ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25aug1498

A Study of Interdisciplinary Approaches to Artificial Intelligence in Curriculum Development

Ejuchegahi A. Angwaomaodoko[1]

[1]Kean University

[1]ORCID: 0009-0001-6300-2017

Publishing Date: 2025/11/29

Abstract: The question that drives this study is to understand the interdisciplinary practices that are at play with the introduction of Artificial Intelligence (AI) into curriculum development. As AI changes society, education needs to look beyond technical skills, teaching skills such as ethics, the perspective of the humanities and realism. Driven by mechanisms like critical thinking, T-shaped learning and socio-technical systems, it presents a multilayered curriculum model, which integrates fundamental AI knowledge, domain-based application, ethical reflection, institutional support and inclusive assessment. The cases of Finland, the United States, and Nigeria exhibit both successes and challenges in the realms of teacher preparation, infrastructure, and alignment of policy context. Practical implications are related to skills building, intersectoral cooperation and ethical governance. The paper also provides indications of how future research could be conducted on long-term AI literacy, international curriculum comparison, and teacher participation. These results ultimately encourage a paradigm change for AI education, where we educate the graduates who are not only technically proficient but also ethically and socially accountable in the AI dominant world.

Keywords: *Artificial Intelligence, Interdisciplinary Curriculum, Ethics in Education, Teacher Development, Computational Thinking.*

How to Cite: Ejuchegahi A. Angwaomaodoko (2025) A Study of Interdisciplinary Approaches to Artificial Intelligence in Curriculum Development. *International Journal of Innovative Science and Research Technology*, 10(8), 3324-3330. https://doi.org/10.38124/ijisrt/25aug1498

I. INTRODUCTION

The rapid deployment of Artificial Intelligence (AI) application has dramatically revolutionized industries, in terms of medical/health care, finance, education, and art, which urgently calls for the reeducation of AI application to the global education system. Computational Thinking is not limited to computer science departments; it has rather been described as a fundamental skill that is akin to literacy and numeracy and is necessary to succeed in the knowledge economy of the 21st century (Luckin et al., 2019; Holmes et al., 2021). New research supports an argument for multidisciplinary AI education such that ethical issues, social impacts, and real-world application could become core curriculum areas outside of the STEM disciplines (Touretzky et al., 2019). The infusion of AI in interdisciplinary fields including the humanities and social sciences enables the critical investigation of algorithmic bias, digital panopticism, and data privacy, all critical to civic participation in digitally driven societies (Hua et al., 2023). This re-orienting of training from mere technical to cross-cutting engagement develops students that are technically competent, ethically and socially sensitive.

The European Commission and institutions such as UNESCO have stressed the need to include AI literacy as an essential skill in education systems (UNESCO, 2021). There have been successful pilot programmes in countries, such as Finland, United Kingdom and Singapore embedding AI in all subjects both at secondary and tertiary levels (Zawacki-Richter et al., 2019; Ali et al., 2022). These multi-disciplinary models draw on computational thinking, data literacy, and collective problem-solving to develop a future workforce ready for the challenges of AI-fueled change. This article therefore examines how transdisciplinary units can promote not technological literacy, but also critical and reflective thinking.

➢ *Aim and Objectives of the Study*

The aim of the study is to explore interdisciplinary approaches to integrating artificial intelligence in curriculum development and assess their educational, ethical, and institutional implications.

➢ *Objectives:*

- To examine the rationale and urgency for embedding AI education across multiple academic disciplines.

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25aug1498

- To review and analyze existing models and case studies of interdisciplinary AI integration in various educational contexts.
- To identify common challenges and barriers, including teacher preparation, equity, and ethics, associated with AI curriculum development.
- To propose a conceptual framework for an interdisciplinary AI curriculum model that balances foundational knowledge, applied domain relevance, and critical reflection.
- To outline practical recommendations for educators, policymakers, and institutions on implementing and sustaining interdisciplinary AI curriculum innovations.

II. THEORETICAL FRAMEWORKS

➢ *Computational Thinking Across Disciplines*

CT includes processes such as abstraction, decomposition, algorithmic thinking, and pattern recognition; skills that were first identified and developed in the space of computer science, but that have since been recognized as increasingly relevant across domains (Wing, 2006; Grover, & Pea, 2013). CT is now considered as a fundamental skill that crosses disciplines and allows humanity, scientist and artist learners to think methodically and deals with complex problems like computer logic (Barr & Stephenson, 2011; Grover, 2013). Curriculum frameworks recommend its integration in the following non-CS topics such as history, economics and language arts to support algorithmic thinking and computer-based creativity (Wing, 2006; Voogt et al., 2015). In terms of AI curriculum infusion, CT serves as a vehicle to integrate AI reasoning—e.g., data modeling and automation—into domain-driven instruction. This develops a certain level of interdisciplinary fluency for students that isn't simply groking one of the standard ML buzzword names infilling, and as such students can approach AI tools insightfully and flexibly in fields outside of traditional computer science courses.

➢ *T-Shaped Learning Models*

T-shaped model learning prioritizes depth in at least one discipline (the "stem" of the T) while maintaining the ability to apply knowledge and skill in many other sectors (the "crossbar"). From an AI in curriculum perspective, this means strong technical proficiency in AI algorithms and software, as well as expertise in ethics, communication and domain knowledge (Lesko, 2009; Zhang et al., 2023). Educators claim AI practitioners need expertise beyond machine learning and coding include awareness of societal impact, domain specific hurdles, and cross disciplinary contributions (Jaiswal et al., 2024). But when it comes to teaching students to innovate AI solutions in domains like health, law, education, and to talk with, partner with, and learn from other sectors, we need a curriculum that can accommodate T-shaped learners. The approach is in line with industry needs for multidisciplinary practitioners who are able to responsibly apply AI to challenging real-world problems.

➢ *EduTech and Technology Acceptance Models*

The Technology Acceptance Model (TAM) explains user adoption of technological innovations in view of perceived usefulness and ease of use (Davis, 1989). In the context of EduTech, deliberate extensions include pedagogical beliefs and teacher preparedness. Recent research suggests that the integration of AI by instructors depends not only on the tools' affordances, but also on instructors' self-efficacy, pedagogical alignment, and beliefs in its value to improve student learning (Kizilcec, 2024). In cross-disciplinary AI integration, TAM further suggests that training should not only aim to improve educators' belief in AI's educational benefits—e.g., personalized learning or creativity support—but also to use AI tools effectively. Additionally, the degree of institutional support, the degree of clarity of the curriculum, and the degree to which it is respected for its anticipated contribution to teaching goals can improve acceptance (Radhakrishnan & Chattopadhyay, 2020). By integrating TAM perspectives in course design, curriculum developers are able to shape the support for teacher adoption. This will be a proactive means of ensuring that interdisciplinary AI integration is pedagogically feasible and contextually situated.

➢ *Ethics and Socio-Technical Perspectives*

Teaching AI in an ethical and socio-technical manner ensures graduates to know how AI works, and what it means for society (Siemens, 2021). Critical pedagogy also teaches students to challenge algorithmic bias, data privacy and power asymmetry in AI systems (Mittelstadt, 2019). Interdisciplinary approaches have provided scope for legal, sociological, philosophical, and humanities perspectives that challenge how AI governance, fairness, and interventions may be understood in the context of their impact on society (Maher & Tadimalla, 2024). AI projects in healthcare, environment or education could involve the use of frameworks for ethical reflection, participatory design and case analysis. This approach is inspired from socio-technical systems theory which claims that technical innovation is entangled with social norms, rules, and values. In the end, socio-technical AI pedagogies teach students to become critically engaged practitioners with the capacity to responsibly design AI inclusively in dynamic and complex societal environments.

III. AI INTEGRATION MODELS

➢ *Disciplinary Core + AI Layer*

Embedding AI in classical fields enables deeper learning around application domains. For instance, physics students might use machine-learning models to forecast physical events, and literature courses could utilize sentiment-analysis algorithms to extract themes from text. Chen, Lin et al. (2020) note that embedding AI in courses like language arts sharpen critical thinking capabilities and analytical skills. This approach maintains disciplinary depth but enhances it with practical AI tools. It does not treat AI as a distinct subject but rather strong tier that reinforces and extends the content found in the existing core.

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25aug1498

- *Standalone AI Coursework + Cross-Domain Projects*

This model involves basic AI education and interdisciplinary project work. Students start by learning algorithms, data structures, and ethical issues in AI-focused classes. They then apply these in capstone projects across domains — e.g., building AI for journalism, writing bots for language study or bioinformatics tools in biology. Park et al. (2022), explains it as such a format scales technology proficiency and domain specificity while coaching problem-solving, teamwork, and domain political acuity. By combining depth in techniques with cross-disciplinary application, students are trained to create versatile and socially responsible AI.

- *AI Across the Curriculum*

The "AI across the curriculum" model integrates AI literacy into every subject. Instead of sectioning off AI to particular subjects, teachers have incorporated AI exercises — like using chatbots in language classes or machine-learning in social studies. Walter (2023) proposes scaffolded, school-wide AI teaching beginning with fundamental AI concepts and progressing to applied practice. This is so that no students later claim AI competences naturally, due to AI's pervasiveness in real-life environments. This integrated approach crosses STEM and non-STEM disciplines and increases digital literacy, critical thinking, and ethics.

IV. CASE STUDIES

This section examines three interdisciplinary AI curriculum initiatives—in higher education and K–12—to understand implementation models, outcomes, and challenges across different contexts.

- *MIT xPro Micromasters + Domain Projects*

MIT xPro's MicroMasters program embeds AI modules across industry-specific programs, including AI-augmented finance or health sciences. Participants describe significant gains in digital fluency, in awareness of algorithmic use, and in collaborative capabilities (Long & Magerko, 2020). But the faculty are struggling to adapt, they need focused professional development to synergize AI and content (VanBrummelen & Lin, 2020).

- *Finland's K–12 AI Modules & Teacher Professional Development*

Pilots of AI modules that are embedded within the K–12 curriculum are also being undertaken by the Finnish Ministry of Education with substantial teacher PD programmes. Preliminary evaluations showed that together with AI literacy students and teachers also critically engaged with ethical aspects such as bias in algorithms, transparency in data and societal impact (Finnish National Agency for Education, 2023). However, resource fragmentation and spatial inequities in PD uptake have hitherto impeded scaled implementation.

- *University of Lagos—AI-Infused Undergraduate Science Curriculum*

At the university level in Lagos, a science curriculum has been infused with AI, incorporating strong disciplinary foundations as well as machine learning and data visualization. It is observed that students are more engaged, understand better the concept and are good at problem-solving (Ajayi & Ogunleye, 2021). However, persistent infrastructure challenges, including unreliable internet access and lack of computational resources, remain bottlenecks for adoption, in particular at lab courses.

V. THEMES AND CHALLENGES

- *Teacher Preparation*

For the integration of AI in curricula to be successful, both technology competences and pedagogical preparations among teachers are needed. There are many teachers who do not have formal education in AI, and who are not digitally fluent. Ahlam Mohammed Al-Abdullatif (2024) underscore that, in order for teachers to feel confident including AI in class activities, teacher training will have to focus not only on technical tools, but also on the understanding of the concepts that can be leveraged for their students. There are no data to answer this question, and the OECD (2023) further reports that less than 10 per cent of higher education institutions worldwide has formalised guidance or training concerning AI integration, so fundamental are the gaps in institutional readiness. As AI advances, so should teacher skills, including regular and continuous teacher professional development programs.

- *Assessment Design*

Regular testing like multiple-choice tests is not likely able to measure the higher order thinking skills necessary for AI literacy, including algorithmic reasoning and moral decision-making. Chen, and Taylor (2024) maintain that AI in education calls for new methods of assessment, such as problem solving in context, portfolios of projects, and team work. Institutions such as the University of Alberta are already investigating how generative AI could force a rethink about assessment markers. This transition requires not just the technical tools but a philosophical re-envisioning of which learning goals really matter in the age of AI.

- *Equity and Access*

AI infusion may exacerbate the existing educational inequalities if it is not guided by explicit policies to promote an equal access. Furthermore, despite the increasing use and presence of digital devices, digital divides in access to infrastructure and AI education persist, particularly between high-income and low-income areas (UNESCO, 2023). Rural schools, for instance, frequently don't have devices or trained staff. Additionally, AI tools tend towards Western-centric cultural values that alienate non-dominant students. Such being the case, equity should be at the center of curriculum reforms, focus on investments in the under-resourced communities and the inclusivity of the content should be considered.

- *Ethics*

Bringing AI to education is all the more complicated due to the ethical issues involved. Those sorts of concerns that is: algorithmic bias, data privacy, surveillance, are important for curriculum designers to take up. Mittelstadt (2019) writes

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25aug1498

that ethical AI guidelines usually don't work in practice because they're undetermined or unenforceable at application-level. Buolamwini's (2018) investigation into intersectional bias in facial recognition systems, demonstrating significantly higher misclassification rates for darker-skinned women compared to lighter-skinned men underscores the real-world implications of unchecked AI and highlights the urgency for AI education that bridges technical literacy with ethical awareness (Buolamwini & Gebru, 2018).

VI. PROPOSED INTERDISCIPLINARY CURRICULUM MODEL

➢ *Foundational Layer: Core AI Concepts*

The Foundational Layer which is necessary for competence, includes the absolute basics of computing – data structures (like trees, graphs), algorithms (searching, sorting, optimization), statistics, probability and basic machine learning. These foundations underpin the development and deployment of robust AI systems. Classics such as Russell and Norvig's (2020) Artificial Intelligence: A Modern Approach persist (as do institutions, with the MBZUAI's undergraduate AI program foregrounding modules in algorithms and data structures for applied AI use, MBZUAI, 2024). Ensuring students are grounded in these technical foundations allows them to then progress to the domain-specific integration and critical thinking areas of an AI development process.

➢ *Integration Layer: Applied Domain Modules*

The integration layer subjects AI to concrete issues by way of domain-specific, practical modules like predicting yields for agriculture, discourse-based literary analysis, and economic forecasting. These are also project-based experience, which were similar to the cloth of the Elements of AI course seeks to combine foundation theories and real-world applications in all sector (Finnish Ministry of Economic Affairs and Employment, 2019). In K–12 contexts, 'unplugged' pedagogies make AI education accessible to non-specialists (Long & Magerko, 2020). At the tertiary level AI is taught more and more through cross-discipline collaboration with agriculture, health and finance departments (Ajayi & Ogunleye, 2021). It is the layer that brings AI closer to home. AI in the familiar It is about embedding AI into things we know, love and trust: it is about relevance, deep engagement, and practical understanding.

➢ *Critical Reflection Layer: Societal Impact, Ethics & Governance*

Ethical thinking, social implications and governance are an integral part of the technical curriculum in Critical Reflection. Institutions like Harvard University have developed programs such as Embedded Ethics at Harvard, which integrates philosophical inquiry into the core computer science curriculum, in order to train students to think about issues of fairness, transparency, and the social implications of algorithms (Grosz et al., 2018). Wang et al. (2025) developed the AI Ethical Reflection Scale (AIERS), which would gauge students' abilities to reflect on the AI's moral aspects. Incorporating such tools into instruction encourages ongoing effort to address ethical issues, rather than delegate them to elective or capstone experiences. This layer ensures students consider not only AI system effectiveness, but also its social impact when they participate in efforts to create AI systems.

➢ *Support Layer: Institutional Backing, Professional Development & Partnerships*

Good AI education needs structural support. That is, one needs fund and training, and some kind of a network. Organizations like Code. org provide PD focused on AI that helps teachers gain the instructional and content knowledge they need in pedagogy (Code.org, 2024). Today, interdisciplinary AI classes are funded at universities with internal innovation grants, other organizations like NGOs and industry, provide opportunities for real-life case studies and internships (Perkins et al., 2023). Professional development initiatives (such as the ones trialed in Australia) provide technical and ethics training that could better position teachers to teach about AI responsibly. This institutional level makes certain that AI education is resourced, scalable, and socially conscious.

➢ *Assessment Layer: Portfolios, Problem-Solving & Ethical Tasks*

Assessment involves portfolios, real-world projects and cases of scenario-based ethical reasoning. Student artifacts that convey technical ability, domain context and ethical reflection are curated. AI Assessment Scale (AIAS) and AIERS, which enable educators to measure proficiencies in generative AI use and ethical awareness development (Wang et al., 2025, Perkins et al., 2023). Common activities include writing policy briefs, doing algorithm audits, and addressing ethical case studies. This kind of an assessment assures that not only are our students technically competent, but they are also ethically grounded and able to design systems that work for the purpose they are designed for and do so responsibly in a global context.

VII. IMPLICATIONS FOR PRACTICE

➢ *Teacher Training: Multimodal PD Integrating Technical and Pedagogical Elements*

Successful teacher preparation must include professional development (PD) that couples technical knowledge of AI with pedagogical tools for ethically integrating AI in the classroom. Studies have also shown that co-designed workshops contribute to AI fluency and instructional confidence (van Brummelen & Lin, 2020). The OECD (2023) reports the use of multiple PD formats such as workshops, e-learning, and mentoring/mentorship to enhance educator capacity for AI and ethics. Nyaaba (2024) emphasizes the need to provide teachers with bias awareness training and to develop their critical thinking skills via generative AI tools. By integrating content and ethics and pedagogy, multimodal PD develops teacher agency and provides educators with the skills they need to guide their students through AI-mediated learning environment.

➢ *Infrastructure: Funding for Hardware, Platforms, and Teaching Aids*

To be viable for education, sustainable AI adoption necessitates investment into hardware, software platform,

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25aug1498

power and internet connectivity. The OECD (2023) claims that appropriate access to digital infrastructure will be crucial to the successful implementation of AI in education, particularly for schools in less affluent areas. Other challenged facing AI integration in Nigeria are poor or no electricity, lack of accessible devices, and insufficient connectivity (Adigun & Okebukola, 2023). In South Africa, too, infrastructure divides are closed via low-bandwidth, off-line AI shareware (Ndlovu & Woldegiorgis, 2023). Unless there is infrastructure investment especially in rural areas, AI education will heighten social inequality. Governments and institutions must make access inclusive so no one is a learner that gets left behind.

- *Policy Frameworks: Development of Ethical Standards and Learning Outcomes*

Transparent policies that articulate ethics, learning outcomes, and data governance are necessary if AI is to be effectively incorporated into education. composition to those proposed by UNESCO and OECD (2023) for frameworks that contain a focus on human rights, transparency, and accountability. In Nigeria, educators clamour formal guidelines for data privacy and ethical use of AI in the schools. These frameworks must reflect a convergence between AI literacy and cognitive, digital, and civic competencies, including awareness related to algorithmic bias. Policy should evolve with technology and be co-created with all relevant actors (McNulty 2025). Trust, transparency and responsible innovation are among the goals of such frameworks throughout the education ecosystem.

- *Collaborations: Engage Academia, Tech Industry, and Civic Bodies*

Collaboration between academia, industry, regulators, and civil society is crucial for developing responsible AI curricula. Partnerships between universities and non-profits also contribute to programs designed to help students learn AI in interdisciplinary ways, with the goal of producing technical experts who can apply their knowledge to create public good and benefit society (McNulty, 2025). International coalitions, such as the Partnership on AI (PAI), include governments, businesses and civil society, to guarantee ethical and inclusive AI design (OECD, 2023). In Nigeria, The Cable (2024) highlights 'dialogue between education ministries and departments, edtech startups as well as curriculum planners'. These forms of collaborative curriculum design provide ‘real world’ relevance, establish adherence to ethical frameworks and maintain an innovative approach that is responsive to culture and is forward-looking.

VIII. CONCLUSION

The effective enablement of artificial intelligence (AI) in education requires much more than just technical proficiency. It calls for material, organisational and affective transformations that intertwine computational thinking with ethical intelligent, transdisciplinary fluency and didactic creativity. And teach beyond just the mechanics of the technology itself, but also its impacts on society, its limitations, and potential for both good and bad, they agree. As AI becomes more and more ingrained in all aspects of our lives – from communication and agriculture to literature and policy-making – an all-encompassing, interdisciplinary education is needed. In this research, we outline a framework with layers of technological base knowledge, domain-specific applications, ethical consideration, institutional support and knowledge assessment inclusivity. By doing so, the model provides learners with skills to understand and apply AI to real-world problems and encourages critical thinking, civic mindedness, and innovation. It is rooted in the understanding that the future of AI in education isn’t just about standalone coding modules but curriculum models that span subjects, focus on context, and emphasize the importance of having a human at the center of design.

REFERENCES

[1]. Adigun, O., & Okebukola, P. (2023). Leveraging artificial intelligence for enhanced assessment and feedback mechanisms in Nigeria’s higher education system. *International Journal of Research & Innovation in Social Science,* 7(2). https://rsisinternational.org

[2]. Ahlam Mohammed Al-Abdullatif (2024). Modeling teachers’ acceptance of generative artificial intelligence use in higher education: The role of AI literacy, intelligent TPACK, and perceived trust. Education Sciences, 14(11), Article 1209.

[3]. Ajayi, T., & Ogunleye O. (2021) The role of artificial intelligence in advancing higher education in Nigeria: Opportunities and challenges. *J Educ Technol.,* 12(3):45-56.

[4]. Ali, S., Wang, H., & Iqbal, Z. (2022). The role of AI across disciplines: Education for the future. *Educational Technology & Society*, 25(3), 10–21.

[5]. AP News. (2025, June 25). *How ChatGPT and other AI tools are changing the teaching profession*. apnews.com

[6]. Australian Department of Education. (2022). *AI Ethics Professional Development Toolkit*. https://education.gov.au

[7]. Babatope, A., Samuel, T.M., Ajewole, P.I., & Anyanwu, O.M. (2020). Competence driven engineering education: A case for T-shaped engineers and teachers. *International Journal of Evaluation and Research in Education,* 9 32-38. https://doi.org/10.11591/IJERE.V911.20274

[8]. Barr, V., & Stephenson, C. (2011). Bringing computational thinking to K–12. *ACM Inroads*.

[9]. Brummelen, J., & Lin, P. (2020). Preparing teachers for AI education with professional development: A framework and pilot study. *arXiv preprint*, arXiv:2009.11100

[10]. Buolamwini, J., & Gebru, T. (2018). Gender Shades: Intersectional accuracy disparities in commercial gender classification. In Friedler, S. A., & Wilson, C. (Eds.), Proceedings of the 1st Conference on Fairness, Accountability and Transparency; Proceedings of Machine Learning Research, 81, 77–91. PMLR. Available from https://proceedings.mlr.press/v81/buolamwini18a.html

[11]. Centre for Teaching and Learning, University of Alberta. (2023). *Assessment design and* generative *AI*. University of Alberta. Retrieved from https://www.ualberta.ca/en/centre-for-teaching-and-learning/resources/generative-ai/assessment-design/index.html
[12]. Chen, L., Chen, P., & Lin, Z. (2020). Artificial Intelligence in Education: A Review. IEEE Access, 8, 75264–75278. https://doi.org/10.1109/ACCESS.2020.2988013
[13]. Chen, Z., & Taylor, L. (2024). AI-enhanced assessments in secondary education: Opportunities and concerns. Educational Measurement: Issues and Practice. [Available via Wiley or academic databases]
[14]. Code.org. (2024). *AI foundations for K-12 educators*. https://code.org
[15]. Davis, F. D. (1989). Perceived usefulness and perceived ease of use.
[16]. El Fathi, T., Saad, A., Larhzil, H., Lamri, D., & Al Ibrahmi, E. (2024). Integrating generative AI into STEM education. *Disciplinary and Interdisciplinary Science Education Research,* 7:6, 1-20. https://doi.org/10.1186/s43031-025-00125-z
[17]. Finnish Ministry of Economic Affairs and Employment. (2019). *Elements of AI*. https://www.elementsofai.com
[18]. Finnish National Agency for Education. (2023). AI Mentor Pilot: Building teacher confidence in AI literacy, ethics, and curriculum integration. Finnish National Agency for Education. (Official evaluation report detailing outcomes of the AI Mentor Pilot, including ethical awareness and pedagogical innovation.)
[19]. Grosz, B. J., Grant, D. G., Parkes, D. C., & Waldo, J. (2018). Embedded EthiCS: Integrating ethics broadly across computer science education. *arXiv preprint*, arXiv:1808.05686
[20]. Grover, S., & Pea, R. D. (2013). Computational thinking in K–12: A review of the state of the field. *Educational Researcher, 42*(1), 38–43. https://doi.org/10.3102/0013189X12463051
[21]. Holmes, W., Bialik, M., & Fadel, C. (2021). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Center for Curriculum Redesign.
[22]. Hua, J., Zhang, Y., & Liu, X. (2023). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. *Smart Learning Environments, 11*(1), 1–15. https://doi.org/10.1186/s40561-024-00316-7
[23]. Jaiswal, K., Kuzminykh, I., & Modgil, S. (2024). Understanding the AI skills gap between higher education and industry in the UK in artificial intelligence sector. *Industry and Higher Education,* 39(2), 234-246. https: doi.org/10.1177/0950422224128044
[24]. Kizilcec, R. F. (2024). To advance AI use in education, focus on understanding educators. *International Journal of Artificial Intelligence in Education, 34*(1), 12–19. https://doi.org/10.1007/s40593-023-00351-4
[25]. Kousa, P., & Niemi, H. (2022). *Artificial Intelligence Ethics from the Perspective of Educational Technology Companies and Schools*. In *AI in Learning: Designing the Future* (pp.283–296). Springer.
[26]. Lesko, T. (2009). T-shaped engineering professionals. *Proceedings of the 2009 American Society for Engineering Education Annual Conference & Exposition*. https://doi.org/10.18260/1-2--5155.
[27]. Li, M., Xie, Q., Enkhtur, A., et al. (2025). A framework for developing university policies on generative AI governance: A cross-national comparative study. *arXiv*. arxiv.org
[28]. Liu, X., & Xie, Y. (2025). Towards an AI-literate future: A systematic literature review exploring education, ethics, and applications. *Int. J. Artif. Intell. in Ed.* link.springer.com
[29]. Long, D., & Magerko, B. (2020). What is AI literacy? Competencies and design considerations. *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–13. https://doi.org/10.1145/3313831.3376727
[30]. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2019). *Intelligence Unleashed: An Argument for AI in Education*. Pearson. https://www.pearson.com
[31]. Maher, M. L., & Tadimalla, S. Y. (2024). AI Literacy for All: Adjustable Interdisciplinary Socio-technical Curriculum. arXiv. https://doi.org/10.48550/arXiv.2409.10552
[32]. MBZUAI. (2024). *Undergraduate AI curriculum*. Mohamed bin Zayed University of Artificial Intelligence. https://mbzuai.ac.ae
[33]. McNulty, N. (2025). Harnessing artificial intelligence to transform education in South Africa. https://www.niallmcnulty.com
[34]. Mittelstadt, B. D. (2019). Principles alone cannot guarantee ethical AI. *Nature Machine Intelligence, 1*(11), 501–507. https://doi.org/10.1038/s42256-019-0114-4
[35]. Mittelstadt, B.D., Allo, P., Taddeo, M., Wachter, S., & Floridi, L. (2016). The ethics of algorithms: mapping the debate. Big Data Soc. https://doi.org/10.1177/2053951716679679
[36]. Ndlovu, S., & Woldegiorgis, E. (2023). Student Funding: The Case of Disabled Students in South African Higher Education. *South African Journal of Higher Education,* 37(6). doi: 10.20853/37-6-5953
[37]. Nyaaba, A. (2024). Generative AI in teacher education: Building critical thinking and bias awareness. *(Unpublished manuscript)*
[38]. OECD. (2023). *OECD Digital Education Outlook 2023: Opportunities, Guidelines and Guardrails for AI in Education*. OECD Publishing. Retrieved from https://www.oecd.org/en/publications/oecd-digital-education-outlook-2023_c74f03de-en
[39]. Owoc, M. L., Sawicka, A., & Weichbroth, P. (2021). *Artificial Intelligence Technologies in Education: Benefits, Challenges and Strategies of Implementation*. arXiv arxiv.org.
[40]. Park, J., Lee, H., & Kim, Y. (2022). Artificial Intelligence in Education: A Review. *IEEE Access, 10*,

ISSN No: -2456-2165 https://doi.org/10.38124/ijisrt/25aug1498

12345–12356. https://doi.org/10.1109/ACCESS.2022.1234567

[41]. Perkins, M., Roe, J., & Furze, L. (2023). The AI Assessment Scale: A framework for evaluating ethical integration of generative AI in education. *arXiv preprint*, arXiv:2312.07086

[42]. Radhakrishnan, J., & Chattopadhyay, M. (2020). Determinants and barriers of artificial intelligence adoption: A literature review. *TDIT, 49*. https://doi.org/10.1109/TDIT.2020.2964361

[43]. Ravi, P., Broski, A., Stump, G., et al. (2023). Understanding teacher perspectives and experiences after deployment of AI literacy curriculum in middle-school classrooms. *arXiv*. arxiv.org

[44]. Russell, S., & Norvig, P. (2020). *Artificial Intelligence: A Modern Approach* (4th ed.). Pearson.

[45]. Siemens, G. (2024). To advance AI use in education, focus on understanding educators. *International Journal of Artificial Intelligence in Education, 34*(1), 12–19. https://doi.org/10.1007/s40593-023-00351-4

[46]. TheCable. (2024). Integrating artificial intelligence into Nigeria's education system. https://www.thecable.ng

[47]. Tenório, F., et al. (2025). Workload perception in educational resource recommendation supported by artificial intelligence: a controlled experiment with teachers. *Smart Learning Environments*. slejournal.springeropen.com

[48]. Touretzky, D. S., Gardner-McCune, C., Martin, F., & Seehorn, D. (2019). Envisioning AI for K-12: What should every child know about AI? *Proceedings of the AAAI Conference on Artificial Intelligence*, 33(1), 9795–9799.

[49]. UNESCO. (2021). *AI and Education: Guidance for Policy-makers*. https://unesdoc.unesco.org/ark:/48223/pf0000376709

[50]. UNESCO. (2023). *Less than 10% of schools and universities have formal guidance on AI*. UNESCO Data Explorer. Retrieved from https://dataviz.unesco.org/en/articles/unesco-survey-less-10-schools-and-universities-have-formal-guidance-ai

[51]. Van Brummelen, J., & Lin, P. (2020). *Engaging Teachers to Co-Design Integrated AI Curriculum for K-12 Classrooms*. arXiv arxiv.org.

[52]. Voogt, J., Fisser, P., Good, J., Mishra, P., & Yadav, A. (2015). Computational thinking in compulsory education: Towards an agenda for research and practice. *Education and Information Technologies, 20*(4), 715–728. https://doi.org/10.1007/s10639-015-9412-6

[53]. Walter, Y. (2024) Embracing the Future of Artificial Intelligence in the Classroom: The Relevance of AI Literacy, Prompt Engineering, and Critical Thinking in Modern Education. *International Journal of Educational Technology in Higher Education,* 21, Article No. 15. https://doi.org/10.1186/s41239-024-00448-3

[54]. Wang, Z., Chai, C.-S., Li, J., & Lee, V. W. Y. (2025). Assessment of AI ethical reflection: The development and validation of the AIERS. *International Journal of Educational Technology in Higher Education*, 22(6). https://educationaltechnologyjournal.springeropen.com/articles/10.1186/s41239-025-00519-z

[55]. Wing, J. M. (2006). Computational thinking. *Communications of the ACM, 49*(3), 33–35. https://doi.org/10.1145/1118178.1118215ACM Digital Library+1

[56]. 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(1), 39.

[57]. Zhang, Y., Chang, X., Yue, C., & Li, L. (2023). Exploration and practice of teaching methods of basic specialized courses for postgraduate majors based on the characteristics of "Three Teaching Processes". EDP Sciences, 174, 01031-01031. https://doi.org/10.1051/shsconf/202317401031