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THE ROLE OF THE SCIENTIFIC RESEARCHER IN THE DEVELOPMENT OF EDUCATION IN THE CONTEXT OF NEW DIGITAL TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE

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Abstract: *The digital transformation of education, accelerated by the integration of artificial intelligence (AI), is fundamentally redefining the role of the scientific researcher. No longer a mere observer of educational processes, the researcher becomes an architect of digital pedagogy, a critical evaluator of technological innovation, and a guardian of humanistic values. This paper examines the contemporary responsibilities of researchers in the field of educational sciences, emphasizing emerging competencies, the adaptation of research methodologies to digital environments, and the ethical implications of AI use in education. The conclusions highlight the need for interdisciplinary collaboration, the development of a robust ethical framework, and the orientation of educational research toward equity and inclusion.*

Keywords: *educational research, artificial intelligence, digital education, scientific competencies, ethics in education*

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INTRODUCTION

Education constitutes the foundation of both individual and collective development, representing one of the most powerful instruments through which society perpetuates its values, culture, and progress. It is not merely an institutional system for transmitting knowledge, but a living and dynamic process of cultivating critical thinking, creativity, and the competencies necessary for adapting to a world in continuous transformation (Luo, Wang & Zhao, 2020).

In Romania, the legislative framework reflects this perspective through the National Education Law no. 1/2011, Article 249, which establishes that the continuous training of teaching, managerial, guidance, and control staff is both a right and a professional obligation. This dual — legal and ethical — dimension underscores the idea that education cannot remain static in a constantly evolving social and technological environment. The professional development of educators, researchers, and trainers thus becomes an essential condition for the quality and relevance of the educational system as a whole (Cohen et al., 2023).

Education is intended to prepare individuals for the multiple challenges of modern existence — economic, social, technological, and moral. It not only provides knowledge but also develops transversal skills such as critical thinking, resilience, collaboration, and ethical discernment. In this sense, contemporary education can no longer be viewed solely as preparation for the labor market, but as a process of forming active, autonomous citizens who are aware of their social responsibility (Ramos-Caro, 2025).

Recent transformations in global society — accelerated digitalization, automation, the globalization of information, and the emergence of artificial intelligence — have profoundly altered the ways in which people learn, communicate, and interact. Traditional education, based on unidirectional teaching and the passive accumulation of information, is gradually being replaced by dynamic, personalized, and collaborative models supported by complex digital technologies (Bițu, 2025).

The American philosopher John Dewey remarked as early as the beginning of the twentieth century that "education is not preparation for life; education is life itself." In the digital age, this statement acquires renewed significance. Life itself has moved into the digital realm — a space that redefines not only social relationships but also the learning process. Education thus becomes a hybrid ecosystem in which the interaction between humans and technology generates new forms of knowledge and new epistemological challenges (Mukti, 2023).

In this context, the role of the scientific researcher in education acquires strategic importance. The researcher is no longer merely an observer of pedagogical phenomena but an active agent of transformation — an architect of the educational future. Their mission is to analyze the impact of emerging technologies on learning processes, to provide scientific grounding for educational decisions, and to contribute to the design of flexible, learner-centered pedagogical models supported by empirical evidence (Gordon et al., 2024).

At the same time, the researcher becomes a mediator between science, technology, and humanity, contributing to the harmonization of technical progress with the ethical and cultural values of education. In an era when algorithms can influence educational decisions and artificial intelligence can personalize learning, the researcher is called upon to ensure a balance between efficiency and equity, between innovation and responsibility (Janumpally et al., 2025).

Viewed through the lens of new technological paradigms, education nonetheless preserves its humanistic essence: cultivating critical spirit, autonomy, and empathy. Its goal is not to provide definitive answers, but to form minds capable of seeking creative solutions and managing the complexity of the modern world. In this regard, the role of the scientific researcher is not only to evaluate and describe educational reality, but to construct and guide it through applied, interdisciplinary, and ethically responsible research (Hale et al., 2024).

Therefore, this paper aims to explore how digital transformation and the emergence of artificial intelligence are reshaping the profile and functions of the scientific researcher in the field of education. The analysis will highlight the epistemological, methodological, and ethical dimensions of this change, emphasizing the importance of interdisciplinary collaboration and continuous professional development in consolidating a scientifically grounded digital pedagogy oriented toward authentic human development (Varma et al., 2023).

RECONFIGURING THE ROLE OF THE RESEARCHER IN THE DIGITAL ERA

The rapid transformations of the past two decades have fundamentally redefined the relationship between knowledge, education, and technology. In a world where access to information has become almost limitless, and cognitive processes are increasingly assisted by algorithmic

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systems, the scientific researcher in education can no longer remain a passive observer of pedagogical reality. They become an agent of transformation, capable of understanding the dynamics of digitalization, critically analyzing its implications, and designing sustainable educational models grounded in empirical evidence and the ethics of academic responsibility (Folcuț, Manta & Militaru, 2023).

In the pre-digital era, educational research was predominantly focused on evaluating teaching and learning processes within relatively stable contexts, where external variables — infrastructure, social environment, teaching resources — evolved slowly. With the digital revolution, these premises have been radically altered. Technological innovations, the emergence of virtual learning environments, and the evolution of artificial intelligence have introduced an unprecedented epistemological fluidity: teaching methods are becoming adaptive, the educational experience is increasingly personalized, and teacher–student interaction extends into hybrid and algorithmic spaces (Gafarurrozi, Rohman & Fathurrohman, 2024).

Consequently, the educational researcher must reconfigure their professional and epistemological profile, integrating multiple competencies: pedagogical, technological, methodological, and ethical. In the digital era, the researcher can no longer operate solely with traditional social science instruments but must master techniques of digital data analysis, methods for evaluating intelligent educational platforms, and emerging concepts from network science or algorithmic analysis of learning behaviors (Lazarenko & Hapchuk, 2024).

This professional metamorphosis is visible at a global level. According to UNESCO (2023), between 2020 and 2024, the use of online learning platforms increased by more than 400%, while investments in educational technologies (EdTech) exceeded 300 billion USD worldwide. This unprecedented expansion in the history of modern education confirms the shift from the transmissive paradigm of knowledge to a participatory and digitally mediated one, in which learning becomes interactive, non-linear, and continuous (Aditya & Suranto, 2024).

However, this rapid growth in access to digital education is not without risks. It generates new forms of inequality, reflected in disparities of access to technological infrastructure, teachers' digital competencies, and students' levels of informational literacy. The researcher is therefore called to investigate these digital divides and to propose policies and strategies that prevent educational polarization between those connected and those excluded from the benefits of technology (Milićević et al., 2024).

Moreover, the transformation of education under the influence of technology raises fundamental epistemological and axiological questions: What does it mean "to learn" in a context where knowledge is mediated by algorithms? How can critical thinking be assessed in an environment where solutions may be automatically generated by artificial intelligence? What is the place of intuition, reflection, and error — essential components of human learning — in a system based on optimization and precision? (Motlagh, Khajavi, Sharifi & Ahmadi, 2023).

The answers to such questions cannot be found within disciplinary isolation. The contemporary researcher must adopt a transdisciplinary vision, capable of integrating concepts from cognitive psychology, computer science, philosophy, sociology, and data science. Only through such epistemological openness can a valid theoretical framework be built for understanding education in the digital age (Wang et al., 2023).

At the same time, the educational researcher must assume a critical and normative role in relation to technology. Not all digital innovations are beneficial to education, and fascination with new tools can lead to the illusion of progress without scientific foundation. Therefore, rigorous

research must distinguish between authentic innovation, based on evidence and measurable outcomes, and pseudo-innovation, dictated by commercial trends or technological fashion (Jacobs et al., 2023).

Another defining element in reconfiguring the researcher's role is ethical responsibility. In the context of new technologies, education increasingly intersects with sensitive areas such as data protection, privacy, cybersecurity, and algorithmic fairness. The researcher must position themselves as a guardian of humanistic values, ensuring that technology does not undermine the fundamental principles of education — intellectual freedom, cultural diversity, and respect for human dignity (Janumpally et al., 2025).

Thus, reconfiguring the researcher's role in the digital era entails a dual responsibility: scientific and social. On one hand, the researcher must develop tools and models that enable the effective integration of technologies into learning processes; on the other, they must ensure that such innovations serve authentic human development rather than cognitive homogenization or dependency on technology (El Ali, 2024).

In essence, the educational researcher of the twenty-first century is no longer merely an evaluator of learning processes but an architect of digital pedagogy — a professional capable of designing, testing, and optimizing technologically mediated educational experiences without losing sight of the human dimension of education (Malynovska & Smyrnova, 2023).

Ultimately, this reconfiguration implies a paradigm shift in the very culture of research: a transition from descriptive data accumulation to the active construction of applied knowledge; from disciplinary isolation to interdisciplinary collaboration; and from research focused on results to research oriented toward social impact and educational transformation (Bițu, 2025).

ARTIFICIAL INTELLIGENCE AND THE TRANSFORMATION OF EDUCATIONAL RESEARCH

Artificial intelligence (AI) represents one of the most significant technological transformations of the twenty-first century, and its impact on education is both profound and multidimensional. From simple tools that automate repetitive tasks to complex adaptive learning systems, AI is redefining the ways in which people acquire, evaluate, and apply knowledge (Xiao et al., 2025). In this context, the educational researcher stands at the center of a paradigmatic shift, in which traditional methods of investigation must be complemented by computational approaches based on large-scale data analysis, predictive modeling, and intelligent algorithms (Çayir, 2023).

The integration of AI into education is no longer a projection of the future but a tangible reality. Higher education institutions and educational organizations worldwide are already adopting intelligent solutions for personalizing learning processes, automating assessment, and improving access to educational resources (Chamboko-Mpotaringa & Manditereza, 2024). According to the OECD report *AI and the Future of Learning* (2024), over 60% of European universities use forms of artificial intelligence to analyze student progress, generate automated feedback, or detect academic plagiarism. This trend illustrates that AI is not merely a support tool but an epistemic actor that influences the very structure of the knowledge process (Katsamakas, Pavlov & Saklad, 2024).

Educational AI manifests itself through a wide range of applications. Intelligent tutoring systems can adapt didactic content in real time to the cognitive needs of each learner (Mukti, 2023). Adaptive learning platforms and automated assessment tools employ machine learning algorithms to identify learning styles and evaluate the complexity of student responses (Ghnemat, Shaout & Al-Sowi, 2022). In addition, virtual educational assistants, integrated into online learning environments, can provide 24/7 support, answering questions and guiding students toward relevant resources (Xing, 2023).

These advances generate an unprecedented abundance of educational data — *learning analytics* — that can be leveraged for a deeper understanding of learning processes. The analysis of massive datasets allows the identification of recurring behavioral patterns and the optimization of pedagogical strategies (Gordon et al., 2024). Nevertheless, the researcher must approach these data critically, developing methodologies that contextualize interpretations and respect ethical standards (Janumpally et al., 2025).

With the development of intelligent systems, a new epistemology of learning is emerging, in which the boundaries between educator, learner, and technology are becoming increasingly fluid (Malynovska & Smyrnova, 2023). The researcher must therefore investigate not only the efficiency of AI tools but also their implications for identity and cognitive autonomy (Varma et al., 2023).

The methodological shift brought about by AI is radically transforming educational research. Predictive models and algorithmic analysis offer a more nuanced understanding of learning processes but also raise critical questions concerning transparency and interpretability (Khakpaki, 2025). In the face of this "algorithmic opacity," the researcher becomes a critical mediator between technology and education (Esakkiammal & Kasturi, 2024).

At the same time, emerging directions such as explainable artificial intelligence (XAI) are becoming priorities for ensuring transparency and trust. These systems provide users with explanations of the reasoning behind algorithmic decisions, encouraging reflective and participatory learning (Rincón-Jiménez et al., 2025).

In conclusion, artificial intelligence is transforming not only education but also the very nature of educational research. It creates opportunities for personalization, advanced analytics, and adaptive learning environments while requiring a deep ethical and methodological reconfiguration in which the researcher becomes the architect of an education founded on meaning, equity, and social responsibility (Xiao et al., 2025).

THE ETHICAL DIMENSION OF DIGITAL EDUCATIONAL RESEARCH

The digital transformation of education, reinforced by the emergence of artificial intelligence and the extensive use of educational data, cannot be analyzed solely through the lens of technological efficiency. It equally demands a profound reflection on the ethical, deontological, and legal dimensions of educational research (Nguyen et al., 2022). In an era where algorithms can influence academic decisions and digital platforms become the primary interface between teacher and student, ethics emerges as a balancing instrument between technological progress and respect for human dignity (Khatri & Karki, 2023).

Education has always been a domain in which the moral dimension occupies an undeniable centrality. In the digital environment, this centrality is amplified. Intelligent technologies can enhance access to knowledge and personalize learning processes, yet they can also generate vulnerabilities such as excessive surveillance, invasive data collection, or digital exclusion (Akgun & Greenhow, 2021). The role of the researcher is to document these risks and to contribute to the development of ethical and sustainable educational policies (Ashok et al., 2022).

According to the *Ethical Guidelines for the Use of Artificial Intelligence in Education* (European Commission, 2024), any AI implementation must comply with the principles of transparency, fairness, accountability, privacy, security, and inclusion — principles also supported by recent research on the ethical governance of educational technologies (Ding, 2025).

Algorithmic transparency has become an essential condition for the scientific and moral validity of research. Its absence can lead to "algorithmic opacity" — the loss of trust and the undermining of scientific legitimacy (Huang et al., 2023).

Fairness and inclusion remain cardinal values. AI models may reinforce cultural or socioeconomic biases; therefore, researchers are called upon to ensure data cleaning, diversification, and contextual validation (Buele-Sabando et al., 2025).

The researcher's responsibility toward users extends beyond the mere publication of results. It implies the assumption of the social and cultural effects of educational innovations (Bond & Khosravi, 2024). Privacy and data protection have become top priorities in the context of massive data collection on learners, requiring strict compliance with GDPR regulations and digital research ethics (Dunlap & Michalowski, 2024).

The ethics of digital education also encompasses anthropological aspects, such as maintaining intellectual freedom and diversity in an algorithm-driven world (Yaumi, 2024). The researcher becomes a guardian of humanistic values, ensuring that AI serves human development rather than social control (Pręgowska & Perkins, 2024).

Equally important is the ethics of interdisciplinary collaboration, as AI integration often involves teams from diverse disciplinary backgrounds. A lack of ethical communication can lead to distorted or partial conclusions (D'Souza et al., 2024).

Finally, the need for a global ethical code for digital educational research is increasingly recognized as an international priority (Zorins & Grabusts, 2021). Such a framework should establish norms regarding data use, algorithmic transparency, and social accountability, thus consolidating digital education as a space for human dignity and intellectual freedom (Mujtaba, 2024).

METHODOLOGICAL INNOVATION IN EDUCATIONAL RESEARCH

The digital transformation of education has brought not only new pedagogical tools but also a profound shift in methodological paradigms. In a world characterized by permanent connectivity and massive data generation, traditional research methods — based on controlled experiments and standardized questionnaires — have become insufficient for understanding the complexity of contemporary education (Kalz & Kreijns, 2022). The scientific researcher is therefore called to adopt interdisciplinary and innovative approaches, adapted to digital realities.

One of the major directions in this evolution is Design-Based Research (DBR) — a collaborative and iterative methodology that combines theory and practice in real-world contexts. DBR allows for the development and refinement of educational solutions through contextualized experimentation, generating both applicable results and emerging theories (McKenney & Reeves, 2021). In digital education, DBR facilitates the rapid integration of technological tools and their continuous adjustment according to empirical feedback (Wang et al., 2023).

Increasingly, educational research adopts agile methodologies, inspired by software development, which privilege adaptability, collaboration, and the rapid revision of research tools. These approaches make it possible to synchronize research processes with the dynamics of technological innovation (Kimmons, 2021).

At the same time, learning analytics and big data research have become central pillars of digital educational research. The analysis of large datasets collected from learning platforms enables fine-grained observation of behaviors and the identification of cognitive patterns, providing a foundation for evidence-based educational decisions (Ferguson et al., 2022). However, these methods also require critical reflection regarding data validity and interpretation, as algorithmic analysis can be affected by biases and the absence of social context (Knight et al., 2022).

The integration of quantitative and qualitative methods, known as data triangulation, has become an essential practice for validating results and achieving a holistic perspective on educational processes (Zawacki-Richter et al., 2023). In digital research, triangulation combines automated

activity logs with narrative data from interviews or reflective journals, providing a comprehensive picture of human–technology interaction.

Moreover, educational research increasingly integrates emerging technologies such as virtual reality (VR) and augmented reality (AR) to analyze behaviors and emotions in controlled yet realistic environments (Jensen & Konradsen, 2021). The use of biometric sensors (EEG, eye-tracking) further expands the neurocognitive exploration of learning processes (Makransky & Mayer, 2022).

At the same time, there is growing interest in participatory research, which involves teachers, students, and educational communities as equal partners in the research process (Tissenbaum & Slotta, 2021). This approach promotes the democratization of knowledge, transforming research into a collaborative and reflexive process.

Finally, the principle of Open Science has become a central reference in modern educational research. By promoting methodological transparency, open access to data, and study replicability, this movement enhances public trust in science and accelerates the pace of scientific progress (Nascimbeni et al., 2023).

INTERDISCIPLINARITY AND THE FORMATION OF A NEW GENERATION OF RESEARCHERS

Educational research in the twenty-first century unfolds within a complex epistemological context, characterized by the convergence of social sciences, cognitive sciences, and digital technologies. In this dynamic environment, interdisciplinarity has become an essential condition for the intellectual survival of the researcher (Schmitt et al., 2023). The complexity of educational phenomena — from personalized learning to the ethical analysis of algorithms — transcends the boundaries of traditional disciplines, requiring an integrative and collaborative scientific culture (Maggio et al., 2023).

The profile of the educational researcher has changed significantly. A purely pedagogical or psychological specialization is no longer sufficient; the new researcher must also master computer science, data analysis, neuroscience, and digital ethics (Lawrence & Levine, 2023). UNESCO (2023) refers to this as a "new epistemic literacy" — the ability to understand human and technological phenomena simultaneously.

This interdisciplinarity is not merely collaborative but integrative: the development of an adaptive educational platform requires convergent contributions from computer science, psychology, sociology, and ethics (Pereira et al., 2023). The researcher thus becomes an orchestrator of knowledge, capable of connecting different scientific languages and creating complex conceptual models.

Interdisciplinarity also stimulates methodological innovation. Collaboration with experts in neuroscience has led to the emergence of neuroeducation, while cooperation with computer scientists has made possible the development of learning analytics and educational data mining — fields that introduce greater predictive rigor into educational research (Lindl et al., 2020).

The major challenge, however, lies in overcoming epistemological and methodological barriers between disciplines. Interdisciplinary cooperation requires an ethics of collaboration, based on mutual recognition of contributions and the avoidance of disciplinary hierarchies (Harvey et al., 2022).

Doctoral and postdoctoral programs play a crucial role in shaping new interdisciplinary researchers. Recent studies show that participation in international projects such as Erasmus+ or Horizon Europe fosters collaboration skills and the development of digital critical thinking (Zervas & Stiakakis, 2024).

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Likewise, initiatives such as One Health Interdisciplinary Collaboration and Digital Health Education programs promote transdisciplinary formation within universities, strengthening the connection between science, technology, and humanistic values (Iatridou et al., 2021).

The formation of this new generation of researchers must also be guided by an ethics of integrity and academic responsibility, in which scientific competencies are combined with moral discernment and critical spirit (Ahmed & Khayal, 2024). In a digital communication era, the researcher must master not only the academic register but also the art of accessible scientific dissemination for the broader public.

In conclusion, interdisciplinarity is no longer an option but a structural necessity of contemporary educational research. It shapes a new generation of researchers capable of integrating technology, science, and ethics into a common endeavor of understanding and transforming education.

CONCLUSIONS

In an era dominated by rapid technological transformations and profound cultural shifts, the scientific researcher in education faces an unprecedented challenge: to reconcile scientific rigor with the dynamics of digital change, innovation with ethics, and efficiency with humanity. Their traditional role—focused on observing and analyzing educational processes—has evolved into a multidimensional and strategic position that combines the competencies of designer, evaluator, data analyst, trainer, and ethicist.

This article has demonstrated that the digital transformation of education is not merely a technological issue but also an epistemological and axiological one, involving a deep reconfiguration of how we understand learning, knowledge, and the relationship between humans and technology. Artificial intelligence, big data, augmented reality, and other emerging innovations provide unprecedented opportunities for the personalization of education and the optimization of teaching processes. At the same time, however, they impose new methodological and ethical imperatives.

The scientific researcher thus becomes an architect of digital pedagogy, a professional called upon to design flexible and inclusive educational models grounded in empirical evidence yet guided by critical reflection. They must evaluate not only the technological efficiency of implemented solutions but also their effects on the formation of autonomous thinking, educational equity, and human values. In this regard, the contemporary researcher stands out through a dual responsibility: toward science, through rigor and method, and toward society, through ethics and vision.

The ethical dimension, examined in depth, represents the cornerstone of this transformation. In the absence of a strong moral framework, technological progress risks becoming an end in itself, and education—a mechanism of algorithmic optimization devoid of human depth. Therefore, the ethics of digital educational research must guide every stage of the scientific process: from data collection and the design of intelligent systems to the dissemination of results and the evaluation of social impact. Respect for privacy, algorithmic transparency, fairness, and inclusion are not merely declarative principles but conditions of legitimacy for scientific knowledge.

At the same time, methodological innovation is redefining research standards. Design-based methods, participatory research, data triangulation, and agile approaches have become indispensable tools for investigating complex educational phenomena in digital environments. Research can no longer be understood as a linear process but as a reflexive cycle of learning, in which hypotheses, methods, and interpretations are continuously adapted to context and emerging results. In this way, educational research rediscovers its creative and transformative dimension.

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Furthermore, interdisciplinarity emerges as the keystone of the new science of education. Only through the integration of perspectives from computer science, psychology, neuroscience, sociology, and philosophy can a comprehensive vision of digital education be constructed. The researcher becomes a mediator between these domains, a translator of scientific languages, and a coordinator of collective knowledge. Consequently, the formation of new generations of researchers must include not only technical and methodological competencies but also a culture of collaboration and global responsibility.

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