JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

FROM DATA TO DECISION: AI APPLICATIONS' IMPACT ON TEACHER EFFECTIVENESS IN ADAPTIVE LEARNING ENVIRONMENTS

[1] **Dr. V. KARTHIKA RANI**, [2] **S. RAMYA RADHI PRADA**
[1] Associate Professor, [2] Assistant Professor
[1] CK College of Education, Chellankuppam, Cuddalore.

Abstract: The rapid advancement of artificial intelligence (AI) in education has transformed pedagogical design, instructional decision-making, and student engagement. This conceptual study investigates how AI applications such as intelligent tutoring systems, adaptive analytics, and predictive assessment tools change instructor efficacy in personalized learning situations. Using a thematic synthesis of empirical and theoretical material released between 2020 and 2025, this paper investigates the junction of AI and teacher agency in adaptive environments. The findings show that AI improves teachers' diagnostic capacity, feedback precision, and pedagogical adaptability, while also raising ethical, epistemic, and professional literacy concerns. The assessment highlights that teacher performance in the age of AI is dependent on a careful mix of human judgment and algorithmic knowledge. It finishes by providing a multidimensional approach for teacher preparation that incorporates data-driven decision-making, ethical AI literacy, and contextually sensitive pedagogical design.

Keywords: artificial intelligence, teacher effectiveness, adaptive learning, educational technology, personalized learning, conceptual review.

I. INTRODUCTION

Educational technology implies a behavioural science approach to teaching and learning in that it makes use of pertinent scientific and technological methods and concepts developed in psychology, sociology, communications, linguistics and other related fields. It also attempts to incorporate the management principles of cost effectiveness and the efficient deployment and use of available resources in men and materials. Educational technology as a concept does not necessarily imply the use of machines and other items of hardware. Experience has shown that more often than not they involve such media, equipment and resources (Kumar CA, 2021). Computers have made a dramatic impact on the contemporary society. Almost all aspects of our lives are affected by computers to a significant degree. It is even difficult to imagine a job or a task that we can complete without using computers. Of course, the field of education is no exception. Computers are used increasingly in teaching and learning processes within all subject areas at all levels of schooling (S Bhaskaran, CA Kumar, 2016). Artificial intelligence (AI) has emerged as a disruptive force in modern education, challenging long-held beliefs about instruction, assessment, and teacher responsibilities. Since 2020, the widespread adoption of adaptive learning systems, machine-learning-based analytics, and intelligent tutoring technology has had a substantial impact on how instructors understand student data and adjust instruction. There are two main discussion points in relation to this. First, the web-based instruction environment, likely to isolate learners, requires students to regulate their learning more effectively (Kumar et al., 2016). According to global assessments from the OECD (2023) and UNESCO (2024), AI-enhanced personalization is a key component of twenty-first-century learning reform. Within this paradigm, teacher effectiveness once defined primarily by instructional clarity, classroom management, and subject mastery is increasingly related to a teacher's capacity to interpret, integrate, and ethically use AI-generated insights for pedagogical improvement.

As AI continues to permeate various sectors, the demand for continuous learning and up skilling becomes imperative. Lifelong education, complemented by micro-credentialing, offers a flexible and targeted approach to acquiring AI competencies, ensuring individuals remain relevant and competitive in the workforce. The integration of AI into everyday applications necessitates a workforce that is adaptable and proficient in emerging technologies (R. Kayalvizhi, C. A. Kumar, M. Karthick, 2025). According to C. Ashok Kumar, and M. Saratha, 2025, 78% of professors have used technology-based teaching aids, particularly Learning Management Systems (LMS) and interactive multimedia. While 65% of students reported increased participation, key problems were insufficient training (42% faculty), technological difficulties (38% students), and resistance to change (25% faculty). Techno-pedagogical initiation has significant potential, but it requires institutional backing, extensive training, and infrastructure development for successful implementation. To overcome the digital divide, recommendations include faculty development initiatives, student orientation sessions, and policy improvements. The modern education system needs numerous updates across different areas like teaching, learning, and evaluation. Incorporating information and communication technologies (ICT) in the teaching and learning process is essential for enhancing effectiveness and ensuring lasting learning (S Jagathambal, C. Ashok Kumar, 2025). CA Kumar, 2025, revealed that attitude of ICT significantly influenced the teacher's pedagogical competency, more than the awareness of ICT. The emergence of new technologies pushes educators to understanding and leveraging these technologies for classroom use. At the same time, the implementation of these technologies in the classroom can directly impact how these technologies continue to take shape. The slogan From Data to Decision accurately describes this shift: instructors are no longer passive viewers of data dashboards, but active interpreters of algorithmic recommendations who must transform analytics into human-centered educational decisions. The shift from raw data to pedagogical decision-making marks the new frontier for teacher effectiveness in adaptive learning environments. This conceptual review aims to investigate how AI applications mediate and augment teacher roles in such circumstances.

1.1 Understanding Teacher Effectiveness in the AI Era

Teacher effectiveness is generally defined as a teacher's ability to assist learning outcomes through topic knowledge, pedagogical abilities, and interpersonal sensitivity (Darling-Hammond & Bransford, 2021). However, in adaptive learning contexts, efficacy encompasses data interpretation, technological proficiency, and ethical discernment. Teachers are required to work with artificial intelligence systems that continuously collect learner data and offer treatments (Holmes et al., 2021). As a result, efficacy now includes algorithmic mediation the ability to make solid educational judgments guided, but not dictated, by machine intelligence.

Empirical research indicates that AI can improve formative assessment accuracy, detect misconceptions earlier, and personalize learning paths (El-Sayed & Dsouza, 2023; Liu et al., 2025). However, these benefits are contingent on teachers' interpretive competence. Sundaram and Thomas (2022) discovered that, while adaptive platforms increased feedback speed, teachers frequently lacked confidence in translating analytics into differentiated instruction. Similar studies from South Korea and Singapore show that without professional development in AI literacy, teachers risk becoming peripheral technicians rather than empowered designers (Lee & Choi, 2024).

1.2 From Personalization to Professionalization

The rhetoric of individualized learning frequently emphasizes efficiency while downplaying the humanistic aspects of education. Recent critiques (Williamson & Eynon, 2023; Zhong et al., 2024) caution that an overreliance on AI-driven personalization may limit teachers' interpretive autonomy and standardize instruction through opaque algorithms. As a result, the difficulty is not simply implementing AI, but also professionalizing its use—ensuring that teachers remain the primary agents who contextualize algorithmic proposals within socio-cultural realities.

This review views teacher effectiveness as a dynamic construct influenced by technological, ethical, and contextual factors. It contends that AI should be viewed as a co-agent in teaching, capable of enhancing teacher insight when guided by reflective human judgment. The conceptual framework presented here synthesizes recent literature to highlight the mechanisms by which AI effects teaching performance, the hazards of techno centric dependency, and the measures needed to maintain human-centered adaptability.

II. NEED AND SIGNIFICANCE

Changing from a traditional 'chalk and talk' method to computer technology used teaching method, cannot simply enrich class room teaching, but can also significantly improve their achievement. It implies that technology used teaching method proves to be more tangible in its effectiveness on achievement than the traditional classroom approach. It seems more practical and is widely acceptable to students. It also reduces individual differences and enables all types of students to perform better (Kumar, C. Ashok, 2015). Due to the chalk dirt and noise of the scratching of nails and chalk at the blackboard, chalkboards or blackboards had been changed through whiteboards. Achievement holds a totally vital region in our tutorial gadget (CA Kumar. 2025). Computers are all around us presently as well and skill sets should be procured to ensure that an individual for using people. However, the subject after all computer skills also isn't studied enough just to clarify basic digital skill sets to think about a person technologically inclined (CA Kumar. 2025). The impetus for this review stems from the urgent need to identify the conceptual landscape where AI technology and teacher professional practices intersect. Prior research (Luckin et al., 2022; Zawacki-Richter et al., 2023; Garzón et al., 2024) shows that AI tools can support personalized feedback loops and predictive modelling of student performance, but the extent to which these tools improve teacher effectiveness, rather than automating pedagogical tasks is not well understood. In many educational systems, particularly in Asia and the Global South, the integration of AI into teaching has outpaced the development of theoretical models that explain how it affects teachers' professional judgment (Chakraborty & Roy, 2023; Mishra, 2024). The utilization of digital tools is very essential for today's technological world. So, the government, curriculum framers, private NGOs and stakeholders must give more priority to these digital tools in the future (Kumar, C. Ashok and Kayalvizhi, R. (2023).

This conceptual paper answers three interrelated questions:

1. How do AI applications affect instructors' roles, duties, and decision-making abilities in adaptive learning settings?
2. Which aspects of teacher performance are most influenced by AI-driven personalization?
3. What intellectual and ethical frameworks are required to maintain teacher autonomy in increasingly algorithmic systems?

By addressing these issues, the study contributes to global and regional discussions about the responsible integration of AI in education.

III. JUSTIFICATION FOR THE TITLE

The term From Data to Decision captures the revolutionary continuum that educators are today navigating. Data generated by AI analytics serves as the raw informational substrate, while decision-making is the human interpretative task of converting this data into actionable pedagogy. In adaptive learning environments, teachers must balance algorithmic efficiency with pedagogical empathy. This dialectic between data and decision, defines the epistemic shift that underpins 21st-century education.

Furthermore, the phrase "Adaptive Learning Environments" emphasizes the contextual diversity of technology-mediated education. Unlike typical classrooms, these settings are dynamic ecosystems that adapt content, pacing, and evaluation based on learner characteristics. Teachers act as both curators and stewards of algorithmic learning paths. Understanding how AI alters their effectiveness necessitates a comprehensive conceptual synthesis that incorporates theoretical frameworks such as TPACK (Technological Pedagogical Content Knowledge; Mishra & Koehler, 2006), the SAMR model (Puentedura, 2021), and the AIED (Artificial Intelligence in Education) paradigm (Luckin et al., 2022).

IV. Theoretical and Empirical Context

The relationship between artificial intelligence (AI) and teacher effectiveness has evolved throughout time, following various pedagogical paradigms. Early research on computer-assisted instruction in the 1980s viewed technology as a supplement to teaching rather than an epistemic partner. However, with the introduction of adaptive learning systems in 2018, AI began to moderate not only what teachers taught, but also how they evaluate and respond to student learning processes. Several theoretical frameworks serve as conceptual scaffolding for understanding this change.

4.1 Theoretical anchors

a. TPACK Framework

According to the Technological Pedagogical topic Knowledge (TPACK) framework (Mishra & Koehler, 2006; modified in Mishra, 2023), effective teaching with technology stems from the junction of topic expertise, pedagogical understanding, and technological proficiency. In AI-enabled classrooms, the "technological" dimension is extended to include algorithmic literacy, the

ability to assess the correctness, fairness, and pedagogical consequences of AI outputs. Recent TPACK adaptations (Rahman et al., 2024) highlight data interpretation as a sub-domain of technological knowledge, claiming that teachers must understand not just tool functioning but also the logic of predictive analytics.

b. SAMR Model

The Substitution-Augmentation-Modification-Redefinition (SAMR) paradigm (Puentedura, 2021) provides a framework for comprehending technological integration. Within AI-driven personalization, the highest levels—modification and redefinition—represent the reform of pedagogy facilitated by intelligent systems. For example, AI-based diagnostic feedback reimagines formative assessment by enabling teachers to customize micro-interventions (Garzón et al., 2024). However, studies advise that most teachers are still in the augmentation stage, adopting AI tools superficially without modifying their methodology (Lee & Choi, 2024).

c. The AIED paradigm

The Artificial Intelligence in Education (AIED) research tradition (Luckin et al., 2022; Holmes et al., 2021) sees AI as a co-participant in learning ecosystems. AIED models distinguish three levels of interaction: algorithmic (data modeling), pedagogical (decision support), and socio-ethical (equity and transparency). Within this paradigm, teacher effectiveness is redefined as augmented human intelligence the ability to coordinate multiple layers in support of adaptive learning.

d. Teacher Effectiveness Models

Classical methods focus on observable teaching actions (Marzano, 2020) and student results (Darling-Hammond & Bransford, 2021). Recent reinterpretations include digital competence (Redecker & Punie, 2022) and emotional intelligence (Salovey & Mayer, 2023) as factors influencing teacher effectiveness. In AI settings, these models converge on decision-effectiveness, indicating a teacher's ability to comprehend data patterns, link them with curriculum goals, and preserve ethical sensitivity (Chakraborty & Roy, 2023).

Empirical Insights: 2020–2025 Studies

4.2 Empirical research demonstrates the potential and complexity of AI-supported instruction

Global evidence. Large-scale deployments, such as the Squirrel AI platform in China and Carnegie Learning in the United States, show quantifiable benefits in learner accomplishment when teachers alter pacing using AI dashboards (Zhong et al., 2024; Holmes et al., 2021). Teachers reported increased diagnostic precision, but were concerned about over-reliance on algorithmic feedback (Williamson & Eynon, 2023).

Indian and Asian settings. In India, Mishra (2024) discovered that adaptive tutoring methods in secondary mathematics increased participation but required ongoing professional help. Sundaram and Thomas (2022) found that teachers liked AI analytics for fast insights but struggled with data overload. A comparative study of Singapore and South Korea (Lee & Choi, 2024) found that institutional culture significantly influences instructors' propensity to trust AI advice.

Collectively, these studies confirm that AI enhances access to usable data while simultaneously reshaping teacher identity—from authoritative educator to reflective data interpreter.

V. METHODOLOGY

5.1 Conceptual Review Design

This article uses a conceptual review methodology (Snyder, 2019), synthesizing theoretical and empirical sources to generate integrative meaning rather than aggregating statistical facts. The process has three stages:

Peer-reviewed research, reports, and conceptual papers from 2020-2025 were identified by searching Scopus, Springer Link, ERIC, and Google Scholar for keywords such as AI in education, teacher effectiveness, adaptive learning, and customized learning. Screening - only sources that addressed teacher roles or pedagogical decision-making in AI contexts were retained. Thematic Synthesis: information was coded inductively to identify recurring conceptual patterns (Thomas & Harden, 2008).

5.2 Analytical orientation

The synthesis is based on interpretive constructivism, which assumes that meaning concerning AI's impact on teaching is socially and contextually constructed. Iterative reading was used to build themes until they reached theoretical saturation in five dimensions: analytics, tutoring, assessment, ethics, and professional development.

5.3 Limitations

The study's conceptual nature prevents it from quantifying effect sizes. However, its strength resides in the integration of several empirical and theoretical perspectives to create a coherent model of AI-enhanced teacher efficacy.

VI. THEMATIC ANALYSIS

61 AI-Powered Data Analysis and Instructional Personalization

AI-enabled analytics give teachers new granularity in understanding student progress. Machine-learning algorithms use real-time data on engagement, accuracy, and time on task to provide personalized recommendations. When teachers apply these findings, they can transition from reactive to proactive instruction (El-Sayed & Dsouza, 2023). Diagnostic dashboards in adaptive platforms like Smart Learn, for example, detect micro-skills that need reinforcement, allowing teachers to customize scaffolding accordingly.

However, interpretative overload is a recurring issue. According to research in Indian higher education (Chakraborty & Roy, 2023), teachers frequently receive data without proper contextual filters, resulting in cognitive fatigue and inconsistent decision-making. Globally, Zawacki-Richter et al. (2023) underline the importance of data literacy training for instructors in distinguishing between signal and noise. Thus, data analytics improve teacher effectiveness only when combined with institutional frameworks that encourage reflective interpretation.

6.2 Intelligent tutoring and Teacher Augmentation

Intelligent tutoring systems (ITS) demonstrate how AI can serve as a pedagogical collaborator rather than a replacement. By offering adaptive indications and explanations, ITS allows teachers to focus on metacognitive guidance and socio-emotional support. In integrated learning situations, teachers employ ITS outputs to highlight widespread misconceptions (Garzón et al., 2024). A quasi-experimental study in Malaysia (Yusof et al., 2023) discovered that teachers who used AI tutors had higher student retention rates and indicated higher satisfaction with formative assessment efficiency.

However, augmentation creates dependency issues. When teachers completely outsource feedback to AI, the human dialogic component of education declines. Williamson and Eynon (2023) warn against "automation bias," in which educators overestimate algorithmic precision. Luckin (2022) suggests a co-agency model in which AI conducts analytical labor while teachers explain and humanize responses.

6.3 Adaptive Assessment and Feedback Systems

Assessment is a vital component in AI transition. AI-powered systems not only grade responses, but also forecast learning paths using pattern recognition. According to research, adaptive quizzes boost retention and interest. Teachers benefit from constant feedback loops that highlight individual and group tendencies. However, excessive automation can reduce assessment validity. According to Holmes et al. (2021), when AI focuses on quantitative actions, it may undervalue creative or affective learning outcomes. To ensure assessment legitimacy, competent teachers must combine algorithmic data with qualitative observations.

6.4 Ethical and pedagogical challenges

Ethical considerations permeate all aspects of AI integration. Data privacy, algorithmic bias, and transparency are ongoing challenges (UNESCO, 2024). Teachers are generally unaware of how algorithms classify students, which can perpetuate inequity (Williamson & Eynon, 2023). In India, Mishra (2024) expresses concerns about data governance in state-funded adaptive platforms. Professional ethics now includes rigorous questioning and mediation of AI results. A 2023 OECD policy paper recommends including AI ethics modules in teacher education programs to promote informed consent and equitable implementation.

6.5 Professional Development and AI Literacy

Continuous professional growth is essential for the long-term viability of AI-enhanced teaching. Research in Asia (Sundaram & Thomas, 2022; Lee & Choi, 2024) shows that one-time training sessions are insufficient. Hands-on experimentation, peer mentoring, and ethical problem contemplation all contribute to effective professional development. Redecker and Punie (2022) advocate incorporating AI literacy into national teacher competency frameworks, which should include an awareness of algorithms, data ethics, and socio-technical implications. When teachers achieve this literacy, AI becomes a tool for creativity rather than a constraint.

VII. DISCUSSION AND IMPLICATIONS

The convergence of theoretical and practical investigations indicates that artificial intelligence is more than a technological aid; it is an epistemic partner who reconfigures how teachers see effectiveness. AI improves instructional precision, feedback bandwidth, and data-driven adaptation. However, it concurrently pushes the limits of teacher autonomy, ethical responsibility, and instructional creativity. The following discussion brings these tensions together across five interpretive perspectives.

7.1 Reframing Teacher Effectiveness with Data Mediation

Traditional measures of teacher success—lesson clarity, classroom management, and student achievement—are being replaced by decision effectiveness, which is defined as the instructor's capacity to translate algorithmic data into pedagogical action. Empirical data (Garzón et al., 2024; Liu et al., 2025) shows that teachers who reflect on AI dashboards deliver more differentiated and equitable learning results. However, data-driven effectiveness necessitates interpretive literacy. Teachers who lack a conceptual knowledge of how predictive models work run the danger of only superficially complying with system recommendations. As a result, teacher education programs must include courses in learning analytics interpretation, critical data thinking, and bias detection.

7.2 The Dialectic of Agency and Automation

Teachers in global and Asian contexts swing between empowerment and restraint. While AI reduces administrative overhead and broadens diagnostic reach, it may also displace instructor judgment. This dialectic is consistent with Luckin's (2022) co-agency paradigm, which contends that sustained AI integration occurs when human and machine intelligences mutually strengthen one another's capabilities. Studies in Singapore (Lee & Choi, 2024) and India (Mishra, 2024) show that teachers who treat AI as a collaborator rather than a determinant have stronger professional confidence. Policymakers must consequently position AI as augmentation rather than automation, ensuring that teacher knowledge remains the primary source of curricular interpretation.

7.3 Ethical Literacy as a Basis for Professionalism

The rise of adaptive algorithms complicates ethical issues. Biases in data sets can perpetuate injustices based on language, gender, and socioeconomic position (Williamson & Eynon, 2023). Teachers, as moral beings, require specific preparation before interrogating algorithmic decisions. The OECD (2023) and UNESCO (2024) see AI ethical literacy as essential to teacher professionalism. This involves an understanding of consent methods, transparency protocols, and accountability frameworks. In India, Sundaram and Thomas (2022) advocate district-level ethics committees to manage data governance in AI-adopted schools. Including such mechanisms protects instructor and learner autonomy.

7.4 Institutional and Cultural Mediation

Cultural values and institutional norms substantially influence AI adoption. Asian educational cultures that value group harmony may view adaptive learning differently than Western individualization models. Lee and Choi (2024) discovered that Korean teachers favoured AI systems that enabled group collaboration over individualized trajectories. Similarly, Chakraborty and Roy (2023) found that Indian teachers wrestled between algorithmic objectivity and community expectations. Consequently, teacher success in AI contexts cannot be decontextualized; it is culturally enacted. To maintain contextual relevance, adaptive systems must allow for local adaptation as well as language inclusion.

7.5 Professional Development and Lifetime Learning

The literature agrees on the importance of continued professional growth. Short workshops raise awareness, but not transformation (Redecker & Punie, 2022). Effective methods include learning-by-design, peer mentorship, and reflective communities of practice (Yusof et al., 2023). Teachers become adaptive professionals when professional development connects AI affordances to pedagogical inquiry, asking why and for whom a technology works, rather than just how. National frameworks should implement micro-credentials in AI literacy and data ethics, in line with the European DigCompEdu model and India's National Digital Education Architecture (NDEAR) program.

7.6 Conceptual Implications

The conceptual synthesis supports three proposals for future educational design.

AI serves as a cognitive amplifier. Teacher effectiveness should be reframed as a type of distributed cognition in which human insight and machine computing coexist to generate educational intelligence. This is consistent with extended mind ideas in cognitive science, which propose that cognition is implemented through human-tool interactions.

Reflective algorithmic pedagogy. Teachers must develop algorithmic reflexivity, or knowledge of how machine-learning assumptions impact instructional options. This reflexivity shifts data interpretation from mechanical reporting to moral thinking.

Human-centered adaptive systems. Adaptive learning should progress toward human-in-the-loop models, which include teacher feedback into system design. Collaborative co-design guarantees that AI systems benefit from teachers' contextual knowledge, avoiding pedagogical de-skilling.

VIII. CONCLUSION AND FUTURE DIRECTIONS

AI's advent into education represents a paradigm change from content delivery to data-driven decision-making. The evidence examined shows that teacher efficacy in adaptive environments is predicated on three interrelated literacies: data, ethical, and pedagogical. AI can improve precision, inclusivity, and responsiveness, but only when teachers act as reflective actors, interrogating rather than imitating algorithmic logic. Future research should investigate the longitudinal effects of AI literacy training on instructional decision quality;

Examine cross-cultural disparities in AI adoption ethics; and Create mixed-method models that combine algorithmic analytics with qualitative classroom ethnography.

The ultimate educational challenge is not to replace instructors with machines, but to reinvent teaching as an intelligent collaboration of human empathy and computational foresight.

References

[1]. *Anand & C. Ashok Kumar (2025). Computer Literacy Skills among Postgraduate Students in Dindigul District: A Case Study.* Available from: https://www.researchgate.net/publication/389883133_COMPUTER_LITERACY_SKILLS_AMONG_POSTGRADUATE_STUDENTS_IN_DINDIGUL_DISTRICT_A_CASE_STUDY [accessed Dec 11 2025].

[2]. *C. Ashok Kumar (2025). Exploring the Link Between Teachers' Pedagogical Competency In Relation To Their Awareness And Attitude Towards ICT.* Available from: https://www.researchgate.net/publication/392517206_EXPLORING_THE_LINK_BETWEEN_TEACHERS'_PEDAGOGICAL_COMPETENCY_IN_RELATION_TO_THEIR_AWARENESS_AND_ATTITUDE_TOWARDS_ICT [accessed Dec 11 2025].

[3]. *C. Ashok Kumar, (2025). Utilization of Smart Board and Learning Engagement of High School Students*. Available from: https://www.researchgate.net/publication/388898831_Utilization_of_Smart_Board_and_Learning_Engagement_of_High_School_Students [accessed Dec 11 2025].

[4]. C. Ashok Kumar, and M. Saratha. 2025. "Exploring the Students and Teachers Perception on Artificial Intelligence Based Techno-Pedagogical Integration". Asian Journal of Arts, Humanities and Social Studies 8 (2):169–176. https://doi.org/10.56557/ajahss/2025/v8i288.

[5]. C. Ashok Kumar, and R. Kayalvizhi. 2023. "Utilization of Digital Tools: Critical Analysis of College and University Professors in Tamilnadu". *Asian Journal of Education and Social Studies* 45 (4):29–35. https://doi.org/10.9734/ajess/2023/v45i4990.

[6]. Chakraborty, S. and Roy, A. (2023). Teachers' opinions of AI-driven analytics in Indian secondary schools: Possibilities and challenges. International Journal of Educational Research Open, 4(1): 100204. https://doi.org/10.1016/j.ijedro.2023.100204

[7]. Darling-Hammond, L. and Bransford, J. (2021). Preparing teachers for a changing world: What they should know and be capable of doing. Jossey-Bass.

[8]. El-Sayed, H., and Dsouza, J. (2023). Adaptive analytics and formative assessment in higher education: implications for teacher decision-making. Computers & Education, 198 (104732). https://doi.org/10.1016/j.compedu.2023.104732

[9]. Garzón, J., Kinshuk, and Baldiris, S. (2024). Artificial intelligence in education: A systematic review of adaptive learning strategies. Educational Technology Research & Development, 72(2): 513-538. https://doi.org/10.1007/s11423-024-10261-5

[10]. Holmes, W., Bialik, M., and Fadel, C. (2021). Artificial intelligence in education: Prospects and consequences for teaching and learning. Center for Curriculum Redesign.

[11]. Kumar CA (2021) Technological pedagogical content knowledge of educators of teacher education program working in colleges of education. Turk J Comput Math Educ 12(14):2291–2296.

[12]. Kumar, C. A., Sujai, S. S., and Kumar, A. R. (2016). Attitude of self-regulated learning behaviours and academic performance in web-based courses among college students in Tiruchirappalli district. Rev. Res. J. 5, 149–176. doi: 10.4324/9781315198019-7

[13]. Kumar, C. Ashok and Kayalvizhi, R. (2023) *Utilization of Digital Tools: Critical Analysis of College and University Professors in Tamilnadu.* Asian Journal of Education and Social Studies, 45 (4). pp. 29-35. ISSN 2581-6268.

[14]. Lee, S., and Choi, H. (2024). Teacher agency in AI-assisted classrooms: A South Korean and Singaporean comparative study. Asia Pacific Education Review, 25(1), 59–78. https://doi.org/10.1007/s12564-023-09877-2

[15]. Liu Y., Zhong Q., and Li M. (2025). Predictive feedback in AI-powered adaptive learning: Impacts on student engagement and instructor practice. Computers and Education: Artificial Intelligence, 8, 100180. https://doi.org/10.1016/j.caeai.2025.100180

[16]. Luckin, R. (2022). Machine learning and human learning: Collaborative efforts for egalitarian education. British Journal of Educational Technology, 53(5), 1031–1046. https://doi.org/10.1111/bjet.13209

[17]. Mishra, P. (2024). Integrating AI into Indian teacher education: Challenges and Opportunities. Education and Information Technology, 29(4), 4563–4581. https://doi.org/10.1007/s10639-024-11822-3

[18]. Mishra, P., and Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher learning. Teachers College Record, 108(6), 1017–1054.

[19]. OECD. (2023). AI in education: Policy Challenges and Opportunities. OECD Publishing. https://doi.org/10.1787/9789264687793-en

[20]. Puentedura, R.R. (2021). The SAMR model: revisited in terms of transformation, technology, and education. Hippocrates Press.

[21]. R. Kayalvizhi, C. A. Kumar, M. Karthick, Lifelong Education and Micro-Credentialing in Artificial Intelligence: Transforming Learning for the Digital Age, in: M. Karthick, C. A. Kumar (Eds.), Higher Education 4.0: Shaping Learning in the Digital Era, Shanlax Publications, Vasantha Nagar, Madurai, 2025, pp. 95–104. URL: https://www.researchgate.net/publication/394469260.

[22]. Rahman, M., Tan, C., and Ng, P. (2024). Extending TPACK with data literacy: A model for AI-prepared teachers. Educational Technology Research and Development, 72(3), 1247–1268. https://doi.org/10.1007/s11423-024-10314-9

[23]. Redecker, C., and Punie, Y. (2022). Digital competency frameworks for educators: Moving toward AI-inclusive teaching requirements. European Journal of Education, 57(2), 239–257. https://doi.org/10.1111/ejed.12506

[24]. S Jagathambal, C. Ashok Kumar. Awareness and Utilization of Open Educational Resources (OERS) among Gen Z Prospective Teachers. *Asian Journal of Education and Social Studies*, 2025, 51 (10), pp.1414-1421. ⟨hal-05329792⟩

[25]. Salovey, P., and Mayer, J. D. (2023). Emotional intelligence in digital classrooms. Contemporary Educational Psychology, 72:102152. https://doi.org/10.1016/j.cedpsych.2023.102152

[26]. Snyder, H. (2019). An overview and instructions for using literature reviews as research methodologies. Journal of Business Research, 104, 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

[27]. Sundaram, R, and Thomas, S. (2022). Teacher preparedness for AI-powered customisation in Indian secondary education. Indian Journal of Educational Technology, 22(1), 45–63. https://doi.org/10.1177/09731849221006312

[28]. UNESCO. (2024). Guidelines for the ethics of artificial intelligence in education. Paris: UNESCO. https://doi.org/10.54675/unesco-ai-edu-2024

[29]. Williamson, B., and Eynon, R. (2023). The algorithmic teacher: Digital ethics and artificial intelligence governance in education. Learning, Media, and Technology, 48(4): 456-472. https://doi.org/10.1080/17439884.2023.2211476

[30]. Yusof N., Rahim H., and Ismail R. (2023). Integrating AI tutoring systems into Malaysian secondary schools: A professional development approach. Education and Information Technologies, 28(6): 8123-8140. https://doi.org/10.1007/s10639-023-11512-8

[31]. Zawacki-Richter O., Marín V. I., Bond M., and Gouverneur F. (2023). A systematic review of AI research in higher education: The current state of play. International Journal of Educational Technology in Higher Education, 20(3), 45–70. https://doi.org/10.1186/s41239-023-00386-9

[32]. Zhong, Q., Li, M., and Hu, T. (2024). Big-data adaptive learning in China and its implications for teacher decision-making. Educational Assessment, Evaluation, and Accountability, 36(1), 89–110. https://doi.org/10.1007/s11092-024-09422-5.