



Reinterpreting the Role of Teachers in the Digital Education Era: Between Technological Challenges and Humanistic

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ABSTRACT

Purpose of the study: This study aims to analyze how digital technologies and artificial intelligence (AI) have transformed teachers' roles in contemporary educational environments.

Methodology: A Systematic Literature Review (SLR) was conducted following the PRISMA 2020 guidelines. Twenty-nine articles published between 2020 and 2025 were selected from the Scopus database and analyzed using qualitative synthesis and VOSviewer bibliometric mapping.

Main Findings: The findings indicate that teachers are transitioning from traditional knowledge transmitters to facilitators, mentors, learning designers, and ethical guides. Although AI can support instructional tasks such as assessment, content generation, and personalized learning, it cannot fully replace the emotional, ethical, and interpersonal dimensions of teaching. The study also identifies major challenges, including digital competency gaps, unequal technological access, and ethical concerns associated with AI integration.

Novelty/Originality of this study: This study contributes a comprehensive understanding of teacher role transformation by integrating findings from recent literature with Social Role Theory. The results emphasize that the future of education depends on balancing technological innovation with human-centered values, highlighting the continuing importance of teachers' empathy, ethical judgment, and emotional support in AI-enhanced learning environments.

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1. INTRODUCTION

The rapid development of digital technologies has significantly transformed educational systems worldwide. The integration of artificial intelligence (AI), learning management systems, adaptive learning platforms, and digital assessment tools has expanded access to education and created more flexible learning environments. Educational institutions increasingly utilize these technologies to improve instructional efficiency, personalize learning experiences, and support data-driven decision making. According to OECD, digital technologies have become a key driver of educational transformation, influencing teaching practices and learning experiences across different educational contexts [1]. Consequently, education is entering a new phase in which technological innovation plays a central role in knowledge acquisition and instructional delivery [2].

Alongside these developments, the traditional role of teachers has undergone substantial transformation. Historically, teachers functioned as the primary source of knowledge and the central authority in the classroom. However, the widespread availability of digital information and intelligent learning systems has reduced the exclusivity of this role, enabling students to access educational resources independently. Recent AI-based

technologies are capable of generating learning content, providing automated feedback, monitoring student progress, and supporting assessment processes [3], [4]. As a result, teachers are increasingly expected to assume responsibilities that extend beyond the conventional transmission of knowledge [1].

Numerous studies have highlighted the benefits of technology integration in educational settings. Digital technologies have been shown to enhance student engagement, facilitate personalized learning, improve accessibility, and support more efficient instructional management [5]. AI applications can analyze learning patterns, identify student needs, and provide adaptive recommendations that help optimize learning outcomes [6]. Furthermore, emerging technologies such as generative AI and intelligent tutoring systems have expanded opportunities for individualized instruction and continuous learning support [7]. These developments demonstrate the growing potential of technology to complement various educational functions traditionally performed by teachers.

Despite these advantages, the increasing presence of digital technologies has also generated significant challenges for educators. Many teachers experience difficulties adapting to rapidly changing technological environments due to limited digital competencies, insufficient professional training, and unequal access to technological infrastructure [8]. In developing countries, these challenges are often exacerbated by disparities in internet connectivity and access to digital devices [9]-[11]. Concerns have also emerged regarding data privacy, ethical issues, academic integrity, and the potential overreliance on automated systems in educational settings [3], [7]. Consequently, the successful integration of technology depends not only on technological availability but also on the preparedness and capacity of teachers to utilize it effectively.

Existing literature has extensively examined educational technology adoption, AI literacy, digital competence, and technology-enhanced learning environments [7], [8], [12]. However, most studies primarily focus on technological effectiveness, implementation strategies, or student learning outcomes. Comparatively fewer studies have explored how technological transformation influences the social, emotional, ethical, and professional dimensions of teachers' roles. The emergence of generative AI technologies, particularly ChatGPT and other large language models, has intensified discussions regarding the future identity and relevance of teachers within increasingly automated educational environments [4]. This situation highlights a significant research gap concerning the comprehensive reinterpretation of teachers' roles in the era of digital and AI-driven education.

The theoretical foundation of this study is informed by Social Role Theory proposed by Biddle [13], which explains how individuals adapt to changing expectations within specific social contexts. According to this perspective, role conflict occurs when multiple expectations compete simultaneously, while role strain emerges when individuals face demands that exceed their available resources and capacities [13]. In contemporary education, teachers are expected to integrate sophisticated technologies while simultaneously maintaining their responsibilities as mentors, facilitators, and moral guides [1], [2]. These evolving expectations create complex professional challenges that require continuous adaptation and role negotiation. Therefore, Social Role Theory provides a useful framework for understanding the transformation of teachers' roles in digital learning environments.

Based on these considerations, a comprehensive synthesis of existing research is necessary to understand how the role of teachers is being redefined in response to digital transformation and artificial intelligence integration. This study employs a Systematic Literature Review (SLR) approach following the PRISMA 2020 guidelines to analyze contemporary scholarly literature on the topic. By examining research trends, thematic patterns, and emerging discussions, this study seeks to identify the evolving functions of teachers within technology-enhanced educational contexts. Furthermore, the study aims to explore the extent to which technology replaces or complements traditional teaching responsibilities while highlighting the continuing importance of humanistic dimensions in education [14]-[16]. Accordingly, the guiding research question is: How does the redefinition of the teacher's role emerge in response to the integration of digital and AI-based technologies in education?

2. RESEARCH METHOD

This study adopts a Systematic Literature Review (SLR) approach to explore how the role of teachers has evolved in the rapidly developing era of digital education. By using the SLR method, PRISMA2020 method, the researcher is able to gather, evaluate, and synthesize a wide range of existing research in a structured and transparent manner, resulting in a more comprehensive understanding of the intersection between technology and the teaching profession. The primary goal of this research is to investigate how technological advancements are reshaping the role of teachers, as well as the challenges and opportunities educators face as they adapt to these changes.

The first step in the research process was to define a clear and focused objective: to examine the transformation of the teacher's role within the context of digital education, particularly in light of increasing technological sophistication. Keywords used in the search included terms like "teacher roles in digital education"

and "impact of AI on teaching." To ensure the findings reflect the most current developments in the field, only articles published between 2020 - 2025 were included in the review.

Once the relevant literature was identified, a screening and selection process was carried out to filter studies based on predefined inclusion and exclusion criteria. Articles were then assessed for quality and relevance, with only those meeting high academic standards selected for deeper analysis. In the synthesis phase, the findings from the selected studies were carefully examined to identify emerging patterns and themes related to the evolving responsibilities of teachers, the integration of technology into teaching practices, and the challenges that educators face in the digital age. Several key themes emerged from the review. One notable example is the integration of Artificial Intelligence (AI) in educational settings, particularly in areas such as assessment and evaluation. AI offers several benefits, including increased objectivity, efficiency, consistency, analytical capabilities, the ability to develop adaptive assessment systems, personalized learning experiences, and even mechanisms for academic integrity. However, these advantages are accompanied by significant challenges, such as concerns around the validity and reliability of AI systems, implementation costs, over-dependence on technology, data privacy and security issues, and shifts in student behavior that may affect learning outcomes [4]. Therefore, the integration of AI in educational assessments must be approached with caution, ensuring data quality and system readiness to address these complexities.

Ultimately, this study seeks to offer deeper insights into how the teaching profession is being reshaped in the digital education landscape and how educators can effectively adapt to technological change while remaining impactful in the classroom. Through this SLR approach, the research aims to shed light on the dynamic role of teachers in digital education and contribute valuable input to the development of more inclusive and forward-thinking educational policies.

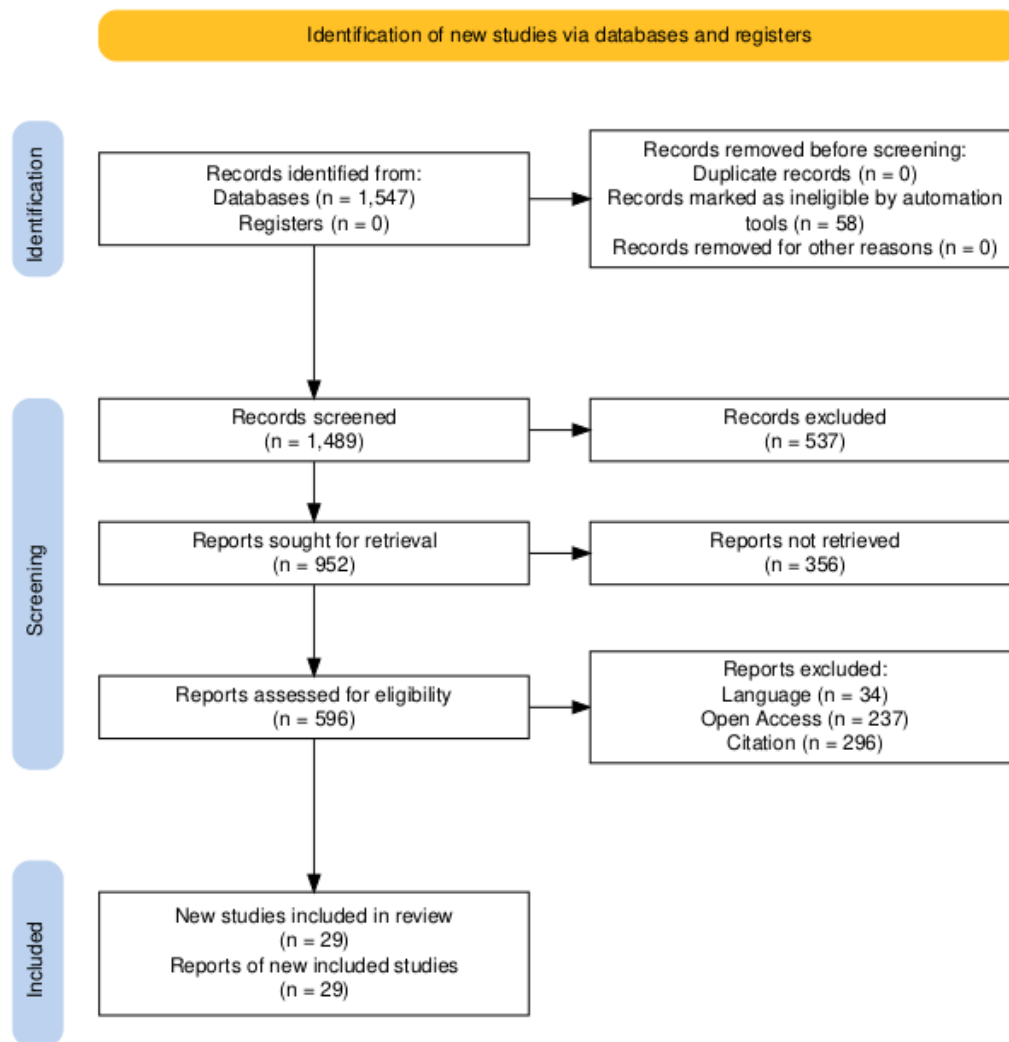


Figure 1. PRISMA 2020 Flow Diagram Analysis

The literature selection process followed the PRISMA 2020 Flow Diagram guidelines. An initial search was conducted through the Scopus database using the keywords "Teacher's Role" and "Artificial Intelligence",

limited to publications between 2020 and 2025, categorized under Social Sciences, written in English, and available in open access format. From a total of 1,547 articles identified, 58 were automatically removed as irrelevant, leaving 1,489 records for screening. After reviewing titles and abstracts, 537 articles were excluded due to misalignment with the research focus, and 952 articles were retrieved for full-text assessment, of which 356 were inaccessible.

A total of 596 full-text articles were assessed for eligibility based on inclusion criteria, language, accessibility, and citation count (minimum 40 citations to ensure academic credibility). Subsequently, 34 articles were excluded due to language, 237 for limited access, and 296 for having fewer than the required citation threshold. Ultimately, 29 articles met all inclusion criteria and were incorporated into the final synthesis to examine the evolving role of teachers in the era of artificial intelligence. The next step involved using VOSviewer to analyze the relationships and keywords appearing across the 29 selected journals. In VOSviewer, there are three key types of visualization — network visualization, overlay visualization, and density visualization.

3. RESULTS AND DISCUSSION

The second figure presents the network visualization, which aims to illustrate the structural relationships and interconnections among the keywords. This visualization helps to reveal how different research themes are conceptually linked, forming clusters that represent distinct yet interrelated areas within the broader topic of study.



Figure 2. Vosviewer Network Visualization

The network visualization generated using VOSviewer illustrates the structural relationships between major keywords found in the 29 analyzed journals. The central node, “artificial intelligence,” dominates the map, indicating it as the primary research focus interconnected with multiple subtopics such as education, ethics, learning support, deep learning, and AI-TPACK. These connections reflect how AI is increasingly integrated into pedagogical frameworks and ethical considerations within educational settings.

On the right cluster, keywords such as “ChatGPT” and “higher education” form a strong linkage, highlighting the growing academic discourse around AI-driven tools in university contexts, especially regarding issues of academic dishonesty and AI-assisted writing. Meanwhile, the left cluster, represented by “AI literacy,” “students,” and “curricula,” emphasizes the pedagogical need for developing AI competencies and integrating literacy into learning programs. Overall, the visualization demonstrates a balanced intersection between technological innovation, ethical awareness, and educational adaptation in the discourse surrounding AI in education.

Expanding on these insights, the visualization reflects how the teacher’s role is gradually evolving alongside the growing influence of AI in education. While artificial intelligence can efficiently handle repetitive or data-driven tasks such as information delivery, grading, and adaptive learning it lacks the emotional depth and ethical sensitivity that define meaningful teaching. The teacher remains a crucial figure in nurturing empathy, critical thinking, and moral awareness qualities that no algorithm can authentically replicate.

Moreover, the network map reveals an emerging intersection between technology, pedagogy, and ethics. This highlights that the future of education will depend not only on mastering digital tools but also on sustaining the human connection that underpins learning. Therefore, professional development for teachers must go beyond technical training, focusing equally on emotional intelligence, ethical awareness, and the ability to integrate technology in ways that preserve the heart of education the relationship between teacher and student.

The network visualization reveals that artificial intelligence serves as the central concept connecting various educational dimensions, including pedagogy, ethics, learning support, AI literacy, and higher education.

This finding suggests that discussions regarding AI in education are no longer limited to technological adoption but have expanded to encompass pedagogical and social implications. The close relationship between AI and educational themes indicates that technological integration increasingly influences how teaching and learning processes are designed and implemented. As AI becomes more embedded within educational systems, teachers are expected to adapt their instructional practices while maintaining educational quality and learner engagement [17], [18]. Consequently, the role of teachers is evolving from information providers to facilitators who help students navigate technology-rich learning environments [19], [20].

The clustering patterns further demonstrate that educational transformation involves multidimensional changes rather than merely technological innovation. The strong association between AI literacy, curricula, and students reflects the growing expectation that educators should possess sufficient digital competence to guide learners in understanding and responsibly utilizing AI technologies. Previous studies have emphasized that effective technology integration depends heavily on teachers' technological pedagogical knowledge and their ability to align digital tools with educational objectives [12], [5]. Therefore, the findings reinforce the notion that teacher preparedness remains a critical determinant of successful educational innovation. Without adequate support and professional development, technological advancements may fail to produce meaningful improvements in learning outcomes [21], [22].

From the perspective of Social Role Theory, the network structure illustrates the emergence of new professional expectations imposed upon teachers. Educators are increasingly expected to balance traditional pedagogical responsibilities with technological competencies and ethical considerations. Such changes create role expansion, where teachers are required to perform multiple functions simultaneously within rapidly evolving educational environments. As a result, professional adaptation becomes essential for sustaining teacher effectiveness and educational relevance in the digital era.

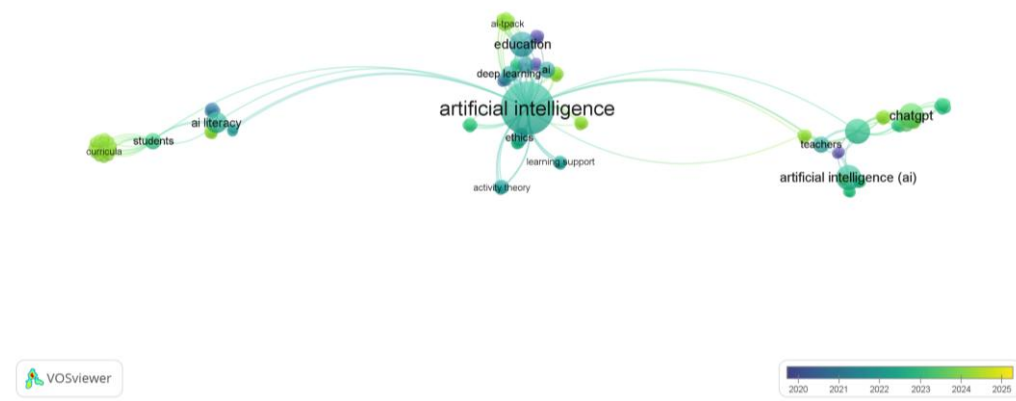


Figure 3. Vosviewer Overlay Visualization

The overlay visualization produced through VOSviewer provides a nuanced depiction of the chronological development of research concerning teachers' perspectives in the post-AI era from 2020 to 2025. The color gradient ranging from dark blue (earlier years) to yellow (more recent years)—illustrates the gradual evolution of scholarly focus and the deepening complexity of academic discourse surrounding the intersection of artificial intelligence and education.

In the initial phase, during 2020–2021 (represented in dark blue), research predominantly concentrated on AI literacy, digital competence, and curriculum integration. This stage signified a foundational period where educators and policymakers sought to understand how AI could be meaningfully introduced into the classroom. The discourse was largely exploratory, aiming to familiarize teachers and students with the fundamental concepts, benefits, and risks of artificial intelligence in learning contexts. The studies during this period reflect the educational community's cautious optimism viewing AI as both a technological advancement and a pedagogical challenge requiring new forms of literacy.

As the field progressed into 2022–2023 (illustrated in green clusters), the thematic emphasis shifted toward pedagogical frameworks, ethical dimensions, and teacher adaptation to AI-based environments. This phase marks a critical transition from theoretical understanding to practical implementation. Concepts such as AI-TPACK and learning support frameworks began to dominate discussions, underscoring the growing awareness that AI integration requires not only technical proficiency but also pedagogical sensitivity. Moreover, ethical concerns ranging from data privacy to the preservation of human agency in automated learning systems became increasingly central to scholarly inquiry.

From 2024 onwards (highlighted in yellow), the visualization indicates a significant transformation in academic interest toward generative AI systems such as ChatGPT and their implications for higher education.

This period reflects a paradigmatic shift in research focus from examining how AI can support education to questioning how it reshapes the identity and authority of teachers. The studies in this stage reveal a more reflective and critical tone, acknowledging that while AI can serve as a valuable co-teaching and assessment partner, it simultaneously raises concerns about academic integrity, authorship, and the authenticity of human learning.

Overall, the overlay visualization demonstrates a clear progression from foundational literacy and adaptation to reflective engagement and ethical negotiation. This trajectory underscores that the role of teachers in the post-AI era is no longer confined to managing technological tools but extends to redefining pedagogical ethics, fostering emotional intelligence, and maintaining the humanistic essence of education. Such an evolution captures the essence of a transformative pedagogical paradigm one where technological innovation must coexist with empathy, wisdom, and the enduring moral presence of the teacher.

The overlay visualization highlights the chronological progression of research themes associated with artificial intelligence and education. Early studies primarily focused on AI literacy, digital competence, and curriculum integration, reflecting initial efforts to understand the educational potential of emerging technologies. During this period, the primary concern was equipping educators and students with foundational knowledge necessary to engage with digital learning environments. These findings indicate that technological readiness was considered a prerequisite for successful digital transformation [23], [24]. Consequently, teachers were viewed primarily as learners adapting to technological change.

As research evolved between 2022 and 2023, scholarly attention shifted toward pedagogical adaptation and ethical considerations. This transition suggests a growing recognition that technology integration involves more than technical proficiency. Researchers increasingly emphasized the importance of pedagogical decision-making, responsible AI use, and the preservation of educational values within digitally mediated learning environments. Such developments highlight the expanding responsibilities of teachers as they navigate the intersection between technological innovation and educational ethics. In this context, teachers are required not only to utilize technology effectively but also to ensure that technological applications align with broader educational goals [25]-[27].

The emergence of ChatGPT and other generative AI systems in recent years has introduced a new phase of educational discourse. Research trends increasingly focus on issues such as academic integrity, authorship, critical thinking, and the future role of educators in AI-assisted learning environments. These concerns reflect a deeper shift from questions of technological implementation toward questions of educational identity and professional relevance. Rather than diminishing the role of teachers, the findings suggest that AI is prompting educators to redefine their professional identity around uniquely human competencies, including creativity, empathy, ethical judgment, and critical reflection. Therefore, the evolution of research trends mirrors the broader transformation of teaching itself in the post-AI era.

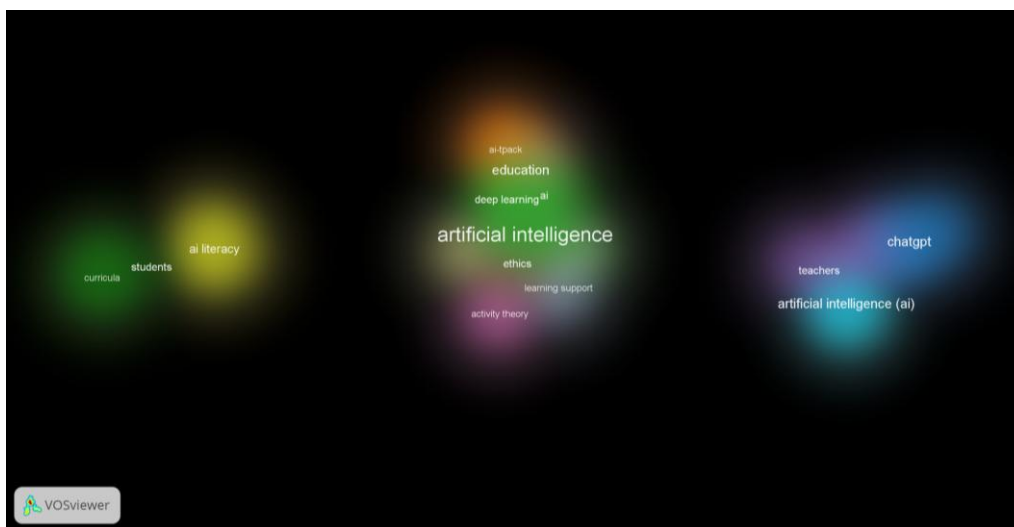


Figure 4. Vos Viewer Density Visualization

The density visualization from VOSviewer highlights the intensity and focus of research themes surrounding the integration of artificial intelligence (AI) in education. Three dominant clusters emerge: (1) *AI literacy and student competence*, (2) *education and ethics in AI implementation*, and (3) *ChatGPT and higher education*. The concentration of terms around “artificial intelligence”, “education”, “ethics”, and “anxiety and stress” indicates that while AI has increasingly influenced the instructional and informational roles of teachers, it simultaneously raises deeper discussions about humanistic and psychological dimensions.

From this visualization, it can be concluded that AI may eventually replace some of teachers' informational and cognitive functions, such as delivering content or providing quick feedback. However, the clusters related to *ethics*, *anxiety*, and *learning support* reaffirm that the emotional, ethical, and psychological roles of teachers remain irreplaceable. Teachers continue to act as moral guides, emotional supporters, and mediators of learning values roles that artificial intelligence, despite its advancement, cannot authentically replicate.

The humanistic aspect of teaching has gained significant attention in the literature, where teachers are expected to act as companions who understand the psychological states of their students, while cultivating effective communication to foster supportive and inclusive learning environments [14], [15]. In conclusion, the reinterpretation of the teacher's role in the digital era positions them as agents of change, individuals who not only master technology but also uphold human values, ethical responsibility, and emotional intelligence in education. Teachers are facilitators and companions who foster inclusive, creative, and empowering learning environments, while navigating both technical and social challenges to ensure that 21st-century education remains relevant, equitable, and deeply human [1], [16].

The density visualization identifies artificial intelligence, education, ethics, learning support, and psychological well-being as the most intensively studied themes within the selected literature. The concentration of these keywords suggests that contemporary educational research increasingly acknowledges the limitations of technology in addressing the human dimensions of learning. Although AI technologies continue to improve instructional efficiency and personalization, they remain constrained in their ability to provide emotional understanding, moral guidance, and authentic interpersonal relationships. Consequently, humanistic aspects of education have emerged as critical areas of scholarly attention [28], [29].

The prominence of themes related to ethics and learning support demonstrates growing concern regarding the broader consequences of AI integration. Educational stakeholders are increasingly aware that technological innovation may create unintended challenges, including algorithmic bias, reduced human interaction, academic misconduct, and psychological dependence on digital systems. In response to these concerns, teachers are expected to serve as ethical mediators who guide students in developing responsible and critical approaches toward technology use [30], [31]. This expanded responsibility further reinforces the importance of teachers within technology-enhanced educational environments.

Furthermore, the density visualization highlights the continuing significance of emotional and psychological support in the learning process. Students require encouragement, motivation, empathy, and social interaction to develop both academically and personally [32], [33]. These needs become even more pronounced in digitally mediated learning environments where direct human interaction may be reduced. Therefore, while technology can support cognitive aspects of learning, teachers remain indispensable in fostering emotional well-being, social development, and moral growth. The findings ultimately suggest that the future of education depends on achieving a balance between technological innovation and human-centered educational values.

The findings of this study have several implications for educational policy and professional practice. First, teacher professional development programs should prioritize digital competence alongside pedagogical and ethical competencies. Educators require continuous training to effectively integrate AI technologies while maintaining meaningful human interactions within learning environments. Second, policymakers should address inequalities in technological access to ensure that digital transformation benefits all educational communities rather than widening existing disparities.

Third, educational institutions should promote a balanced approach to technology integration. While AI can improve efficiency and support personalized learning, its implementation should complement rather than replace human-centered educational practices. Finally, curriculum development should incorporate AI literacy, digital ethics, and critical thinking skills to prepare both teachers and students for participation in increasingly technology-driven societies. Through these efforts, educational systems can leverage technological innovation while preserving the fundamental human values that define meaningful learning experiences.

4. CONCLUSION

It can be concluded that while digital technology has undeniably transformed the landscape of global education, it has not rendered the role of teachers obsolete. On the contrary, these changes reaffirm the urgent need to reposition teachers as adaptive, creative, and empathetic companions in the learning journey of students in the digital era. The role of teachers has indeed evolved. They are no longer the sole source of knowledge, as the internet now offers thousands, if not millions, of learning resources. However, this abundance of information has given rise to a new need: teachers are now essential as information curators, helping students discern between scientifically valid content and misleading or manipulative sources.

Teachers are also vital as guardians of values, such as honesty, perseverance, collaboration, and empathy. Learning is no longer just about arriving at the correct answers, it is about understanding the process, embracing mistakes, and growing from experience. Technology can teach logic, formulas, and even languages,

but it still lacks the ability to respond to a child's fear of falling behind, or to celebrate small achievements that may be invisible to data but deeply felt by the human heart present in the classroom. Nevertheless, teachers face considerable challenges, including limited infrastructure and access to technology, insufficient training, and psychological pressure stemming from shifting responsibilities and the looming fear of being replaced by automated systems such as artificial intelligence (AI). Therefore, equitable policy support, continuous professional development, and accessible infrastructure are essential to ensure that this transformation is truly inclusive and just.

Furthermore, the visualization suggests a clear shift in research focus, from early discussions on *AI literacy* and *curriculum integration* toward more complex debates on *ChatGPT adoption*, *academic integrity*, and *ethical boundaries*. This evolution reflects how teachers are no longer merely adapting to technological tools but are also redefining their identity within AI-driven learning environments. As AI becomes more capable of automating information delivery, grading, and content generation, educators are being challenged to emphasize human-centered skills, such as empathy, creativity, and moral reasoning. In essence, the post-AI era positions teachers not as transmitters of knowledge but as ethical facilitators and emotional anchors in the learning process. The psychological dimensions of teaching such as managing students' anxiety, fostering digital well-being, and guiding responsible AI use remain deeply human tasks that cannot be outsourced to machines. Thus, while AI reshapes the functional aspects of education, the teacher's moral and psychological presence continues to serve as the irreplaceable core of meaningful learning. In a world increasingly dominated by technology, the role of teachers remains irreplaceable in building relationships, creating meaning, and instilling humanity in the learning process.

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