such, research has overwhelmingly indicated the complementary nature of the relationship. A systematic review of the research on teachers showed that AI can be used to support teachers in three distinct phases: planning (e.g., student needs identification), implementation (e.g., timely monitoring of learning), and assessment (e.g., automated assessment). (Celik et al., 2022) They also noted persistent concerns including issues of the reliability of AI-generated output, technical capability, and the applicability of AI to diverse classroom contexts. These restrictions do not eliminate the need for teacher judgement, but rather make it necessary.

This is evidenced by design studies. The purpose of the real-time classroom awareness tool for AI-supported classrooms was set as a teacher–AI complementarity where the system would provide information that would not be easily visible to teachers alone and teachers would make the decisions for instruction, as explained by Holstein et al. (2019), who worked with teachers to co-design the tool. Kim et al. (2022) conducted interviews with five leading teachers in the design of the student–AI collaboration, and identified four roles that the teachers played: gatekeeper, pedagogical decision-makers, assessor and creator of a safe-to-fail classroom culture. The authors report that although their sample was small and their results are preliminary, they have found the roles they discuss repeated throughout the literature.

The findings in this context are presented with regard to those of Ouyang and Jiao (2021). They distinguish three paradigms of AIEd: AI-directed (the learner as recipient), AI-supported (the learner as collaborator) and AI-empowered (the learner as leader). There will be no automatic transition from the first paradigm to the third. It demands teachers to create learning activities where students ask questions, adjust and make decisions about the use of AI tools themselves, instead of using the tools and letting AI do all the work.

Specific knowledge is required for teachers to be able to perform these roles. The TPACK framework (Mishra & Koehler, 2006) suggests that the integration of technological knowledge, pedagogical knowledge, and content knowledge is needed to be successful in technology integration. Celik (2023) took this further and added an ethical component to it to give rise to Intelligent-TPACK, which he found that technological knowledge was not enough to review the decisions taken with the use of AI, and that it was useful primarily when integrated with pedagogical knowledge. The stakes are skyrocketed with Generative AI. We believe that the educational potential of LLM will be realized through the development of competencies on how to use them and how they can be used, which will be the responsibility of both teachers and learners, as argued by Kasneci et al. (2023). In this report, which looks at the role of management educators, Lim et al. (2023) characterize generative AI as a paradox of sorts—a friend and a foe, capable and dependent, accessible and restrictive.

This trend is echoed by recent integration of generative AI research that emerged from the field. Based on the analysis of 79 empirical studies of K-12 teachers, Cincioğlu et al. (2026) concluded that a collaborative function is seen as the primary use of generative AI in K-12 education, with instructional design and co-planning being the most salient. The researchers

reported by Ayubian et al. (2026) identified three main predictors of successful integration: AI literacy, pedagogical knowledge, and self-efficacy, while institutional support, PD, trust and teacher autonomy were factors that impact the adoption of AI more than access to technology.

3.3 Ethics: Risks that Fall Unevenly

The third theme is: Ethics of AI in Education; particularly the inequitable distribution of risk. According to Akgun and Greenhow (2022), there are five common ethical concerns: privacy, surveillance, autonomy, bias and discrimination. They illustrate these harms in a real example, such as a 2020 grading system in England, which disadvantaged students from under-represented groups; and they show that these harms are not theoretical, but rather they are real and often associated with learners' identity as they are already disadvantaged. In regard to equity, a systematic review of 53 studies on the ethics and regulation of generative AI in education also cautioned that the digital divide may grow if people are not granted access to these tools, and recommended human oversight of their use and digital literacy (García-López & Trujillo-Liñán, 2025). However, ethical issues are under-represented in research about teachers, as Cincioğlu et al. (2026) found just three of 79 studies. The field of AIEd, according to Holmes et al. (2022) who report on the opinions of the AIEd research community, has no generally agreed-upon ethical guidelines. They argue that the ethics of AI in education must not be confined to the ethics of data and algorithms but extend to the ethics of education, which relates to pedagogical decisions concerning what content, how, and to whom it is being taught. That is the place where teachers are placed. Teachers are the ones who have to see the specific classroom it is deployed in, whereas those who design and sell the AI system seldom do.

Nazaretsky et al., (2022) identified that teachers' trust in the use of AI-powered education technology is a key determinant in its adoption and was found to be impacted by misconceptions and fears about the technology. A professional development programme that helped them understand how the AI had made its decisions and demonstrated that the AI could support, but not supplant, teachers' work helped ease their concerns and boost their trust in the AI. The idea is that the aim should be a mixture of trust and not taking things on faith, nor reacting in the opposite direction. That's the direction taken by Chan's (2023) survey of students and teachers from Hong Kong's universities: teachers were overwhelmingly supportive of the institution's plans for risk management of generative AI, while they were much more worried than students about the overuse of generative AI. Based on this, Chan suggests an AI policy

framework comprising pedagogical and governance and operational aspects. From a policy perspective, UNESCO guidance in the field of generative AI includes recommendations for a human-centred approach, including protection of human agency, data privacy, age limits for the independent use of generative AI tools and investment in teacher and learner capacity building (Miao & Holmes, 2023). It is accompanied by an AI competency framework for teachers that outlines five dimensions: a human-centred mindset, the ethics of AI, AI foundations and applications, AI pedagogy and AI for professional learning at three levels of progression: acquire, deepen and create (Miao & Cukurova, 2024). Both documents assume a capable and informed teacher who will act in response to them in the classroom.

3.4 The Shifting Digital Divide and the Indian Context

The fourth theme is related to access. The concept of 'digital divide' has changed. In an even more connected society as found in the Netherlands, Van Deursen and van Dijk (2019) demonstrate how the topos of inequality have evolved from the physical to material: ranging from the devices people use to the hardware or software maintenance costs, as well as the opportunities those devices afford. The inequalities in digital skills, uses and outcomes are driven by these material differences. This translates to connectivity without inclusion for AI. Using a competent AI application under the guidance of a teacher, with the use of a laptop, will be a vastly different experience than using the same tool with no guidance on a shared mobile phone.

The aspect of these gaps is well-documented in India. Dhawan (2020) noted some of the challenges that COVID-19 forced online learning to face, including unreliable electricity supplies and internet connectivity, particularly in smaller cities, lack of access to devices for students and educators, and the potential for increased device and data costs to exacerbate inequalities. A significant policy response. The National Education Policy 2020 has specific mention of the use of technology and how technology can be integrated into education, there is an explicit mention of it addressing the issue of the digital divide and there is a specific mention of a National Educational Technology Forum to guide the use of technology (MHRD, 2020). However, teacher preparedness for the use of AI is weaker. A bibliometric study of AI research on the digitally empowered teacher revealed that the awareness of teachers in India about AI is still inadequate for the proper implementation of AI-enhanced pedagogy in schools and identified the gap between the researcher's impact on AI in India and other leading

countries in the field (Davis et al., 2024). Recent Indian studies show that the same is true. Razi-ur-Rahim et al. (2026) conducted a survey of 455 faculty members in higher education institutions in India, revealing that perceived usefulness, ease of use, and output quality had a significant impact on faculty intentions for using generative AI, while suggesting hands-on training and institutional support. The study of student volunteers working in rural schools in Rajasthan and Delhi found that infrastructure restrictions, language barriers, and teachers' lack of familiarity with AI limited the ability of teachers to leverage the use of LLM, while teachers viewed AI as complementary rather than a substitute for human teaching (Goyal et al., 2025).

Access is not the only form of literacy needed for inclusion. Ng et al. (2021) conceptualise AI literacy in four aspects: knowing and understanding AI, using and applying it, evaluating and creating with it, and attending to AI ethics. AI tools are new experiences for many first-generation learners and teachers are the only adults who can systematically develop these skills. Together, all the evidence points to the digital divide in AI-powered learning being a divide in mediation—that is, between the learner and the knowledgeable adult.

4. The Teacher-as-Bridge Framework

All four themes come together with one conclusion: AI is not the key to inclusiveness. It impacts on learning and equity through those who create the link between technology and the learner. Based on this insight, the paper offers the following framework, Teacher-as-Bridge (Figure 1 and Table 1). The framework places the teacher in the middle between the capability of AI and inclusive learning outcomes. It identifies four teacher mediating functions and three enabling conditions that enable the mediating functions. **Pedagogical orchestrator –** Teachers determine the contexts, timing and ways in which AI may be used in learning activities, and teachers craft tasks that enable learners to become more active users of AI tools rather than passive users (Holstein et al., 2019; Ouyang & Jiao, 2021). **Ethical gatekeeper –** Algorithms do not make pedagogical judgements and teachers address issues of bias, privacy and age-appropriateness of tools (Akgun & Greenhow, 2022; Holmes et al., 2022). **Trust calibrator –** Teachers demonstrate and encourage trust in AI outputs within an appropriate level, while avoiding the extremes of excessive dependence on AI and blanket rejection (Chan, 2023; Nazaretsky et al., 2022). **Equity broker –** Teachers recognize the learners who do not have access, skills, and confidence, and they cater to this by narrowing down instead of widening the gap in the use of AI (Dhawan, 2020; van Deursen & van Dijk, 2019). All of these roles are

dependent upon supporting conditions. Both teachers and students require AI literacy as captured in the Intelligent-TPACK framework (Celik, 2023) and four aspects of AI literacy (Ng et al., 2021). The policy of any institution should provide explicit direction and freedom for teachers to make decisions (Chan, 2023; Miao & Holmes, 2023). Teachers need something to mediate with – infrastructure (devices, connectivity and technical support) needs to be available. (MHRD, 2020)

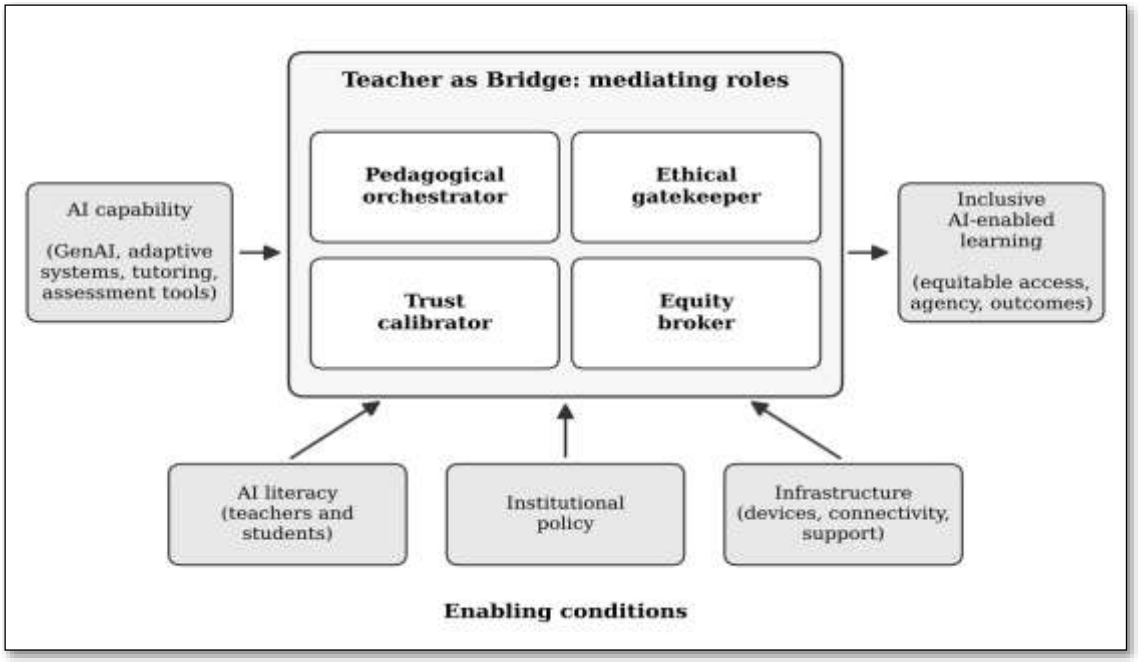


Figure 1. ***The Teacher-as-Bridge Framework***

Table 1. The Teacher-as-Bridge Framework: Mediating Roles and Enabling Conditions

Component	What the teacher does	Key sources
Mediating role 1: Pedagogical orchestrator	Decides where and how AI enters learning; designs tasks that move learners from AI-directed to AI-empowered use	Holstein et al. (2019); Ouyang & Jiao (2021); Kim et al. (2022)
Mediating role 2: Ethical gatekeeper	Screens tools for bias, privacy and age-appropriateness; makes pedagogical judgements algorithms cannot	Akgun & Greenhow (2022); Holmes et al. (2022)
Mediating role 3: Trust calibrator	Models and teaches appropriate trust in AI outputs; guards against over-reliance and rejection	Nazaretsky et al. (2022); Chan (2023)
Mediating role 4: Equity broker	Identifies learners lacking access, skills or confidence; adapts AI use to narrow gaps	van Deursen & van Dijk (2019); Dhawan (2020); Goyal et al. (2025)
Enabling condition: AI literacy	Integrated technological, pedagogical and ethical knowledge for teachers and students	Ng et al. (2021); Celik (2023); Miao & Cukurova

Component	What the teacher does	Key sources
		(2024); Ayubian et al. (2026)
Enabling condition: Institutional policy	Clear guidance on pedagogy, governance and operations; autonomy for teachers	Chan (2023); Miao & Holmes (2023); Razi-ur-Rahim et al. (2026)
Enabling condition: Infrastructure	Devices, connectivity and technical support	MHRD (2020); Dhawan (2020)

Note. Framework developed by the authors from the reviewed literature. Intended outcome: inclusive AI-enabled learning.

The framework yields four propositions for empirical testing:

P1. The positive effect of AI tool use on learning outcomes is stronger when teachers actively orchestrate AI use than when students use AI tools without teacher mediation.

P2. Teachers' AI literacy, including its ethical dimension, is positively associated with the extent to which they perform the gatekeeping and trust-calibration roles.

P3. Teacher mediation moderates the relationship between learners' socio-economic disadvantage and the benefits they gain from AI-enabled learning, weakening the link between disadvantage and lower benefit.

P4. Clear institutional AI policy and adequate infrastructure are positively associated with teachers' willingness and capacity to perform all four mediating roles.

These propositions can be tested through survey-based structural equation modelling of teachers and students, through quasi-experimental classroom studies comparing mediated and unmediated AI use, and through case studies of institutions at different stages of AI adoption.

5. Implications

For teacher education and professional development. If teachers are the bridge, then investing in teachers is investing in inclusion. Professional development should go beyond tool training and build Intelligent-TPACK: the combined technological, pedagogical and ethical knowledge needed to integrate AI responsibly (Celik, 2023). Evidence that explaining how AI reaches its decisions can increase teachers' trust (Nazaretsky et al., 2022) suggests that such programmes should address how AI works, not only how to use it. UNESCO's AI competency framework for teachers (Miao & Cukurova, 2024) offers a ready structure for such programmes, and Indian evidence underlines the need for hands-on training (Razi-ur-Rahim et al., 2026).

For higher education institutions. Institutions should replace blanket bans or unregulated adoption with clear AI policies that address pedagogy, governance and operations (Chan, 2023). Such policies should give teachers the autonomy to decide how AI is used in their courses and should protect time for experimentation. Assessment design deserves particular attention, since generative AI challenges conventional assignments while also creating opportunities to assess process and judgement rather than only the final product (Kim et al., 2022; Lim et al., 2023).

For policymakers. Implementation of NEP 2020's technology agenda should treat teacher capacity as part of the infrastructure, not as an afterthought. Measures of progress should include indicators of teacher AI literacy and of AI use among disadvantaged learners, not only device distribution and connectivity. Following UNESCO's guidance (Miao & Holmes, 2023), policy should keep human agency, data privacy and age-appropriate use at the centre of AI adoption.

For AI developers and technology departments. Tools should be designed *with* teachers rather than *for* them (Holstein et al., 2019). Interdisciplinary collaboration between education, management and computer science faculty, as called for by Bond et al. (2024), can help ensure that AI tools adopted by institutions are pedagogically sound, transparent about their limitations, and usable in low-resource settings.

6. Limitations and Future Research

As a conceptual review, this paper has limitations. The selection of literature was purposive rather than systematic, and other relevant studies may have been missed. Several of the reviewed studies were conducted outside India, so their transferability to Indian classrooms requires empirical confirmation. The evidence base on generative AI in particular is still young and is changing rapidly. Finally, the Teacher-as-Bridge framework is a proposal rather than a validated model. Future research should test the four propositions, develop and validate measures for the four mediating roles, and examine AI adoption in Indian higher education institutions across urban–rural, language-medium and socio-economic divides.

7. Conclusion

The debate about AI in education has too often been framed as a contest between humans and machines. The literature reviewed here suggests a different framing. AI is most valuable when

it augments rather than automates teaching, and its benefits reach the learners who need them most only when a capable teacher stands between the tool and the learner. The Teacher-as-Bridge framework makes this argument explicit by identifying four roles through which teachers make AI inclusive and three conditions that enable those roles. For India, where policy ambition for technology-enabled education is high and gaps in access and teacher preparedness remain, the message is clear: the future of AI in education will depend less on the intelligence of the machines than on the agency of the teachers who use them.

References

Akgun, S., & Greenhow, C. (2022). Artificial intelligence in education: Addressing ethical challenges in K-12 settings. *AI and Ethics, 2*(3), 431–440. https://doi.org/10.1007/s43681-021-00096-7

Alfarwan, A. (2025). Generative AI use in K-12 education: A systematic review. *Frontiers in Education, 10*, Article 1647573. https://doi.org/10.3389/feduc.2025.1647573

Ayubian, S., Aguilar Chávez, G., Wiafe, E., Shahsavari, V., Khamisani, N., Quidwai, N. U. S. S., Simmons, D., Rios, A., Sadique, F., & Clark, J. S. (2026). Teachers and generative AI: A systematic review of adoption, competence, professional development, and socio-technical experiences. *Education Sciences, 16*(9), Article 1501. https://doi.org/10.3390/educsci16091501

Bond, M., Khosravi, H., De Laat, M., Bergdahl, N., Negrea, V., Oxley, E., Pham, P., Chong, S. W., & Siemens, G. (2024). A meta systematic review of artificial intelligence in higher education: A call for increased ethics, collaboration, and rigour. *International Journal of Educational Technology in Higher Education, 21*, Article 4. https://doi.org/10.1186/s41239-023-00436-z

Celik, I. (2023). Towards Intelligent-TPACK: An empirical study on teachers' professional knowledge to ethically integrate artificial intelligence (AI)-based tools into education. *Computers in Human Behavior, 138*, Article 107468. https://doi.org/10.1016/j.chb.2022.107468

Celik, I., Dindar, M., Muukkonen, H., & Järvelä, S. (2022). The promises and challenges of artificial intelligence for teachers: A systematic review of research. *TechTrends, 66*, 616–630. https://doi.org/10.1007/s11528-022-00715-y

Chan, C. K. Y. (2023). A comprehensive AI policy education framework for university teaching and learning. *International Journal of Educational Technology in Higher Education, 20*, Article 38. https://doi.org/10.1186/s41239-023-00408-3

Cincioğlu, O., Mutlu Bayraktar, D., & Altan, T. (2026). Teachers' use of generative artificial intelligence in K–12 education: A systematic review. *Frontiers in Education, 11*, Article 1935733. https://doi.org/10.3389/feduc.2026.1935733

Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education, 20*, Article 22. https://doi.org/10.1186/s41239-023-00392-8

Davis, D., Praveen, G. M., & Gafoor, K. A. (2024). Quantitative insights from research on artificial intelligence for digitally empowered teachers: A bibliometric analysis. *Indian Journal of Educational Technology, 6*(2), 209–218. https://journals.ncert.gov.in/IJET/article/view/429

Dhawan, S. (2020). Online learning: A panacea in the time of COVID-19 crisis. *Journal of Educational Technology Systems, 49*(1), 5–22. https://doi.org/10.1177/0047239520934018

García-López, I. M., & Trujillo-Liñán, L. (2025). Ethical and regulatory challenges of generative AI in education: A systematic review. *Frontiers in Education, 10*, Article 1565938. https://doi.org/10.3389/feduc.2025.1565938

Goyal, H., Garg, G., Mordia, P., Ramachandran, V., Kumar, D., & Challa, J. S. (2025). Thematic insights into the impact of large language models on K-12 education in rural India from student volunteers' perspectives. *Scientific Reports, 15*. https://doi.org/10.1038/s41598-025-18047-1

Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Buckingham Shum, S., Santos, O. C., Rodrigo, M. T., Cukurova, M., Bittencourt, I. I., & Koedinger, K. R. (2022). Ethics of AI in education: Towards a community-wide framework. *International Journal of Artificial Intelligence in Education, 32*(3), 504–526. https://doi.org/10.1007/s40593-021-00239-1

Holmes, W., & Tuomi, I. (2022). State of the art and practice in AI in education. *European Journal of Education, 57*(4), 542–570. https://doi.org/10.1111/ejed.12533

Holstein, K., McLaren, B. M., & Aleven, V. (2019). Co-designing a real-time classroom orchestration tool to support teacher–AI complementarity. *Journal of Learning Analytics, 6*(2), 27–52. https://doi.org/10.18608/jla.2019.62.3

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., … Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences, 103*, Article 102274. https://doi.org/10.1016/j.lindif.2023.102274

Kim, J., Lee, H., & Cho, Y. H. (2022). Learning design to support student-AI collaboration: Perspectives of leading teachers for AI in education. *Education and Information Technologies, 27*, 6069–6104. https://doi.org/10.1007/s10639-021-10831-6

Lim, W. M., Gunasekara, A., Pallant, J. L., Pallant, J. I., & Pechenkina, E. (2023). Generative AI and the future of education: Ragnarök or reformation? A paradoxical perspective from management educators. *The International Journal of Management Education, 21*(2), Article 100790. https://doi.org/10.1016/j.ijme.2023.100790

Miao, F., & Cukurova, M. (2024). *AI competency framework for teachers*. UNESCO. ISBN 978-92-3-100707-1

Miao, F., & Holmes, W. (2023). *Guidance for generative AI in education and research*. UNESCO. ISBN 978-92-3-100612-8

Ministry of Human Resource Development. (2020). *National Education Policy 2020*. Government of India. https://education.gov.in/sites/upload_files/mhrd/files/nep_update/National_Education_Policy_2020_en.pdf

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Nazaretsky, T., Ariely, M., Cukurova, M., & Alexandron, G. (2022). Teachers' trust in AI-powered educational technology and a professional development program to improve it. *British Journal of Educational Technology, 53*(4), 914–931. https://doi.org/10.1111/bjet.13232

Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence, 2*, Article 100041. https://doi.org/10.1016/j.caeai.2021.100041

Ouyang, F., & Jiao, P. (2021). Artificial intelligence in education: The three paradigms. *Computers and Education: Artificial Intelligence, 2*, Article 100020. https://doi.org/10.1016/j.caeai.2021.100020

Razi-ur-Rahim, M., Uddin, F., Chauhan, J., & Faisal, K. P. (2026). GenAI in Indian higher education: Faculty at the crossroads of adoption. *Asian Education and Development Studies, 15*(1), 41–72. https://doi.org/10.1108/AEDS-04-2025-0194

van Deursen, A. J. A. M., & van Dijk, J. A. G. M. (2019). The first-level digital divide shifts from inequalities in physical access to inequalities in material access. *New Media & Society, 21*(2), 354–375. https://doi.org/10.1177/1461444818797082

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education – where are the educators? *International Journal of Educational Technology in Higher Education, 16*, Article 39. https://doi.org/10.1186/s41239-019-0171-0