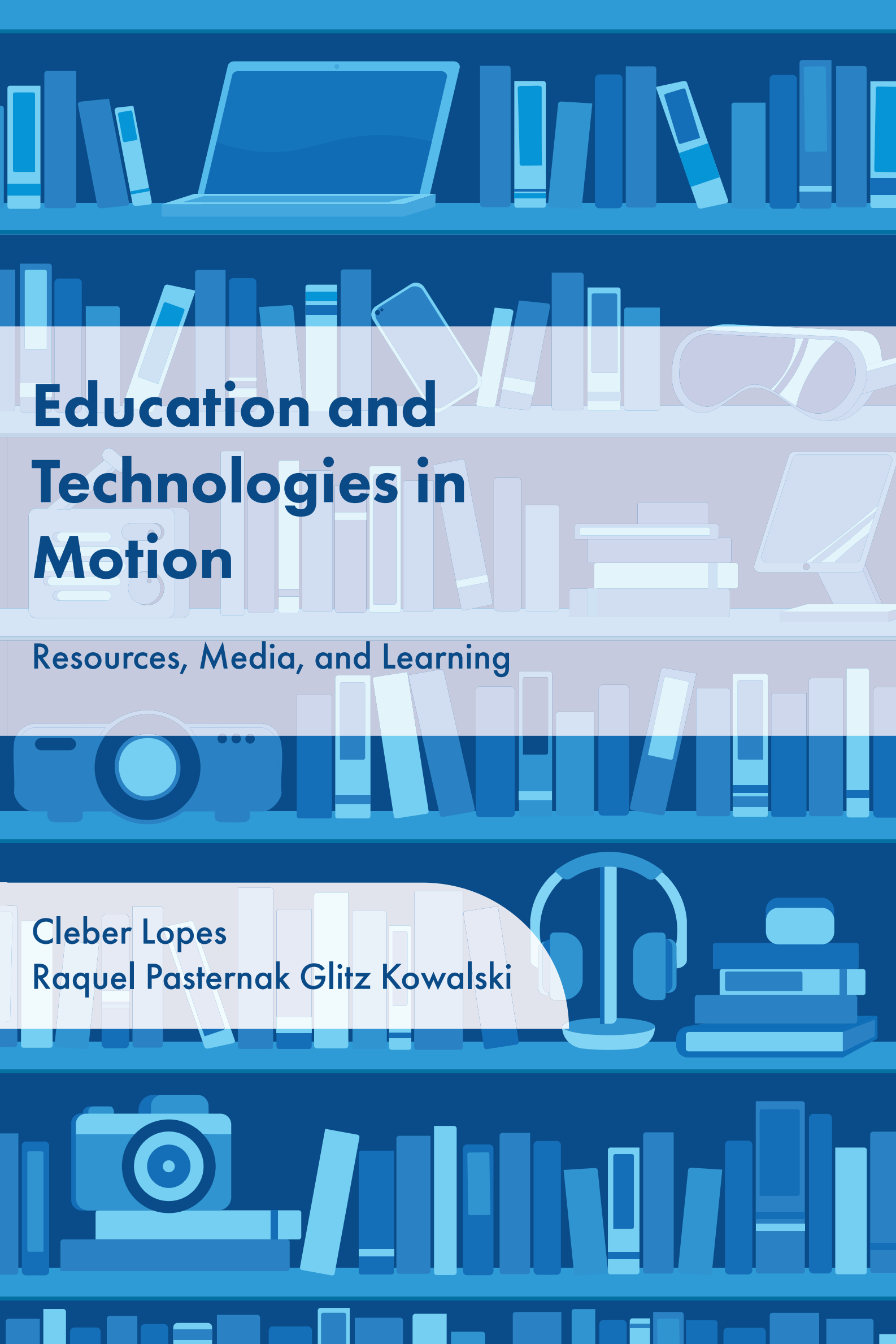


The background is a stylized illustration of a bookshelf. The shelves are filled with books of various heights and colors, primarily in shades of blue and purple. Interspersed among the books are several technological items: a laptop on the top shelf, a smartphone on the second shelf, a VR headset on the third shelf, a desktop monitor on the fourth shelf, a camera on the fifth shelf, and a pair of headphones on the sixth shelf. The overall aesthetic is modern and tech-oriented.

Education and Technologies in Motion

Resources, Media, and Learning

Cleber Lopes
Raquel Pasternak Glitz Kowalski

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A Seven Publicações Ltda é comprometida em garantir a integridade editorial em todas as etapas do processo de publicação, evitando plágio, dados ou resultados fraudulentos e impedindo que interesses financeiros comprometam os padrões éticos da publicação.

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Dados Internacionais de Catalogação na Publicação (CIP)
(Câmara Brasileira do Livro, SP, Brasil)

L864e Lopes, Cleber.
 Education and Technologies in Motion [recurso
 eletrônico] : Resources, Media, and Learning / Cleber Lopes,
 Raquel Pasternak Glitz Kowalski. – São José dos Pinhais,
 PR: Editora Seven, 2026.
 Dados eletrônicos (1 PDF).

ISBN 978-65-6109-337-8

1. Educação. 2. Tecnologia. 3. Aprendizagem. 4. Mídia.
I. Kowalski, Raquel Pasternak Glitz. II. Título.

CDU 37:004

Bruna Heller - Bibliotecária - CRB10/2348

Índices para catálogo sistemático:

1 Educação 37

2 Tecnologias digitais 004

DOI: 10.56238/livrosindi202668-

Seven Publications Company

CNPJ: 43.789.355/0001-14

editora@sevenevents.com.br

São José dos Pinhais/PR

BOOK ORGANIZERS

Profa. Dra. Raquel Kowalski

Prof. Me. Cleber Lopes

BOOK AUTHORS

Alejandro Pérez Carvajal

Alex Bruno Fendiekovski

Aline Rosenente Taverna

Ana Carolina Ingeinczaki

Caroline Carmona Marques Gonçalves

Cecilia Emilia da Silva Paveslki

Claudete Zaclikevic

Daniele Saheb Pedroso

Dirlei Terezinha Fachinello

Emerson da Silva Grizotes

Everson Luiz Oliveira Motta

Gabriela Condeza Zuñig

Gabriele Polato Sachinski

Geovana Ribeiro Bone

Glaucia da Silda Brito

Guiullianna Carolina Q. L. Drapczynski Bot

Jorge Ricardo Martins Trigo

Katia Ethienne Esteves dos Santos

Lilian Amaral da Silva Souza

Luciani de Sousa Amaral Santos

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Manuel Jacinto de Assenção Jardim

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Neusa Nogueira Fialho

Patrícia Fonseca Ferreira Fleury

Patricia Lupion Torres

Raquel Pasternak Glitz Kowalski

Sullyvan Soares Jonsson

Welington Tavares dos Santos

PREFACE

Dear Readers,

It is always an honor to preface a work such as *Education and Technologies in Motion: Resources, Media, and Learning*, particularly because Professors Raquel Kowalski and Cleber Lopes organized it. This invitation allowed me to express my deep recognition of these professionals, who organized this work and presented records of a long journey in research and teaching practice, with an emphasis on the use of technology in the service of teaching and learning. The authors' expertise is reflected in the excellent reflections they have developed, which can help teachers and students in their personal and professional development.

The work aims to discuss the transformations of educational processes arising from the articulation of digital technologies, educational resources, media, and innovative pedagogical practices. It brings together theoretical and empirical Studies focusing on topics like didactic mediation and artificial intelligence, entrepreneurial education, continuing teacher training, hybrid teaching, school management, and digital literacies, among others. Thus, it offers relevant contributions to researchers, teachers, and managers who work in educational contexts undergoing constant transformation. To do so, they need to renew and deepen pedagogical conceptions and continually rethink the use of digital resources.

In this book, as recorded by the organizers, the productions emerged from a research process carried out over the years, especially within the Graduate Program in Education at the Pontifical Catholic University of Paraná, where they work in the research group Pedagogical Practice in Teaching and Learning with Educational Technologies (PRAPETEC). The book was written as a realization of the group's possible dream: to share the research findings with their peers and to provide teachers at different levels of education with resources that can support teaching and learning, particularly by embracing technology and media that can present potential advances in teaching.

Overall, the book proposes didactic mediation as a foundation for developing new pedagogical strategies suited to the online and connected era. It emphasizes embracing digital transformation to shift educational paradigms and highlights the importance of incorporating emerging digital literacies into teacher training. Additionally, it encourages the exploration of open educational Ecosystems within both public and private education contexts. The innovative themes in the work prompt us to consider important directions for Education professionals, particularly in their ongoing personal and professional growth. It emphasizes the importance of learning how to learn, think critically, create, innovate, and construct knowledge throughout their lives.

The authors warn educators that the computerized network is becoming increasingly influential in the twenty-first century, offering a more democratic platform for sharing publications. This enables teachers to find resources that help bridge social gaps and facilitate the integration of knowledge online through digital access.

Historically, the computer was introduced in the twentieth century as a multifunctional tool. With the advent of the internet and the World Wide Web, their capabilities have improved in this century, especially in expanding educational environments. The evolution of the Web across its various generations continues to broaden access to and usage of platforms, applications, and databases, facilitating research and the dissemination of information.

The continuous movement on the WEB has been providing opportunities to produce knowledge and make it available on the computerized network, but it should be noted that, in this digital movement, teachers can enhance communication between peers and with students, and it deserves attention to ethical considerations. Technology advances and introduces society to Artificial Intelligence (AI), which has been the focus of advances but also of critical positions arising from the warranted ethical care in the authorship, sharing, and dissemination of knowledge production.

In a broader view, this work can be compared to the weaving of threads intertwined in the production of the chapters, as they present collaborations arising from investigations that can support advances in education. In particular, in the use of technology in teaching at all levels of education, loaded with possibilities for paradigmatic changes, which are configured in elaborations, which, in addition to the technical vision, allow for a more humane and solidary education, such as the sharing of research findings recorded in the chapters that make up this work.

The themes presented share a common point: the search for advancement in education, which provokes readers to reflect, learn, teach, and act in teaching, seeking a new vision.

By recommending an attentive and reflective reading of the work, I hope that teachers are provoked to swell the ranks in the search for relevant teaching, that they use technology at the service of learning, that they drive a new paradigm in education that includes a more humane vision, which requires a fraternal, fair and supportive attitude, in which teachers can act as protagonists in teaching with competence, Ethics, creative and innovative spirit.

The themes encourage the development of dialogical, reflective, creative, and democratic educational spaces. These spaces facilitate educational practices that utilize digital resources and promote an epistemological shift, fostering learning through processes that emphasize ethical stance, solidarity, peace, social justice, democracy, respect, and fraternal coexistence.

Curitiba, March 2026

Dr. Marilda Aparecida Behrens

Dr. in Education

Retired professor of the Graduate Program in

Education of the Pontifícia Universidade Católica do Paraná- PUCPR

PRESENTATION

We present the volume *Education and Technologies in Motion: Inclusive Environments, Ethics, and Pedagogical Innovation*, which continues this collection's commitment to fostering academic debate on the challenges and opportunities of education amid rapid social, cultural, and technological change. This book arises from the understanding that thinking about contemporary education involves more than just following innovations; it requires critically understanding them, contextualizing them within real training and pedagogical settings, and aligning them with ethical, inclusive, and human-centered principles. By gathering researchers and authors from diverse backgrounds, experiences, and fields of study, the volume highlights the value of interdisciplinary dialogue and collective knowledge creation.

Though digital technologies have become prominent in recent educational developments, their mere presence does not ensure pedagogical transformation, equity, or quality. The chapters explore the relationship between education and technology through a broader lens, integrating themes like pedagogical innovation, teacher training, artificial intelligence, care, inclusion, accessibility, and social justice as interconnected and complementary dimensions. The works reflect, through varied theoretical and methodological approaches, a shared concern: how education can respond responsibly, sensitively, and rigorously to current demands.

These reflections not only analyze trends but also suggest pathways, raise questions, and broaden horizons for teaching, research, and the creation of more conscious and inclusive learning environments. Additionally, the publication demonstrates the strength of academic networks that span institutions, countries, and disciplines. Its pages feature contributions engaging with emerging and urgent issues, all while emphasizing the significant role of humans in education. Accordingly, the volume promotes an understanding of education rooted in dignity, diversity, and social responsibility. We extend our gratitude to the authors who shared their investigations, experiences, and insights, enriching the contemporary educational dialogue. We also thank the guest professor who wrote the preface, offering readers a valuable perspective on the themes presented.

We hope this book will resonate with researchers, educators, students, and others interested in the intersection of education, technology, ethics, and inclusion. May it foster new connections, inspire transformative practices, and reinforce the idea that educational innovation is an act of intellectual responsibility, human sensitivity, and a commitment to the common good.

Cleber Lopes

Raquel Kowalski Pasternak Glitz Kowalski

Organizers

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CHALLENGES OF ENTREPRENEURIAL EDUCATION IN THE ON-LIFE ERA: FROM DIGITAL TRANSFORMATION TO CHANGING EDUCATIONAL PARADIGMS

  10.56238/livrosindi202668-001

Dirlei Terezinha Fachinello

Instituto Federal de Educação, Ciência e Tecnologia do Acre – (IFAC-Brasil)

Centro de Estudos Globais -CEG (Portugal)

E-mail: dirlei.fachinello@ifac.edu.br

Orcid: <https://orcid.org/0009-0005-5483-5518>

Jorge Ricardo Martins Trigo

Centro de Estudos Globais -CEG (Portugal)

E-mail: jorgermtrigo@gmail.com

Orcid: <https://orcid.org/0009-0006-5720-2553>

Manuel Jacinto de Assenção Jardim

Universidade Aberta (Portugal)

Centro de Estudos Globais -CEG (Portugal)

E-mail: jacinto.jardim@uab.pt

Orcid: <https://orcid.org/0000-0002-0600-3128>

INTRODUCTION

The world in which we live "is no longer a physical and visible world, but rather a complex and inseparable set of worlds and informational and material combinations, an info-world or a network of networks". Consequently, the environment we inhabit is no longer physical and is understood as a kind of computerized territoriality, accessible at a touch. We then find a new world, made up of dice and concrete elements such as stone, bricks, and plants, capable of multiplying their forms. This new world has become hybrid, with a computerized, matter-pixel materiality within a connective architecture.

From a philosophical perspective, Bauman reflected on the social space and the physical space transformed by technological development, using a utopian model of the homogeneity of city formation (which does not resemble any existing real city) in a scenario where capital has no fixed domicile and the economy moves by its own means and motives.

Thus, through technology, knowledge and education have found a vector for globalization, communication, and the transmission of knowledge beyond physical space. This is an irreversible path. It is about the evolution of humanity at an increasing speed, placing us at the apex of the transition to an OnLife world and Education. We are, therefore,

now of building history. Such a transition places education at the forefront of new epistemological and methodological demands.

In view of this, if knowledge is globalized beyond physical space, education must also transcend its traditional methods. In this context, Entrepreneurial Education (EE) needs to deepen the development of mindsets for solving complex problems, decision-making under uncertainty, and creating value on platforms and networks.

In light of this transformation, it is essential to identify the paradigmatic challenges that the OnLife environment imposes on the design, curriculum, and practices of Entrepreneurial Education. Thus, the objective of this article is to analyze how the OnLife paradigm reconfigures its pedagogical foundations and the entrepreneurial skills necessary in contemporary times.

METHODOLOGY

The research on which this article is based was developed in a phased and gradual manner, structured in two complementary moments. The first stage consisted of an in-depth survey and mapping of the theoretical productions on Entrepreneurial Education (EE), Digital Education and the OnLife Education paradigm, constituting a literature review of a qualitative, exploratory and theoretical-conceptual nature. **Databases such as Scopus, Web of Science, SciELO, and Google Scholar were consulted, using descriptors related to EE, digital education, and OnLife, and applying inclusion criteria that favored publications between 2010 and 2025 with recognized theoretical relevance.** This approach proved to be the most appropriate to understand a phenomenon that is characterized by ontological and epistemological complexity, given the hybridization between physical and digital materialities and the emergence of new learning ecologies in contemporary times.

The option for a qualitative approach is justified by the fact that the processes investigated, such as the transformation of pedagogical dynamics, the reconfiguration of the teaching role and the emergence of entrepreneurial skills in hyperconnected ecosystems, are not susceptible to direct measurement. In coherence with interpretative epistemology, we sought to understand how different authors conceptualize essential elements of the OnLife world, marked by the computerization of space, the collapse of the boundaries between online and offline, and the constitution of a network architecture that involves human and non-human actors (Floridi, 2015; Schlemmer et al., 2020). Thus, the investigation focused on the interpretation of the discourses, models and theoretical

frameworks that structure the contemporary reflection on these themes, delimiting a corpus composed of scientific articles, books and institutional documents selected from thematic relevance and epistemological consistency.

The theoretical framework of the study articulates three main axes: (i) the theories of Entrepreneurial Education, especially those that conceive it as an experiential, transversal and collaborative process (Dolabela, 1999; Araújo & Davel, 2018; Jardim, 2022); (ii) the debates on Digital Education and networked learning, which problematize the limitations of traditional paradigms and point to the constitution of hybrid and reticular educational ecosystems (Moreira & Schlemmer, 2020); and (iii) the philosophical and socio-technical conceptualization of OnLife Education, which describes the transition to a computerized territoriality and a connective ecology of co-engendering between humans and technologies (Floridi, 2015; Schlemmer, 2023). The articulation of these axes allowed us to analyze how EE can be reinterpreted in the light of new ways of inhabiting, learning and interacting in the digitized world.

The second phase of the research consisted of the systematization and interpretative deepening of the theoretical data collected, with the aim of identifying the paradigmatic challenges that the OnLife context imposes on curricular design, pedagogical practices and the development of entrepreneurial skills. This stage implied an analytical and comparative reading of the different theoretical currents, highlighting convergences, tensions, and conceptual gaps. A critical-interpretative analysis was employed, with thematic categorization derived from exploratory reading of the corpus, guided by emerging categories such as: hyperconnectivity, learning ecologies, transversal skills for innovation, maker culture, network learning, co-creation of knowledge and teaching role in the digital age.

The analysis took place in two complementary moments: first, the historical and conceptual path of Entrepreneurial Education (EE) was revisited; then, this field was reinterpreted in the light of the OnLife paradigm, observing how the convergence between the physical and digital worlds changes the formative requirements of entrepreneurship. This approach allowed us to understand EE as part of a socio-technical ecosystem in transformation. The combination of theoretical analysis, critical review and contextual interpretation showed that OnLife Education redefines entrepreneurship, bringing it closer to connective, creative and sustainable skills. In short, it is a theoretical-qualitative investigation aimed at illuminating the challenges and opportunities of EE in a scenario

marked by informational fluidity and the growing interdependence between human beings and technology.

RESULTS

ENTREPRENEURIAL EDUCATION

Entrepreneurial Education (EE), which has already established itself globally as a critical driver of economic growth and rising living standards, is at the center of discussions about future training. In recent decades, entrepreneurship has been consistently recognized as a critical factor in generating jobs, stimulating economic growth, and raising society's living standards. This perception is widely disseminated globally, leading governments across all continents to implement various measures and incentives to support the creation of new enterprises. Among these measures, Entrepreneurial Education (EE) has been consolidated as a relevant theme for several actors, including administrators, academics and researchers (Dobra-Constantinescu et al., 2024) (Araújo & Davel, 2018)

Conceived as a set of teaching practices and methodologies that aim, predominantly, at training individuals capable of creating new businesses and boosting economic development, EE is often presented at the international level as a predictable, linear process, emphasizing the planning of stages and the expectation of a specific return. (Araújo & Davel, 2018) In more practical terms, it covers the curricular structures that educational institutions, such as universities, must make available to enable students to acquire knowledge, skills and competencies related to entrepreneurship, such as identifying opportunities, integrating resources and critical thinking. (Dobra-Constantinescu et al., 2024)

This recognition of entrepreneurship as a social driver is intensified in the context of the Digital Society, where digital transformation imposes an environment in constant change and uncertainty. In this society, what is "new" is updated every second, requiring entrepreneurial training to move beyond traditional linear models and focus on innovating, adapting, and creating value in hyperconnected environments. Entrepreneurial Education itself, historically grounded in action and experience, is recognized as an intrinsic requirement of the twenty-first century. (Santos Junior et al., 2023) (Santos Junior et al., 2023)

The objective of entrepreneurial education, therefore, is to promote the learning of the entrepreneurial spirit through a conceptual reconfiguration sustained by the development of transversal human skills essential to entrepreneurship. (Silva, 2019).

For, entrepreneurship education is about a: Garden (2022a)

Teaching-learning process that aims to develop the skills necessary to create original and valuable products and services. It seeks to respond to the need for students to be increasingly successful in their personal, social and professional lives, and to use tools that allow them to achieve their life projects. (Jardim, 2022a)

Education for entrepreneurship is, according to some, a strategic field for the advancement and development of societies, serving as a catalyst for economic growth, social cohesion, organizational success, and personal fulfillment. Consequently, its purpose is to foster essential, transversal skills demanded across all professional spheres, such as initiative, lateral (out-of-the-box) thinking, teamwork, creativity, innovation, and the ability to take calculated risks.

Recognized as a widespread issue in school systems and considered one of the key competencies for lifelong learning in education policies in Sweden, Europe, and throughout the West, the concept of Entrepreneurial Education centers on the interests, motivations, and real-life context of young people as the basis of their learning processes. Reflection is a key factor in this development, emphasizing essential skills such as creative thinking, communication, cooperation, initiative, openness, and responsibility, largely through teaching practices based on experimental and collaborative learning, combined with responsible and reflective practices.

It is salutary to differentiate the approaches between conventional teaching and learning for entrepreneurship, using to clarify the main characteristics of each approach: Dolabela (1999)

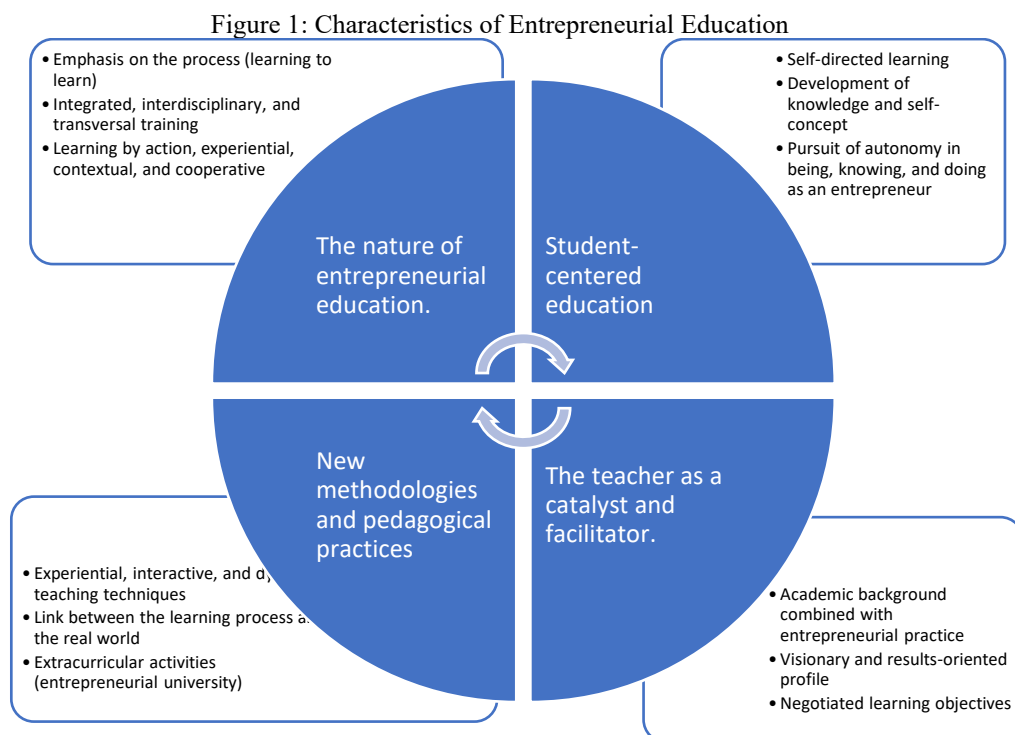
Table 1: Traditional teaching and entrepreneurship learning

Conventional	Entrepreneurship
Emphasis on content, which is seen as a goal	Emphasis on process, learning to learn
Led and mastered by the instructor	Appropriation of learning by the participant
The instructor passes on the knowledge	The instructor as a facilitator and learner; participants generate knowledge
Acquiring "correct" information once and for all	What is known can change
Strongly scheduled curriculum and sessions	Flexible and needs-driven sessions
Objectives of education imposed	Negotiated learning objectives
Priority for performance	Priority for performance-generating self-image
Rejection of the development of conjecture and divergent thinking	Divergent conjecture and thinking seen as part of the creative process
Emphasis on analytical and linear thinking; Left part of the brain	Whole-brain involvement; increased left-brain rationality through holistic, nonlinear, intuitive strategies; emphasis on the confluence and fusion of the two processes

Theoretical and abstract knowledge	Theoretical knowledge largely complemented by experiments in the classroom and outside
Resistance to community influence	Encouraging community influence
Emphasis on the outside world; An interior experience considered inappropriate to the school environment	Emphasis on the outside world; An interior experience considered inappropriate to the school environment
Education, seen as a social necessity for a certain period of time, to establish minimum skills for a given role	Education seen as a lifelong process, only tangentially related to school
Unaccepted errors	Errors as a source of knowledge
Knowledge is the link between student and teacher	Human relationship between teachers and students is of fundamental importance

Source: Dolabela (1999, p. 116)

In the same perspective, , they argue that entrepreneurial education Schaefer & Minello (2016) has its own characteristics that differentiate it from other traditional teaching models, considering that its emphasis lies in the student's learning process with "focus on action and learning to learn. The following figure summarizes these specificities:



Source: Schaefer & Minello (2016. p. 77)

Thus, entrepreneurial education is experiential, contextual, and cooperative, and must occur in an integrated, interdisciplinary, and transversal way to other disciplines and stages of education. The experience is configured as a pedagogical mechanism that enables the student to perform an action, internalize a principle or concept derived from it, and

consolidate this learning through its application in contexts or situations analogous to the real world. (Schaefer & Minello, 2016; Araújo & Davel, 2018)

ONLIFE DIGITAL EDUCATION

The second decade of the present millennium has been characterized by an era of profound social and technological transformations, which impose daily challenges to the personal, economic, political, cultural, and educational spheres. The growing ubiquity of technological innovations is manifested in the dissemination of a wide range of digital resources, notably in virtual environments and on social media platforms, and in the growing influence of algorithmic action and nanotechnology. (Santos & Torres, 2021)

The reconfiguration of the environment to a hyperconnected society has been happening gradually, with networked technologies driving disruptive movements in various dimensions of life, such as science, leisure, and work, depending directly on the availability of the technological infrastructure necessary for this. This new housing space brought paradigm shifts to social, commercial, cultural, and especially educational relations.

In the educational sphere, this evolution of digital technologies has led to many approaches and proliferation of terms related to digital-mediated education that, in the perception of , often do not Moreira & Schlemmer (2020) have the proper conceptual rigor, as can be seen in the following table:

Table 2 – Education models and their characteristics

Education Model	Definition / Main Focus	Nature of Interaction	Key Differential
Digital-mediated education and its variants	Umbrella term that encompasses the use of digital technologies in the educational process.	It varies according to the specific model (it can be face-to-face, distance, synchronous or asynchronous).	The use of digital technologies is not limited to the replacement of methods, but to the creation of new scenarios.
Remote teaching or remote class	Emergency and provisional transposition of methodologies and practices of physical face-to-face teaching to online media.	Use of online tools for synchronous/asynchronous classes, maintaining the logic of the face-to-face curriculum.	An emergency/provisional character, it is not supported by consolidated research in the area.
Distance learning	Teaching practice where the teacher and the student are separated in space or time.	It can be synchronous or asynchronous. Emphasis on the act of teaching at a distance.	Physical or temporal separation between instructor and student; focus on content transmission.
Distance education (EAD)	Educational paradigm established and consolidated by research, which aims at distance learning.	It varies, but is planned and structured specifically for the distance modality.	Focus on student learning, with conceptual rigor and theoretical support.

Education Model	Definition / Main Focus	Nature of Interaction	Key Differential
eLearning	Use of the internet and/or other digital media to develop education.	Predominantly online, flexible.	Emphasis on the electronic/digital component for the provision of education.
Online Education	An educational process that takes place exclusively or primarily in virtual learning environments and networks.	Interaction mediated entirely by technology, synchronous and asynchronous.	Learning takes place on the network, with a focus on online connectivity and interaction.
Web-based learning	Web-based learning, using resources and tools from the internet.	Completely online.	Focus on the World Wide Web as the primary platform for learning.
Open Learning	Educational philosophy focused on removing barriers to access and providing flexibility to the student.	Varies (face-to-face, distance, or hybrid).	Principles of accessibility, flexibility, and elimination of barriers.
Hybrid Education	A broader concept than <i>Blend Learning</i> , involving the pedagogical combination of different times, spaces, methodologies and technologies.	Mixed, with planned and intentional integration.	A vision that goes beyond simple combination, involving transubstantiation and new ecologies .

Source: (Moreira & Schlemmer, 2020)

Digital Education goes beyond the use of hardware, software and communication networks and the development of computational thinking. It is understood as a movement between human and non-human actors who coexist and communicate directly, without mediation by representation. , explain that Digital Education occurs through teaching and learning processes that are co-engendered with different Digital Technologies (DT), Schlemmer & Moreira (2020) which may or may not be interconnected in a network. This vision extends along a continuum from Digitally Enriched Face-to-Face Education to Fully Online Education, including Hybrid Education.

ONLIFE EDUCATION

The term "OnLife" was coined to describe the new experience of a hyperconnected reality, in which it no longer makes sense to ask whether someone is online or offline. This expression was also used to name a project chaired by Floridi at the European Commission: The "OnLife Initiative" (The OnLife Initiative: concept reengineering for rethinking societal concerns in the digital transition) whose central focus was to carry out a "conceptual reengineering" with the aim of "rethinking social concerns in the digital transition". The result of this project was the launch of Floridi (2015) *The OnLife*

Manifesto in Brussels by the European Commission's Directorate-General for Communications Networks, Content and Technology (DG Connect) in February 2013. (Floridi, 2015)

In the perception of Floridi (2015), the OnLife context is defined by four major challenges that characterize the impact of Information and Communication Technologies (ICT) on our reality: weakening of the distinction between reality and virtuality; weakening of the distinction between human, machine and nature; transition from scarcity to abundance of information; and transition from the primacy of properties/individualities to the primacy of connectivity, processes and networks.

We are experiencing a change in the ecology of learning, a movement conducive to the passage from a school made of classrooms and classes, to an ecology of data platforms, access, co-production and sharing of content in an interactive way" (Schlemmer et al., 2020. p. 21)

Based on this, they emphasize that it is crucial to move beyond the educational paradigm in favor of a cosmogram vision. This perspective is based on the network logic that structures the ecology of learning within OnLife Education. In this way, the teaching-learning process is based on reticular, connective and atopic epistemologies, promoting an essential co-engendering between human and non-human actors and, consequently, going beyond the anthropocentric perspective. Schlemmer et al. (2020)

This hyperconnected reality is the result of the hybridization of the biological, physical and digital worlds that requires a rethinking of the educational paradigm, overcoming epistemologies and theories that are limited only to human beings, maintaining an anthropocene view of the world, so that the digitalization of the world and the generalized connection allow the construction of networks and interactive connective architectures where learning comes to be understood from an ecosystem logic in which actors humans and diverse entities dialogue and build an intelligent ecology. (Schlemmer et al., 2020)

In summary, reconfiguring reality into a hyperconnected, ecosystemic learning environment highlights the growing importance for individuals and faculty to develop transversal skills. These skills are essential for navigating uncertainty and fostering innovation in the digital age. In this paradigm shift, where connectivity and processes take precedence, Entrepreneurial Education serves as a key tool to cultivate mindsets for solving complex problems, making decisions under uncertainty, and creating value through

platforms and networks. It prepares individuals to proactively engage with the computerized world of today. According to OnLife Education, entrepreneurial curricula and practices should encourage the development of innovative projects aligned with maker culture and networked learning. These approaches embody reticular logic by promoting co-production and interactive sharing of content. (Souza et al., 2025)

THE ONLIFE ENTREPRENEURIAL TEACHER AS A CATALYST FOR CHANGE

In general, the teacher is required to go beyond the theoretical domain of his discipline. The role is expected to offer comprehensive support to students, ranging from health and nutrition support to social services, mental health, and special learning needs. To meet this complex range of skills, teaching requires the collaboration and support of a robust pedagogical and social support network. UNESCO, in the report *Reimagining our futures together: a new social contract for Education*, highlights that "The task of teaching is not carried out by a single individual who, in a classroom and behind closed doors, guides the student in activities or classes". Thus, the design of curricula and pedagogical practices, especially those grounded in open and shared knowledge, should be a collaborative process that actively involves teachers, ensuring that the needs of students in their specific contexts are fully met. The document proposes developing pedagogies based on participatory approaches and collaborative learning, fostering continuous exchange within the collegiate.

In a context of transition to OnLife Education, it is imperative to analyze the teaching function, which, contrary to common sense about technological advancement, is increasingly indispensable. The UNESCO International Commission on the Futures of Education's report, in its Chapter 5, presents a detailed and comprehensive approach to this theme.

In short, the successful transition to OnLife Education requires not only the transformation of the educational process itself but, fundamentally, the reconfiguration of the role and support offered to the teacher, a central actor on whom great responsibilities and expectations rest. In this sense, they argue that it is necessary to initiate specific educational processes to improve teachers' professional quality, with the aim of reaching the OnLife teaching level. Moreira & Schlemmer (2020) propose training and qualification programs for educational agents aimed at the development of training and digital education projects, expanding the concept of online to an OnLife digital education (Moreira & Schlemmer, 2020).

DISCUSSION

CHALLENGES AND SKILLS OF ENTREPRENEURIAL EDUCATION IN THE ONLIFE ERA

The premise of the articulation and combination of distinct educational spaces and environments underpinned the creation of the Future Classroom Lab (FCL) by European Schoolnet in 2012, in Brussels. FCL was conceived as an innovative and technologically enriched environment, characterized by flexible and reconfigurable spaces, whose main purpose is to challenge the faculty to revisit and rethink the intersection between pedagogy, technology and the design of the spatial configuration of classrooms. The FCL was structured in six pedagogical innovation scenarios — Create, Interact, Present, Investigate, Share and Develop — which aim to foster the adoption of methodologies that promote meaningful learning. The model has expanded globally, inspiring other projects, such as the Innovative Educational Environment (AEI) in Portugal, which integrates technological resources and adaptable furniture to promote multiple dynamics of activity, translating a holistic view of the teaching-learning process e being recognized as catalysts for the development of transversal skills in the students who use them, with digital technologies playing a decisive role in enabling the desired pedagogical and methodological changes. (Moreira & Horta, 2020)

Entrepreneurial Education in the OnLife era imposes a paradigmatic challenge: the transposition of the frontier of face-to-face/distance learning to the integration of the simulation of market environments in training. In this context, Information and Communication Technologies (ICT) are no longer mere supports and assume the role of central didactic resources, allowing the simulation of activities and problem situations inherent to the current market. The educational Metaverse thus emerges as a promising pedagogical frontier, offering an immersive space for experience and action that perfectly aligns with the vision of EE as a deliberate practice and experiential learning. By simulating hybrid and complex contexts, the Metaverse empowers students to develop entrepreneurial skills, such as leadership and problem-solving, required by the global and digital world. (Santos Junior et al., 2023)

The imperative to develop skills that transcend the physical domain in the era of computerized territoriality is robustly articulated by the Entrepreneurial Skills Framework for the Global and Digital World (Jardim, 2022b) that provides a solid framework to interconnect the intersection between Entrepreneurial Education and the OnLife paradigm:

Table 3: Entrepreneurial Skills for the Global and Digital World

Focus and openness to novelty	Value creation	Effective communication
Creativity and innovation	Strategic planning and evaluation	Clear and visual communication
Spirit of initiative	Troubleshooting	Teamwork and networking
Self-efficacy and resilience	Transformational leadership	Digital communication

Source: Jardim, 2022. p. 06.

The tripartite structure of the framework, which emphasizes Focus and openness to novelty, Value Creation and effective Communication, constitutes a direct response to the network logic and the co-engendering between human and non-human actors proposed by OnLife Education. Specifically, the "Effective Communication" category, by encompassing the skills of Digital Communication and Teamwork and Networking, clearly manifests the need to act in fluid digital environments and to manage the abundance of information, central characteristics of OnLife, is a prerequisite for successful entrepreneurship.

Consolidating Entrepreneurial Education from the OnLife perspective involves the articulation between normative imperatives and the innovation of pedagogical practices (Souza et al., 2025)

While reticulating, the OnLife Education Paradigm presupposes non-centrality, whether in the content, in the teacher or in the student, which points to the need for connective, networked pedagogies. AnOnLife education also presupposes the overcoming of online *and* offline *dualism*, providing the constitution of connective ecosystems of innovation in education, instigating an atopic inhabitation that develops in an econectography connecting diverse intelligences. (Schlemmer, 2023. p. 74)

For, the conception of Entrepreneurial Education (EE) within the OnLife framework goes beyond simply using digital tools like networking platforms, discussion forums, or e-learning environments, and moving past isolated problem-solving. This perspective requires a shift in how we understand knowledge, framing the process as part of an ecosystem and ecological logic, emphasizing cognition and action as interconnected between human and non-human actors. Therefore, a societal reevaluation of entrepreneurship becomes necessary, valuing it beyond competition and capital. Educational institutions should foster entrepreneurship within ecologically connected contexts, aiming to develop leadership and innovation rooted in planetary sustainability. The authors believe that transforming EE OnLife fundamentally depends on rethinking methodologies, designing entrepreneurship programs to foster innovative projects aligned with maker culture and network learning. This shift towards network creation and

collaboration is essential, reflecting the interconnected and fluid nature of the OnLife reality, and enabling students to act proactively within digital territorialities. Souza et al. (2025) (Souza et al., 2025)

For the promotion of these skills in the OnLife environment, the figure of the teacher is essential and must be actively developed. A study carried out by highlights the role of the teacher in entrepreneurial education, whose research results pointed out that the entrepreneurial teacher is often conceived as an enthusiastic individual who is not afraid to break with habitual patterns, acting as a driving force for change. This teacher acts primarily as a guide rather than a principal, demonstrating courage to grant students the freedom necessary for their development. The concept implies a "shift of power" in the teacher-student dynamic, in which the educator relies on the willingness and ability of students to utilize their own abilities. The European Commission reinforces this profile, describing the entrepreneurial teacher with qualities such as a positive attitude, passion for what he does, confidence in teaching, ability to listen, being an energetic and undisputed leader with a talent for prioritizing possibilities over obstacles. Therefore, it is essential that Entrepreneurial Education (EE) is clearly articulated with a theoretical framework and that the professional development of teachers is actively promoted in this context. Leffler (2020)

Consequently, the curriculum needs to be restructured to incorporate this new formative perspective, requiring educators to develop specific skills and abilities that allow them to know and understand which ecologies will be connected and what type of environment can be created (SCHLEMMER, 2023, p. 78-79).

Finally, they state that "in epistemological terms, OnLife Entrepreneurial Education emphasizes the importance of co-creation of knowledge in a network, preparing students to innovate/invent in a connective-ecology". For the authors, the learning environment acts as a catalyst for the development of a network of competencies for OnLife entrepreneurial education, through practical and interconnected experiences that reflect the complexity and problematizations inherent to the hyperconnected world. Souza et al. (2025. p. 32)

FINAL CONSIDERATIONS

This article's reflection highlights that Entrepreneurial Education (EE), when viewed through the OnLife paradigm, gains a broader scope beyond traditional models centered on business creation. In a world characterized by hyperconnectivity, merging physical and digital realities, and the rise of networked learning ecologies, entrepreneurship

becomes more intricate, demanding skills in innovation, collaboration, resilience, critical thinking, and the ability to navigate unstable and unpredictable environments.

The analysis shows that simply integrating digital technologies does not bring about the necessary transformation. EE OnLife requires an epistemic and methodological shift that redefines the student as a co-creator of learning and recognizes knowledge as a shared, interactive process. Innovative settings like flexible labs, hybrid formats, and immersive experiences in the educational Metaverse exemplify this change by fostering experiential learning, real-world problem solving, and collaborative projects aligned with maker culture and network principles.

In this process, teachers are not replaced by technology; instead, they become even more central. The OnLife entrepreneurial educator acts as a mediator, ecosystem designer, and facilitator of student independence, requiring ongoing training to operate effectively in interconnected and complex environments. Their role is crucial in guiding students to develop entrepreneurial skills suited to the digital territoriality of today.

It is important to note that this study, being theoretical and conceptual, does not aim to cover all aspects of the topic. The lack of empirical research invites future studies to explore how educational institutions, teachers, and students are adapting to OnLife Education. Case studies, comparative analyses, and research within real contexts can deepen and challenge these conclusions.

In conclusion, embracing OnLife Entrepreneurial Education involves understanding entrepreneurship as a connected, ethical, and sustainable activity capable of creating value across various dimensions, including the economic. By integrating networks, ecology, and innovation, this article helps expand the discussion on the challenges and opportunities of entrepreneurial training in a world profoundly shaped by digitalization and complexity.

REFERENCES

- Araujo, G. F. de, & Davel, E. P. B. (2018). Educação empreendedora, experiência e John Dewey. *Revista Pensamento Contemporâneo Em Administração*, 12(4), 1. <https://doi.org/10.12712/rpca.v12i4.13291>
- Bauman, Z. (2001). LIVRO- MODERNIDADE LÍQUIDA. In Rio de Janeiro: Jorge Zahar Editor.
- Dobra-Constantinescu, A., Maier, V., & Coțiu, M.-A. (2024). Entrepreneurship Education. <https://doi.org/10.5772/intechopen.1006044>
- Dolabela, F. (1999). Oficina do Empreendedor: A Metodologia de ensino que ajuda a transformar conhecimento em riqueza (Cultura Editores Associados, Ed.; 1st ed.). Cultura.
- Floridi, L. (2015). The OnLife Manifesto (L. Floridi, Ed.). Springer International Publishing. <https://doi.org/10.1007/978-3-319-04093-6>
- Jardim, J. (2022a). 365+ Dicionário de Empreendedorismo (Mais Leituras). www.legis.pt
- Jardim, J. (2022b). COMPETÊNCIAS EMPREENDEDORAS PARA SER BEM-SUCEDIDO NO MUNDO GLOBAL E DIGITAL: proposta de um quadro de referência. *Video Journal of Social and Human Research*, 1(2), 1–24. <https://doi.org/10.18817/vjshr.v1i2.24>
- Leffler, E. (2020). An Entrepreneurial Attitude: Implications for Teachers' Leadership Skills? *Leadership and Policy in Schools*, 19(4), 640–654. <https://doi.org/10.1080/15700763.2019.1668021>
- Moreira, J. A., & Horta, M. J. (2020). Educação e ambientes híbridos de aprendizagem. Um processo de inovação sustentada. *Revista UFG*, 20. <https://doi.org/10.5216/revufg.v20.66027>
- Moreira, J. A., & Schlemmer, E. (2020). Por um novo conceito e paradigma de educação digital OnLife. *Revista UFG*, 20. <https://doi.org/10.5216/revufg.v20.63438>
- Santos, K. E. E. dos, & Torres, P. L. (2021). Educação digital - híbrida e OnLife. *Revista UFG*, 21. <https://doi.org/10.5216/revufg.v21.70045>
- Santos Junior, V. B. dos, Diniz Neto, A. J. G., Oliveira Aquino, B., & Bottentuit Junior, J. B. (2023). FORMAÇÃO EMPREENDEDORA COMO DEMANDA DA SOCIEDADE DO DIGITAL: possibilidades a partir do metaverso educacional. *TICs e EaD Em Foco*, 9.
- Schaefer, R., & Minello, I. F. (2016). Educação Empreendedora: premissas, objetivos e metodologias. *Revista Pensamento Contemporâneo Em Administração*, 10(3), 60. <https://doi.org/10.12712/rpca.v10i3.816>
- Schlemmer, E. (2023). O protagonismo ecológicoconectivo e a emergência das hiperinteligências no Paradigma da Educação OnLife. *CADERNOS IHU IDEIAS* No 348, 1. https://www.researchgate.net/publication/371250242_O_protagonismo_ecologico-conectivo_e_a_emergencia_das_hiperinteligencias_no_Paradigma_da_Educacao_OnLife

Schlemmer, E., Felice, M. Di, & Serra, I. M. R. de S. (2020). Educação OnLife: a dimensão ecológica das arquiteturas digitais de aprendizagem. *Educar Em Revista*, 36. <https://doi.org/10.1590/0104-4060.76120>

Schlemmer, E., & Moreira, J. A. M. (2020). Ampliando Conceitos para o Paradigma de Educação Digital OnLife. *Interacções*, 16(55).

Silva, J. F. (2019). Educação Empreendedora. In *Dicionário de Educação para o Empreendedorismo* (Vol. 1, pp. 227–232).

Souza, G. H. S. de, Schlemmer, E., & Santos, A. P. S. dos. (2025). Desenvolvendo a Educação Empreendedora sob a Perspectiva da Educação OnLife. In *Educação & Inovação* (pp. 11–38). Editora do IFNMG. <https://doi.org/10.29327/5498353.1-1>

Unesco. (2022). Reimaginar nossos futuros juntos: Um novo contrato social para a educação. www.unesco.org/open-access/terms-use-ccbysa-port

DIDACTIC MEDIATION IN DISTANCE LEARNING CHEMISTRY MONITORING: INTEGRATION OF INNOVATIVE STRATEGIES FOR ENGAGEMENT AND LEARNING

 Crossref  10.56238/livrosindi202668-002

Neusa Nogueira Fialho

Maria Alice Witt

Sullyvan Soares Jonsson

INTRODUCTION

Distance education (EAD) has been consolidated as a strategic modality in the Brazilian higher education scenario, especially because it expands access to academic training and enables flexible learning. However, this modality also presents specific challenges, such as the difficulty of maintaining continuous interaction between students and teachers, the dispersion in activity monitoring, and the need for greater student autonomy. In this context, it is essential to implement support strategies that promote student engagement and the effectiveness of the educational process. Academic monitoring is one of these strategies, serving as a link among students, professors, the coordination office, and the institution.

Monitoring plays a crucial role in the teaching and learning process, both in the face-to-face modality and in distance education, serving as an essential link between the didactic content and students' effective understanding. In a virtual environment, where face-to-face interaction is limited, the monitor becomes a learning facilitator, helping to resolve complex questions, explain abstract concepts, and provide guidance on carrying out practical and theoretical activities.

In the Chemistry Degree course at the institution in question, the monitoring program was introduced as a recent initiative in distance courses, with the objective of improving academic performance, helping to overcome pedagogical difficulties, and stimulating more collaborative and participatory learning practices. Monitoring is thus presented as a concrete response to the needs of pedagogical support in distance learning, especially in courses with a high degree of theoretical and practical complexity, as is the case with Chemistry.

The introduction of monitoring in the institution's Teaching Degree in Chemistry was driven by systematic observations conducted by the teacher-tutor throughout her experience across the disciplines offered. Such observations supported the development of a project that outlined the main challenges anticipated in the implementation of monitoring, including the need to improve student engagement, sense of belonging, interactivity, and study habits.

Monitoring plays a crucial role in the teaching-learning process, both in face-to-face and distance education (EAD). In virtual contexts, where face-to-face interaction is inherently limited, the monitor emerges as an essential facilitator of learning. Its performance ranges from helping resolve complex doubts and explaining abstract concepts to guiding the execution of practical and theoretical activities, establishing a vital link between the didactic content and students' effective understanding.

In the institution's Distance Learning Chemistry Degree, the monitoring program was recently implemented to optimize academic performance, address pedagogical challenges, and encourage collaborative and participatory learning practices. In this way, monitoring is configured as a strategic response to the demands for pedagogical support in distance learning environments, particularly in courses characterized by a high degree of theoretical and practical complexity, as is the case with Chemistry.

The introduction of monitoring in the institution's Teaching Degree in Chemistry was driven by systematic observations conducted by the teacher-tutor throughout her experience across the disciplines offered. Such observations supported the development of a project that outlined the main challenges anticipated in the implementation of monitoring, including the need to improve student engagement, sense of belonging, interactivity, and study habits.

The pedagogical difficulties faced by students were identified and presented in the project, with an emphasis on chemical and mathematical calculations and chemical reactions, themes that permeate the discipline under monitoring. The central proposal was that monitoring offers differentiated support through synchronous interactive moments, aimed at supporting students not only with the specific difficulties of the disciplines but also with the organization of studies and the punctual delivery of evaluation activities.

In addition, the observations made by the teacher-tutor evidenced the need to expand communication among peers to facilitate the timely clarification of doubts and, thus, enable the proper performance of the evaluations. It was also verified the relevance of intensifying the engagement and interactivity between students, the teacher-tutor and the educational

institution, as well as improving student participation in synchronous meetings, considered strategic for strengthening the training process.

These aspects were duly contemplated in the monitoring project, which began to guide the structuring of synchronous moments with an emphasis on promoting interactivity, stimulating critical-reflective thinking and encouraging students' intellectual autonomy. The proposal seeks, therefore, not only immediate support for academic activities, but also the consolidation of practices that contribute to the integral formation of students, both personally and professionally.

Thus, monitoring began to play a strategic role in the educational process, configuring itself as a pedagogical action that responds to the emerging demands of the distance learning modality, especially in courses that require a high degree of abstraction and logical reasoning, such as the Degree in Chemistry.

The justification for this study lies in the importance of evaluating in depth the effects of this action within the context of distance education, understanding to what extent monitoring contributes to student learning, the optimization of institutional support, and the development of teacher training for monitors. Considering the current expansion of distance learning courses and the growing demand for effective pedagogical mediation strategies, it is essential to analyze practices, such as monitoring, in a systematic and reasoned way.

The present investigation is characterized as qualitative research, of the experience report type, an approach that focuses on the description, reflection and critical analysis of practices experienced in specific educational contexts. This type of research does not seek to generalize results but rather to develop an in-depth understanding of concrete reality, valuing practical experience as a legitimate source of knowledge. By reporting on and examining the actions undertaken by the monitors in 2024 and 2025, the study adopts a reflective perspective, highlighting both the challenges faced and the advances observed, thereby contributing to the improvement of support programs in distance higher education.

Thus, this work aims to analyze the effectiveness of the monitoring program in the distance-learning Chemistry course at a large institution in Curitiba, based on performance across two distinct cycles.

The analysis considers the impact of monitoring on students' academic performance, the reduction in demand for assistance through institutional channels, the evolution of the pedagogical strategies adopted, and the development of the monitors' teaching skills. By exploring this practice from an evolutionary and experiential

perspective, the aim is to strengthen innovative and effective pedagogical actions in the context of distance education.

DEVELOPMENT

Monitoring is a pedagogical practice that goes beyond simple academic support, it represents a bridge between the faculty and students, promoting the strengthening of the teaching-learning process. By acting as mediators, monitors contribute to the creation of a more collaborative, accessible, and dynamic environment where knowledge is shared meaningfully. Cunha Júnior (2009) highlights that monitoring, when well guided, contributes to the formation of bonds among students and strengthens learning through peer-to-peer knowledge exchange. Academic monitoring is recognized as an essential pedagogical support service that promotes theoretical deepening and the development of technical skills in students, contributing to their overall improvement (Zingra *et al*, 2018; Pereira, 2023).

As part of its historical trajectory, academic monitoring precedes the modern conception of Higher Education, having been initially structured as a pragmatic mechanism to assist the teacher and maintain discipline in the classroom. In Classical Antiquity, this role of pedagogical and disciplinary aid to the teacher was exercised by the pedagogue (Dantas, 2014). This function was consolidated in the Middle Ages (twelfth and thirteenth centuries) with the *proscholus* or "repeater" assisting in the schooling of students (Giles, 1987 *apud* Frison, 2016), being rigorously systematized in the sixteenth century by the Jesuits who selected the best students, called "decurions", who were then responsible for taking lessons and recording mistakes by colleagues (Frison, 2016; Dantas, 2014). In Brazil, the proposal for this pedagogical aid was introduced in 1827, based on the Lancaster Monitor Method (also known as mutual teaching). This fact marked the popularization of this model by using advanced students to replicate teaching to large masses. However, this insertion in the Brazilian context was intended to adjust to the social order and disciplinary control, focusing on elementary instruction (memorization) and not the joint stimulus of reading and writing (Neves, 2005; 2007 *apud* Almeida, 2013). It was only with the expansion of Higher Education in the second half of the twentieth century that monitoring extrapolated this initial role of ordering and elementary instruction, and began to be integrated as a resource for the academic improvement of students and practical initiation to teaching (Almeida, 2013).

The institutionalization of monitoring in Brazilian Higher Education was formally consolidated in Law No. 5,540, of November 28, 1968 (Law for the Reformulation of Higher Education), more specifically, with Article 41, which designated that universities should create the function of monitor for students who demonstrated technical-didactic aptitude, through a specific selection process. This law also established that monitoring should be remunerated and recognized as a title for later entry into the higher teaching career. Decree No. 66,315, of 1970, regulated this law, instituting prerequisites (having attended the course with good academic performance and completed 50% of the total course load) and a workload of 30 hours per week of activities. This practice was restricted during the Military Regime, with a drastic reduction in the workload to 12 hours per week (in 1977), a measure that remains in force at several universities.

In the 90s, monitoring was ratified by Law No. 9,394 (of December 20, 1996, Law of Guidelines and Bases of National Education - LDBEN) which maintained it as a possibility for students to use teaching and research tasks, and not as an institutional obligation. In terms of performance, several regulations and internal regulations of higher education institutions reinforce the prohibition of the monitor replacing the teacher, teaching classes, carrying out evaluations or developing bureaucratic activities in the absence of the teacher, ensuring that the monitor remains in the role of learner, mediator and facilitator of learning (Almeida, 2013; Dantas, 2014; Frison, 2016).

In chemical education, monitoring takes on an even more strategic role. As it is a discipline that involves abstract concepts, symbolic language and laboratory practices, the support of monitors can be decisive for the understanding of the contents. They assist in solving exercises, preparing for evaluations and, especially, in monitoring practical activities, where they reinforce safety standards, guide procedures and help consolidate the relationship between theory and practice. Thus, the performance of the student-monitor favors the construction of a more dynamic and participatory learning environment, allowing the exchange of experiences between students and teachers, and stimulating student protagonism through active methodologies (Lima and Sousa, 2023; Sousa et al, 2019).

Although monitoring is recognized as a valuable pedagogical intervention, its potential in Higher Education, especially in Chemistry, is undermined by cognitive and curricular gaps that many students inherit from high school. The first major challenge lies in the transition of students/culture from High School to Higher Education, evident in basic cycle disciplines such as General and Inorganic Chemistry and Analytical Chemistry (Silva

et al., 2020; Alves, Cruz and Valério, 2021). In these contexts, monitoring has been used to mitigate the lack of prior knowledge, which represents an obstacle for more than half of the students (69%), who say that this gap hinders their learning (Silva *et al.*, 2020). This difficulty also encompasses barriers to abstraction and interpretation of the technical language of science (Alves, Cruz and Valério, 2021). In disciplines such as Analytical Chemistry, a commonly identified difficulty centers on neutralization volumetry, which requires students to translate written language into mathematical and chemical language (Alves *et al.*, 2021). For subsequent disciplines such as Biochemistry, the deficiency in previous concepts such as the concept of polarity (present in the high school curriculum) compromises the understanding of more complex aspects such as the classification of amino acid side chains (Klassen; Ávila, 2024). Thus, monitoring can play a fundamental role as a curricular bridge with regard to the identification and resumption of knowledge that are prerequisites in higher education, seeking to solve students' difficulties by rebuilding meaningful relationships between basic concepts and more advanced ones.

Another challenge concerns the low attendance of students in the monitoring meetings due to the unavailability of extra-class schedules, which limits the scope of this support. However, an interesting point reported by different authors is the valorization of monitoring in the affective domain, since monitors use a simpler and more accessible language that allows them to break the teacher-student barrier and create a safe environment for questioning (Klassen; Ávila, 2024; Silva *et al.*, 2020; Franco, 1998; Alves, Cruz and Valério, 2021). Despite this perception of value (satisfaction with the clarification of doubts reported by the students), there is a disparity in the academic performance item: in a General and Inorganic Chemistry I class, even with the support of the monitoring, 50% of the interviewees had average performance and 42% poor (Silva *et al.*, 2020). On the other hand, the offer of a monitoring program in Organic Chemistry represented a reduction of around 12% in the number of students who took the final exam and 14% in the number of students who failed the discipline (Sousa Júnior *et al.*, 2007).

Considering monitoring programs at the national and international levels, it is observed that the central challenges are shared, with solution approaches that represent the different specificities of the institutional structures of education. The main similarity reinforces the presence of the monitor as a mediator and facilitator who, due to his proximity and accessible language, helps students in the social construction of knowledge (Torres; Irala, 2014; Frison, 2016; Dantas, 2014). In fact, monitoring represents a strategy for initiation to teaching, essential for the deepening of content and the development of

communication and oratory skills (Silva *et al.*, 2024; Dantas, Lopes and Silva, 2018). However, the most evident disparity concerns pedagogical professionalization. International monitoring programs emphasize formal training in teaching techniques, such as the Socratic method of questioning and the BOPPPS model (Objectives, Pre-assessment, Participatory Learning, Post-assessment, and Summary; Schick, 2018; Lin *et al.*, 2025). In these cases, it was found that the instructor-monitor without specific pedagogical training tends to use a discourse focused on content transmission more than 50% of the time, even when addressing constructivist beliefs (Atieh; York, 2022). Another point of tension reported brings the issue of equity and financial barriers in international models, where the lack of remuneration or scholarship limits the participation of underrepresented groups within the university context (Kattoum *et al.*, 2023). In terms of the analysis of monitoring programs, while the Brazilian context often explores reports of experience and qualitative perception of learning, the analyses of international interventions explore quantitative data on engagement or the reduction in retention and dropout rates in higher education (May *et al.*, 2022; Báez-Galib *et al.*, 2005).

Monitoring in Chemistry can contribute to the development of active methodologies, such as study groups, experimental workshops, and peer tutorials, making learning more attractive and contextualized. This action also favors the formation of a scientific culture among students, encouraging critical thinking and investigative curiosity, so that monitoring is also a space for initiation to research.

In fact, monitoring is an important complementary pillar in teacher training and the initiation of research in Higher Education, as it allows experimentation with different teaching-learning strategies while reflecting on the results of interactions with students seeking this pedagogical support. In the context of Chemistry, especially in disciplines that require theoretical and experimental rigor such as Analytical Chemistry (Dantas, Lopes and Silva, 2018) and Organic Chemistry (Sousa Júnior *et al.*, 2017), academic monitoring goes beyond mere content reinforcement, consolidating itself as an essential space for teaching initiation by requiring the monitor to have a more in-depth mastery of the contents in the face of students' questioning, leading him to a more rigorous study routine. The need to deepen content knowledge is crucial for pursuing an academic career as a researcher in the field of teaching and science. By experiencing teaching through monitoring, the student-monitor experiences the teaching routine by critically elaborating didactic activities with the use of illustrations and educational applications to deal with abstract concepts (Dantas, 2014; Silva *et al.*, 2024). This practical experience contributes to the

construction of a more conscious and committed teacher identity, developing pedagogical skills, didactic mediation and oratory (Silva *et al.*, 2024; Almeida, 2013). In addition, monitoring awakens the sense of academic research by instigating the search for pedagogical alternatives that promote improvements in the teaching and learning process (Silva *et al.*, 2024).

Thus, academic monitoring is understood as an activity that goes beyond technical support, being an opportunity for teacher training and deepening the knowledge acquired throughout the undergraduate course, while contributing to the teaching-learning process of colleagues (Lima and Sousa, 2023; Sousa *et al.*, 2019). Therefore, monitoring not only complements the teaching work, but also enriches the training of those involved, promoting a more inclusive, participatory and effective education — especially in challenging areas such as Chemistry.

ORGANIZATION OF MONITORING WORK: STRATEGIES AND EVOLUTION

The methodology adopted for the monitoring project was a hybrid approach, considered essential to meet the diverse needs and routines of distance-learning students, incorporating synchronous and asynchronous activities. The synchronous meetings were held via Microsoft Teams, focusing on the structured review of weekly content and the real-time resolution of doubts, as a strategy to also address the social isolation associated with the distance learning modality. In turn, the asynchronous resources made available in the Virtual Learning Environment (VLE) were designed to diversify learning possibilities, allowing students to consume content on demand.

Over the two years evaluated (2024 and 2025), the monitoring organization demonstrated careful planning and continuous adaptation to the needs of students in the distance-learning modality. In mid-2024, the first weeks were dedicated to organizing materials and methodological planning. A key strategy was to send a form to students to identify their availability and preference for active participation in online meetings. Based on this, fixed schedules were defined for monitoring, for example, in the months of August to October, in 2024 the monitoring worked on Monday nights and Wednesday afternoons; Similarly, in the period from March to May 2025, the meetings took place weekly on Mondays, in the evening.

Dissemination and engagement were priorities in both cycles. In both years, informative folders were used, such as the example presented in Figure 1, and were widely disseminated in the course's WhatsApp groups, in the Chemistry community and in the

Virtual Learning Environment (VLE). This dissemination was complemented by invitation videos recorded by the monitor. In the subsequent cycle, this practice was maintained because it proved to be efficient in the monitoring work.

Figure 1: Monitoring Disclosure Banner



Source: The authors (2025).

A central element in both periods was the creation of specific *WhatsApp* groups for monitoring. These groups served as private channels for students to share doubts and difficulties and were also used to send links to access the meetings and to provide support and recorded materials. The practicality and agility of communication via *WhatsApp* were highlighted as key strengths, enabling effective interaction among students, monitors, teacher-tutors, and course coordinators.

Faced with the challenge of students' inability to participate in synchronous sessions, which is common in the distance learning modality, the monitoring demonstrated adaptability. Thus, one of the initiatives was to create a *YouTube* channel to store the recordings of the meetings, making the links available via *WhatsApp*. This strategy allowed students to access the material at a flexible time, without the need for active participation in synchronous time. Another initiative was to record the synchronous meetings and make the videos available in the VLE, within the specific disciplines. In addition to these formal and informal communication channels, complementary strategies were developed, such as the use of Instagram as a pedagogical tool, through the initiative "Send your questions and receive a story", as shown in Figure 2. This practice went beyond the limits of the Virtual

Learning Environment, using a social network of constant use by students as an accessible didactic mediation strategy, promoting greater interaction and agility in communication.

Figure 2: Use of Instagram as a Pedagogical Tool



Source: PUCPR VLE (2025).

The elaboration of diversified and innovative teaching materials was a constant, among them we mention videos explaining practices within the institution's virtual laboratory, videos with experiments using low-cost materials, quizzes, games using the *Wordwall website*, PowerPoint presentations, podcasts and cards. The production of these materials was made possible and enhanced using artificial intelligence (AI) tools, highlighting the LM Notebook for the organization and prior systematization of content, optimizing the monitoring workflow. In terms of content, the actions were carried out in different modules. For Organic Chemistry, video classes were produced focusing on specific concepts (such as hybridization and organic functions) and audio classes in podcast format. For the disciplines of Professional Practice and Methodology in the Teaching of Chemistry, structural support was developed through introductory guides to projects, weekly summaries called "chemical catches" and texts aimed at critical reflection on the methods of learning assessment. In a subsequent module, for disciplines such as Nuclear Chemistry and Professional Practice (Laboratory of General and Inorganic Chemistry), the methodology to support students consisted of weekly video analyses in the "reacts" format of the classes (Figure 3) enriched with additional supplementary content available in the VLE.

Figure 3: "Reacts" of the classes

Semana 3 - Apanhado químico

Pessoal, já está disponível um vídeo breve com os conceitos trabalhados na semana 3, além de um podcast para quem prefere revisar ouvindo.

Os materiais abordam diferentes níveis de representação na Química – macroscópico, microscópico e simbólico – fundamentais para compreender a ciência. É destacada a importância da linguagem química, com seus símbolos e fórmulas, e o desenvolvimento de competências para utilizá-la corretamente, em vez de apenas memorizar.

Também há foco na estrutura atômica, explicando como os átomos constituem toda a matéria e trazendo conceitos essenciais como isótopos, inclusive com aplicações na agricultura para o estudo de nutrientes. Para diferenciar isótopos, isótonos e isóbaros vou preparar um material a parte para vocês logo logo.

Por fim, os textos exploram as reações químicas e sua representação por equações, ressaltando a conservação de átomos e as leis de Lavoisier e Proust, indispensáveis para entender as transformações da matéria no dia a dia.

Esses recursos foram pensados para aproximar vocês dos conceitos químicos, conectando desde a estrutura da matéria até suas transformações.

Podcast sobre a semana 3

Áudio de revisão da semana.

Ideias semana 3

Pessoal, já está disponível um vídeo breve com alguns dos conceitos trabalhados na semana 3. Além disso, também preparei um podcast para quem prefere ouvir os conteúdos de forma mais descontraída.

Aproveitem esses materiais para revisar os pontos principais e fortalecer o aprendizado!

Source: PUCPR VLE (2025).

The monitoring also created forms for content suggestions and podcasts on the National Student Performance Exam (ENADE). There was a significant focus on explanatory videos and recorded resolution of exercises, especially for more complex content, such as Chemical Kinetics. This adaptation was even a direct response to students' requests to help them understand complex calculations.

The existing collaboration between teacher-tutors and the course coordination was another important pillar of the monitoring project, with an emphasis on holding regular meetings between the monitors and the teacher-tutor, a moment used to clarify doubts, provide administrative assistance, discuss methodologies, and engagement strategies. The course coordinator also provided ongoing support with the dissemination of materials and exchanged ideas to foster student engagement. These partnerships were crucial for the adaptation and improvement of the monitoring work.

EFFECTIVENESS OF MONITORING PRACTICES: STUDENT PERFORMANCE

The monitoring demonstrated a positive and quantifiable impact on the students' academic performance, overcoming challenges such as chemical and mathematical calculations, and chemical reactions. The performance of academic monitors, according to Pereira (2023), is associated with a positive impact on student performance, especially when monitoring is integrated with collaborative practices and self-regulation strategies for learning. Comparing the years 2023 and 2024, there was an improvement in the final

averages in the subjects attended: in the Professional Practice discipline: Organic Chemistry Laboratory, the percentage of students with a final average above 7.0 increased from 44.44% in 2023 to 50% in 2024; in the discipline of Organic Chemistry, the improvement was even more significant, with the percentage of students with a final average above 7.0 jumping from 57.14% in 2023 to 80% in 2024.

The data collected for 2024 and 2025 showed an even more significant growth in the approval rate in the disciplines listed for monitoring: in the discipline of Chemical Kinetics, the number of approved students (final average > 7.0) increased from 50% in 2024 to 75% in 2025, while the number of failed students decreased from 33.3% to 12.5%; in the discipline of Professional Practice: Physical Chemistry Laboratory, the improvement was remarkable, with the percentage of students with a final average above 7.0 rising from 42.9% in 2024 to 100% in 2025, and the number of failures completely zero.

These data prove that monitoring is, in fact, fundamental to the teaching and learning process, contributing to gains and significant improvements in performance. Zingra et al. (2018) highlight that the presence of monitors in the educational environment helps overcome academic difficulties and is perceived by teachers and students as a factor that favors school performance.

EFFECTIVENESS OF MONITORING PRACTICES: REDUCTION OF MESSAGES IN "TALK TO US"

Another robust indication of the effectiveness of monitoring is the significant decrease in messages sent to the institution's official "Talk to Us" channel to clarify content-related doubts. This channel, sometimes overloaded, received many specific doubts. Comparing the years 2023 and 2024, it was noted that: the Inorganic Chemistry discipline saw a reduction from 11 messages in 2023 to 9 in 2024, although most were still about summative activities; the disciplines of Organic Chemistry and Professional Practice: Preparation of Didactic Materials for the Teaching of Chemistry zeroed out the messages in 2024 (there were 2 and 11, respectively, in 2023).

In 2025, the improvement was even more significant: there was a 100% increase in messages about content via "Talk to Us" compared with 2024. In 2025, there were no messages from students with doubts about the content of the subjects; only doubts about the structuring of the evaluation activities. This significant reduction in the flow of messages demonstrates the monitor's commitment and effectiveness, minimizing students'

difficulties and facilitating the teacher-tutor's work. Monitoring redirected support, becoming the main point of contact for content questions.

EVOLUTION AND COMPREHENSIVE IMPACT OF MONITORING WORK

The comparison between the periods mentioned reveals a consistent evolution and continuous improvement in the monitoring program. Initially, monitoring focused on establishing its presence in a recent distance-learning context, with strategies for dissemination and scheduling. Adapting to students' unavailability led to the creation of asynchronous resources, such as a YouTube channel. This flexibility was reinforced by the availability of materials recorded directly in the VLE and the monitor's proactive creation of specific videos requested by students for complex calculations, demonstrating a more refined response capacity. This continuous evolution demonstrated that the focus of the monitor's work was on the creation, management, and availability of learning resources compatible with the dynamics of the distance modality, with a constant search for multimodal and interactive formats, which have been essential for student engagement and for deepening understanding of the covered content.

Student engagement, initially a timid challenge, showed progress, with positive comments in the WhatsApp group and direct praise in the satisfaction survey, including a student's testimony to the monitor.

In addition to the academic gains for students, monitoring also proved to be a fundamental space for the personal and professional growth of the monitors. The remarkable development of the monitor who worked in this action in 2024 stands out, showing significant improvement in academic writing, in the production of relevant teaching materials, compatible with active and dynamic methodologies, including the production of articles for presentation at events, and a scientific article entitled: University/school interconnection and digital technologies in the context of chemistry teaching, published in the journal *Contribuciones a Las Ciencias Sociales*, in the same year of operation. Regarding the profile of the monitor in the year 2025, skills such as organization, active listening, patience, group management and clear communication are emphasized, essential for future teaching, especially in virtual environments.

For future cycles, the analyses point to the continuity of the concern with the synchronous engagement of students, with proposals for the creation of Instagram and study groups, and study agendas, in addition to greater diversification of materials, focus on videos and commented exercises, more interactive online meetings, and the use of

practical resources, such as online simulations. The use of simulations in teaching Chemistry, when accompanied by trained monitors, enhances understanding of abstract concepts and increases student engagement in the proposed activities (Demelash, Andargie, and Belachew, 2024). In addition, plans to expand the offer of schedules and introduce differentiated activities demonstrate a commitment to continuous improvement.

FINAL CONSIDERATIONS

The data presented show that monitoring in the Chemistry Degree course in the distance-learning modality was not only established as a positive and essential action for the teaching and learning process but also demonstrated a remarkable improvement in its effectiveness. Through a flexible organization and adaptive strategies, such as the intensive use of digital platforms (*WhatsApp*, *YouTube*, *VLE*, *Microsoft Teams*) and the production of varied teaching materials, the monitoring was able to significantly improve the academic performance of students and reduce the demand for support in official channels, optimizing the work of the teacher-tutors. The analysis of the practices described here demonstrates that effective student support through monitoring in Distance Education can go beyond the mere availability of materials in virtual learning environments. In fact, proactive monitoring that uses technological tools to organize and deliver content in a multimodal, interactive way is essential for expanding engagement and fostering effective understanding of content in distance-learning Chemistry, helping to build a sense of community and proximity.

The constant search for feedback and the ability to integrate new approaches, combined with the professional development of monitors, solidify monitoring as a fundamental pillar for the success and quality of distance education in the institution. The mediation carried out by the monitors adds value and brings together students, monitoring, teachers-tutors, coordination and the university.

REFERENCES

- ALMEIDA, R. S. de. Aspectos históricos da monitoria no ensino superior e sua importância para a preparação docente: a monitoria em Geografia Agrária. In: Colóquio Internacional: Educação e Contemporaneidade, 7., 2013, São Cristóvão, SE. Anais [...]. São Cristóvão: Universidade Federal de Sergipe, 2013. ISSN 1982-3657. Disponível em: <https://ri.ufs.br/bitstream/riufs/10340/32/31.pdf>. Acesso em: 25 nov. 2025.
- ALVES, F. W. N.; CRUZ, F. S. B.; VALÉRIO, R. B. R. A monitoria como instrumento facilitador no ensino/aprendizagem de química analítica na FACEDI. Revista CEC&T – Centro de Ciências e Tecnologia da Universidade Estadual do Ceará, Fortaleza/CE, v. 2, n. 4, p. 29-40, jan./jul. 2021. Disponível em: <https://revistas.uece.br/index.php/CECiT/article/view/4477>. Acesso em: 18 nov. de 2025.
- ATIEH, E. L.; YORK, D. M. Give and Take: Narrowing the Gap between Theory and Practice of Peer Instructors over Time. Journal of Chemical Education, [S.l.], v. 99, n. 10, p. 3370–3385, set. 2022. Disponível em: <https://pubs.acs.org/doi/10.1021/acs.jchemed.2c00170>. Acesso em: 24 nov. 2025.
- BÁEZ-GALIB, R.; COLÓN-CRUZ, H.; RESTO, W.; RUBIN, M. R. Chem-2-Chem: A One-to-One Supportive Learning Environment for Chemistry. Journal of Chemical Education, v. 82(2), 2005. Disponível em: <https://pubs.acs.org/doi/abs/10.1021/ed082p1859>. Acesso em: 24 nov. 2025.
- CUNHA JÚNIOR, F. R. da. Monitoria: uma possibilidade de transformação no ensino médio. Orientadora: Maria Cecília Camargo Magalhães. Dissertação (Mestrado em Linguística Aplicada e Estudos da Linguagem). Pontifícia Universidade Católica de São Paulo, São Paulo, 2009. Disponível em: <https://www.academia.edu/18687963>. Acesso em: 3 jul. 2025.
- DANTAS, L. V. M.; LOPES, T. M. S.; SILVA, D. D. Relato de experiência da monitoria acadêmica na disciplina de Química Analítica II: compartilhando conhecimentos. Educação Ciências e Saúde, v. 5, n. 2, p. 98-110, jul./dez., 2018. Disponível em: <http://dx.doi.org/10.20438/ecs.v5i2.193>. Acesso em: 18 de nov. de 2025.
- DANTAS, O. M. Monitoria: fonte de saberes à docência superior. Revista Brasileira de Estudos Pedagógicos, Brasília, v. 95, n. 241, p. 567-589, set./dez. 2014. Disponível em: <https://www.scielo.br/j/rbeped/a/HwcpZxZZjQm3rQDL33zQk8z/?lang=pt>. Acesso em: 24 nov. 2025.
- DEMELASH, M.; ANDARGIE, D.; BELACHEW, W. Enhancing secondary school students' engagement in chemistry through 7E context-based instructional strategy supported with simulation. Pedagogical Research, [S. l.], v. 9, n. 2, art. em0189, 2024. Disponível em: <https://files.eric.ed.gov/fulltext/EJ1421121.pdf>. Acesso em: 24 nov. 2025.
- FRISON, L. M. B. Monitoria: uma modalidade de ensino que potencializa a aprendizagem colaborativa e autorregulada. Pro-Posições | v. 27, n. 1 (79) | p. 133-153 | jan./abr. 2016. Disponível em: <https://www.scielo.br/j/pp/a/WsS9BVxr8VXR796zcdDNcmM/?format=html&lang=pt>. Acesso em: 24 nov. 2025.

KLASSEN, D.; ÁVILA, E. Monitorias em Química: importância na formação acadêmica do monitor. In: 43º Encontro de Debates Sobre o Ensino de Química, 21 a 23/11/2024 – UniPampa e IFSUL Bagé, 2024. Disponível em: <https://edeq.com.br/submissao2/index.php/edeq/article/view/582>. Acesso em: 24 nov. 2025.

KATTOUM, R. N.; ABBOOD, I.; HUFF, K. E.; BAILLIE, M. T. Perceived Barriers to Equitable Participation in the Learning Assistant Program. *Journal of Chemical Education*, [S.l.], v. 100, n. 6, p. 2495-2503, jun. 2023. Disponível em: <https://pubs.acs.org/doi/10.1021/acs.jchemed.2c00635>. Acesso em: 24 nov. 2025.

LIMA, A. L. V.; SOUSA, C. R. de. Metodologia ativa como instrumento na monitoria acadêmica: um relato de experiência. Quixadá: UNICATÓLICA, 2023. Disponível em: <https://www.researchgate.net/publication/378348793>. Acesso em: 3 jul. 2025.

LIN, P.; ZHOU, Q.; MA, J.; WANG, X.; WU, J. Peer tutoring in higher education: power from pedagogical training. *Humanities & Social Sciences Communications*, 12:723, 2025. Disponível em: <https://doi.org/10.1057/s41599-025-04860-6>. Acesso em: 18 nov. 2025.

MAY, M. L.; WILLIAMS, R. V.; MAY, J. A.; MOMMER, D. M.. Engaging Early College Students in Their Chemical Education through Academic Support: A Pandemic Era Effort. *Journal of Chemical Education*, v. 99, [n. 11, p. 3654–3661], out. 2022. Disponível em: <https://pubs.acs.org/doi/10.1021/acs.jchemed.2c00137>. Acesso em: 18 nov. 2025.

PEREIRA, R. A monitoria acadêmica como potência na aprendizagem colaborativa e autorregulada: analisando suas ressonâncias no desempenho dos estudantes. *Revista Foco*, v. 16, n. 2, 2023. Disponível em: <https://www.researchgate.net/publication/368285469>. Acesso em: 3 jul. 2025.

SCHICK, C. P. Trying on Teaching: Transforming STEM Classrooms with a Learning Assistant Program. In: *Strategies Promoting Success of Two-Year College Students*, Chapter. Washington, DC: American Chemical Society, 2018. p. 3-27. (ACS Symposium Series, v. 1280). Disponível em: <https://pubs.acs.org/doi/10.1021/bk-2018-1280.ch001>. Acesso em 27 nov. 2025.

SILVA, E. S.; VASCONCELOS, E. A. de L.; PAIXÃO, M. de F. M. Monitoria de Química: aulas de reforço como estratégia para facilitar a aprendizagem. *Revista de Ensino de Engenharia*, v. 39, p. 420-431, 2020. Disponível em: <https://encurtador.com.br/KmfQ>. Acesso em 27 nov. 2025.

SILVA, R. J.; SILVA, E. M. F.; LIMA, L. C. B.; SILVA, F. C. Monitoria no ensino superior de química: contribuições para a formação docente - relato de experiência. *Revista de Estudos Interdisciplinares*, 6(1), 01–23, 2024. Disponível em: <https://revistas.ceeinter.com.br/revistadeestudosinterdisciplinar/article/view/822>. Acesso em 27 nov. 2025.

SOUSA JÚNIOR, J. A.; SILVA, A. L.; MAGNO, A.; SANTOS, M. B. H.; BARBOSA, J. A. Importância do monitor no ensino de química orgânica na busca da formação do profissional das ciências agrárias. In: XI Encontro de Iniciação à Docência. UFPB-PRG, 2017. Disponível em:

http://www.prac.ufpb.br/anais/xenex_xienid/xi_enid/monitoriaped/ANAIS/Area4/4CCADCFSMT03.pdf. Acesso em 27 nov. 2025.

SOUSA, M. S. de et al. A monitoria acadêmica como instrumento facilitador no processo de ensino e aprendizagem no curso de enfermagem: um relato de experiência. Belém: Universidade do Estado do Pará, 2019. Disponível em:

<https://www.researchgate.net/publication/336887633>. Acesso em: 3 jul. 2025.

TORRES, P. L.; IRALA, E. A. F. Aprendizagem colaborativa: teoria e prática. In: Complexidade: redes e conexões na produção do conhecimento. Curitiba: Senar, 2014. p. 61-93. Disponível em:

https://www.researchgate.net/publication/271136311_Aprendizagem_colaborativa_teorica_e_pratica. Acesso em: 24 nov. 2025.

ZINGRA, K. N.; BRANCO JUNIOR, A. G.; REIS, A. R. P. dos; SOUZA, T. F. de; SOUSA, C. M. de. Monitores no processo de ensino-aprendizagem: avaliação da tríade envolvida. EDUCA - Revista Multidisciplinar em Educação, 2018. Disponível em:

<https://www.academia.edu/91767539>. Acesso em 27 nov. 2025.

EDUCATION, ALGORITHMS AND EMANCIPATION: PAULO FREIRE IN THE AGE OF ARTIFICIAL INTELLIGENCE

  10.56238/livrosindi202668-003

Guiullianna Carolina Q. L. Drapczynski Bot

Master's student in Education at the Pontificia Universidade Católica do Paraná (PUCPR), graduated in Pedagogy from the same institution and licensed in Biology. Awarded the Brother Clemente Ivo Juliatto Prize for University Leadership, she is a specialist in Educational Psychology and in Special and Inclusive Education. Currently, she investigates the interfaces between gamification, transdisciplinarity, and creativity in teacher training. She has experience in teaching Science and Biology, as well as working with deaf students. She is a member of the study groups "PRAPETEC/PUCPR - Pedagogical Practice in Face-to-Face and Distance Education" and "GELE.IA/UFMT Free Study Group on Education and Artificial Intelligence".

E-mail: guiullianna.bot@pucpr.edu.br

Lattes: <http://lattes.cnpq.br/6603092780863206>

Ana Carolina Ingeinczaki

Master's student in Education at PUCPR, graduated in Design from the same institution (2023) and awarded the Marcelino Champagnat academic merit prize. Member of the PRAPETEC/PUCPR group, she works in the area of Arts with an emphasis on Graphic Design and Illustration. Currently, she is investigating the potential of Mind Maps in Collaborative Learning in Higher Education.

E-mail: ana.ingeinczaki@pucpr.edu.br

Lattes: <http://lattes.cnpq.br/7364235413272278>

Emerson Da Silva Grizotes

Master's student in Education at PUCPR. Graduated with a Bachelor's degree in Chemistry from the Federal University of Paraná (UFPR) in 2020.

Currently researching the potential of storytelling and open educational resources for scientific literacy.

Member of the "PRAPETEC/PUCPR" group.

E-mail: grizotes.emerson@pucpr.edu.br

Lattes: <http://lattes.cnpq.br/2354870084577925>

Katia Ethienne Esteves dos Santos

PhD in Education from PUCPR, with over 40 years dedicated to teacher training and Digital Education.

Graduated in Pedagogy and Social Studies, specialist in Educational Technologies. Currently, she is a professor in Postgraduate Studies and coordinator of the EAD Pedagogy course at PUCPR, where she leads the Digital Teacher Competencies project (CREARE).

She is a member of the PRAPETEC research group, serves on scientific committees of national events (EDUCERE, CIAED and Humanitas) and develops pedagogical materials for institutions such as UNESCO.

E-mail: katia.esteves@pucpr.br

Lattes: <http://lattes.cnpq.br/7680630419858481>

INTRODUCTION

The rise of artificial intelligence (AI) as an unavoidable aspect of social, economic, and technological life today challenges traditional educational practices and theories (Pinheiro Porto & Soares Ramos Procasko, 2024). The swift spread of AI, particularly Generative Artificial Intelligence (IAGen), signifies a major societal shift (Carvalho & Silva, 2024).

Based on methodologies such as *machine learning*, *deep learning*, and natural language processing, these systems not only influence everyday life, but radically alter the way knowledge is produced, shared, and consumed (De Oliveira, 2017). The moment is one of a true epistemological displacement of humanity to the *infosfera*, a new cognitive and social environment in which the condition "onlife" blurs the already tenuous distinction between online and offline (Floridi, 2014). In this hyperconnected ecosystem, AI emerges not only as a tool, but as a form of agency, reconfiguring powers, relationships, and subjectivities (Floridi, 2017).

In view of this scenario, the theoretical legacy of Paulo Freire, Patron of Brazilian Education, takes on a renewed and urgent critical dimension (Sampaio & Arango, 2020). Freire helps us to interrogate the ethical and political implications of the new educational paradigm. Based on the understanding that technology is not neutral (Vieira Pinto, 2007), but a structural part of human development and hegemonic dispute, it is evident that the information society and the domain of data inaugurate new power relations, in which education becomes a strategic field of ideological dispute (Schneider, Vosgerau & Fernandes, 2023). The computerized human experience, converted into "predictive capital" (Zuboff, 2019), guides the logic of large corporations, BigTechs, transforming education into an environment tensioned between autonomy, surveillance, and commodification (Pimentel & de Paula Berino, 2025).

Transferring this ethics to AI involves recognizing that these technologies arise from conflicted social relations rather than being neutral tools. When examining AI origins, a predictive behavior emerges, focused on manipulation for profit (ZUBOFF, 2019). In education, AI risks reinforcing what could be called "Banking Education 2.0" – a digital update of Freire's criticism. Digital platforms fragment knowledge, automate tasks, and tie autonomy to algorithms and metrics, creating an environment of passivity, consumption of pre-made answers, and job insecurity (Freire, 2023; Costa Zanardi, 2025). The inner mechanisms of machine learning and deep learning often remain hidden from most educators and students, leading to "algorithmic opacity" (Ueno & Muraro, 2024). This

opacity restricts epistemological curiosity, as access to the origins of information is blocked by technical and political barriers (Souza & Poli, 2024). AI and digital platforms also tap into neurobiological pathways linked to addiction. Their design employs behavioral psychology to trigger dopaminergic responses via constant stimuli—likes, notifications, digital rewards—creating a false sense of engagement while hindering the reflective, rigorous pursuit of knowledge (Heggler, Szmoski & Miquelin, 2025; Schneider, Vosgerau & Fernandes, 2023). This approach echoes Freire's critique of the banking model: instant gratification weakens systematic effort, fosters passivity, and stifles critical curiosity (Ueno & Muraro, 2024; Freire, 2023).

In this scenario, a key question arises: How can Freire's Critical Pedagogy principles be utilized to steer and assess the ethical, dialogical, and emancipatory application of Artificial Intelligence within an educational environment increasingly influenced by algorithms and dominated by Surveillance Capitalism's logic? Starting from this concern, the chapter suggests interdisciplinary approaches to explore the risks and opportunities of a digitally-based education rooted in Freire's ideas.

The work is structured around four main axes: (a) Critically examining AI through the lens of Banking Education to highlight how control and alienation mechanisms are being updated; (b) Addressing the challenges posed by algorithmic opacity and biases as barriers to awareness and action, while incorporating insights from neuroscience on algorithmic addiction; (c) Detailing Freire's technological praxis, considering the principles of political use, domination, sociological reduction, and critical consciousness, in dialogue with Álvaro Vieira Pinto; (d) Introducing LiteracIA, a critical literacy framework for artificial intelligence designed to promote autonomous and dialogical learning.

The rationale behind this work stems from the urgent need to analyze and guide the ethical, dialogical, and emancipatory use of AI, amid an education landscape increasingly mediated by algorithms. It seeks to explore how Freire's principles can serve as a form of resistance against dehumanization and commodification of knowledge driven by the technological paradigm.

This chapter targets educators, researchers, school administrators, undergraduates, and anyone committed to fostering a democratic school. By integrating theories, practical examples, and interdisciplinary insights, the chapter aims to bolster critical pedagogy that emphasizes autonomy, social justice, and transformational dialogue.

Finally, this introduction invites readers to reflect on the complex relationships between technology, subjectivity, and education. Freire's legacy is reaffirmed as an ethical

and political tool to guide innovative, dialogical, and responsible practices in the age of artificial intelligence. Each subsection raises questions about how to nurture education for freedom and critique amid digital challenges, and how to collaboratively forge new emancipatory possibilities for today and tomorrow.

CRITICAL TRANSFORMATIONS IN DIGITAL EDUCATION

Paulo Freire saw Banking Education as a process of depositing knowledge into the student, who is a collector of information that becomes an archive, without the power of creativity or critical analysis of reality (Freire, 2023). By denying the subject's freedom of thought, the school manufactures human beings who fit into the capitalist mode of production, reproducing an abomination to the different. This is a process of interdiction and denial of the human body in pedagogical practice that must be denounced, as it suppresses the potential for learning (Brighente, 2016).

This critique finds a new and potent field of manifestation in the digital age (Tayar & Batista, 2025). The growing dissemination of AIGens and similar interfaces challenges different professional fields, especially education.

And would Paulo Freire embrace AI? Authors such as Marco Silva (2025) in the preface to the book "*Generative AI and education: practices and theorizations*" bring the answer to this reflection:

If Paulo Freire were alive and inserted in the cybercultural context, he would probably use generative artificial intelligence in his classes, research, and publications. Just as it used television to present topics that generate dialogue in the classroom, today it would adopt generative AI to promote the co-creation of knowledge, critical training, and horizontal conversation between algorithms, educators, and students.

On the other hand, if AI is used only for the purpose of providing content, it reinforces the banking logic, teaching the student to prioritize the ready-made answer over the process of knowledge construction, reiterating one of the main concepts elaborated by Freire defined in *the Pedagogy of the Oppressed*:

Instead of communicating, the educator makes "announcements" and deposits that the students, mere incidences, patiently receive, memorize and repeat. This is the "banking" conception of education, in which the only margin of action offered to students is to receive deposits, store them and file them. Margin to be collectors or fixers of the things they file.... Educators and students file themselves to the extent that, in this distorted vision of education, there is no creativity, there is no transformation, there is no knowledge. There is only knowledge in invention, in

reinvention, in the restless, impatient, permanent search that men make in the world, with the world and with others. Hopeful search too.

The great ethical-pedagogical challenge imposed by AI is algorithmic opacity. The inner workings of the systems of *deep learning* e *machine learning* is inaccessible, the call *Black Box*, the so-called *black box*, that prevents the student from realizing and achieving a critical perception of the influence of these technologies on their own way of thinking and acting (Souza, & Poli, 2024). Thus, students end up using these tools without reflecting on how and which of their data are collected and processed, which limits not only their digital autonomy, but also a central element of teaching: the grounded, conscious, and critical exchange of ideas.

AI, when trained on vast databases, reproduces and amplifies historical and social biases, resulting in discrimination, and, above all, ignoring diversity, an inherently human characteristic. In this way, it despises the culture and customs of those on the margins of society. This algorithmic discrimination violates fundamental rights and perpetuates cycles of exclusion, materializing the dominant ideology (Migalhas, 2025).

The pedagogy of the question emerges, then, as an instrument to subvert the logic of the ready-made answer offered by generative AI. Instead of using chatbots as oracles of truth, educators and students should be encouraged to interrogate the gaps, hallucinations, and biases of these systems. The question, in this context, is no longer just a request for information from the machine and becomes a tool to unveil the contradictions of digital reality and strengthen intellectual autonomy.

In the context of AI, this implies that technology should not replace human mediation, but serve as a resource to amplify dialogue and collaboration (Tayar, 2025). AI can act as a "cognitive partner" in which human cognition and machine data processing interact to expand analytical and creative capabilities, as long as the human maintains the leading role and the capacity for ethical and moral judgment.

The awareness process is the foundation for the use of AI to become an act of freedom. Awareness is not only the recognition of the existence of technology, but critical understanding. This requires the development of a LiteracIA (critical literacy in AI), which empowers subjects not only to consume, but to appropriate technology to deepen their awareness of their own reality (Farbiarz; Coaracy, 2025).

The term "literacy" is imported from linguistic science and brings concepts that differ from literacy and literacy, carrying a meaning that transcends the mere instrumental

and technical capacity to read and write. In this way, reading and writing acquire a political character of social insertion. Therefore, "literacy" encompasses these concepts as a complex set of skills that constitute reading and writing, such as word identification, orthographic mastery, and the application of linguistic and cognitive processes for comprehension (GABRIEL, 2017).

This conceptual specificity makes it particularly suitable for the design of a critical pedagogy in the digital age, as it insists on the relevance of the processes of signification of reading and writing without reducing them to decontextualized technical competences.

Based on UNESCO's 2025 guidelines, AI Pedagogy serves as a guiding framework for education that critically incorporates smart technologies into hybrid and online learning methods. UNESCO highlights that AI pedagogy should focus not just on tools, but on enhancing human agency, advocating for algorithmic justice, and fostering skills that enable learners to understand, communicate with, and co-create alongside intelligent systems—while maintaining control over them.

This perspective confirms that AI should serve ethical, inclusive, and emancipatory goals, positioning students as active agents in shaping desirable futures. The AI Pedagogy advocated by UNESCO emphasizes critical literacy that combines autonomy, creativity, and social responsibility—values strongly aligned with Freire's legacy and vital for education to meet the challenges of the algorithmic age. When applied appropriately, these concepts help prevent mechanization and foster humanization. Consequently, the collective knowledge-building process in schools, mediated by AI, shifts from mere pattern reproduction to a dynamic, hopeful pursuit of understanding.

ALGORITHMIC ADDICTION AND THE SUPPRESSION OF CRITICAL CURIOSITY

Digital design activates the brain's reward system, releasing dopamine (Schneider, Vosgerau, & Fernandes, 2023), and generating an incessant search for quick gratification, which compromises cognitive development. The design of digital platforms is not neutral; It is designed to exploit human psychological vulnerabilities, aiming at behavior modification at scale. This mechanism operates through a system of intermittent rewards, analogous to the operation of slot machines in casinos, which releases dopamine in the brain, creating cycles of compulsion and addiction. Features such as "likes", notifications and infinite scrolling are designed to keep the user "stuck" with the loss of self-awareness and automaticity of behavior.

According to Freire, moving from naive curiosity to critical understanding requires systematic effort, intellectual engagement, and a continual questioning attitude (Ueno & Muraro, 2024). Algorithmic addiction fosters passive consumption and data archiving, which hampers the ability to fully develop, participate in knowledge creation, and be a critically aware citizen. This addiction, by providing instant gratification and ready-made answers (such as from generative AIs and search engines), diminishes the effort needed for knowledge building, promoting passivity that prevents critical awareness. The ease of immediate responses acts as an "anesthetic" to curiosity, replacing restless searching with passive consumption of information.

Currently, algorithmic logic reshapes and intensifies Freire's critique of Banking Education, as platforms and algorithms assume the role of knowledge custodians and do not challenge students to step outside their comfort zones. By emphasizing response speed and efficiency over reflective thinking, generative AI can hinder critical skills, turning learning into a mechanical process of consuming prepackaged results without understanding their origin or context.

This undermines the learner's independence, transforming them from an active 'reader of the world' into an object read and profiled by machines. The cognitive damage caused by algorithmic addiction directly supports Capitalism's interests, which treat human experience as raw data to be exploited for predicting and controlling behavior. For this system to function, users must stay engaged, predictable, and ideally uncritical. Algorithmic addiction reinforces these oppressive structures through several mechanisms: (1) suppression of will via choice architecture; (2) privatization of learning by monopolizing knowledge; and (3) opacity and power conferred by the algorithmic black box, which prevents critical awareness.

The first principle for AI to act as a tool of liberation and not domination. This implies articulating technology with the underlying themes to promote the expression of opinions, the development of critical thinking, and the overcoming of technological naivety (Costa & Fialho, 2020). Naivety, as Lévy (2010) warns, is born from the mistaken belief that technology has an external and neutral origin, when in reality it expresses interests, disputes and historical choices.

The second principle refers to the need for a technological praxis, understood as the conscious mastery of technology and its processes (Costa & Fialho, 2020). Understanding this dimension is a condition for educators and students to use AI as a mediator of the critical reading of the world. The intentional use of AI, therefore, involves social

responsibility and ethical engagement, guiding its application to improve collective living conditions (Schlesener, 2025; Costa & Fialho, 2020).

In the third principle, sociological reduction, Freire (2018) feared that technological innovations would be imposed "from the top down", in a non-dialogical way (Costa & Fialho, 2020). In line with Álvaro Vieira Pinto (2007), sociological reduction implies analyzing and understanding the historical, economic, and political contexts in which technological artifacts are developed. Vieira Pinto argued that the ideologization of technology aims to silence political manifestations and clothe society with positive ethical values.

The fourth and final principle is the attitude assumed towards technology: a critically curious, vigilant, and inquiring posture, to which Freire intercedes (Costa & Fialho, 2020). The focus is on using technology, not being used or manipulated docilely as an object by it.

To confront the mechanization of thought and the capture of attention, the pedagogies of dialogue and questioning emerge as tools of resistance. Education should not be the consumption of algorithmic "communications", but an act of dialogical communication. LiteracIA, as critical literacy, teaches how to question the non-neutrality of technology and its embedded ideologies.

The critical use of AI, therefore, needs to align with the ethical perspective required by the new digital environment. The concept of *Storm* by Luciano Floridi provides the ecological framework for this ethic. AI is a form of artificial agency that challenges the principle of human autonomy, requiring a balance between the decision-making power we hold and the one we delegate to autonomous systems. A digital education committed to liberation requires a "Freirean neuroscientific" synthesis. This means understanding that the struggle for critical consciousness is not only epistemological or political, but also neural and behavioral.

Thus, critical pedagogy is updated to confront Surveillance Capitalism, reaffirming that the ontological vocation of the human being is to "be more" — something unattainable if the mind is chained to algorithmic addiction. Freire's struggle for digital sovereignty and algorithmic transparency should thus be seen as an ethical imperative of Education *OnLife* (Floridi, 2024).

LIMITS OF AI FOR AUTONOMY AND CREATIVITY

The true liberation of men can only be successfully achieved from praxis, from reflection based on learning. Human beings can only reaffirm their role in society by becoming a conscious body (Brighente, 2016). Only through the joint work of student and teacher will a liberating pedagogical practice be possible, one that, in the context of AI technologies, is even more necessary.

The adoption of AI in educational settings, known as *EdTech* imposes an urgent reflection on the nature of creativity and human autonomy, for Freire (2021), technology is one of the "great expressions of human creativity". Although AI has unprecedented data-processing and automation capabilities, an analysis informed by the thinking of Paulo Freire and Maria Cândida Moraes reveals ontological and epistemological limits of the machine, reaffirming creativity as an irreplaceable attribute of the human condition.

To achieve such goals, it is necessary, initially, to dismantle myths about neutrality and technological inevitability, thereby leading to a critical reflection on the Bigtech industry. Starting from critical awareness, space is created for a change in students' behavior regarding AIs.

This curiosity is based on the problematization of what are the interests of those who hold the domain of BigTechs. This question corroborates Webb (2020), who points out that the way humanity uses AI will be decisive in the path that will be traced, and Scott and Shaw (2023), who state that the positive use of AI involves its use for humanity and by humanity.

For Paulo Freire, technology is, in its genesis, a natural expression of the creative process of human beings. However, he understands creativity not only as a technical or cognitive skill, but as an ontological vocation and a political act (Pontes; Pimenta, 2019). In this sense, Freire's creativity is intrinsically linked to the ability to intervene in the world. and it is the tool that allows subjects to overcome the "limit situations" and glimpse the "viable unprecedented", a future that is not a repetition of the past, but a new and liberating construction. Therefore, Freire's creativity is ethical and political: it requires decision-making, a break with determinism, and responsibility for the construction of history (De Andrade; Do Nascimento, 2024).

In line with Freire's humanist vision, Maria Cândida Moraes (2019), supported by complex thinking, expands the understanding of creativity. For the author, creativity is a complex, plural, and multidimensional phenomenon, which cannot be reduced to simple problem solving (Queiroz; Pine; Queiroz Júnior, 2025). Moraes (2019) argues that

education should promote learning that dialogues with uncertainty and life, recognizing the interdependence between the individual, society, and nature. Creativity, in this systemic view, manifests itself in the encounter of the conscious human being with his world, emerging from self-eco-organizing processes that connect subjectivity to objectivity (Moraes, 2015). Unlike linear and fragmented logic, complex learning values the unforeseen and the emergent, essential characteristics of life that the machine does not have. AI, especially generative AI, operates on statistical probability models and large volumes of data (*Big Data*).

Unlike home computers that, since the 1980s, have been programmed by humans and fulfilled predetermined functions, AI is governed by a probabilistic system, with distinct logic and functionality. Although AI algorithms are developed by humans, they "learn" from large data sets (*Big Data*) (Le Voci Sayad, 2024).

Although it can generate fluid and impressive content, AI is limited to identifying and repeating existing patterns in its databases; it recombines the past, but does not create it in the ontological sense. Its content, when analyzed, presents distributions of words, pixels, or other elements of the data that have been consumed, and identifies and repeats common patterns (e.g., which words usually appear followed by other words) (UNESCO, 2024, p. 8).

Therefore, it is necessary to reflect and develop a critical stance, as AI does not understand the world, objects, or social relations. AI is incapable of producing transcendence or genuine creative rupture, as it does not have the "existential need" for dialogue, nor the awareness of the incompleteness that drives human beings to create. As Moraes (2015) points out, human creativity involves the ability to go beyond what is learned, to imagine what does not exist and to transform reality based on consciousness, attributes absent in algorithms.

Autonomy and creativity, for Freire and Moraes, are assets. Freire defends a pedagogy of question and problematization to unveil reality, since AI tends to offer ready-made answers that end the investigation cycle and accommodate the subject. Autonomy, understood as the ability to govern oneself and make conscious decisions, is threatened when we delegate the judgment and curation of knowledge to the machine, losing the ability to "read the world" critically.

Education, inspired by the creativity of Moraes and the pedagogy of liberation of Freire, must affirm human creativity as an irreplaceable attribute. AI should be understood

not as a subject or a substitute for the teacher, but as a tool or part of learning and that should be mastered and directed by human intentionality.

It is necessary to cultivate educational spaces that value dialogue, lovingness, and the collective construction of knowledge, where technology serves to expand, and not atrophy, the human capacity to dream, to be indignant, and to build the unprecedentedly viable. Only in this way will education be able to ensure that technology is at the service of humanization and ethics, and not of oppression or the mechanization of life.

EDUCATION AS AN ACT OF LOVE AND HOPE IN THE ALGORITHMIC AGE

The insertion of AI in education challenges pedagogical practice. Algorithms do not love, do not suffer, do not wait, and do not dialogue; they process, calculate, and predict. Education must reaffirm itself as an act of love and hope, rather than a system of guaranteed results. Articulating the *Lovingness*, the *hope*, the *Ethics* and the *Dialogicity* Freireana with the challenges of AI is to propose an antidote against the mechanization of learning. It is to argue that, even in environments mediated by algorithms, education must remain a meeting between subjects, mediated by the world, to pronounce and transform it. For the algorithm, the student is not a being of possibilities, but a set of statistical data to be optimized.

Paulo Freire positions loving-kindness not only as a desirable quality, but as an epistemological and political foundation of educational practice (De Andrade; Do Nascimento, 2024). In *Pedagogy of Autonomy*, Freire (2018) states that educational practice requires "loving the students". This "loving well" is an ethical commitment to the humanization of the other, which requires from the educator a posture of acceptance and defense of the student's dignity.

In the algorithmic era, loving-kindness works as a criterion of truth and validity for technology. If AI operates through "equivalence without equality", treating distinct human beings as mere patterns of interchangeable data (Zuboff, 2019), the educator's loving act rescues the uniqueness of each student. Pedagogical love is the refusal to accept that the student is reduced to a user profile or an object of prediction.

Freire's loving-kindness requires "courage". While AI can personalize instruction based on performance metrics, it cannot provide the emotional support, empathy, and recognition that underpin the ontological safety necessary for learning. Educating as an act of love implies recognizing that education is not only the training of technical skills, but

the formation of integral human beings (Freire, 2023), whose emotions and feelings cannot be "datafied" without losing their essence.

Therefore, educating lovingly in the age of AI means using technology to expand the possibilities of care, but never delegating the responsibility for the bond to the machine. It means rejecting systems that monitor and punish, to paraphrase Foucault when he wrote *Watch and Punish*, by characterizing the control and normalization of bodies and minds. As the author states, "discipline 'manufactures' docile bodies; it is the specific technique of a power that takes individuals at the same time as objects and instruments of its exercise" (FOUCAULT, 1998). In this sense, opting for practices that welcome and liberate is to reaffirm that loving-kindness is the ethical barrier that prevents the student from being treated as a thing.

Discipline thus manufactures exercised submissive bodies, "docile" bodies. Discipline increases the strengths of the body (in terms of utility) and decreases these same forces (in political terms of obedience). In a word: it dissociates power from the body; it makes it on the one hand an "aptitude", a "capacity" that it seeks to increase; and on the other hand it inverts the energy, the power that could result from it, and makes it a relation of strict subjection. If economic exploitation separates force and product from labor, let us say that disciplinary coercion establishes in the body the coercive link between increased aptitude and accentuated domination (FOUCAULT, 1998, p. 119).

In the face of algorithms that try to predict and control the behavior of students by defining in advance their learning paths, their probable careers and their risks of dropout, Freire's hope affirms that human beings are unfinished and that, for this very reason, their future cannot be codified in a database. In favor of the intellectual emancipation of students, of dialogue, and not of their indoctrination, Paulo Freire in *Pedagogy of Hope*, institutes hope as an "ontological necessity". Critical hope is not passive waiting, but an, active "hoping", a verb of action.

It is necessary to have hope, but hope of the verb to hope; Because there are people who have hope for the verb to wait. And hope from the verb to wait is not hope, it is hope. To hope is to get up, to hope is to go after, to hope is to build, to hope is not to give up! To hope is to carry forward, to hope is to join with others to do differently. (FREIRE, 2014)

Paulo Freire's concern with technology was not directed at the resource or instrument itself, but at the human actions, therefore political, ethical, and ideological, that guide its use. For the Patron of Brazilian Education, the emancipatory or oppressive

potential of technology does not reside in the artifacts themselves, but in the intentions that mobilize their use.

Freire argued that computers and other technological resources could not only prevent the impoverishment of the educational experience but also significantly expand students' critical and creative capacity. In his words, the ethical-political sense of technology always depends on human choices: "It depends on who uses it, for what and for whom and for what."

Therefore, the educator who acts with critical hope in the age of AI (1) rejects the idea that AI is neutral and uncontrollable. He understands it as a human, historical, and political production, capable of being transformed and redirected. (2) It identifies and critiques the mechanisms of digital oppression, such as algorithmic bias, data surveillance, and the commodification of attention, treating them not as insurmountable barriers but as challenges to be overcome. (3) It uses technology itself to create forms of resistance and collective construction, imagining futures in which AI serves emancipation and not profit.

In line with Lévy's (2010) perspective, technology should be understood as a phenomenon that integrates technique, humanity, and the ways in which subjects signify and relate to these processes, thus overcoming the reductionist dichotomy between human and machine. From this perspective, Freire understands technology as one of the "great expressions of human creativity" (FREIRE, 1968). It is a constitutive part of the historical and cultural development of humanity, manifesting itself as an unfolding of its inventive and liberating praxis (FREIRE, 1968).

While AI seeks to eliminate uncertainty to ensure profit, liberating education creates space for human freedom and creativity. Educating with hope is teaching the student to break with the filter bubbles and to write his own story.

The integration of AI into education is not only a technical issue but also a deeply ethical one. This Freirean ethic is opposed to the utilitarian ethics that often guide the development of EdTechs, where efficiency and scalability trump human dignity and privacy. In the algorithmic age, ethics requires educators and institutions to question: "For whom and against whom are machines being put to use?"

In the digital age, the world that regulates us is also a virtual, algorithmic, and connected world. The challenge is to ensure that technology serves as a bridge to human encounter, not a wall. The computer can simulate a conversation, but it cannot participate in the communion of consciences that characterizes Freire's dialogue.

Technology does not replace the teacher, nor the meeting between students. AI can be a resource for dialogue, providing information and scenarios, but construction must take place between human subjects. As Nóvoa (2021) warns, "education is always a human relationship" and the dilution of teaching professionalism into technological "facilitators" impoverishes training.

[...] All education seems to be reduced to learning, and to measurable learning: students are learners, schools are learning environments, teachers are facilitators of learning [...], but it must be said that if human beings learn, it is almost always because they are taught. Let us not, therefore, devalue the two terms of the same equation. Without teachers, our education will be much poorer and more limited. (NÓVOA, 2022, p.45)

Instead of accepting AI's answers as absolute truths, the educator should use the *output* of the machine as a material for problematization. Online dialogue should seek the collective construction of knowledge, where technology serves to bring together different contexts and realities (Pimentel; By Paula Berino, 2025).

Education in the algorithmic era, if based on Paulo Freire's principles, can be a space of resistance and reinvention. The act of educating, rescues humanity in the face of the indifference of the machine. Esperançar breaks with technological determinism, stating that the future is open and can be built. Ethics imposes limits on the exploitation of data and demands that technology serve life. And dialogicity ensures that, even in a world of digital connections, education continues to be the transformative encounter between human beings.

It is not competing with the processing capacity of machines, but cultivating what they will never have: the ability to love, to dream, to be indignant and to build, together, a fairer world. AI can process the past, but only conscious, loving, and hopeful human beings can, through praxis, give birth to the future, an education where technology amplifies our humanity, rather than replacing it.

CONCLUSION: FREIRE'S LEGACY AND HUMANIZATION IN THE ALGORITHMIC SOCIETY

The trajectory of this chapter reveals that the intersection between Paulo Freire's pedagogy and the emergence of Artificial Intelligence (AI) is not only a technical debate about didactic tools but an ontological and political dispute about the future of human education. The analysis of emerging tensions shows that the uncritical insertion of AI in

education risks updating and sophisticating Banking Education. In this scenario, the student's passivity is not only required by the authoritarian teacher but induced by adaptive platforms and chatbots that deliver ready-made answers, suppressing the intellectual effort necessary for the construction of knowledge.

Algorithmic addiction, fueled by mechanisms of immediate reward and persuasive design, acts as an anesthetic for epistemological curiosity, replacing the restless search for instant gratification and compromising the intellectual autonomy necessary for emancipation.

In addition, the technological opacity, the "black box" nature of deep learning, stands as a new architecture of power. If, for Freire, reading the world precedes reading the word, in the digital age this reading is obstructed by algorithms that operate under commercial secrecy and reproduce discriminatory biases, making invisible the structures of oppression that sustain Surveillance Capitalism. Education, therefore, faces the risk of becoming a mechanism for adapting the individual to the logic of the data market, instead of being a practice of freedom.

However, complexity, as illuminated by the thought of Maria Cândida Moraes in dialogue with Freire, reminds us that education cannot be reduced to the linearity of algorithmic programming. Human creativity, intuition, affectivity, and the ability to deal with the unforeseen are attributes that escape the binary logic of machines. AI can process information and simulate patterns, but it does not have the ability to attribute ethical and existential meaning to experience, nor to construct the "viable novelty" through Praxis transformadora.

Faced with this scenario, the answer lies not in the rejection of technology but in the implementation of a critical LiteracIA. This new literacy, based on Freirean principles, is not limited to instrumental "knowing how to use" but requires a political understanding of technology: knowing in favor of whom and against whom machines operate. LiteracIA should empower educators and students to demystify the supposed neutrality of the technique, to question algorithmic biases, and to use AI as an object of problematization, not as an "oracle of truth".

In this sense, the AI Pedagogy proposed by UNESCO (2025) reinforces the need for intelligent systems to be integrated into education not as substitutes for human mediation, but as devices that amplify agency, creativity, and cognitive justice in the onlife ecosystem.

International guidelines point out that the future of learning requires a combination of critical thinking, advanced digital literacies, algorithmic ethics, and the ability to co-create with machines responsibly. This perspective converges profoundly with Freire's legacy by stating that technology only fulfills its social function when it enhances autonomy and strengthens educational democracy.

Incorporating AI Pedagogy into everyday school life implies recognizing that the future is not an inevitable destiny shaped by algorithms, but a field of possibilities that subjects collectively build through praxis, hope, and critical imagination.

Therefore, the increasing prevalence of Artificial Intelligence does not render Freire's educational principles outdated; instead, it heightens their relevance and urgency. In a world where machines are capable of learning (machine learning), the unique human advantage lies in the capacity to Criticize, Feeletransform. Only through an education that consciously combines humanization, rigorous criticism, and Praxis can we challenge the algorithm's logic, transforming it from a tool of oppression and surveillance into one that fosters liberation and supports the development of a more just, democratic, and humane society.

REFERENCES

- AMIEL, T. Conteúdos educacionais, abertura e vigilância na ecologia digital. In: F. J. de Almeida, G. Torrezan, L. Lima, & R. E. Catelli (Eds.), *Cultura, educação e tecnologias em debate* (3rd ed.). SESC São Paulo, 2019. Disponível aqui.
- BRIGHENTE, Miriam Furlan; MESQUIDA, Peri. Paulo Freire: da denúncia da educação bancária ao anúncio de uma pedagogia libertadora. *Pro-Posições* | v. 27, n. 1 (79) | p. 155-177 | jan./abr. 2016 155
- CARVALHO, Jaciara de Sá; SILVA, Roberto Cardoso Freire da. Dimensões para formações críticas frente às tecnologias orientadas por dados. *Revista Diálogo Educacional*, v. 24, n. 83, p. 1449-1462, 2024.
- CAVALCANTE, Livia Teixeira Canuto; OLIVEIRA, Adélia Augusta Souto de. Métodos de revisão bibliográfica nos estudos científicos. *Psicologia em Revista*, Belo Horizonte, v. 26, n. 1, p. 83-102, abr. 2020
- COSTA, Alan Ricardo; BEVILÁQUA, André Firpo; FIALHO, Vanessa Ribas. A atualidade do pensamento de Paulo Freire sobre as tecnologias: letramentos digitais e críticos. *Olhar de Professor*, v. 23, p. 1-16, 2020.
- DA CRUZ QUEIROZ, Marina Carla; DE PINHO, Maria José; DE QUEIROZ JÚNIOR, Expedito. COMPLEXIDADE:: UM OLHAR PARA CRIATIVIDADE NA EDUCAÇÃO. *Revista Sapiência: sociedade, saberes e práticas educacionais* (2238-3565), v. 14, n. 2, p. 90-109, 2025.
- DE ANDRADE, O.; DO NASCIMENTO, EFVBC. A DIALOGICIDADE FREIREANA à LUZ DA INTERNACIONALIZAÇÃO EDUCATIVA E LIBERTADORA. *CONTEXTO*, v. 39, n. 121, 2024.
- DE OLIVEIRA, Ivanilde Apoluceno. *A dialogicidade na educação de Paulo Freire e na prática do ensino de filosofia com crianças*. 2017.
- FARBIARZ, Alexandre; COARACY, Lucas Lima. DIÁLOGOS FREIRIANOS E INTELIGÊNCIA ARTIFICIAL: CAMINHOS PARA UMA LITERACIA. *Revista Interinstitucional Artes de Educar*, [S. l.], v. 11, n. 1, p. 355–374, 2025. DOI: 10.12957/riae.2024.86241. Disponível em: <https://www.e-publicacoes.uerj.br/riae/article/view/86241>. Acesso em: 15 out. 2025.
- FARBIARZ, Alexandre; COARACY, Lucas Lima. DIÁLOGOS FREIRIANOS E INTELIGÊNCIA ARTIFICIAL: CAMINHOS PARA UMA LITERACIA. *Revista Interinstitucional Artes de Educar*, v. 11, n. 1, p. 355-374, 2025.
- FLORIDI, Luciano. *Ética da inteligência artificial: princípios, desafios e oportunidades*. Tradução de Juliana Vermelho Martins. Curitiba: PUCPRESS, 2024. 396 p.
- FOUCAULT, M. *Vigiar e punir*. 18. ed. Petrópolis: Vozes, 1998.
- FREIRE, P. *Ação cultural para a liberdade e outros escritos*. Tradução: Claudia Schilling. Rio de Janeiro: Paz e Terra, 1968.

FREIRE, P. *Pedagogia da Autonomia: Saberes necessários à prática educativa*. São Paulo: Paz e Terra, 2018.

FREIRE, P; PASSETTI, E. *Conversação Libertária com Paulo Freire*. São Paulo: Imaginário, 1994-1995.

FREIRE, Paulo. *Pedagogia da esperança: um reencontro com a Pedagogia do oprimido*. 23. ed. Rio de Janeiro: Paz e Terra, 2014.

FREIRE, Paulo. *Pedagogia do oprimido*. 86. ed. Rio de Janeiro: Paz e Terra, 2023. 256 p.

GABRIEL, Rosângela. Letramento, alfabetização e literacia: um olhar a partir da ciência da leitura. *Revista Práxis*, Novo Hamburgo, v. 14, n. 2, p. 76-88, jul./dez. 2017.

HEGGLER, João Marcos; SZMOSKI, Romeu Miqueias; MIQUELIN, Awdry Feisser. As dualidades entre o uso da inteligência artificial na educação e os riscos de vieses algorítmicos. *Educação & Sociedade*, v. 46, p. e289323, 2025.

LE VOCI SAYAD, Alexandre. *INTELIGENCIA ARTIFICIAL Y PENSAMIENTO CRÍTICO*. 2024.

LÉVY, P. *Cibercultura*. Rio de Janeiro: Editora 34, 2010.

LISBOA, Edson da Silva Rodrigues; LOPES, Luís Fernando. Tecnologia e histórias de vida: emancipação freiriana nas disciplinas de inteligência artificial. *Revista Diálogo Educacional*, v. 23, n. 77, p. 844-860, 2023.

MIGALHAS. Discriminação algorítmica e a violação dos direitos fundamentais. 2025. Disponível em: <https://www.migalhas.com.br/depeso/431950/discriminacao-algoritmica-e-a-violacao-dos-direitos-fundamentais>. Acesso em: 15 out. 2025.

MORAES, M. C. A formação do educador a partir da complexidade e da transdisciplinaridade. *Revista Diálogo Educacional*, vol. 7, núm. 22, septiembre-diciembre, 2007, pp. 13-38.

MORAES, M. C. *Saberes para uma cidadania planetária: homenagem a Edgar Morin*. Rio de Janeiro: Wak, 2019.

MORAES, M. C. *Transdisciplinaridade, criatividade e educação: fundamentos ontológicos e epistemológicos*. Campinas: Papirus, 2015

NÓVOA, Antônio. *Escolas e professores - proteger, transformar, valorizar*. Colaboração de Yara Alvim. Salvador: SEC/IAT, 2022.

NÓVOA, Antônio. Um novo contrato social da educação - repensar juntos os nossos futuros. *Jornal de Letras - JL Educação*, ano 41, n.1335, 1 a 14 dez. 2021.

PIMENTEL, Mariano; DE PAULA BERINO, Aristóteles. *GPT PAULO FREIRE: CONVERSANDO COM UMA SIMULAÇÃO DO PATRONO DA EDUCAÇÃO*

BRASILEIRA: talking to a simulation of the Patron of Brazilian Education. Revista Interinstitucional Artes de Educar, v. 11, n. 1, p. 63-83, 2025.

PIMENTEL, Mariano; DE PAULA BERINO, Aristóteles. GPT PAULO FREIRE: CONVERSANDO COM UMA SIMULAÇÃO DO PATRONO DA EDUCAÇÃO BRASILEIRA. Revista Interinstitucional Artes de Educar, v. 11, n. 1, p. 63-83, 2025.

Pinheiro Porto, F., & Soares Ramos Procasko, J. C. (2024). Desafios e Perspectivas da Pedagogia Crítica na Era Digital: uma reconfiguração freiriana do papel docente. EaD & Tecnologias Digitais Na Educação, 12(17), 73–85.
<https://doi.org/10.30612/eadtde.v12i17.19536>

PINTO, Vieira. O conceito de tecnologia. 1. ed. São Paulo: Contraponto, 2007. 548 p. ISBN 978-85-85910-67-9.

PONTES, Rosana Ferreira; PIMENTA, Selma Garrido. La pedagogía crítica de Paulo Freire: elementos para una propuesta en el campo de la didáctica. Revista Chilena de Pedagogía, v. 1, n. 1, p. 1-15, 2019.

SAMPAIO, Ana Maria Mendes; ARANGO, Diana Elvira Soto. Paulo Freire e a Pedagogia Crítica: seu legado para uma nova pedagogia do Sul. Revista Ibero-Americana de Estudos em Educação, v. 15, n. 3, p. 1072-1093, 2020.

SCHLESENER, A. H. Ética na pesquisa em educação: os limites e desafios ante a Inteligência Artificial. Práxis Educativa, [S. l.], v. 20, p. 1–12, 2025. DOI: 10.5212/PraxEduc.v.20.24293.004. Disponível em: <https://revistas.uepg.br/index.php/praxiseducativa/article/view/24293>. Acesso em: 12 out. 2025.

SCHNEIDER, Maria Fernanda Moretti; VOSGERAU, Dilmeire Sant'anna Ramos; FERNANDES, Luana Fonseca Duarte. O Diálogo nas Redes Sociais Digitais Em Prol Da Educação: uma análise a partir das reflexões de Paulo Freire. Momento-Diálogos em Educação, v. 32, n. 01, p. 215-238, 2023.

SCOTT, Kevin; SHAW, Greg. O futuro da inteligência artificial: de ameaça a recurso. HARLEQUIN, 2023.

SILVA, Marco. Prefácio. In: PIMENTEL, Mariano; CARVALHO, Felipe. IA generativa e educação: práticas e teorizações. Porto Alegre: Sociedade Brasileira de Computação, 2025. p. [11–30]. E-book. ISBN 978-85-7669-658-2.

SOUZA, Júlia; POLI, Leonardo Macedo. O desafio da transparência algorítmica. Scientia Iuris, v. 28, n. 2, p. 149-162, 2024.

TAYAR, Isadora Mendes; BATISTA, Gustavo Araújo. INTELIGÊNCIA ARTIFICIAL NA EDUCAÇÃO: ENTRE A OPRRESSÃO E A EMANCIPAÇÃO NA PERSPECTIVA DA PEDAGOGIA DA AUTONOMIA. Cadernos da FUCAMP, v. 43, 2025

TAYAR, Isadora Mendes; BATISTA, Gustavo Araújo. INTELIGÊNCIA ARTIFICIAL NA EDUCAÇÃO: ENTRE A OPRESSÃO E A EMANCIPAÇÃO NA PERSPECTIVA DA PEDAGOGIA DA AUTONOMIA. Cadernos da FUCAMP, v. 43, 2025.

THE ONLIFE MANIFESTO. Being Human in a Hyperconnected Era. An initiative of the European Commission. 2015. Disponível em: <https://ec.europa.eu/digital-single-market/sites/digital-agenda/files/Manifesto.pdf>.

UENO, Yasmin et al. A TRANSIÇÃO DA CURIOSIDADE INGÊNUA PARA EPISTEMOLÓGICA CRÍTICA E SUA IMPORTÂNCIA NO CONTEXTO DA PEDAGOGIA LIBERTADORA FREIRIANA. 2024.

UNESCO, 2024. Guia para a IA generativa na educação e na pesquisa. Disponível em: <https://unesdoc.unesco.org/ark:/48223/pf0000390241>. Acesso em: 7 nov. 2025.

WEBB, Amy. Os Nove Titãs da IA: como os gigantes da tecnologia e suas máquinas pensantes podem subverter a humanidade. Alta Books, 2020.

ZUBOFF, S. A era do Capitalismo de Vigilância: A luta por um futuro.

BETWEEN RESOURCES AND RELATIONSHIPS: CHALLENGES OF SCHOOL MANAGEMENT IN THE EMERGENCE OF OPEN EDUCATIONAL ECOSYSTEMS IN THE PUBLIC TEACHING CONTEXT

  10.56238/livrosindi202668-004

Welington Tavares dos Santos

Doctoral student in Education

Professor in the Public Education Network, Paraná / Brazil
PUCPR

Orcid: <https://orcid.org/0009-0004-2951-4539>

E-mail: santos.welington@educacao.pr.gov.br

ECOSYSTEMS: FROM THE ECOLOGICAL CONCEPT TO THE SYSTEMIC METAPHOR

The term *ecosystem* originates in Ecology and was coined by Arthur George Tansley in 1935 to designate the system, including simultaneously the complex of organisms and the set of physical factors that make up the environment in which they live (Schowalater, 2016).

Ecological literature has established definitions that highlight the dynamic and relational nature of the concept: an ecosystem is a complex, ever-changing system of communities of plants, animals, fungi, and microorganisms, along with their surrounding non-living environment, interconnected through flows of energy, matter, and information. (Nowzari, 2019) This shift from focusing on isolated elements to emphasizing interactions is supported by systems-thinking authors. Capra (2014), in presenting a systemic view of life, describes ecosystems as networks of relationships in which each component's understanding depends on its connections with others across multiple levels and scales. From this standpoint, the focus moves away from cataloging organisms or resources to examining patterns of organization and the processes of interdependence that sustain life.

This aligns with the Theory of Complexity (Morin, 2005), which models living and human systems as open, self-organizing totalities characterized by uncertainties, feedback, and emergent phenomena. By integrating Ecology with systems thinking, thinkers like Capra (1997) suggest that the concept of ecosystem is more than a biological technical term; it is a relational paradigm with strong heuristic potential for rethinking education, society, and culture.

According to this view, what defines an ecosystem is not merely the presence of numerous elements but their co-evolution within a network, creating distinct configurations of resilience, vulnerability, care, and transformation. Over the last twenty years, the vocabulary of ecosystems has increasingly influenced analyses of social, economic, and educational systems, especially amid the transformations linked to the knowledge economy and lifelong learning. Terms such as innovation ecosystems, knowledge ecosystems, and more recently, learning or educational ecosystems have become common in reports by international organizations, public policies, and academic research.

International reports, such as WISE's on Learning Ecosystems (Hannon et al., 2021, p. 13), define learning ecosystems as configurations of actors, resources, spaces, and relationships articulated around the purpose of lifelong learning, inside and outside formal institutions.

Other studies, synthesized in literature reviews on learning ecosystems, show how the ecological metaphor has been applied to describe educational arrangements that integrate schools, universities, families, community organizations, companies, digital technologies, and public policies into complex collaborative networks (Hannon et al., 2021, p. 13).

In the field of educational policies, OECD and UNESCO documents have used the term to highlight the need to think about education beyond the classroom, in "learning ecosystems" that articulate multiple levels (micro, meso, macro, chronosystems) and dimensions (curriculum, governance, territories, technologies) (OECD, 2021, p. 107).

These texts underscore that educational ecosystems entail a diversity of actors, institutional flexibility, openness to partnerships, and appreciation of non-school spaces, which requires a profound reconfiguration of the management logic and forms of regulation of public schools.

In educational research, the term educational ecosystems is used to describe expansive and diffuse educational environments that include formal organizations, community initiatives, teaching professional networks, digital resources, and research practices, connected by streams of knowledge and collaboration (Cosner et al., 2021, p. 20).

Recent conceptualizations draw attention to the risk of a merely rhetorical use of the ecological metaphor — in which any network of partnerships is labeled an ecosystem

— and advocate more rigorous definitions that preserve the relational and processual core of the original ecological concept.

In research on entrepreneurial ecosystems, for example, Harrison and Rocha (2025) point out that, at best, the entrepreneurial ecosystem is a weak and inadequate metaphor, offering limited value as an analytical tool when there is no clear conceptual content between the source and destination of the metaphor.

Similarly, Archer et al. (2025) show that, in learning environments, the ecological metaphor may not capture essential aspects of human dynamics if applied non-critically.

In this sense, Kinchin (2022) observes that the incremental adoption of ecological terminology can increase pedagogical fragility when it remains detached from deep epistemological analyses. These examples support the need for more rigorous definitions that preserve the relational and processual nature of the ecological concept by transposing the metaphor to social and educational systems.

OPEN EDUCATIONAL ECOSYSTEMS AND OPEN SCHOOLING

Within this broader movement, the notion of open educational ecosystems emerges, closely aligned with the agendas of open education, open science, and open *schooling*.

Researchers such as Okada, Sherborne, and Panselinas Kolionis (2025) propose understanding networked learning mediated by open educational resources, digital technologies, and community projects, such as learning ecologies or learning ecosystems, in which students, teachers, families, and external partners co-develop investigations, social interventions, and critical uses of AI, all anchored in the CARE–KNOW–DO model (p. 5).

From this perspective, an open educational ecosystem is understood as a fabric of relationships that articulates care, knowledge production, and transformative action.

This understanding dialogues directly with the CARE–KNOW–DO model, in which CARE refers to relationships of care, welcoming, and ethical responsibility; KNOW refers to the collective and situated construction of knowledge; and OD corresponds to transformative action oriented toward social and educational intervention.

Although the studies by Okada (2025), Torres, and Kowalski (2022) do not propose theorizing educational ecosystems as a central concept, their analyses of Open Schooling offer empirical and pedagogical contributions that allow interpreting the school as part of a broader relational arrangement, here analyzed through the lens of educational ecosystems.

In these studies, therefore, the emphasis is not on the formulation of a normative concept of an open educational ecosystem, but on concrete practices of opening the school to the territory, to citizen science, to inter-institutional collaboration, and to the resolution of real-world problems, overcoming instrumental or merely technological conceptions of educational innovation.

At the same time, recent studies on educational ecosystems in contexts of social vulnerability highlight that this language is coherent only when considered in light of the complexity of the material and political conditions in which schools operate.

Okada et al. (2025) reinforce this understanding by emphasizing that learning ecosystems emerge only when there are fabrics of relationships that sustain processes of investigation, creation, and action.

Such fabrics are not produced in a vacuum: they depend on specific historical, social, and institutional conditions. Ignoring these constraints results in transforming the concept of ecosystem into a mere rhetorical label — dissociated from the concrete realities of public schools.

Thus, this language is coherent only when considered in light of material and political conditions, reaffirming that educational openness is always situated and that the potential of an ecosystem depends on the extent to which it is enabled or constrained by the context in which it is inscribed.

The incorporation of the concepts of educational ecosystem and open schooling as analytical lenses is not merely a terminological choice but an epistemological movement that guides the interpretation of the concrete experience of school management presented in this chapter.

When revisited from the perspective of the Theory of Complexity, these concepts shift the view from education as a closed system centered on prescriptions and resources to an expanded understanding of the school as a living organism, marked by interdependencies, tensions, and emergencies.

The notion of ecosystem — originally formulated in the field of ecology and later appropriated by systemic and educational studies — allows us to understand the school not as a sum of sectors, functions, or technologies, but as a dynamic network of relationships among people, knowledge, resources, cultures, norms, and material conditions.

This perspective implies recognizing that each management action is simultaneously pedagogical, political, relational, and organizational; and that its

effectiveness depends not only on the supply of resources but also on the quality of the connections that sustain collective processes of learning and action.

In a similar vein, open schooling emphasizes educational practices that cross the traditional boundaries of the school, promoting investigation, social participation, co-authorship, and the ethical use of technology. This approach reinforces that openness is not reduced to access to platforms, OER, or innovative methodologies: it materializes in the school's ability to articulate tissues of care (CARE), knowledge (KNOW), and transformative action (OD).

Thus, educational initiatives can only be fully understood when inserted into the social, cultural, and political contexts that condition them — a point that is particularly relevant in territories marked by social vulnerability, as in the case under study.

These theoretical frameworks, therefore, are not presented in an abstract or merely conceptual way. They guide the reading of the management action by allowing the interpretation of concrete movements made by the management team as expressions of an attempt to build an open educational ecosystem in adverse conditions.

By shifting the focus from resources to relationships, processes that typically go unnoticed in traditional management models become evident: micro-arrangements of trust, mediations carried out by teachers and pedagogues, collaborative strategies in response to infrastructure scarcity, the opening of the school to the territory and cultural diversity, and negotiations with centralizing policies.

Thus, adopting this framework makes it possible to understand school management not only as the administration of resources but as an intentional, situated, and complex action that seeks, even amid structural and political limitations, to create conditions for the school to become a living, open ecosystem that promotes learning, care, and social justice.

THE PUBLIC CONTEXT OF EDUCATION

The experience that led to this report took place in a school in a region of high social vulnerability in southern Brazil, marked by two simultaneous movements that strain it: on the one hand, violence, structural precariousness, and historical inequalities; on the other, the presence of industries and factories that attract intense population flows and contribute to a heterogeneous social configuration.

The analysis presented in this chapter is based on a qualitative study conducted between 2022 and the first semester of 2025 in a public school marked by social vulnerability, international migration, and recurrent structural challenges.

The actions developed by school management during this period did not stem from a prior project to build an open educational ecosystem, but from situated responses to concrete problems of daily school life and initiatives linked to Open Schooling, especially in the context of the CONNECT project.

The notion of an open educational ecosystem therefore emerges as an analytical category constructed a posteriori, based on reflection on practices that, when articulated, began to reveal relational, collaborative, and territorial dynamics compatible with an ecosystem reading of the school.

The methodological approach adopted is close to an interpretative case study, anchored in principles of action research and in the description of the institutional routine. The information analyzed was built from the combination of direct observation of management practices, analysis of school documents, administrative records, statistical data of the institution, and monitoring of face-to-face and digital interactions.

This multiplicity of sources made it possible to understand not only what was done, but also how the actions emerged, consolidated, and began to configure what we call an open school ecosystem. The school serves about 1,300 students, distributed in 52 classes — 19 in Elementary School, 19 in High School, 06 in Youth and Adult Education - EJA, 05 language classes (Portuguese for speakers of other languages and Spanish), and 04 special education classes — accompanied by a team of 110 teachers and 27 administrative and operational employees.

Approximately 40% of the students are in a situation of socioeconomic vulnerability, and the school also has 168 migrant or foreign students, from six Latin American and Caribbean countries, especially Venezuela (135 students), Cuba (21), Haiti (10), as well as Portugal and Peru. This multicultural and socially complex context was central to defining management actions and constitutes the empirical setting that supports the analyses in this chapter.

The quantitative data analyzed include institutional indicators of teacher participation, pedagogical projects, school mediations, conflict rate, attendance at extracurricular activities, and academic results.

For example, about 90% of teachers regularly participated in training and pedagogical meetings; 3 to 5 interdisciplinary projects were observed per year; and the extracurricular projects of music, sports, art, skateboarding, fanfare, Spanish and Portuguese for speakers of other languages involved, on average, 25 students per action, with an attendance rate close to 80%.

Regarding school climate, a significant change was observed compared with previous years. In earlier periods, there was an average of about ten disciplinary incidents per week. As of 2024, this number began to vary between one and two incidents per month. This reduction is associated with intensified follow-up and mediation practices, with two to four mediations conducted daily by the management team.

Data on academic performance from 2022 to 2024, available in institutional records, were also considered. They reveal variation in pass and repetition rates over the years and help contextualize the pedagogical challenges faced during this period.

The analysis of these data was guided by thematic analysis procedures, allowing the identification of emerging patterns that structure the understanding of the school as a living ecosystem: reorganization of spaces, care practices, strengthening of relationships, learning networks, teacher participation, intercultural reception and dialogued management.

The triangulation of data, documents and observation strengthened the reliability of the interpretations, ensuring that the results presented are consistent with the reality experienced by the school community.

It is noteworthy that this study has its own limitations, given the research carried out in real contexts: dependence on institutional records, the absence of formal interviews and the non-generalizable nature of the results. However, as Stake (1995) argues, the strength of a case study lies not in statistical generalization, but in its ability to offer insights that are transferable to other educational contexts.

In this sense, the experience analyzed here aims to contribute to the debate on school management and open educational ecosystems in public and complex realities.

The school space, therefore, assumes a role that goes beyond its instructional function: it becomes a gathering place, a point of reference and, for many students, the last or only opportunity to access symbolic, social and professional resources that can broaden horizons in the face of daily adversities.

The school is inhabited by a growing diversity of students: young people from the southern region, migrants from other Brazilian states and, above all, students from Latin American countries impacted by political crises, authoritarianism and economic instability.

This migration gives the institution a transnational character and requires pedagogical and management practices that are sensitive to cultural, linguistic and historical differences. As Rabelo and Okada (2023) and Torres (2020) point out, open educational ecosystems are only fully constituted when they recognize and integrate the diversity of knowledge, cultures, and experiences that circulate in the school territory.

Aware of this expanded function, the management team sought to build a differentiated design of action, not in the sense of offering magical solutions or fully solving persistent structural problems, but of producing sensitizing and alternative actions, capable of valuing the person, recognizing their potential and sustaining processes of possible transformation.

In addition to these external dynamics, the school faces internal challenges common to the Brazilian public network, which directly interfere with the school climate and produce an ecology of tensions that conditions the performance of management.

The challenges that stand out the most are low student participation, learning difficulties and accumulated gaps, teacher demotivation, a lack of teachers in fundamental curricular components, insufficient policies to value teaching and high levels of bureaucratization.

In view of this set of factors, conventional educational proposals, alien to the context and centered only on the execution of transitory institutional programs, proved to be insufficient.

Thus, local management has made a commitment to interpret the territory, activate its networks, understand its tensions and produce contextualized responses. (Oliveira et al., 2025) However, to produce significant changes, it would be necessary to favor the emergence of a "new school".

The term *new school* does not refer to the administrative creation of a new institution, but to the emergence of a new way of existing as a school, it is to recognize that, in the face of a territory simultaneously marked by vulnerabilities, migrations, historical precariousness and community powers, the school management decided to build an ecosystem different from that foreseen by the logic of traditional educational policy.

It is a proposal in which relationships take center stage, technologies serve as mediators rather than ends, cultural diversity becomes a source of knowledge, learning becomes situated, the community recognizes itself as a partner, and the school asserts itself as a space of care, protection, and dignity.

This movement does not eliminate all challenges, but it opens possibilities and displaces the school from repetitive patterns. From the perspective of the Theory of Complexity, transformation does not result from the total control of the system, but from creating conditions for the emergence of the new, since educational systems reorganize themselves when exposed to new relationships, interactions, and levels of uncertainty.

In this sense, management action can be understood not as a simple operational adjustment, but as an intentional project of cultural reconfiguration, guided by a vision of the school as a living ecosystem, open and committed to the social transformation possible in its context.

Management had to act on several fronts, recognizing that an educational ecosystem is not transformed by a single axis of intervention, but by the gradual and intentional articulation of multiple dimensions. However, these actions were not implemented simultaneously or abruptly, as the very complex nature of the school environment requires continuous cycles of observation, listening, adaptation, and dialogue.

As Paro (2016) argues, the school can only be effectively transformed when management recognizes its condition as a human institution, marked by social relations, conflicts, meanings, and concrete needs, and, for this very reason, requires permanent processes of analysis and collective reorganization. In this understanding, changing the school is not adopting ready-made packages, but building, with the collective, responses situated to the real conditions in which the institution operates.

In this sense, the management team began a systemic diagnostic process, seeking to understand the potentialities and limitations in the different spheres that make up the school routine: the human, the administrative, the financial, the pedagogical, and the structural.

In the administrative aspect, considered very challenging, careful observations were made, based on objective indicators and concrete elements capable of influencing the organizational climate, relationships, and learning. More than collecting data, it was about interpreting the school environment as an ecosystem, in which small changes can generate broad effects.

The initial results of an institutional diagnosis carried out by a group of communication and public relations students from the Pontifical Catholic University of Paraná – PUCPR, in 2022, showed important weaknesses in the school climate, internal communication, and the organization of educational spaces, especially with regard to the daily relationships between students, teachers, and other school professionals.

Participant observations and questionnaires applied to students, families and the community indicated, at the time, difficulties in coexistence in the classroom, recurrent failures in institutional communication and ambiguous perceptions about the school's image and reputation in the territory

In view of this scenario, one of the first fronts of action of the management focused on the reorganization of the school space and the material conditions of operation,

understanding that such dimensions directly influence the institutional climate and the possibilities of interaction.

Environments that were previously conceived only as circulation spaces began to be thought of as places of coexistence, in which organization, cleanliness, aesthetics and functionality could favor more respectful relationships and a sense of belonging.

In the pedagogical sphere, the diagnosis pointed to the need for greater support for the teaching work, both in terms of infrastructure and the supply of accessible and functional materials. The school management invested in the expansion and organization of digital and analog resources, to enhance the teaching and learning process.

Projectors, interactive screens, working photocopiers, colored paper, posters, artistic materials, pedagogical games and other inputs began to compose a set of resources systematically available to teachers, responding to demands historically identified in the school routine.

This action was not only configured as logistical support. In management planning, the expansion of resources was understood as part of a relational strategy, as it was recognized that the mere existence of tools does not guarantee pedagogical innovation.

The assumption that guided these decisions was that the resources should serve clear educational purposes, favoring practices based on creativity, dialogue and teacher authorship, and not only on the reproduction of predefined models.

In addition, the management expanded the possibilities of situated learning, offering institutional conditions for teachers to carry out field classes and educational experiences outside the physical space of the school, fully funded by the school.

These initiatives dialogue with the understanding that learning is built on participation in real social practices, inseparable from the context and community relations, as discussed by Lave and Wenger (1991). By moving the educational process beyond the walls of the school, it sought to strengthen links between school knowledge, territory and concrete experiences of the students.

These initial actions — reorganization of spaces, strengthening of material conditions, expansion of pedagogical resources, and creation of opportunities for expanded learning — made it possible to establish minimum bases for functioning and institutional stability, which are fundamental in a context marked by historical vulnerabilities.

As these improvements were implemented, it became increasingly evident that the central challenge lay not only in providing adequate infrastructure or materials, but in rebuilding the relationships that underpin school life.

Although more favorable conditions for teaching work were provided throughout the administration, there was still a need to overcome disciplinary boundaries, break organizational bubbles and strengthen interactions capable of producing more integrated collective practices.

RELATIONSHIPS AS A STRUCTURING AXIS OF THE SCHOOL ECOSYSTEM

If, at first, the reorganization of spaces, the expansion of resources and the qualification of material conditions represented indispensable advances, the continuity of the process revealed that the deeper transformation of the school depended on another dimension: relationships.

In everyday school life, relationships constitute the fabric that connects people, practices, knowledge, conflicts, expectations and meanings. In this way, more than isolated resources, it is the relationships that determine the vitality, permeability, and adaptive capacity of an educational ecosystem.

Authors such as Paro (2016) insist that the school is, above all, a human institution, sustained by bonds, subjectivities, and permanent negotiations; and that management can only produce significant changes when it considers these elements as structuring the educational work.

In the same direction, Morin (2005) highlights that living systems are organized by the quality of their interactions, by the feedback that is produced and by the bonds that are built between individuals and collectives. Thus, thinking of the school as an ecosystem means recognizing that its strength is not only in the materials or norms that regulate it, but in the network of relationships that makes cooperation, belonging and meaning emerge.

In the context investigated, the existence of resources, even when expanded and organized, was not enough to guarantee collaborative or innovative practices, given that many teachers remained isolated in their classrooms, restricted to disciplinary boundaries.

In addition, students found it difficult to engage in projects that required co-responsibility; families showed interest but lacked mediations that would facilitate their participation; and the technical-administrative teams, sometimes overloaded, found themselves distant from pedagogical decisions.

Faced with this scenario, the need to establish an open relational culture emerged, guided by principles of trust, dialogue, and co-responsibility. It was not a matter of creating

new bureaucratic procedures, but of instituting modes of coexistence and cooperation that would configure a more connected ecology.

These initial actions, including the reorganization of spaces, the strengthening of material conditions, the expansion of pedagogical resources, and the creation of opportunities for expanded learning, laid important foundations for the school's daily functioning and for the stabilization of historically fragile processes.

At the time, the priority was responding to concrete demands identified in the institutional diagnosis, especially those related to the school climate, the conditions of teaching work, and the organization of the educational environment.

However, as these improvements were implemented, it became increasingly evident that, although necessary, they remained anchored in a predominantly resource-centered logic as a condition for educational quality.

This focus proved relevant in a context marked by historical scarcity, but it was insufficient to promote deeper changes in school culture. Challenges related to interpersonal relationships, the fragmentation of pedagogical practices, and the difficulty of building collective actions that went beyond disciplinary and organizational boundaries persisted.

In this context, as of 2023, the approach to the Open Schooling proposal, especially through the CONNECT project, began to serve as an additional articulating element. Contact with the CARE-KNOW-DO model did not inaugurate management actions, but it offered an interpretative and pedagogical key capable of strengthening and giving greater coherence to the referrals already under development in the school.

The progressive incorporation of these principles allowed management to shift the exclusive focus on resources to a more relational understanding of the educational process. Resources and technologies have come to be understood not as ends in themselves, but as means at the service of more collaborative, dialogical, and socially committed pedagogical relations.

This movement did not eliminate the existing challenges, but it opened up new possibilities for action and interpretation, favoring the emergence of more integrated practices that are coherent with the reading of the school as a living system in permanent reorganization.

CHALLENGES AND EMERGENCIES TO CONSTITUTE AN OPEN EDUCATIONAL ECOSYSTEM IN PUBLIC SCHOOLS

Given the analytical questions raised, it becomes clear that building an open educational ecosystem in a public school involves viewing daily school life not as a static scene but as an organism in constant reorganization. Morin (2005, p. 33) states, "every living system must be conceived as a process, and not as a state," helping us understand that school transformation is ongoing—driven by movement, tensions, continuous adjustments, and the capacity to reorient actions when faced with new challenges.

The specific context, characterized by social vulnerability, migration, historical inequalities, and institutional tensions, is not a barrier to openness; rather, it highlights the very field of opportunities in which openness assumes ethical, social, and pedagogical significance. To ensure this openness isn't limited to isolated or intuitive initiatives, one key element is essential: knowledge and strategic planning that can guide management in a critical, contextualized, and forward-looking way.

Thus, the open educational ecosystem did not arise from an idealized plan but from successive, interconnected actions: reorganizing resources, activating relationships, expanding interactions among subjects, creating new spaces for participation, strengthening care practices, and embracing diversity as a pedagogical value. Working with the concept of ecosystem within an environment historically shaped by hierarchical, fragmented, and disciplinary logics poses a significant challenge. Paro (2016, p. 28) reminds us that "the school is, above all, a human institution, and it is in the quality of the relationships that are established in it that the possibility of carrying out its educational work resides."

Along this path, the school gradually ceased to operate as a fragmented institution, predominantly guided by administrative demands and reactive responses, to configure itself as a more integrated relational arrangement, in which resources, pedagogical practices and human relations began to feed each other.

This transformation did not stem from a prior project to implement an educational ecosystem, but from the accumulation of decisions and actions that, by responding to concrete problems in daily school life, produced new forms of organization and interaction. In this sense, the notion of an open educational ecosystem is consolidated in this study as an analytical category, constructed a posteriori to interpret an ongoing process.

What was observed was the emergence of a school that began to engage more systematically with its territory, recognizing both social vulnerabilities and cultural

strengths; to welcome students from multiple origins, languages, and migratory trajectories; and to value collaborative and interdisciplinary practices as alternatives to curricular fragmentation.

In this movement, traditionally peripheral training fields such as art, music, sports, and culture were integrated into the school routine, expanding the meanings of learning and strengthening bonds of belonging.

The educational experience began to extend beyond the limits of the classroom through expanded projects and situated learning, connected to students' real experiences and the social context in which the school is embedded.

Digital technologies, in turn, were progressively reinterpreted as pedagogical and communicative mediators, not as ends in themselves or instruments of control. From the point of view of management, this rearrangement implied a substantive change in posture: management began to be conceived less as an instance of inspection and more as human mediation, oriented to listening, negotiation, and the construction of conditions for collective action.

The expansion and reorganization of communication channels with the community reinforced this displacement, contributing to greater transparency, co-responsibility, and participation. By bringing together these elements, the school began to operate not only as a bureaucratic organization but as an adaptive system, in which decisions, relationships, and practices are continuously reorganized.

This reading is supported by approaches to complexity, which understand social systems as open, nonlinear, and sensitive to interactions (Morin, 2005; Capra, 2014), and it dialogues with references to open schooling and educational innovation, understood here as processes oriented toward possible social transformation, not as finished technical solutions.

Recognizing this movement, however, does not mean affirming its completeness. On the contrary, the case clearly shows that the construction of open educational ecosystems in public schools is necessarily unfinished, tense, and conditioned by persistent structural realities.

Among them, the recurrent lack of teachers, material precariousness, centralizing educational policies, normative evaluation cultures, the constant migration of students, teaching overload, and the objective limits on participation by the school community stand out.

It is in this scenario that fundamental analytical questions emerge, indispensable for deepening understanding of the challenges of school management in this process. Among them, the following stand out: how to sustain relational practices in contexts marked by high teacher turnover and intense administrative demands; which management strategies can ensure continuity of actions in the face of transitory policies and changes in government.

Other equally important issues include the most effective way to integrate digital technologies without reducing them to surveillance instruments or to the mechanical execution of tasks, and how to ensure that interdisciplinary and extracurricular projects are institutionalized beyond individual efforts.

It is in this unstable, incomplete, and relational movement that the real possibilities of building open educational ecosystems in the context of public schools are outlined. The school is understood not as a passive scenario of policies and programs, but as an organism in permanent reorganization, which requires from school management an attentive, dialogical, and responsive posture toward the tensions that cross the educational routine.

FINAL CONSIDERATIONS

The path analyzed in this chapter shows that the construction of educational responses in public contexts marked by social vulnerability, migration and institutional instability is not carried out through isolated technical solutions or the simple adoption of concepts in vogue in the educational debate.

On the contrary, it is a progressive, situated and relational process, in which, and relational process, in which school management has an important role, as it acts permanently in the midst of tensions, limits,

The experience discussed demonstrates that there was no initial intention to constitute an open educational ecosystem. However, this understanding emerges retrospectively, as an analytical category, from observing a set of actions that, over time, began to articulate resources, relationships, pedagogical practices, and links to the territory.

In this sense, the open educational ecosystem is not presented as a model to replicate but as an interpretive key for understanding how public schools can reorganize in the face of complex and persistent challenges.

The results indicate that the reorganization of resources — spaces, materials, technologies, and working conditions — was a necessary condition for stabilizing the school routine and responding to historical demands.

The most significant advance occurred when management recognized that such resources only produce transformative effects when integrated into qualified relationships, guided by care, dialogue, co-responsibility, and participation. In this sense, the approach to Open Schooling, especially from the CONNECT project and the CARE–KNOW–DO model, contributed to giving greater coherence and pedagogical intentionality to this movement, without replacing or standardizing the practices already in progress.

By assuming the school is an adaptive, open and relational system, management has shifted from a predominantly administrative logic to a mediating action, sensitive to the human dynamics that sustain school life.

This displacement allowed for the expansion of collaborative practices, the strengthening of community bonds, the integration of different training fields, and the re-signification of the use of technologies as pedagogical and communicational mediations.

Even so, the case analyzed makes it clear that such advances coexist with important structural limitations, such as teacher turnover, work overload, centralizing educational policies, and normative evaluative cultures.

It is precisely in this unfinished, tense character that the study's main analytical contribution lies. Experience shows that the construction of open educational ecosystems in public schools does not occur through the elimination of conflicts, but through the ability to inhabit tensions, open possibilities, and create conditions for the emergence of new forms of organization and learning.

In closing, the chapter does not offer definitive answers but proposes open-ended questions that should guide future research and management practices committed to public education.

Issues related to the sustainability of relational practices, the continuity of actions in the face of transitory educational policies, the critical integration of technologies, and the strengthening of care in environments marked by external goals and evaluations show that the challenges of school management in complex public contexts are not solved by prescription or isolated technical solutions.

Facing such challenges requires attentive, reflective, and ethically committed management, capable of recognizing the school as a living public space, crossed by tensions and under permanent construction, in which transformation is produced less by the imposition of models and more by the continuous creation of conditions for dialogue, co-responsibility, and collective action.

In this horizon, the notion of an open educational ecosystem, analyzed here, contributes to understanding school management not as an instance of control but as a relational practice that connects subjects, knowledge, and territories in relation to possible social transformation.

REFERENCES

- ARCHER, L. et al. (2025). Critically conceptualising relationships between formal and informal learning settings using ecosystem and market metaphors. *International Journal of STEM Education*.
- CAPRA, Fritjof. *The web of life: a new scientific understanding of living systems*. New York: Anchor Books, 1997.
- CAPRA, Fritjof; LUISI, Pier Luigi. *The Systems View of Life: A Unifying Vision*. Cambridge: Cambridge University Press, 2014.
- COSNER, Shelby A.; WHALEN, Samuel P.; RICHARD, Meagan S.; HEBERT, Martha M. Exploring educational ecosystems through the lens of intermediary organizations: insights for policy and practice. Doha: WISE – Qatar Foundation, 2021. (*Learning Ecosystems and Leadership*).
- HANNON, Valerie; THOMAS, Louise; WARD, Sarah; BERESFORD, Tom. *Local learning ecosystems: emerging models*. 2021.
- HARRISON, R. T.; ROCHA, I. (2025). Close enough to speak; distant enough to learn?" A critique of the entrepreneurial ecosystem metaphor. *Journal of Technology Transfer*. DOI: <https://doi.org/10.1007/s10961-025-10206-w>
- KINCHIN, I. M. (2022). The ecological root metaphor for higher education. *Education Sciences*. DOI: <https://doi.org/10.3390/educsci12080528>
- LAVE, Jean; WENGER, Etienne. *Situated learning: legitimate peripheral participation*. Cambridge: Cambridge University Press,
- MORIN, Edgar. *Introdução ao pensamento complexo*. 3. ed. Porto Alegre: Sulina, 2005.
- Nowzari, H. (2019). Ecosystems. In: Romaniuk, S., Thapa, M., Marton, P. (eds) *The Palgrave Encyclopedia of Global Security Studies*. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-74336-3_396-1
- OECD (2021), *Embedding Values and Attitudes in Curriculum: Shaping a Better Future*, OECD Publishing, Paris, <https://doi.org/10.1787/aee2adcd-en>.
- Okada, A., Sherborne, T., Panselinas, G. et al. Fostering Transversal Skills Through Open Schooling Supported by the CARE-KNOW-DO Pedagogical Model and the UNESCO AI Competencies Framework. *Int J Artif Intell Educ* (2025). <https://doi.org/10.1007/s40593-025-00458-w>
- OLIVEIRA, A.S.; SOUSA, M.M.; COSTA, R.G.O.; MARTINS, T.R. Desafios da educação no futuro: um olhar a partir de Edgar Morin. *Revista Eletrônica Amplamente*, Natal/RN, v. 4, n. 2, p. 235-248, abri./jun., 2025.
- PARO, Vitor Henrique. *Gestão democrática da escola pública*. 7. ed. São Paulo: Cortez, 2016.
- RABELLO, C. R. L.; OKADA, A. Escolarização aberta no desenvolvimento de multiletramentos em projetos de proteção ambiental. *Revista Diálogo Educacional*, Curitiba:

Editora PUCPRESS, v. 23, n. 77, abr./jun. 2023. DOI: doi.org/10.7213/1981-416X.23.077.DS01.

SCHOWALTER, Timothy D. Ecosystem structure and function. In: *Insect Ecology: An Ecosystem Approach*. 4. ed. [S.l.]: Elsevier, 2016. p. 367-404. DOI: 10.1016/B978-0-12-803033-2.00011-X.

TORRES, Patrícia Lupion; KOWALSKI, Raquel P. Glitz; RIBEIRO, Silvar Ferreira; OKADA, Alexandra (Orgs.). *Educação, pesquisa e inovação*. Curitiba: Insight, 2020.

BETWEEN KNOWLEDGE AND TECHNOLOGIES: ETHICAL AND EDUCATIONAL CHALLENGES IN TIMES OF ARTIFICIAL INTELLIGENCE

  10.56238/livrosindi202668-005

Alex Bruno Fendiekovski
PUCPR

Luciani de Sousa Amaral Santos
PUCPR

Cecilia Emilia da Silva Paveslki
PUCPR

Patricia Lupion Torres
PUCPR

INTRODUCTION

This chapter offers a critical, transdisciplinary reflection inspired by Edgar Morin's complex thinking on the ethical and educational issues arising from the growth of Artificial Intelligence (AI). It examines how technological changes in learning, teaching, and living impact society. The discussion focuses on how education can serve as a bridge between human knowledge and intelligent systems, fostering ethical, critical, and responsible development of 21st-century citizens.

This proposal is guided by the challenge of understanding how to incorporate ethical principles, human values, and cognitive skills into modern education to address issues such as AI, misinformation, and social shifts affecting education. The main aim is to explore how ethical standards, public policies, and socio-emotional competencies can be integrated with current educational practices to foster a conscious, human-centered use of Artificial Intelligence, aligned with values like dignity, justice, solidarity, and social responsibility.

The chosen approach is qualitative and bibliographic, relying on key documents like UNESCO's 2021 Recommendation on AI ethics, along with contemporary theoretical works by Morin (2005, 2008, 2011, 2015) and Fadel et al. (2024).

This analysis adopts a complexity perspective to examine how education can bolster ethical, critical, and creative abilities amidst technological impacts and social transformations characteristic of the digital era. Ultimately, this chapter aims to advance the academic dialogue on how to shape education amid rapid technological change,

reaffirming the vital roles of schools and teachers in cultivating an ethical, democratic, and humanized digital culture.

FAKE NEWS, NARRATIVE DISPUTES, AND THEIR IMPACTS

The rise of fake news as a key element in the modern communication landscape reveals more than just an informational issue; it uncovers a fundamental conflict over the historical narrative shaping collective existence. In a world characterized by rapid change, narrative fragmentation, and algorithm-driven experiences, the spread of false content acts as a strategic tool for manipulating memory, identity, and perceptions of the present. Here, the line between fact and fiction blurs, and historical experiences are challenged by discourses aimed at rewriting the past to influence current political actions.

Consequently, disinformation not only distorts interpretations but also hijacks the process of meaning-making, colonizing the social imaginary and affecting sociability, identity, and society's ethical-political outlook. In the early 2000s, we faced an unparalleled acceleration in methods of communication, interpretation, and meaning-making. Digital networks, widespread access to information, and the rapid dissemination of texts, images, opinions, feelings, and falsehoods have created a new mode of communication characterized by immediacy and constant exposure.

As a result, content consumption and production have become quicker, more fragmented, and driven by algorithmic logic that influences perceptions and fabricates temporary consensus. The intersection of technology, digital platforms, and socio-political shifts has fostered instability, turning information into an endless stream and a raw material for profound symbolic conflicts.

This whole scenario, therefore, leads to the fact that in 2016 the word chosen by the Oxford dictionary as the term of the year was "post-truth", defined as the circumstance in which "objective facts have less influence on the formation of public opinion than appeals to emotion or personal beliefs" (English Oxford Living Dictionaries, 2018). The following year, the Collins dictionary highlighted the expression "*fake news*", pointing out the proliferation of false content that presents itself as news, often structured to generate sensationalism, political manipulation or economic gain. Both terms evidence the advent of a global phenomenon that reconfigures the public sphere, reorients the relationship between citizens and institutions, and challenges the very notion of shared truth.

However, as historiography shows, the circulation of false information is not a historical novelty. Marc Bloch, in his classic 1921 essay *Reflections of a Historian on False*

News of War, already warned that error spreads only when it finds, within society, a "favorable breeding ground," fed by fears, collective anxieties, prejudices, and passions. Bloch (1921) observed that, in times of conflict, rumors and distortions circulated among both soldiers and civilians, shaping emotional landscapes that influenced perceptions and behavior. He wondered, restlessly, how such simple and unfounded news could spread so widely and resist rational scrutiny. The answer, as he demonstrates, lies in the symbolic fabric of societies: in the representations, inherited memories, and prior structures of meaning that precede (and condition) the reception of fake news.

Examples abound in Marc Bloch's work, such as his account of the widespread rumors during the Franco-Prussian War, which caused fear and concern among future soldiers. As Leandro Karnal notes, narratives manipulated in the Modern Age—particularly through the instrumentalization of lies—have served as a means of power since the sixteenth century. They function to shape expectations, control interpretations, and dispute legitimacy. The manipulation of truth is not just about distorting information but also acts as a technology of authority and world-building.

Throughout history, various forms of fake news have influenced significant upheavals and interests. Today, the term "fake news" is a contemporary synthesis of a much older phenomenon, which takes on new dimensions through algorithmic logic, digital media, and global connectivity. From 2016 onward, heightened by the U.S. elections and geopolitical conflicts, the concept entered dictionaries and critical debates worldwide, encompassing disinformation, polarization, microtargeting, and automated manipulation. Since then, its prominence in dictionaries and discussions has increased.

Understanding this trajectory is crucial for addressing current challenges. The rise of disinformation goes far beyond simple factual errors; it involves strategic dissemination of false content driven by political, economic, or ideological motives. Disinformation functions as a technique, a symptom, and a language—mobilizing emotions, capturing attention, and influencing decisions within an information ecology saturated by speed, superficiality, and virality.

In this context, it is essential to bring this discussion closer to Edgar Morin's reflections. For the thinker of complexity, phenomena such as Artificial Intelligence, digital manipulations, and post-truth cannot be analyzed in isolation or fragmented: they constitute expressions of an intricate global system, in which technological, cultural, political, and anthropological dimensions are intertwined. The contemporary crisis of information, according to Morin (2011), is simultaneously a crisis of rationality,

democracy, ethics, and humanity; It is a civilizational phenomenon that requires complex thinking, multidimensional articulation, and understanding of the interdependencies that structure the planet.

The Seven Knowledges Essential for Future Education offer crucial insights for tackling the challenges of the digital era. The principle of relevant knowledge emphasizes education that can contextualize, globalize, and grasp the complexity of phenomena—particularly important given the flood of data, misinformation, and artificial narratives shaping modern experiences. Teaching the human condition involves preparing individuals to recognize their vulnerabilities in relation to technology, fostering responsibility, critical thinking, and awareness of the impacts of their actions on society. Teaching earthly identity, on the other hand, entails recognizing one's belonging to a planetary, interconnected community, where issues such as disinformation, automation, and AI demand ethical and cooperative solutions.

In view of all this scenario, the emergence and expansion of Artificial Intelligence occurred, a movement that further intensifies the need for these principles. Over the past few years, UNESCO has developed international guidelines for the ethical use of AI, indicating that education needs to play a central role in the formation of citizens capable of navigating digital environments saturated with automated information. AI expands potentialities, but it also amplifies risks: it reinforces information bubbles, creates synthetic content indistinguishable from reality, accelerates flows, and modulates behaviors. Faced with this scenario, complex thinking becomes not only pertinent but urgent.

By linking Morin, technology, AI, and the post-truth era, it becomes clear that we face more than just technological issues; we are confronting deep civilizational disruptions. Disinformation, manipulation, and artificial intelligence are interconnected, reflecting a larger crisis that affects how we create meaning, interact with others, and organize society. Education, which produces meaning and shapes citizenship, is crucial in addressing this complexity, and Edgar Morin's insights are particularly valuable here.

In this context, combating fake news is not only about verification tools or improving fact-checking methods; it's about restoring the ethical, critical, and historical foundations essential for democratic life. Understanding that disinformation acts as a form of power that can rewrite history and influence the future highlights the need to enhance educational practices. These should foster complex thinking, critical media literacy, and a collective commitment to truth—as a shared endeavor rather than just an algorithmic product. Since fake news threatens our shared historical narrative, effective education must

reintroduce memory, dialogue, and responsibility, enabling individuals to engage with history actively—as creators, not passive consumers of manipulated stories.

CRITICAL TRAINING IN THE DIGITAL SOCIETY: BETWEEN MORIN, AI AND THE CHALLENGES OF FAKE NEWS

We can observe, as presented by Morin (2000), that education, thinking about the present-future, is necessary in the path of considering that it is no longer possible for our world to be observed only externally and objectively, but by understanding the intermediaries and subjective connections that involve us. Therefore, given the widespread massification and the flow that connects generations, critical and reflective training is essential for working with fake news and developing the ability to reflect on it, as it is necessary to determine what to do with these practices.

If, therefore, we think of a work of understanding human existence as a concern for the whole, it is not possible to focus only on the individual, but on citizenship as a whole and, in current times, on global citizenship in the digital. In this dialogue, we have an advance towards the need for innovation in education, not being instrumental or aesthetic, but a movement that is organized in the sense of understanding new knowledge.

Given the technological situation encountered, as already mentioned, the objective of the chapter is to examine the advancement of Artificial Intelligence. It is interesting to note that AI does not work as a solution to problems but rather aids learning outcomes. When we consider the advance of disinformation, the teaching dimension needs to involve critical, even responsible, acts. Because, as Morin (2000) himself puts it, knowledge needs to move towards a need to think about forms of content that articulate the whole with the parts, integrating different dimensions of reality to understand complex problems and that demonstrate the teaching of the human condition, because understanding that contemporary challenges are common and seeking the notion that a democratic society, and in facing the impacts of fake news that it can generate in society, it is a fundamental axis to act and live in the uncertainties that the contemporary world presents us.

The impact of fake news in the context of technological advances is moving toward a global impact, as evidenced by UNESCO's concern with the theme. Artificial Intelligence, already mentioned in the introduction to UNESCO texts, highlights that it must be on a path for the good of society. In addition, the use of technology is a topic of discussion, not a resolution to debates or conversations. In this way, UNESCO shows a work of concern with this advance as well.

It is interesting, therefore, to note that, at the same time, UNESCO produced, in the year 2021, reflections on a guide to the ethical use of Artificial Intelligence, recognizing that it alone will not produce necessary solutions. When we think about facing the most different challenges, whether in the field of criticality with fake news or in the individual development of students, the way in which this concern is produced is remarkable.

Furthermore, in the challenges encountered, we can observe that the concerns of UNESCO's ethical use document align with these biases: Academic integrity; Data protection; Cognitive bias, Gender, diversity and inclusion; Digital inequality and accessibility; Lack of regulation.

In view of this, we note the challenges encountered with these massive flows of data and with direct influences on behaviors and trajectories. We think of scenarios where students become just repeaters of data and information that reaches them, are targets of this avalanche of information, and are unable to critically elaborate their reading of their own reality with such information.

This information in large quantities demonstrates the concern, because the ethical challenge pointed out is the integrity of the production and knowledge that is developed. Artificial Intelligence ends up being used to write texts, answer evaluations, answer exams, and threatens the principles of authorship, honesty and intellectual originality. In addition, the concern is how this impact is negatively affecting the productions and critical consciousness of students.

According to UNESCO (2021), other impacts are the data and privacy that this hyper-connected context can generate, in addition to the notion that disinformation, the central theme of the discussion, can be spread by its databases. As the guide points out, for example: the case of ChatGPT, which does not distinguish between true and false but carries biases that are being delivered. In view of this, the challenge is evident: all this information, without the critical mediation that educators can provide, ends up producing students who can naturalize biased or inaccurate answers.

Given this scenario, it is notable that Moran (2018) brings several fundamental points to this discussion. The big issue is that, according to the author, there is a significant gap between real education and the education we want. In addition, for the author, the major problems are found in the structures of Brazilian education, since AI is already impacting, as the guides demonstrate, education and other areas. For this, education, according to Moran (2018), must move towards provocative, dynamic, active, and stimulating education, because:

Increasingly, the teacher must interconnect real and digital situations, physical and virtual contact, face-to-face and virtual learning, because "the physical and virtual worlds are not opposed, but complement each other, integrate, combine in an increasingly larger, continuous and inseparable interaction" (Moran, 2018, p. 9).

In view of this, if education is not perceived as an institution in movement and that must move towards characteristics such as: a living, pleasant and stimulating space, we end up entering moments when the external will not be important and the structures, as Moran mentions, end up remaining in outdated forms that do not encourage students or even help in the understanding of reality and critical understandings.

Based on this, with these changes mentioned, "it is necessary to understand the fundamental role that digital skills have acquired in recent years, especially in education, when they emerge as an alternative for the integral formation of subjects." (Behar et al, 2013), here the fundamental notion is that digital is not just about working with technology, but the use in everyday life, as presented by Behar and Silva (2022), are skills that are understood as a set of knowledge, skills and attitudes, which, with the safe and critical use of a Digital Technology, allow the subject to solve certain basic problems in all spheres of life.

It is interesting, in view of this definition, to highlight how "all spheres of life" is mentioned, as it is not just about the digital itself but about its connection to other spheres of life. It is about the ability, in working with the student, to rethink the role of a citizen in a society that is becoming increasingly connected and facing constant challenges for generations.

This can even be seen in the work the BNCC highlighted when it mentions digital skills, which emphasizes digital culture, critical thinking, and digital citizenship, citing some of the objectives that are always cited by these guiding documents. Therefore, if we are dealing with a complete education that involves integrating the learner into reality, and their current reality also incorporates the digital, it is necessary that their right to education be guaranteed to work with the recognition of learning in the digital environment.

This analysis shows that the challenges and goals proposed are directly shaped by intense communication, growing data, and technological changes. Morin (2000) emphasizes the importance of education in facing these challenges, especially when they reveal uncertainties and blindness. Consequently, teaching about earthly identity and the human condition is essential for developing students' ability to critically interpret their role

in the world and the information they receive, fostering critical thinking and autonomy in a highly interconnected, globalized context.

Digital citizenship, highlighted as a key objective, involves understanding human complexity and confronting reality ethically and responsibly, considering the impacts of Artificial Intelligence, disinformation, and digital surveillance. Education then becomes a space for reconstructing relationships—between individuals, knowledge, the self, and the planet—requiring sensitivity, discernment, and shared responsibility. Furthermore, Morin underlines knowledge areas such as recognizing others, ethics for the future, and understanding as foundational for a dialogue with technologies and societal challenges. For Morin (2000), teaching comprehension entails shaping individuals capable of empathy, dialogue, and critical analysis of complex realities.

Core competencies, therefore, are necessary for navigating between contradictory information and automated systems that do not always distinguish between true and false. Likewise, Morin's (2000) human ethics points to the need to prepare students to act responsibly in digital environments, aware of the social, political, and moral implications of their interactions.

Therefore, it is necessary to affirm that an education committed to the seven knowledge integrates criticality, digital responsibility, human sensitivity, and a complex understanding of the world. Such a perspective offers a way for digital education to be not only technical but also profoundly humanizing, capable of preparing students to live, understand, and transform society amid the uncertainties of the contemporary world.

THE ETHICAL-EDUCATIONAL PROBLEM IN THE AGE OF ARTIFICIAL INTELLIGENCE

The accelerated integration of Artificial Intelligence (AI) across sectors of society has brought about profound transformations in education, changing how we learn, teach, and produce knowledge. UNESCO (2021) highlights that the impacts of AI extend beyond the technological domain to ethical, subjective, sociopolitical, and cultural dimensions, which require complex, humanized educational responses. Thus, understanding the role of AI in education requires rethinking formative purposes in a context marked by automated decision-making and massive flows of information.

In this context, Lévy (2010) anticipates that digital ecosystems expand cognitive capacities but also strain human autonomy, thereby requiring a cognitive ecology that preserves criticality and discernment. Santaella (2016) reinforces the idea that we live in a

saturated informational environment, in which the distinction between truth and manipulation becomes increasingly difficult to discern. AI intensifies this scenario by operating based on unbalanced data, replicating patterns that are not always transparent.

The increasing automation of algorithmically mediated decisions makes this challenge even more evident. The *Guide ChatGPT and AI in Higher Education* (Unesco/IESALC, 2023) explains that generative models produce coherent responses, but without semantic understanding or factual verification. This reveals that AI lacks awareness, intentionality, or ethical sense, highlighting important limitations for the educational field.

This point aligns with Silveira (2019), who warns of "algorithmic colonialism," a concept that shows how automated systems shape behaviors and perceptions without users' control or awareness. The replacement of human deliberative processes with algorithms poses political and democratic risks, especially in educational environments.

In the pedagogical field, Marco Silva (2018) states that in AI-mediated environments, students tend to adopt a passive posture when receiving ready-made answers, thereby reducing the learning experience. Without critical mediation, AI can reinforce cognitive shallowness, as intellectual engagement is replaced by instant solutions.

From an ethical point of view, Moran (2018) highlights that technologies expand learning only when articulated with formative intentionality, human accompaniment, and educational responsibility; otherwise, they can induce errors, reinforce prejudices, and compromise the cognitive autonomy of students and teachers.

To face this scenario, Pretto (2021) defends robust algorithmic governance policies and the need for a school posture of "radical transparency" in the use of technologies. Teachers and students need to understand the limitations, risks, and interests involved in digital systems, consolidating a critical digital citizenship.

This perspective dialogues with Freire (1996), who, even before contemporary AI, stated that liberating education requires constant problematization, critical awareness, and the ability to identify power relations. In the algorithmic context, this critique becomes crucial to resist digital manipulation and heteronomy.

Another central challenge is the massive dissemination of *fake news*, intensified by algorithms that prioritize engagement over veracity (UNESCO, 2021). Santaella (2018) shows that we live in a "hyperaccelerated" ecosystem, in which the speed of information circulation makes it even more difficult to establish criteria for truth and reliability.

Generative AI worsens this issue by training on vast amounts of data, including biased content (UNESCO/IESALC, 2023). Silveira (2019) shows that models trained on unbalanced data tend to reproduce and reinforce stereotypes, which deepens social and cultural inequalities. Another key concern is algorithmic opacity. These systems often function as "black boxes," making it hard to audit, hold accountable, or understand how they work (UNESCO, 2023). Sodr  (2021) notes that technological mediation can create illusions of neutrality and objectivity, concealing the values and interests that shape the algorithms. Privacy and autonomy are also central issues.

The ChatGPT Guide (2023) highlights that using the system requires sharing personal data, raising ethical questions about information security. Silveira (2019) describes this as "controlled hypervisibility," where individuals become traceable and predictable. The disparity in access to technology, as highlighted by UNESCO (2021), demonstrates how AI can exacerbate social exclusion. Di Felice (2017) emphasizes that unequal distribution of digital infrastructure causes inequality, while Silva (2018) and Pretto (2021) argue that technological inclusion depends on pedagogical and cultural conditions, not just access. Morin's (2005; 2015) reflections provide a vital theoretical foundation for understanding these issues. He advocates for education that integrates knowledge, embraces uncertainty, and reconnects cognitive, emotional, ethical, and social aspects. In "The Well-Made Head" and "The Seven Knowledges," Morin emphasizes that knowledge must be contextualized and that education means understanding the human condition.

AI, by reducing individuals to patterns and data, directly challenges these principles. Conversely, Fadel et al. (2024) suggest curricula in the AI era should combine knowledge, skills, character, and metacognition to foster critical thinking, ethics, and self-regulation. When considering perspectives from UNESCO (2021; 2023) and modern Brazilian scholars, it becomes clear that the ethical and educational challenges of AI are complex, multi-layered, and require coordinated efforts. Education plays a crucial role as a mediator between humans and machines, tasked with preparing individuals to use AI critically, creatively, responsibly, and humanely.

ACTIVE METHODOLOGIES, AUTHORSHIP AND CRITICAL PEDAGOGICAL PRACTICES IN THE AGE OF ARTIFICIAL INTELLIGENCE

The expansion of Artificial Intelligence (AI) in everyday school life demands not only ethical and epistemological analyses but also the formulation of concrete pedagogical practices that integrate criticality, creativity, and student protagonism. If the previous chapters discussed the ethical challenges and complexity that the algorithmic phenomenon goes through, this chapter is dedicated to examining **how active methodologies, intellectual authorship and teacher mediation can serve as tools for critical resistance and humanization of education in the digital age.**

UNESCO (2021) reinforces that the incorporation of smart technologies must be linked to values such as dignity, equity, and autonomy, to avoid practices that reproduce exclusion, surveillance, or cognitive dependence. For such principles to be implemented in schools, it is not enough to provide digital devices and platforms; we must also transform how we teach and learn to ensure that students actively participate in constructing knowledge.

In this scenario, Active Methodologies play a decisive role. By prioritizing inquiry, dialogue, problem-solving, experimentation, and collaborative learning, these approaches converge with the epistemology of complexity advocated by Morin (2005; 2008; 2011; 2015). The author argues that learning implies articulating theory and practice, integrating knowledge, and recognizing uncertainty as a constitutive part of knowledge. When applied to the use of AI, such methodologies require students to reflect on the cognitive processes involved, discuss how algorithms function, and critically analyze the information produced by generative systems.

Fadel *et al.* (2024) complement this perspective by arguing that the contemporary curriculum should develop competencies related to creativity, critical thinking, character, citizenship, and metacognition. Instead of replacing human cognitive processes, AI should be used as a tool to expand the capacity for analysis, research, and content production. However, such use is only formative when students are invited to understand the limits, biases, and possibilities of digital systems.

Brazilian authors give even more specific contours to this debate. Silva (2018) highlights that technology-mediated pedagogical practices only produce meaningful learning when they stimulate active participation, authorship, collaboration, and dialogue. In digital environments, this implies that AI cannot be used as a provider of immediate

answers, but as a trigger for problematizations and debates. For Silva, *online education* must break with the instructions model and promote interactions that develop reflection and protagonism.

Moran (2020) reinforces this premise by stating that the teacher of the twenty-first century is not only a transmitter of content, but a curator, mediator, and researcher. Its function is to create conditions for students to develop intellectual autonomy, learn to critically analyze information sources, and understand the impact of technology on society. In the age of AI, the teacher assumes a central role in ethical guidance, encouraging authorship, and building a learning environment that favors research and independent thinking.

Intellectual authorship is one of the most challenging elements of this scenario. The growing use of tools such as *ChatGPT*, *DALL·E*, *Gemini*, and *Bard* raises doubts about *originality, creativity, and text* production. UNESCO/IESALC (2023) warns that Generative AI does not produce original knowledge but recombines previously existing information. In a formative environment, such characteristics can induce students to use automated texts without comprehension or reflection. Therefore, it is essential to develop pedagogical strategies that treat AI as a support, not a substitute, for student authorship.

In this sense, practices such as comparative analysis of human texts and AI-generated texts, authorial rewriting, problematization of algorithmic biases, and reflective use of digital tools can foster deeper learning. Silveira (2019) argues that understanding algorithmic flows is an indispensable condition for preserving autonomy and creativity in the digital age. The school, by incorporating this principle, must teach students to recognize manipulations, selectivities, and invisibilities that operate behind the scenes of intelligent systems.

Digital ethics needs to cross all these pedagogical practices. Sodr  (2021) states that we live in a moment of "mediatization of life", in which technologies shape perceptions, affections, and modes of interaction. This requires education to develop ethical training that includes care for privacy, data protection, critical thinking about social networks, and reflection on the impact of algorithms on the construction of reality. Ethics is not, therefore, an isolated content, but a transversal dimension that sustains all pedagogical practice.

Another decisive element is digital inclusion. Pretto (2021) and Di Felice (2017) highlight that inequality in access to technologies is one of the biggest challenges in Brazilian education. Without connectivity, infrastructure, and teacher training policies, AI tends to reinforce cognitive, cultural, and informational inequalities. Thus, pedagogical

projects need to ensure that all students have real opportunities to learn, experiment, and produce knowledge in digital environments.

The complex thinking formulated by Morin returns as a structuring axis by showing that educational processes must articulate reason, sensitivity, ethics and collective commitment. In his works, Morin (2011; 2015) argues that teaching implies recognizing that education is a political and ethical act that can both reproduce established patterns and foster subjects capable of questioning, confronting, and reinventing current structures. By transposing this conception into the context of Artificial Intelligence, it becomes clear that active methodologies only gain full meaning when they invite students to critically reflect on the human condition amid technologies that shape perceptions and social practices.

This understanding dialogues with analyses by Brazilian authors. Moran (2020), when discussing the role of the teacher in digital times, reinforces that technology cannot be conceived as a neutral element, as it influences choices, cognitive habits, and forms of interaction. Likewise, Santaella (2018) emphasizes that, in digital culture, the presence of automated systems requires greater capacity for interpretation and discernment on the part of the subjects, since the informational environment is complex, fast, and saturated. From this perspective, the reorganization of pedagogical practices becomes indispensable, as AI demands approaches based on dialogue, problematization, and active participation.

When considering these elements, it becomes evident that AI cannot be applied as a simplifying or merely instrumental solution. Silveira (2019) argues that algorithms carry logics that shape subjectivities and invisibly regulate behaviors, which requires a critical position from educators and students. In this sense, Sodr  (2021) points out that technology mediates perceptions and ways of life, reinforcing the need for educational practices that question the mechanisms of power and selection operated by digital systems.

In this process, teachers and students begin to assume a place of co-authorship in the construction of knowledge, expanding what Silva (2018) calls interactive pedagogy, in which all participants share investigation, creation, and reflection. Teaching, therefore, is not limited to guiding the use of technologies but involves creating conditions for subjects to understand the limits, potentials, and ethical implications of AI.

When integrated with complex thinking and digital ethics, active methodologies evolve into practices that not only embed technologies but also redefine them. Pretto (2021) highlights that critical digital education should focus on fostering autonomy, participation, and political consciousness, ensuring students are not merely consumers of algorithmic

solutions. In this context, AI can broaden learning opportunities if used thoughtfully, responsibly, and ethically.

Consequently, the pedagogy of the AI era requires significant epistemological and methodological changes. It calls for teachers who shape thought, students who lead in intellectual creation, and institutions dedicated to justice, democracy, and human dignity. Only through these efforts can we develop a digital future where technology serves emancipation, creativity, and critical thinking, rather than submission, repetition, or passivity.

REFERENCES

BEHAR, Patrícia Alejandra (org.). Competências em Educação a Distância. Porto Alegre: Penso, 2013. 312 p.

BEHAR, P. A.; SILVA, K. K. A. da. Competências digitais na educação a distância: perspectivas para a pós-pandemia. In: MATTAR, João (Org.). Educação a distância pós-pandemia: uma visão do futuro. São Paulo: Artesanato educacional, 2022.

BLOCH, Marc. Réflexions d'un historien sur les fausses nouvelles de la guerre. *Revue de Synthèse Historique*, Paris, v. 33, n. 1-3, p. 13-35, 1921.

DI FELICE, Massimo. Redes digitais e ecologia cognitiva. São Paulo: Paulus, 2017.

FADEL, Charles et al. Educação em quatro dimensões: as competências que os estudantes precisam para o sucesso. São Paulo: Fundação Telefônica Vivo, 2024.

FREIRE, Paulo. Pedagogia da autonomia: saberes necessários à prática educativa. São Paulo: Paz e Terra, 1996.

LÉVY, Pierre. Cibercultura. São Paulo: Editora 34, 2010.

MARCO SILVA. Educação online: práticas interativas e aprendizagem colaborativa. São Paulo: Loyola, 2018.

MORAN, José Manuel. A educação que desejamos: novos desafios e como chegar lá. Campinas: Papirus, 2018.

MORAN, José Manuel. Metodologias ativas para uma educação inovadora. Campinas: Papirus, 2020.

MORIN, Edgar. A cabeça bem-feita: repensar a reforma, reformar o pensamento. Rio de Janeiro: Bertrand Brasil, 2008.

MORIN, Edgar. Ensinar a viver: manifesto para mudar a educação. Lisboa: Instituto Piaget, 2015.

MORIN, Edgar. Introdução ao pensamento complexo. Porto Alegre: Sulina, 2005.

MORIN, Edgar. Os sete saberes necessários à educação do futuro. 2. ed. São Paulo: Cortez; Unesco, 2011.

PRETTO, Nelson. Educação e tecnologias: o novo ritmo da informação. São Paulo: Papirus, 2021.

SANTAELLA, Lúcia. A pós-verdade é verdadeira? São Paulo: Estação das Letras, 2018.

SANTAELLA, Lúcia. Culturas e artes do pós-humano: da cultura das mídias à cibercultura. São Paulo: Paulus, 2016.

SILVA, Marco. Sala de aula interativa: educação e tecnologias. São Paulo: Loyola, 2018.

SILVEIRA, Sérgio Amadeu da. Governança algorítmica e discriminação digital. São Paulo: Sesc, 2019.

SODRÉ, Muniz. A ciência do comum: notas para o método comunicacional. Petrópolis: Vozes, 2021.

UNESCO. Recomendação sobre a Ética da Inteligência Artificial. Paris: Unesco, 2021.

UNESCO/IESALC. Guia sobre ChatGPT e Inteligência Artificial na Educação Superior. Caracas: Unesco/IESALC, 2023.

HYBRID EDUCATION AND CONTINUING TEACHER EDUCATION: A SYSTEMATIC LITERATURE REVIEW

  10.56238/livrosindi202668-006

Maira Rosenente Taverna

Aline Rosenente Taverna

Caroline Carmona Marques Gonçalves

Daniele Saheb Pedroso

INTRODUCTION

The rapid technological and pedagogical changes in recent decades have greatly influenced teaching and learning methods, prompting teachers to continually update their skills and knowledge. In this context, integrating Digital Information and Communication Technologies (DICT) has become a key focus in educational innovation, especially for enhancing interaction, knowledge creation, and diversifying teaching strategies (Schuartz and Sarmiento, 2020).

Considering these changes, the role of the teacher takes on new configurations, demanding competencies that involve both the mastery of technologies and the ability to integrate digital resources into contextualized pedagogical practice. The pandemic period from 2020 to 2023 made this need even more evident, by requiring emergency migration to remote and hybrid modalities without most teachers having prior notice to work in these contexts. As stated by Rocha et al (2020, p.66), teachers faced significant challenges, since "[...] the teachers had not had specific training for a teaching context like this, challenging for the entire school community [...]". The authors also reinforce that continuing education is essential for teachers to develop criteria to select technologies and use them in a critical and meaningful way.

In this sense, understanding the relationships between continuing education and hybrid teaching becomes fundamental. Hybrid teaching, by integrating face-to-face and digital environments, requires new forms of planning, mediation and organization of learning from the teacher, mobilizing professional knowledge that is articulated both with previous experiences and with the contemporary demands of teaching practice. As presented by Rocha *et al.*

[...] the challenge regarding the role of the teacher in teaching refers to the appropriate choice of technologies that take advantage of the characteristics of children and young people in the technological age, explore their skills and encourage them to actively participate in learning [...] (Rocha, *et al.* 2020, p. 64).

Focused on this training and challenges, the authors also point out that subjects who have greater contact with different technologies and new experiences with them have greater facilities for working with technology. Thus, investigating how this approach has been discussed in academic productions allows us to identify the advances, challenges and training possibilities. Drawing on teacher training and aspects related to hybrid teaching, this study sought to identify the characteristics and contributions of hybrid teaching in the continuing education of Basic Education teachers.

To carry out this, a systematic literature review study was carried out, based on the organization of the data found with the principles of the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA 2020) protocol, in which it sought to carry out an analysis of the academic productions of the Coordination for the Improvement of Higher Education Personnel (CAPES) databases, *Scientific Electronic Library Online* (SciELO) and *Education Resources Information Center* (ERIC). The research seeks to highlight which practices, methodologies, and results have been reported in the literature found, offering subsidies for the understanding of the role of hybrid teaching in the professionalization of teachers and in the transformations of pedagogical practices.

CONTINUING EDUCATION OF TEACHERS

Continuing teacher training is one of the main strategies to ensure the quality of teaching and keep up with the constant transformations in the educational scenario. In view of the speed with which new technologies and social demands emerge, it is insufficient to think of teacher training only as an initial moment. Focused on this understanding of changes and educational updating, Monteiro (2001, p.223) presents teacher training as a

[...] teachers' commitment to action configures their professional substantivity. The value of action to grow professionally through reflection on the knowledge implicit in it could thus be beyond any doubt, since action constitutes the most fabulous raw material for our professional development¹

Connected to the reflection on knowledge presented by Monteiro (2001) and to the changes in knowledge within education, Imbernón (2010) discusses continuing education,

¹ Excerpt in Portuguese from Portugal

which should be understood as a permanent process of knowledge construction, linked to the professional context and the real needs of pedagogical practice.

Focused on this understanding of knowledge for education, Tardif (2014) points out that there is knowledge that constitutes it. Among these areas of knowledge, the author discusses the need for reflection on teacher training and also points out the need to link the subjects' experiences with theoretical issues. In this way, it would enable them to situate themselves in the school environment and to elaborate ways to organize themselves. In this sense

[...] teacher training, or, more concretely, the professional development of teachers, appears to us as the only element capable of integrating these fields of knowledge into practice and which have long been mutually ignoring each other [...] (Garcia, 1999, p.139)

In this way, continuing education is presented as a means of updating knowledge that education professionals need, which is linked to various spheres of their training and seeks to establish forms of connection with the experiences of these subjects and, from these, allow changes in teaching practice and their relationship with other co-workers (Alvarado-Prada et al. 2010).

HYBRID TEACHING

Blended learning emerges as a pedagogical approach that integrates, in a planned way, face-to-face and online activities in the teaching and learning process, as presented by Horn and Staker (2015, p. 34), "Blended learning is any formal educational program in which a student learns, at least in part, through online teaching, with some element of student control over time, the place, the path and/or the rhythm".

This modality considers the various factors that influence an individual's learning, recognizing learning difficulties with the support of teachers, colleagues, and autonomous learning. It aims to identify different forms of learning (Moran, 2015). According to Moran (2015, p. 17), the term hybrid means "mixed, blended," reflecting a teaching approach that moves away from traditional classroom methods to promote greater flexibility, autonomy, and personalized learning (Horn; Staker, 2015). Additionally, Bacich, Tanzi, and Moran (2015) emphasize that hybrid teaching redefines pedagogical practices by integrating active methodologies that enhance student participation and the critical use of digital technology.

METHODOLOGY

The present research is a systematic literature review, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) protocol. This approach aims to identify, evaluate, and synthesize, in a transparent and reproducible manner, studies addressing hybrid teaching in continuing teacher education.

The methodological process was developed in four main stages of the PRISMA protocol, namely: (I) definition of the problem and eligibility criteria; (II) search and identification of academic productions; (III) screening and selection; (IV) critical analysis of the selected studies.

Initially, the central research question was defined: What are the characteristics and contributions of hybrid teaching in the continuing education of Basic Education teachers? Next, a set of descriptors and filters was established for the CAPES, SciELO, and ERIC databases, as shown in Figure 1. Research-inducing terms were used in the indexing databases: "blended teaching", "continuing teacher education", "blended learning", and "teacher professional development", in addition to establishing a study timetable from 2014 to 2024 and prioritizing peer-reviewed and open-access publications.

Table 1: Descriptor terms used for the initial selection of academic productions

Database	Inducing terms and search filters for collecting productions	Results
CAPES	Hybrid teaching and continuing teacher education	55
	Open access	48
	Time Table 10 years	43
	Peer-reviewed	20
SciELO	("blended learning" OR "hybrid teaching" OR "hybrid education" OR "hybrid learning" OR "hybrid methodologies") AND ("teacher professional development" OR "continuing teacher training" OR "in-service teacher education" OR "continuing teacher training" OR "in-service teacher training" OR "teacher professional development")	3
	Time Table 2014-2024	3

ERIC	("blended learning" OR "hybrid teaching" OR "hybrid education") and ("continuing teacher training" OR "teacher professional development")	129
	Peer reviewed Only e Full text available on ERIC	37
	Last 10 years	30
	Journal Articles	26
	Higher Education	11
Duplicate documents between databases		No repetition
Total documents for the analysis of the inclusion and exclusion criteria		34

Source: prepared by the author

Following the initial selection of academic publications, analysis of titles, abstracts, and full texts was conducted to identify inclusion and exclusion criteria for the final analysis. Thus, productions not related to continuing teacher education, which did not deal with hybrid teaching or were not fully available, were excluded, too. Outline these criteria: Figure 2 presents this selection and the documents contained and analyzed in each database. At the end of the screening, 14 documents composed the corpus of the analysis.

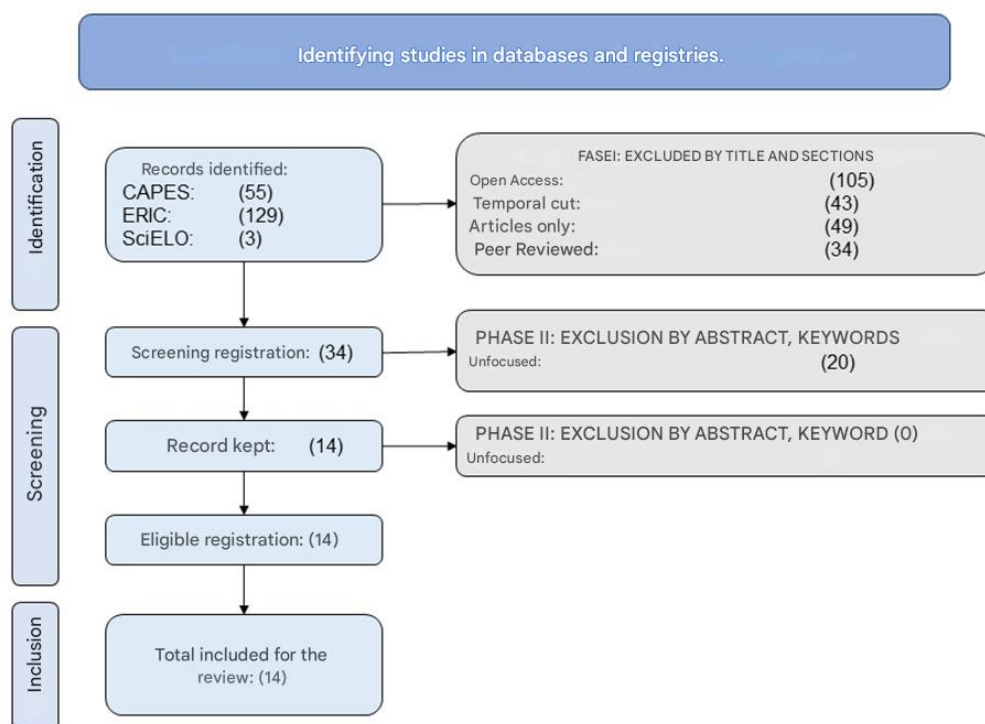
Table 2: Inclusion and exclusion criteria for selected productions

Inclusion criteria	Database	Number of documents
Connection between issues of hybrid teaching for the continuing education of teachers; Presentation of criteria about the use of hybrid teaching, what are its possibilities and difficulties for the construction of continuing teacher training courses.	CAPES	8
	SciELO	1
	ERIC	5
Total documents for analysis		14
Exclusion criteria	Database	Number of documents
Lack of access to academic production; Not connecting continuing teacher training with hybrid teaching; Not working with the continuing education of teachers; Not working with blended learning issues	CAPES	12
	SciELO	2
	ERIC	6
Total productions removed after screening		20

Source: prepared by the author

In order to present the data collection paths in the databases, Figure 1

Figure 1: Descriptive flowFigure of the three stages of the PRISMA 2020 protocol



Source: prepared by the author

To organize the data of the analyzed articles, Figure 3 displays these academic works, cataloging each by author(s), publication year, title, and source database, as summarized in Figure 3.

Table 3: Productions analyzed

Document analysis number	Year	Author(s)	Title	Database
1	2021	Cíntia Rabello	Technology-mediated language learning and teacher training: digital resources in online learning beyond the pandemic	CAPES
2	2022	Denis Eduardo Peixoto and Maria José Fontana Gebara	Hybrid Teaching of Active Didactics: The Seasons of the Year in the View of Basic Education Teachers. A Topocentric Study	CAPES

3	2021	Rafael Vetromille-Castro and Helena dos Santos Kieling	Active methodologies and digital resources for teaching L2: a review of paths and possibilities	CAPES
4	2020	Celina Aparecida Almeida Pereira Abar, Renata Udvary Rodrigues, Marcio Vieira de Almeida	A Hybrid Teaching Model: A Proposal for Continuing Education of Pedagogical Teachers	CAPES
5	2021	Alany da Silva Menezes, Diaria Barros Ferro, João Silva Rocha, José Eduardo Silva	Teacher training in the teaching of Mathematics in times of social isolation in hybrid teaching: a systematic review	CAPES
6	2018	Maria Elisabete Bersch, Eliane Schlemmer	Continuing Education in a hybrid and multimodal context: resignifying pedagogical practices through gamified learning projects	CAPES
7	2023	Bruna Eduarda Rocha, Stela Castilhos Morigi dos Santos, Claudiane Ribeiro, Carine Bonato	Teacher's perception of hybrid education	CAPES
8	2018	Vera Lucia Pontes dos Santos, Cleide Jane de Sá Araújo Costa	Teaching, training and innovation: interconnected paths in the configuration of pedagogical knowledge in higher education	CAPES
9	2020	Rosita Romero Alonso, Blanca Montt Fabres, Claudio Maregatti Solano, María Elena Gracia Romero, Daniel Segura Ángel	Investigación-acción, aula invertida y formación basada en competencias. Elementos clave para una efectiva formación b-learning en liderazgo directivo	SciELO

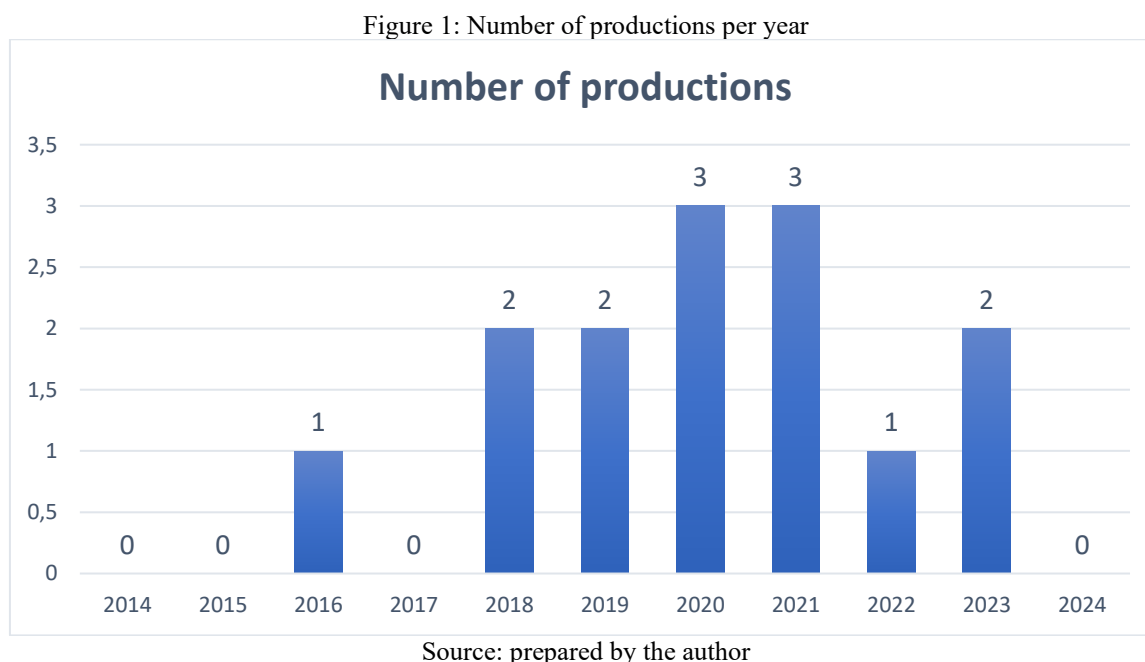
10	2019	Spyros Papadakis, Angeliki Gariou- Papalexiou, Nikolaos Makrodimos	How to Design and Implement a Flipped Classroom Lesson: A Bottom up Procedure for More Effective Lessons	ERIC
11	2019	Eileen Kennedy, Diana Laurillard	The potential of MOOCs for large- scale teacher professional development in contexts of mass displacement	ERIC
12	2023	Luis Hernando Tamayo Cano, Andrés Felipe Riascos Gómez, Jorge Eduardo Pineda Hoyos	Needs Analysis to Design an English Blended Learning Program: Teachers' and Administrators' Voices	ERIC
13	2020	Jayaluxmi Naidoo, Asheena Singh- Pillay	Teachers' Perceptions of Using the Blended Learning Approach for STEM-Related Subjects within the Fourth Industrial Revolution	ERIC
14	2016	Karsten Gynther	Design Tablework for an Adaptive MOOC Enhanced by Blended Learning: Supplementary Training and Personalized Learning for Teacher Professional Development	ERIC

Source: prepared by the author

After cataloguing the selected productions, an in-depth reading of the full texts was carried out, with the objective of identifying recurrent thematic categories, methodologies used, educational contexts addressed and main results pointed out in relation to the use of hybrid teaching in the continuing education of teachers. The entire analysis process was conducted based on the principles of transparency and reproducibility recommended by the PRISMA 2020 protocol, ensuring the validity and consistency of the steps carried out in this systematic review.

RESULTS AND DISCUSSION

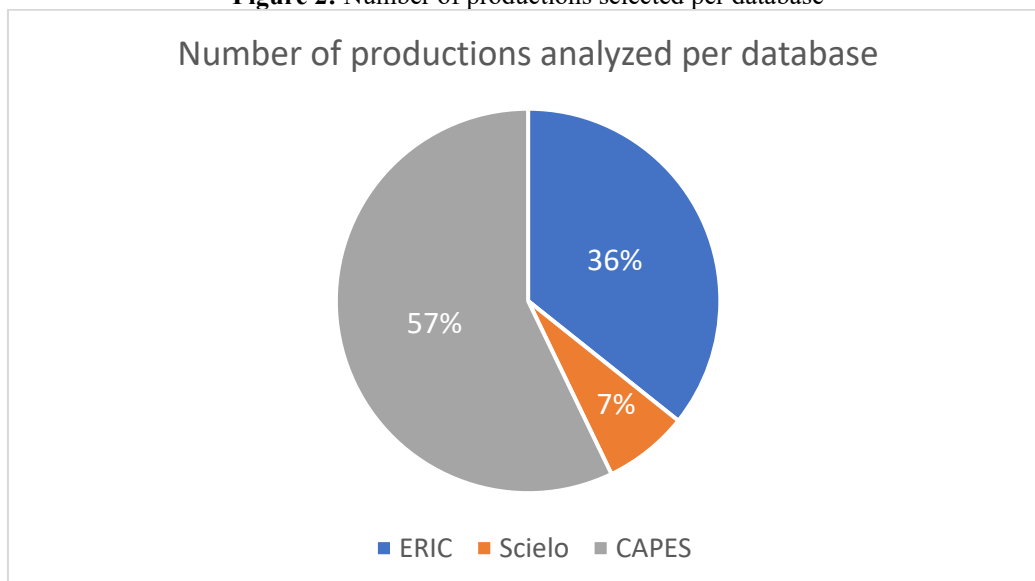
From the initial analysis of the 14 studies, it was possible to identify some points in relation to the years of publication (Figure 1) of these so that there is a concentration of publications from 2018 onwards, with the highest peaks of publication on the subject being in the years 2020 and 2021, coinciding with the pandemic context and the intensification of the use of digital technologies in education.



Returning to the issues of publications and increased discussions about technologies in education, it was possible to identify this greater predominance in the period still in the analysis of the texts for the inclusion and exclusion criteria henceforth the justifications of why work with hybrid teaching. From Graph 1, there is stability in relation to the number of publications from 2018 to 2023, and a large drop in relation to 2024, the year in which no production was obtained for this analysis.

Regarding the indexing databases in which the productions were found, Figure 2 shows that 57% of the analyzed productions belong to the CAPES database, 36% to ERIC, and only 7% to SciELO.

Figure 2: Number of productions selected per database



Source: prepared by the author

In view of the objectives of the articles analyzed, Table 4 presents in a schematized way the main study objectives of the documents, the research methodologies used to achieve these research objectives, and the significant results found by the authors.

Table 4- List of studies of the documents analyzed

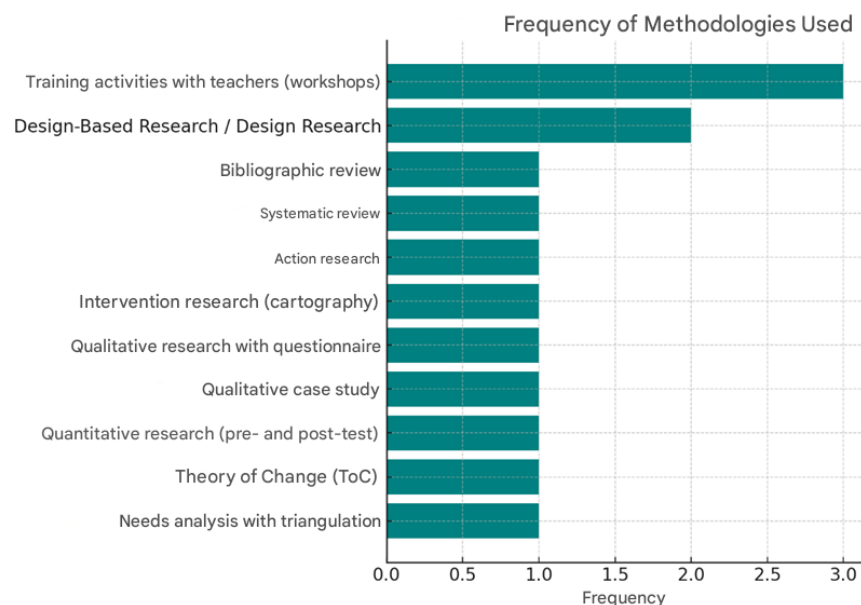
Article No.	Main Objective	Methodology	Significant Results
1	Assess L2 learning in a remote context and with digital technologies	Action research	He highlighted the positive role of digital resources in motivating and developing students
2	Reflect on the use of blended learning and active methodologies in science teaching	Didactic workshop with 21 teachers	Teachers broadened their perception of the use of virtual resources and rotation by stations
3	Review possibilities for language teaching based on active technologies and methodologies	Literature review	They suggest critical integration of digital resources in undergraduate courses
4	To investigate the use of the flipped classroom model in continuing education in Mathematics	Design Research	Use of GeoGebra and Moodle increased engagement and pedagogical appropriation
5	Analyze hybrid teaching in times of social isolation	Systematic review (2017–2021)	They show a lack of digital skills and urgency in training for the new scenario
6	Resignifying pedagogical practices in hybrid and multimodal contexts	Intervention research (cartography)	Gamified projects expanded engagement and school culture change
7	Investigate how teachers perceive blended learning and its implications	Qualitative research with questionnaire	Recognition of potential, but with caveats about infrastructure and training
8	Analyze the impact of a hybrid course on pedagogical action in higher education	Qualitative case study	Hybrid training contributed to greater didactic innovation

9	Evaluate B-Learning Course in Educational Leadership for Principals	Quantitative research (pre and post-test)	They observed gains in knowledge and good evaluation of the methodology
10	Propose an effective model for flipped classroom as teacher professional development	Workshops and seminars with teachers	Increased active participation and didactic effectiveness
11	Investigate the use of MOOCs in forced displacement contexts	Theory of Change (ToC)	Potential for outreach and adaptation in crisis contexts
12	Raise requirements for creating a hybrid English course at a Colombian university	Needs analysis with triangulation	Need for personalization according to institutional context and culture
13	Explore teachers' perceptions of blended learning in STEM subjects	Interviews and workshops with teachers	Teachers recognized the potential of hybrid, but pointed out structural barriers
14	Create an adaptive model for MOOC with blended learning	Design-Based Research (DBR)	Success in personalizing teacher training

Source: prepared by the author

From Table 4, it is possible to identify that the most used methodology among the analyzed studies was the implementation of teacher training on hybrid teaching, with 3 of the studies analyzed. Another method of recurrence among the productions was the study of theoretical reviews on the theme, with 2 documents recurring. To represent more clearly the methodologies used in productions, Figure 3 is presented.

Figure 3: Frequency of methodology of the studies analyzed



Source: prepared by the author

Regarding the facilities and difficulties of using hybrid teaching in teacher training, studies generally identify common characteristics. Among the difficulties, the lack of internet access in some locations and limited knowledge of the platform are highlighted in

the productions. In comparing the facilities, points such as students' autonomy to investigate and study the topics of study and participants' motivation are highlighted. Table 5 presents additional issues with facilities and production difficulties.

Table 5: Facilities and difficulties of hybrid teaching in teacher training

Use of the hybrid teaching model	
Facilities	Difficulties
Access to content at any time of the subject's day.	Teachers' lack of preparation to deal with some technological resources and unequal access to technology and infrastructure
Increasing student autonomy in order to encourage the responsibility of participants;	Overload of the participants, mainly due to their time management to carry out asynchronous activities,
Increased motivation to study considering the activities proposed in class (main indications in the use of videos, interactive websites and other asynchronous media)	Problems in carrying out group activities (especially in relation to online development activities).
Leverage knowledge of different technologies	Lack of interaction with other people.
Allow the knowledge of different pedagogical practices and how to use them in their reality	Difficulties in curricular adaptation.
Faster feedback possibilities and at more flexible times	Lack of feedback from teachers in online activities

Source: prepared by the author

Regarding the challenges associated with lack of preparation in using technology, Bacich, Neto, and Trevisani (2015) highlight issues related to how the target audience perceives and relates to technology. Some individuals may not be digital natives and therefore need to adapt to this field, which can increase their difficulties. Overall, the studies reviewed show positive outcomes from hybrid teaching in teacher training. They indicate that this approach is effective in engaging research participants and offers diverse ways to work with technology, helping educators develop new practices in their classrooms.

FINAL THOUGHTS

From the investigation into the characteristics and contributions of hybrid teaching in the continuing education of Basic Education teachers, it was possible to identify that the results of this systematic review show that hybrid teaching has been consolidated as a relevant approach in the continuing education of teachers. Most of the productions problematize the preparation of teachers for the use of technology, mainly reflecting the pandemic context, which has led to a significant increase in the presence of digital technologies in the educational environment.

The studies also show that hybrid teaching can enhance teachers' participation and motivation in their training, making it necessary to plan courses intentionally and anchor them in active methodologies. Thus, hybrid teaching helps address issues such as autonomy in learning, the critical appropriation of technologies, and the resignification of pedagogical practices.

Regarding the positive aspects of hybrid teaching, the studies analyzed highlight the use of models such as the flipped classroom and station rotation, in addition to the integration of strategies such as gamification, the use of digital platforms, and collaborative practices. These elements, when present in training programs, favor the personalization of learning and the development of digital skills, and they also expand the ability to articulate theory and practice.

However, key challenges were also identified, including limitations in technological infrastructure, initial resistance from teachers to methodological changes, workload overload, and the lack of qualified feedback during training. These issues highlight the need to plan hybrid training in a contextually aware manner, taking into account teachers' actual working conditions and the resources available within institutions. Consequently, hybrid teaching could be an effective strategy for ongoing teacher development. It is essential to invest in infrastructure, develop coherent training policies, and foster a pedagogical culture open to innovation. Additionally, research on the actual meanings and practical application of knowledge gained through hybrid training is crucial to understand what influences and facilitates changes in teaching practices within this modality.

REFERENCES

ALVARADO-PRADA, Luis Eduardo; FREITAS, Thaís Campos; FREITAS, Cinara Aline. Formação continuada de professores: alguns conceitos, interesses, necessidades e propostas. *Rev. Diálogo Educ. Curitiba*, v.10, n. 30, p.367-387, ago. 2010. Disponível em http://educa.fcc.org.br/scielo.php?script=sci_arttext&pid=S1981-416X2010000200009&lng=pt&nrm=iso. Acesso em: 27 jul. 2025

BACICH, Lilian; NETO, Adolfo Tanzi; TREVISANI, Fernando de Mello. Personalização e tecnologia na educação. In BACICH, Lilian; TANZI NETO, Adolfo; MORAN, José Manuel (Org.). *Ensino híbrido: personalização e tecnologia na educação*. Porto Alegre: Penso, 2015

HORN, Michael B.; STAKER, Heather. *Blended: using disruptive innovation to improve schools*. San Francisco: Jossey-Bass, 2015

HORN, Michael B.; STAKER, Heather. *Blended: Usando a Inovação Disruptiva para aprimorar a educação*. Porto Alegre: Penso, 2015

GARCIA, Carlos Marcelo. *Formação de professores: Para uma mudança educativa*. Porto: Editora Porto, 1999

IMBERNÓN, Francisco. *Formação docente e profissional: formar-se para a mudança e a incerteza*. São Paulo: Cortez, 2010

MONTEIRO, Lourdes. *A construção do conhecimento profissional*. 2. ed. Lisboa. Instituto Piaget, 2005

MORAN, José. Um conceito-chave para a educação, hoje. In BACICH, Lilian; NETO, Adolfo Tanzi; TREVISANI, Fernando Mello (Org.). *Ensino híbrido: personalização e tecnologia na educação*. Porto Alegre: Penso, 2015

ROCHA, Flavia Sucheck Mateus ad; LOSS, Taniele; ALMEIDA, Braian Lucas Camargo; MOTTA, Marcelo Souza; KALINKE, Marco Aurélio. O Uso de Tecnologias Digitais no Processo de Ensino durante a Pandemia da CoViD-19. *Revista Interações*, v. 16, n. 55, p. 58–82, 2020. Disponível em: <https://revistas.rcaap.pt/interaccoes/article/view/20703>. Acesso em: 25 jul. 2025

SCHUARTZ, Antonio Sandro; SARMENTO, Helder Boska de Moraes. Tecnologias digitais de informação e comunicação (TDIC) e processo de ensino. *Revista katálisis*, v. 23, p. 429-438, 2020. Disponível em: <https://www.scielo.br/j/rk/a/xLqFn9kxxWfM5hHjHjxbC7D/>. Acesso em 25 jul. 25

TARDIF, Maurice. *Saberes necessários e formação profissional*. Petrópolis: Editora Vozes, 2014

REFERENCES OF THE DOCUMENTS ANALYZED

- ABAR, Celina Aparecida Almeida Pereira; RODRIGUES, Renata Udvary; ALMEIDA, Marcio Vieira de. Um modelo de ensino híbrido: uma proposta para formação continuada de professores pedagogos. *Tangram – Revista de Educação Matemática*, Dourados, v. 3, n. 3, p. 44–59, 2020. Disponível em: <https://periodicos.ufms.br/index.php/Tangram/article/view/10218>. Acesso em: 27 jul. 2025
- ALONSO, Rosita Romero; CUBILLO, Pedro; MADRIGAL, Adriana; BARRANTES, Yorleny. Investigación-acción, aula invertida y formación basada en competencias: elementos clave para una efectiva formación b-learning en liderazgo directivo. *Revista Innovaciones Educativas*, Costa Rica, v. 22, n. 32, p. 19–33, jan./jun. 2020. Disponível em: <https://revistas.una.ac.cr/index.php/innovaciones/article/view/14231>. Acesso em: 27 jul. 2025
- BERSCH, Maria Elisabete; SCHLEMMER, Eliane. Formação continuada em contexto híbrido e multimodal: ressignificando práticas pedagógicas por meio de projetos de aprendizagem gamificados. *Revista Tempos e Espaços em Educação*, São Cristóvão, v. 11, n. 1, p. 71–92, dez. 2018. Disponível em: <https://www.seer.ufs.br/index.php/revtee/article/view/7899>. Acesso em: 27 jul. 2025
- GYNTHER, Karsten. Design framework for an adaptive MOOC enhanced by blended learning: supplementary training and personalized learning for teacher professional development. *The Electronic Journal of e-Learning*, v. 14, n. 1, p. 15–30, 2016. Disponível em: <https://files.eric.ed.gov/fulltext/EJ1099171.pdf>. Acesso em: 27 jul. 2025
- KENNEDY, Eileen; LAURILLARD, Diana. The potential of MOOCs for large-scale teacher professional development in contexts of mass displacement. *London Review of Education*, v. 17, n. 2, p. 141–158, 2019. Disponível em: <https://discovery.ucl.ac.uk/id/eprint/10079363/>. Acesso em: 27 jul. 2025
- MENEZES, Alany da Silva; FERRO, Diaria Barros; ROCHA, João Silva; SILVA, José Eduardo. Formação do professor no ensino da Matemática em tempos de isolamento social no ensino híbrido: uma revisão sistemática. *Research, Society and Development*, v. 10, n. 5, e43810515162, 2021. Disponível em: <https://rsdjournal.org/index.php/rsd/article/view/15162>. Acesso em: 27 jul. 2025
- NAIDOO, Jayaluxmi; SINGH-PILLAY, Asheena. Teachers' perceptions of using the blended learning approach for STEM-related subjects within the Fourth Industrial Revolution. *Journal of Baltic Science Education*, v. 19, n. 4, p. 583–593, 2020. Disponível em: <https://oaji.net/articles/2020/987-1596569152.pdf>. Acesso em: 27 jul. 2025
- PAPADAKIS, Spyros; GARIOU-PAPALEXIOU, Angeliki; MAKRODIMOS, Nikolaos. How to design and implement a flipped classroom lesson: a bottom-up procedure for more effective lessons. *Open Journal for Educational Research*, v. 3, n. 2, p. 53–66, 2019. Disponível em: <https://doi.org/10.32591/coas.ojer.0302.02053p>. Acesso em: 27 jul. 2025
- PEIXOTO, Denis Eduardo; GEBARA, Maria José Fontana. Ensino híbrido de didáticas ativas: as estações do ano na visão de professores da educação básica. Um estudo topocêntrico. *Abakós*, Belo Horizonte, v. 10, n. 1, p. 35–51, maio 2022. Disponível em: <https://periodicos.ufmg.br/index.php/abakos/article/view/39083>. Acesso em: 27 jul. 2025

RABELLO, Cíntia. Aprendizagem de línguas mediada por tecnologias e formação de professores: recursos digitais na aprendizagem on-line para além da pandemia. *Ilha do Desterro*, Florianópolis, v. 74, n. 3, p. 67–90, set./dez. 2021. Disponível em: <https://www.scielo.br/j/ides/a/SZPdT43YJhGCjkSMWqfjTwn/?lang=pt>. Acesso em: 27 jul. 2025

ROCHA, Bruna Eduarda; SANTOS, Stela Castilhos Morigi dos; RIBEIRO, Claudiane; BONATO, Carine. Percepção do professor em relação à educação híbrida. *Revista de Gestão e Secretariado*, São Paulo, v. 14, n. 6, p. 8982–8996, 2023. Disponível em: <https://ojs.revistagesec.org.br/secretariado/article/view/2276>. Acesso em: 27 jul. 2025

TAMAYO CANO, Luis Hernando; RIASCOS GÓMEZ, Andrés Felipe; PINEDA HOYOS, Jorge Eduardo. Needs analysis to design an English blended learning program: teachers' and administrators' voices. *Profile: Issues in Teachers' Professional Development*, v. 25, n. 1, p. 193–210, 2023. Disponível em: <https://revistas.unal.edu.co/index.php/profile/article/view/101316>. Acesso em: 27 jul. 2025

VETROMILLE-CASTRO, Rafael; KIELING, Helena dos Santos. Metodologias ativas e recursos digitais para o ensino de L2: uma revisão sobre caminhos e possibilidades. *Ilha do Desterro*, Florianópolis, v. 74, n. 3, p. 351–368, set./dez. 2021. Disponível em: <https://www.scielo.br/j/ides/a/CLZ7dCzpmvxZ9jq7qNzxqVy/>. Acesso em: 27 jul. 2025

SANTOS, Vânia Lúcia Pires dos; COSTA, Cleidiane José da Silva Araújo. Docência, formação e inovação: percursos interconectados na configuração do conhecimento pedagógico na educação superior. *ETD - Educação Temática Digital*, Campinas, v. 20, n. 1, p. 1–24, jan./mar. 2016. Disponível em: <https://periodicos.sbu.unicamp.br/ojs/index.php/etd/article/view/8649170>. Acesso em: 27 jul. 2025

COLLABORATIVE CONTINUING EDUCATION AND METHODOLOGIES FOR ACTIVE LEARNING IN CORPORATE EDUCATION

 Crossref  10.56238/livrosindi202668-007

Lucymara Carpim
PUCPR

Raquel Pasternak Glitz Kowalski
PUCPR

Claudete Zaclikevic
PUCPR

INTRODUCTION

The teaching and learning process in the contemporary scenario has demanded new educational practices from teachers, considering the aspects of a transformative and complex education, considering that the current disruptive contexts demand the adoption of technologies in the teaching and learning process to contribute to the construction of significant knowledge, in addition to the need for teaching proposals that allow the student to experience, experiencing, tasting, ascertaining and engaging with learning (Fava, 2018), requiring a posture of both the educator and the students that is much more committed and involved with learning to learn, which according to Morin (2015, p. 128) means "[...] learning at the same time by separating and reconnecting, analyzing and synthesizing [...]".

In order for educational actions to be more meaningful and interactive, one possible way is to think about the transposition of actions anchored in conservative teaching approaches, which in some cases still focus only on the reproduction of knowledge, and adopt more dynamic teaching strategies, with innovative paradigmatic foundations, especially in the theory of complexity (Morin, 2000), which aims to involve students in individual and collective activities, favoring the connection with the plurality of knowledge necessary today to live and coexist in spaces of constant change. This paradigmatic movement, focusing on a complex or systemic view (Morin, 2000), requires the student to become an active protagonist in their learning process, considering thinking in movement, dynamic in its construction, and in a creative process.

To this end, it is essential that educational practices are based on a more innovative proposal, in which educator and student act through methodologies for active learning, as

these place the student at the center of the process and when the relationship between theory and practice leads to the development of meaningful learning, thus the "[...] knowledge involves the construction of a meaning [...]" (Andrade and Sartori, 2018, p. 179). Therefore, teaching methodologies must consider the learning objectives and the articulation with the professional, educational and social reality of the students. To better understand this scenario, the result of an investigation carried out with 52 professionals, who participated in a leadership training program, proposed by an educational institution, which works with continuing education, was chosen, so the following problem was chosen: How do the participants manifest themselves about the activities carried out from collaborative problem-based learning and *design thinking*, focused on a complex vision for the production of knowledge? The objective was to analyze the manifestations of the participants arising from the process of collaborative problem-based learning and *design thinking*, focused on a complex view.

For the elaboration of the above, the answers/manifestations obtained in the application of a questionnaire and semi-structured interview were considered. The research methodology is a qualitative approach of the exploratory type, of an interpretative nature. In the training process, collaborative problem-based learning and *design thinking* were chosen, in order to promote greater interaction between the contents worked on and the teaching practices for meaningful learning, stimulating the discussion about real situations experienced in the workplace, connected with the social and educational aspects of the students.

COLLABORATIVE LEARNING IN THE VIEW OF COMPLEXITY IN CORPORATE EDUCATION

Many challenges arise in the educational and business spaces, as the dynamics of transformation constantly put both teachers and students on their toes, requiring them to keep up with changes in professional, social, and educational contexts and fostering a new attitude towards learning and interpersonal relationships.

Thus, the adoption of teaching strategies that keep the student in a continuous movement of learning requires the educator to transpose conservative teaching practices, which still excel in the fragmentation of knowledge, to educational actions that lead to the acceptance of the paradigm of complexity, in which the student needs to articulate and contextualize knowledge (Morin, 2000).

Fragmented knowledge can hardly be used to recognize and face problems and situations "[...] that emerge from a world to whose natural complexity is added the complexity resulting from this very knowledge transformed into action that incorporates new facts into reality, through technology." (D'Ambrosio, 2012, p. 228).

The paradigm of complexity proposes reconnecting knowledge and the vision of the whole, considering each piece of knowledge as part of a whole, that is, as making sense within a context in which being and knowledge go together. As Morin (2000, p. 36) points out, "it is necessary to situate information and data in their context so that they acquire meaning [...]". This act of innovating teaching practice, leading the student to learn how to learn, is based on the theory of complexity and the paradigmatic changes that guide the learning space to be more collaborative and more engaging, because the student needs to understand that he is an agent responsible for his learning, that he needs to develop his autonomy to investigate, dialogue with his peers, and share systematized knowledge, understanding the significance of learning and where he can apply the knowledge built in his reality of life.

Paradigm or vision of complexity is understood as what Morin (2000, p. 38) defends:

Complexus means that which has been woven together; In fact, there is complexity when different elements are inseparable constitutive of the whole (economic, political, sociological, sociological, affective, mythological), and there is an interdependent, interactive and inter-retroactive fabric between the object of knowledge and its context, the parts and the whole, the whole and the parts, the parts among themselves. Therefore, complexity is the union between unity and multiplicity.

The aforementioned innovative learning space demands a flexible, open educator, committed to the cognitive and social development of the student, in view of the current professional context, which expects people to understand that the new times present new dilemmas and challenges requiring that we think about a more humane leadership. In this process, understanding that the future begins within the individual and that being a leader today in the organizational scenario is also a process of taking care of others, believing in the potential and abilities of each professional within their human, social, and professional specificities (Casarin, 2022).

It is necessary, therefore, to understand that professional and social knowledge are essential, and that the corporate environment includes people whose thinking and actions

are shaped by their emotional, professional, cultural, and social dimensions; in this multidimensionality, they need to be respected and valued.

The above is in line with what is proposed by the complex thinking guided by Morin (2020), which presents the importance of teaching overcoming standardized productions with a focus reduced to technical knowledge, which also has its importance, but which needs to add the appreciation of people's social and emotional aspects, aiming to enable learning to be developed by students from the reconnection of knowledge, because, according to Morin (2000, p. 38), "[...] the human being is at the same time biological, psychic, social, affective and rational [...]", and the author adds, "[...] society includes the historical, economic, sociological, religious dimensions [...]". It is, therefore, a multidimensional view of human beings that needs to be understood by both educational institutions and organizations to provide guidance to leaders so they can act and present a more ethical and humanized position.

This perspective emphasizes that by encouraging ongoing education for organizational leaders, a commitment is made to emphasize the importance of respecting and valuing people throughout the educational process. It involves exploring activities that reflect their professional and social realities, fostering dialogue about the significance of human transformation. Leaders are guided to understand their role in cultivating leadership aligned with future needs. Achieving an innovative, paradigmatic vision requires starting from a broader, more meaningful perspective that incorporates complex thinking. This approach also calls on professionals from various fields to open themselves to self-knowledge and awareness of how their attitudes impact not only their lives but also those they interact with, as noted by Casarin (2022, p. 21).

The context of continuing education requires students to prepare for the transformations that arise at different levels and spaces, which requires openness to the new, adapting situations according to the challenges and demands that arise, because just as knowledge in organizations also undergoes constant changes, in view of exponential and disruptive innovations, a leader who builds continuous learning environments is required, certain that the diversity of content and information available is enormous and that knowledge needs to be shared, which demands leaders and professionals who are also an eternal learner (Magaldi and Salibi Neto, 2022).

The space of collaborative learning requires that technical and technological concepts be understood by students through problematizations and contextualizations of knowledge, in an interactive way, prioritizing dialogue and collective, cooperative work.

According to Morin (2000), the changes that occur in relation to the production of knowledge require investigations and research, because the accumulation of information made available in the knowledge society generates the need to problematize real situations and adopt new teaching methodologies in order to meet the expectations and demands of society and students, thus requiring dialogical and integrated practices.

Another important factor to be mentioned is that complex thinking guides teaching practices to transpose teaching with a focus only on reason, but that the teaching approach considers the emotions and intuition of the learning subjects, which requires the creation of new teaching approaches, leading the professional to learn meaningfully, as Moreira and Masini (2001, p. 14) point out, "new ideas and information can be learned and retained to the extent that the relevant and inclusive concepts are adequately clear and available in the individual's cognitive structure [...]".

It is therefore up to the educator to plan dynamic teaching environments, respecting differences in *mindset*, because intelligence is not a fixed quality, all individuals have capacities that can be stimulated, as they have different aptitudes that need to be understood and directed. It is in this context that the paradigm of complexity warns that as agents of change, leaders/managers/teachers need to welcome a new paradigm in their actions.

It is necessary to point out that the corporate world is also undergoing transformations, in a scenario where it was important to focus only on productivity and profit, but which today requires organizations to realize that people are essential for their growth and development and as such they need to prepare individuals for a new mental model, as pointed out by Cassarin (2022, p. 49),

[...] The leadership of the future is relationship-focused and will be made up of people who understand people, who understand how to make choices that promote human well-being, who understand what it means to put human beings first, without losing sight of the results [...] Leadership is a social phenomenon.

Therefore, it is important to consider continuing education by exploring activities that not only mimic professional tasks but also connect with the social, emotional, and educational facets of the participants.

INNOVATIVE TEACHING AND MEANINGFUL COLLABORATIVE LEARNING IN ORGANIZATIONAL CONTINUING EDUCATION

We live in a world marked by uncertainties and instabilities driven by changes in science, the economy, and society. These shifts directly impact education and professional environments, demanding individuals who can think critically, work collaboratively, and develop autonomous research skills. The current scenario requires continuous knowledge-building, as Morin (2005, p. 31) notes, "[...] knowledge remains an adventure for which education must provide indispensable support."

This wave of change extends beyond educational and social contexts to organizations. Globally, this process has prompted leaders to reflect and invest in ongoing training to keep pace with innovation. Many companies now recognize the importance of leadership development programs, not just in technical skills but also in fostering humane and supportive behaviors. They aim to prepare employees for lifelong learning, which is essential today. As Magaldi and Salibi Neto (2018, p. 148) highlight, "the future of organizations demands the development of new skills by their workers. For individuals, they will be required to prepare themselves to develop skills that they do not even know." These competencies include both hard skills (technical abilities) and soft skills (interpersonal skills), essential for adapting to the knowledge revolution. Society's evolution also influences organizational environments, as Schlochauer (2021, p. 48) emphasizes.

[...] If the work environment changes by leaps and bounds, learning is also undergoing its transformation, not only as a result of major technological disruptions, but as part of a true cultural revolution. The same scenario that impacts society also impacts the learning process, absurdly expanding our possibilities as learners [...].

Therefore, methodologies for active learning enable more dynamic and meaningful learning, especially in organizational learning, which requires that educational actions create learning situations that reflect the realities experienced by professionals in their work environments.

We live in an era in which knowledge is essential for the survival of any institution or profession. Increasingly, the demand for concrete connections between education and employment is evident (Schlochauer, 2021), reinforcing the importance of continuing education to keep pace with continuously generated information, especially about

technological and social transformations, which require people to engage more with new knowledge.

This knowledge is not only in terms of organizational innovations, but also in scientific, cultural, social, economic, and political aspects, requiring workers to keep up with this evolution, because "maintaining an active professional life is an important part of life, fundamental for our subsistence. But only a part. To be full citizens, integrated into the world in which we live, we need more than to guarantee our subsistence" (Schlochauer, 2021, p. 39).

Continuous learning, in addition to contributing to the professional's updating of technical and technological aspects, also needs to make sense in behavioral aspects, requiring that the educator, when acting in the continuing education of professionals, offer practical activities, with the use of methodologies for active learning, which can generate learning experiences that explore interpersonal relationships. such as communication and the importance of dialogue, interaction through cooperative and collaborative work, as pointed out by Torres and Irala (2021, p. 91):

[...] these methodologies recognize the potential to promote more active learning by stimulating critical thinking; the development of interaction, information negotiation and problem-solving skills; the development of the capacity for self-regulation of the teaching-learning process.

It is about promoting learning spaces, which involve the integration of knowledge, which provide dialogue and the exchange of information and experiences, so that knowledge is learned in a collaborative way and also allows the systematization and connection of information, so that learning is contextualized and meaningful.

The twenty-first century demands that educational institutions and organizations promote the development of people who are critical, reflective, creative, and autonomous, so that they can act in their communities in a more integrated, committed, and ethical way, understanding that continuous learning brings benefits to all. Thus, cooperation and dialogue stand out as the bases for meaningful learning, which can meet the demands of the twenty-first century (Schlochauer, 2021). The challenges that arise in this century point to a responsible citizenship, a planetary education, educating for life that demands a humane, fraternal, and solidary vision, among others of relevance desired in peaceful coexistence on the planet.

Given the scenario presented, it is essential that organizations invest in the continuing education of professionals, ensuring that it is innovative, presents principles that prompt employees to reflect on what they are learning, and, through active teaching strategies, mobilizes the knowledge built, articulating with the professional, social, cultural, organizational, and educational frameworks, and enabling learning in a collaborative, dialogical, and participatory way.

Innovative learning needs to contribute to the leader, so that he remains up to date and integrated with the challenges presented by the corporate world in continuous transformation, because "the ability to maintain his relevance in the labor market is not related to what the individual currently knows and masters, but to what he will learn from now on" (Magaldi and Salibi Neto, 2018, p. 149).

Learning today is the differentiator for a more entrepreneurial, innovative, and inclusive work environment. To prepare leaders who value the human dimension and encourage continuous learning in their subordinates, they need to become leaders who build learning environments (Magaldi, Salibi Neto, 2022).

For the professional environment and individuals to be receptive to lifelong learning, it is essential that they understand that future challenges call on everyone to reflect on common values and goals, since disruptive technologies affect not only corporate spaces but also our lives, reshaping educational, social, and cultural environments. Therefore, it is time to think about *upskilling* (teaching new skills to optimize performance) and *reskilling* (training for a new position in the company), that is, professionals need to be aware of their technical, technological, and interpersonal requalifications and commitment to improve their current professional skills. (Schlochauer, 2021).

This paradigmatic movement includes the advent of the fourth industrial revolution, which has left significant marks on society, as it alerts to technological issues and how they will change society and companies; however, it makes it clear that it is essential "[...] ensure that the Fourth Industrial Revolution is led by humans and for humans. Human values must be respected for their own sake, rather than just being quantified in financial terms. [...] People with the capacity to perform meaningful actions [...]" (Schwab; Davis, 2018, p. 44).

Continuing education movements need to consider technical and technological aspects, especially socio-emotional and interpersonal knowledge, to ensure the development of leadership skills that see the human being in its integrality and multidimensionality as an agent of change, and that the transformations that occur benefit everyone.

ACTIVE METHODOLOGIES: PROBLEM-BASED LEARNING AND DESIGN THINKING

Although much is said and written about the need for schools and teachers to adopt innovative teaching methodologies in the educational environment, these practices still do not occur in their effectiveness, since they require pedagogical actions to be more dynamic, placing the student active in the learning process, strengthening their autonomy in the search for learning to learn. It should be clarified that the use of active-learning methodologies, by both teachers and managers, requires dedication and time to plan and develop activities that meet the needs of the groups involved.

The planning and organization of activities involve methodological preparation before starting the continuing education process in the company or in educational institutions. When activities are planned based on learning objectives, they enable collaborative practices through actions that bring challenging problematizations, that stimulate research, exchange and dialogue among peers, that promote critical reflection, favor interpersonal relationships, that allow exploring students' experiences, requiring a higher level of commitment to the aspects of learning and sharing doubts and discoveries.

The use of methodologies for active learning can provide students with emancipation regarding their own learning, allowing them to dialogue with knowledge, reflect on what they learn and why they learn it, and where they can apply this knowledge, perceiving the meaning of knowledge, so that they can apply the knowledge built, analyzing possible solutions to problems and making assertive decisions.

To provide this dynamic and dialogical environment, it is possible to adopt methodologies for active learning, as these "[...] are teaching strategies centered on the effective participation of students in the construction of the learning process, in a flexible way [...]" (Moran, 2018, p. 4), and in this context, it is essential that the teacher develops activities that lead the student to interact with knowledge, that they are receptive to working cooperatively and collectively, in search of understandings that allow them to put into practice the knowledge investigated.

The proposal for the adoption of methodologies for active learning is to make it so that, "[...] Students develop higher thoughts by practicing, investigating, debating, respecting different points of view, emphasizing and promoting social aspects. Knowledge is learned in a shared way, activating creativity and critical thinking" (Fava, 2018, p. 160).

In the adoption of these methodologies, the teacher is a mediator, he mediates the activities, provoking and stimulating students to seek solutions to problem situations

together, "[...] the ideal teaching-learning process occurs through a dialogical relationship between teachers and students [...]" (Lima et al., 2023, p. 3). The activities can be exposed through case studies that reflect real situations experienced by the students, arousing curiosity, valuing the discoveries, leading them to engage with the studies, enhancing in the students autonomy, freedom of expression, decision-making, that is, active involvement in the learning process.

There are several possibilities to adopt methodologies for active learning in continuing education programs, especially in the adult educational process. In this scenario, two methodologies are presented that were applied to promote meaningful learning in the continuing education program for the development of leaders, problem-based learning and *design thinking*.

Problem-based learning proposes situations that motivate students to collaboratively interpret, evaluate and solve problem situations, aiming to expand conceptual, practical and behavioral knowledge, because the "[...] problem places the student at the center of the process, as the protagonist. However, it is necessary to build problem situations that will structure this learning, so that these scenarios or problems are situations that are characterized as a problem for the students" (Camargo and Daros, 2018, p. 43).

The idea is that the student learns by considering real events, through problematizations, which allow analyzing the information, transforming it into new ideas, and seeking alternatives for new discoveries. Therefore, the questions, reflections, and collective dialogues serve to help the students together seek new options to solve the problem.

For Moran (2018, p. 15), problem-based learning involves

[...] research, evaluate different situations and points of view, make choices, take risks, learn through discovery, and move from simple to complex. Well-planned challenges help mobilize the desired skills, whether intellectual, emotional, personal, or communicational.

In this sense, it is important to consider the proposal of a problem-situation in which the student can make the connection between theory and practice in the learning process, because problem-based learning puts the student into action, when he must develop his analytical capacity, arguing, proposing, and discussing the topic of study (Mello, Almeida Neto and Petrillo, 2020). This methodology requires a teacher who is attentive to student

involvement, mediating and guiding to continuously stimulate the process of learning to learn.

Building new knowledge through problem-based learning:

[...] It is an instructional strategy that is organized around the investigation of real-world problems. Students and teachers are involved in analyzing, understanding and proposing solutions to carefully designed situations in order to guarantee the learner the acquisition of certain skills foreseen in the school curriculum. The situations are, in fact, scenarios that involve students with facts from their daily lives, both from school and from their home or city (Lopes et al., 2019, p. 49).

The student, when sharing his doubts, uses his previous knowledge, researches together, ends up understanding the concepts, reflects on them, seeks alternatives to compose a resolution proposal that makes sense, based on the formulation of scenarios and plausible explanations for possible solutions.

An important factor is that it is up to the teacher to provide subsidies for students to access articles, books, reports, videos, in short, all material that can support and favor investigations and provoke dialogues. "[...] There is no clear and defined boundary in which, on the one hand, the teacher would be teaching and, on the other, the student learning. The teaching-learning process takes place in the interaction between both, mediated by language" (Lima et al., 2023, p. 3). Another essential point is that when looking for possibilities to solve the problem-situation, it generates new knowledge and can be applied in the student's educational, social and/or professional practice.

The proposal to adopt *design thinking* as a methodology for active learning is part of collaborative work, requiring the generation and proposal of new ideas, aimed at creating innovative solutions to problem situations (Camargo and Daros, 2018).

As in problem-based learning, *design thinking* aims to point out situations that explore the obstacles or challenges of the professional's daily life, requiring students to reflect critically and constructively, suggest creative and innovative proposals, and investigate, make new readings, so that they can have enriching and at the same time challenging experiences together.

In this methodology, it is possible to create and recreate interactive proposals that require those involved in the activity to be receptive to sharing and asking, through an understanding of the problem context and the organization of stages of thought to organize their ideas and propose possible solutions. It is, therefore, "a way of describing a set of

principles that can be applied by several people to a wide variety of problems" (Brow, 2010, p. 8).

For active learning methodologies to deliver learning benefits, the activities chosen need to create situations that foster interpersonal relationships, and it is up to professionals to develop active listening, empathy, and respect for different thoughts and proposals, seeking open and flexible dialogue. The student, in turn, needs to be receptive to developing new mental models, thus imagining different scenarios, that is, being aware of different ideas, consolidating an integrative thought, without, however, ceasing to question, aiming at improving the learning process.

METHODOLOGICAL REFERRAL OF THE RESEARCH

The research started from an exploratory qualitative approach, of an interpretative nature, considering the investigation with 52 professionals who participated in a leadership development program, in an educational institution that works with corporate continuous training and has as teaching support the adoption of methodologies for active learning, in order to contribute to a more meaningful, collaborative and applicable learning to the reality of individuals.

Qualitative research, as Minayo (2001, p. 14) points out, "[...] works with the universe of meanings, motives, aspirations, beliefs, values and attitudes, which corresponds to a deeper space of relationships, processes and phenomena that cannot be reduced to the operationalization of variables". Thus, without losing scientific focus, it allows researchers to contribute with greater participation in relation to the appropriation of the results obtained in the investigation. A point to be highlighted is that in this research approach the concern is to understand the results obtained and present the dynamics that occurred in relation to the constructed knowledge and social relations.

The type of exploratory research, "[...] aims to give a general explanation of a given fact, through the delimitation of the study [...]" (Oliveira, 2010, p. 65), in the case of investigation, as it seeks to present an overview of the phenomenon investigated and can result in deeper research based on new problems. It was decided to accept the interpretative nature, which aims to synthesize the ideas of the investigated, pointing out how the statements/manifestations presented are connected with the theoretical positions of other authors, as pointed out by Severino (2007, p. 59), in the interpretative analysis, "[...] it is to take one's own position regarding the ideas enunciated, it is to overcome the strict message of the text, it is to read between the lines [...]" it is to dialogue with the author".

To complement the investigation, some authors were included who served as epistemological, philosophical, and ontological subsidies, to allow a greater connection between educational principles, continuing education, and corporate, contributing to the vision of complexity, as support to what demands a dialogical, innovative, and integrative teaching of knowledge and practices. Thus, the theoretical contributions were consolidated in the search for relevant authors who deal with the themes investigated, such as: Behrens (2000), Moran (2018), Moraes (2020), Torres (2021), Morin (2000, 2020), Cassarin (2022), Camargo and Davos (2022), Magaldi and Salibi Neto (2022), in addition to other authors who complemented the studies and investigations.

The participants of the research are corporate professionals, with various backgrounds, such as: economists, administrators, accounting, human resources, psychology, etc., who participated in active educational activities in a space of continuing education, in the PDL – Leadership Development Program, whose themes of the curricular contents worked were: emotional intelligence and agility, self-knowledge, role of the leader in the current contemporary scenario, communication management, difficult conversations, nonviolent communication, conflict and feedback management, people and team development, burnout syndrome, interpersonal and personal skills, equity, innovation, healthy work environment.

The semi-structured instrument consisted of two open-ended questions: one answered via an online questionnaire and the other via a face-to-face interview conducted after the end of the training program. The questions contemplated the proposal to identify how the active practice of the activities allowed the appropriation of knowledge. In this context, the research participant has the possibility of discussing his considerations with greater propriety, favoring greater interaction between the researched and the researched.

In the considerations of Manzini (1990, p. 154), the "[...] semi-structured interview focuses on a theme whose script presents relevant questions, allowing the collection of more simplified and free information, breaking with the standardization of answers."

Professionals from two medium-sized companies in the industrial economic segment, located in the city of Curitiba, participated in the research, who evidenced the need to better prepare their leaders in behavioral aspects. 52 participants in the training program act as managers and already have experience leading teams; they were designated by their immediate directors to participate in the leadership training program, with a focus on behavioral and socio-emotional development. The classes had approximately 80 hours

of discussion, dialogue, interaction, reflection, systematization, discovery, and creative, collective construction of knowledge.

The interviews with the leaders took place in the last two meetings, individually and by invitation, to allow the participants to make themselves available to contribute to the research. Of the 52 participants, 30 contributed to the interview that was conducted by the program's teacher.

CONTRIBUTIONS OF THE LEADERS PARTICIPATING IN CONTINUING EDUCATION

The investigation took place with the objective of giving participants in the leadership development program (PDL) the opportunity to discuss the acceptance of the fundamentals of the new paradigm of complexity (Morin, 2005) in an interactive and collaborative way. They discussed new paradigms and had access to information and knowledge that would contribute to their professional and personal growth and development, as team leaders.

The proposals of the educational activities were directed by the understanding by professionals of how to lead teams in the current corporate scenario, which has increasingly excelled in promoting a more humanized environment, understanding that the best technology that an organization has today is its human potential, as it is the people who have intelligence and innovative capacity to create and innovate in the social space, personal and professional.

This context of an innovative organizational environment requires professionals who know themselves so that they can lead in this exponential world in which we live, which demanded a continuing education program that would stimulate professionals, through methodologies for active learning, aiming to allow greater connection with knowledge in order to develop socio-emotional skills, as paths for learning that could be enhanced in the practice of their social, personal and professional reality.

In this way, it was investigated through experiences in activities carried out from problem-based learning and *design thinking*, which allowed collaborative learning and made it possible to perceive whether these contributed to the significant construction of knowledge, favoring the consolidation of a dynamic and interactive teaching and work environment.

For data preparation and analysis, the manifestations obtained in the application of a questionnaire and semi-structured interviews were considered. The answers provided by

the participants were very objective and demonstrated the relevance of the educational practice through the adoption of a teaching methodology that made them protagonists in their own learning.

The professionals' contributions were coded as P (professional) to safeguard anonymity, with the answers indicated as P1, P2, and P52.

In the question that aimed to discuss the various educational practices and how they contributed to their learning, the following manifestations were obtained:

It provided greater contact with other colleagues through extensive discussions, creating an interactive environment that was very useful for assimilating the topics presented. P06

I learned a lot, more emphasis than what was visible, that with team collaboration we have surprising results, because in dynamism we were able to find ourselves in many aspects, and we were able to grow in knowledge and as a person, in addition, all activities had examples and concepts were passed on in practice, which facilitated the understanding of the topics covered. P12

The activities contributed to the learning of all involved, as it allowed interaction between the participants and the teacher. P15

It was observed that the respondents, in addition to the construction of knowledge, also demonstrate that the relationships between peers complement the knowledge, since, in collaborative learning, "[...] it is expected that learning will occur as a side effect of an interaction between peers who work in a system of interdependence in solving problems or in carrying out a task proposed by the teacher [...]" (Torres; Irala, 2014, p. 65).

In addition, it was inquired about collaborative work and its contribution to making the actions more interactive, since they establish connections and allow the student to hear other interpretations and understandings. Thus, the participants manifested themselves:

We had access to different points of view from other sectors and understood more effectively the impact that is caused when a thoughtless attitude is taken by a leader. I learned a lot of new things and how to deal with various situations. P16

With these activities, we were able to root some learning and put it into practice in the company and we also built knowledge and linked it to the company's daily life, helping to know how to behave and how to be a more connected leader. P21

I learned a lot, but I emphasize what was super visible, that with team collaboration we have amazing results. P31

From the professionals' answers, it was possible to see that the collaborative activities allowed interaction that welcomed other points of view, consolidating the

construction of knowledge that can be applied in the leader's daily life, even reflecting on the development of new patterns of behavior, which is in line with what Cassarin (2022, p. 150) points out, "a connected leadership encourages honest dialogue among the team and can motivate it to give the best of itself, to develop and learn [...]".

It is observed that the professionals were able to perceive the connection between the theoretical contexts and the practices applied during the activities, contributing so that the knowledge can be adopted in their reality in the organization as a leader and directing integrated actions in relation to innovative corporate processes and procedures. In this sense, the following manifestations are presented by the respondents:

The activities were important, it opened my mind, helping in my communication with the team [...], in addition, it contributed to learning in practice, making it possible to internalize knowledge more quickly, allowing interaction between participants [...] it was not only based on theory but also united collaborative practice. P32

[...] I learned how a leader has to behave at various times, so the interactive activities allowed me to understand the connection between the organization's processes and the innovative performance as an agent of change, with a focus on people. P6

[...] I noticed many flaws in my posture and attitudes as a leader, and with the activities I was able to improve and reflect on some relevant things about the importance of people in my team and how I should value their knowledge and encourage them to always improve, a more humanized vision. P8

It can be seen in the professionals' statements that the proposed activities led to learning through practice, considering sharing through interactive discussions, improving their communication process with their subordinates, praising the connection between theory and practice, one of the recommendations pointed out by the authors that encourage the adoption in the educational environment of methodologies for active learning, who excel in protagonism and interactivity among students in the process of learning to learn. Interaction is highlighted as a process of growing together, as proposed by Moraes (2021, p. 154), "[...] Interactivity is also fundamental with regard to the processes of knowledge construction [...], it is a condition for the emergence of cognitive processes. This is because every organism interacts with something external to itself so that it can know and learn [...]".

The focus is on encouraging pedagogical actions that develop individuals' critical thinking, emphasizing the importance of teamwork, sharing experiences, and exploring doubts during learning. This approach highlights that working with peers when facing daily

challenges enables students to discover new ways to resolve critical situations through dialogue, creation, reflection, and seeking alternative solutions. Since everyone is responsible for their own learning and that of the group, it is essential to foster empathy, respect, and engagement to build meaningful and innovative knowledge.

FINAL CONSIDERATIONS

The present research adopted a qualitative, exploratory, and interpretative approach by studying participants in a leadership development program at an educational institution focused on corporate continuous training that uses active-learning methodologies. The problem investigated allowed us to perceive how the participants manifested themselves in the activities carried out through collaborative problem-based learning and design thinking, focused on a complex vision of knowledge production. The objective of the research was fulfilled by enabling the experience of the process and the analysis of participants' manifestations arising from collaborative learning based on problems and design thinking, with a focus on a complex view. Thus, it contributed to more meaningful learning applicable to individuals' realities, using the principles of qualitative research as defined by Minayo (2001) as theoretical support to understand the results obtained and the dynamics of the relationships and knowledge constructed.

The results revealed that educational activities based on active-learning methodologies, such as problem-based learning and design thinking, promoted collaborative and meaningful learning among participants. The professionals' answers indicated an appreciation of the interactive environment provided by the activities, as well as the relevance of discussions and exchanges of experiences among colleagues for the construction of knowledge.

The analysis of the manifestations showed that collaborative learning, stimulated by active learning methodologies, enabled professionals to develop socio-emotional skills and apply the knowledge acquired through their experiences in their daily professional practice. In addition, interaction with diverse points of view and the connection between theory and practice were highlighted as essential elements for meaningful learning and the development of new patterns of behavior in the practice of more innovative and humanized leadership.

The results also corroborate the theoretical perspectives of authors such as Cassarin (2022) and Moraes (2021), who emphasize the importance of interactivity, dialogue, and collaborative practice in knowledge construction. Therefore, the educational activities

adopted in the leadership development program have been shown to stimulate the protagonism of professionals in learning and in the development of skills necessary to work in an increasingly dynamic and complex corporate environment, which requires leaders who dialogue with their teams, and who also see them as agents of change and protagonists of a more humanized and healthy professional environment.

Therefore, the relevance of methodologies for active learning is highlighted, especially problem-based learning, design thinking and collaborative learning for the training and development of leaders, emphasizing the importance of promoting dynamic, interactive teaching environments that stimulate reflection, creativity and the search for innovative solutions to contemporary organizational challenges.

REFERENCES

ANDRADE, Julia Pinheiro; SARTORI, Juliana. O professor autor e experiências significativas na educação do século XXI: estratégias ativas baseadas na metodologia de contextualização da aprendizagem. In: BACICH, Lilian; MORAN, José. Metodologias ativas para uma educação inovadora: uma abordagem teórico-prática. Porto Alegre: Penso, 2018.

BEHRENS, M. A. Projetos de aprendizagem colaborativa num paradigma emergente. In: MORAN, J. M.; MASETTO, M. T.; BEHRENS, M. A. Novas tecnologias e mediação pedagógica. Campinas: Papirus, 2000. p. 67-132.

BROW, Tim. Design Thinking: uma metodologia poderosa para decretar o fim das velhas ideias. Rio de Janeiro: Elsevier, 2010.

CASSARIN, Tonia. Liderança exponencial: a transformação humana a é o motor dos líderes do futuro. Rio de Janeiro: Decola, 2022.

CAMARGO, Fausto; DAROS, Thuinie. A sala de aula inovadora: estratégias pedagógicas para fomentar o aprendizado ativo. Porto Alegre: Penso, 2018.

D'AMBROSIO, Ubiratan. A prática transdisciplinar na universidade. In: MAGALHÃES, Solange Martins Oliveira; SOUZA, Ruth Catarina Cerqueira Ribeiro de. Formação de professores: elos da dimensão complexa e transdisciplinaridade. Goiânia: Ed. da PUC de Goiás, Liber Livros Editora, 2012.

FAVA, Rui. Trabalho, educação e inteligência artificial: a era do indivíduo versátil. Porto Alegre: Penso, 2018.

LIMA, A.; ALTHAUS, D.; REGINA BUDZIAK PARABOCZ, C.; DIAS TEIXEIRA, S. Como ajudar professores do magistério superior a transformar metodologias passivas em metodologias ativas na sala de aula: a prática da Clínica da Atividade Docente em foco. Revista Brasileira de Estudos Pedagógicos, v. 104, p. e5468, 12 set. 2023.

LOPES, R. M.; ALVES, N. G.; PIERINI, M. F. SILVA FILH), M. V. Características gerais da aprendizagem baseada em problemas. In: LOPES, R. M.; SILVA FILHO, M. V.; ALVES, N. G. (org.). Aprendizagem baseada em problemas: fundamentos para a aplicação no Ensino Médio e na formação de professores. Rio de Janeiro: Publiki, 2019. p. 47-74.

MAGALDI, Sandro; SALIBI NETO, José. Gestão do Amanhã: tudo o que você precisa saber sobre gestão, inovação e liderança para vencer na 4ª revolução industrial. São Paulo: Editora Gente, 2018.

MAGALDI, Sandro; SALIBI NETO, José. Liderança disruptiva: habilidades e competências transformadoras para liderar na gestão do amanhã. São Paulo: Editora Gente, 2022.

MANZINI, Eduardo J. A entrevista na pesquisa social. Didática, São Paulo: v. 26/27. P. 149-158, 1990 Disponível em: Web.eduinclusivapesq-uerj.pro.br

MELLO, Clayson de Moraes; NETO, José Rogério Moura de Almeida; PETRILLO, Regina Pentagna. Educação 5.0: educação para o futuro. Rio de Janeiro: Freitas Bastos, 2020.

- MINAYO, Maria Cecília de Souza. (Org.) Pesquisa Social: teoria, método e criatividade. Petrópolis, RJ: Vozes, 2001.
- MORAN, José. Metodologias ativas para uma aprendizagem mais profunda. In: BACICH, Lilian, MORAN, José (Orgs.). Metodologias ativas para uma educação inovadora: uma abordagem teórico-prática. Porto Alegre: Penso, 2018. p. 2-25.
- MORAES, Maria Cândida. Paradigma educacional ecossistêmico: por uma nova ecologia da aprendizagem humana. Rio de Janeiro: Wak Editora, 2021.
- MOREIRA, Marco Antônio; MASINI, Elcie F. Salzano. Aprendizagem significativa: a teoria de David Ausubel. São Paulo: Centauro, 2001.
- MORIN, Edgar. Os sete saberes necessários à educação do futuro. São Paulo: Cortez, 2000.
- MORIN, Edgar. Ensinar a viver: manifesto para mudar a educação. Porto Alegre: Sulina, 2015.
- MORIN, Edgar. É hora de mudarmos de via: as lições do coronavírus. Rio de Janeiro: Bertrand Brasil, 2020.
- OLIVEIRA, Maria Marly de. Como fazer pesquisa qualitativa. Petrópolis, RJ: Vozes, 2010.
- SCHWAB, Klaus; DAVIS, Nicholas. Aplicando a quarta revolução industrial. São Paulo: Edipro, 2018.
- SCHLOCHAUER, Conrado. Lifelong learners: o poder do aprendizado contínuo. São Paulo: Editora Gente, 2021.
- SEVERINO, Antônio Joaquim. Metodologia do trabalho científico. São Paulo: Cortez, 2007.
- TORRES, P. L.; IRALA, E. A. F. Aprendizagem colaborativa: teoria e prática. In: Complexidade: Redes de conexões na produção do conhecimento. Curitiba: SENR-PR, 2014. p. 61-93.
- TORRES, P. L.; IRALA, E. A. F. Aprendizagem colaborativa: teoria e prática. In: TORRES, P. L. (Org.). Ciência, inovação e ética: tecendo redes e conexões para a produção do conhecimento. Curitiba: SENAR-PR, 2021. p. 19-32.

TEACHERS' PERCEPTIONS OF ARTIFICIAL INTELLIGENCE IN EDUCATION: EXPERIENCED KNOWLEDGE AND NEW POSSIBILITIES

 Crossref  10.56238/livrosindi202668-008

Lilian Amaral da Silva Souza

Gabriele Polato Sachinski

ABSTRACT

This chapter explores teachers' perceptions of Artificial Intelligence (AI) in education, focusing on experiential knowledge, pedagogical methods, and the application of Information and Communication Digital Technologies (ICTs). Using a qualitative approach, teachers' answers to the open question "What surprised you the most about AI?" were examined. These responses were analyzed considering theoretical frameworks on teacher training and experiential knowledge, including direct quotes from sections on teaching practices and the integration of ICTs in educational settings. The findings identify five key categories: agility and practicality; content creation; supporting teaching practices; a humanized view of AI; and resistance or critique. The results emphasize the need for ongoing professional development to enhance digital skills and foster a critical understanding of AI in teaching. Ultimately, AI can be a valuable pedagogical tool when incorporated within reflective and ethical training processes.

Keywords: Artificial Intelligence. Teacher education. ICT. Teaching practice.

INTRODUCTION

The technological intensification of the last decades has profoundly transformed the modes of production, circulation, and appropriation of knowledge. In the educational field, such changes are manifested in the incorporation of digital tools, curricular restructuring, new forms of interaction, and a reconceptualization of the teaching role. In this scenario, Artificial Intelligence (AI) emerges as one of the main vectors of transformation, stimulating debates about its potentialities and limits in basic education.

Although several technologies have already been integrated into everyday school life, AI represents a significant departure due to its potential to automate complex cognitive tasks, generate content, support the personalization of learning, and offer new forms of pedagogical analysis. Such capacities, still expanding, confront traditional conceptions of teaching and problematize consolidated practices, demanding critical reflection on technical, ethical and pedagogical aspects.

Teacher training is central to this process, as teachers are subjects who build knowledge based on their experiences (Tardif, 2014). In relation to AI, this construction is

marked by both enchantment and concerns, especially in the face of its rapid evolution and the uncertainties arising from it. Therefore, understanding how teachers perceive AI contributes to the elaboration of training policies that respond to contemporary challenges, reinforcing the school as a space for critical and cultural mediation.

In this chapter, teachers' perceptions of AI in education are investigated and articulated in relation to the theoretical debate on teacher training and the use of DICTs. To this end, responses to an online instrument were analyzed, categorized qualitatively. Then, the theoretical debate is presented, fully preserving the sections on practice in the teacher training process and the consolidation of DICTs in practice, followed by the methodology, results, and discussion.

PRACTICE IN THE TEACHER TRAINING PROCESS

The teaching profession is essentially practical. From the moment the work begins, the teacher is constantly learning whether in the teacher-teacher, teacher-school, or teacher-student relationship or through reflection on one's own practice. In this sense, Tardif (2014, p. 228) conceives educators as subjects of knowledge, stating that:

Teachers by profession have specific knowledge that is mobilized, used and produced by them in the context of their daily tasks [...] in their daily work with students, they [educators] are the main actors and mediators of culture and school knowledge.

Following this line of thought, it is noted that, during professional practice and through their personal experiences, school or not, teachers build not only their professional identity but also their professionalization – that is, they develop and improve their own work methods. Thus, it is essential for the teacher to assume himself as a critical and reflective subject of his own praxis, to the extent that he can learn from them rather than merely reflect on his experiences. Perhaps this is one of the greatest demands of the teaching career: always the teacher is called to rethink his own professional practice, because, as Education is an essentially human practice, new demands and requirements arise with social changes. Thus, there is no way to dissociate practice and teacher training.

In this regard, Tardif (2014, p. 228) states that teachers "have specific knowledge that is mobilized, used and produced by them within the scope of their daily tasks [...] In their daily work with students, they [educators] are the main actors and mediators of culture and school knowledge". Succinctly, the author proposes that, amid professional practice,

teachers, while stimulating students' learning, build their own knowledge. From this perspective, the author points out that such an experience triggers three main consequences regarding the formation of the teacher's professional identity.

The first of them concerns the understanding of the teacher as a subject of knowledge specific to his work, possessing know-how built *in* and *by* practice during his training. In this author's view, the teacher is "a subject who assumes his practice based on the meanings that he himself gives it, a subject who has knowledge and know-how from his own activity and from which he structures and guides it" (Tardif, 2014, p. 230).

The second consequence concerns the need to conceive of the educator as an agent in his own practice, rather than a mere applicator of theories, often distant from the school environment. In this regard, Tardif (2014, p. 236) draws attention to the impossibility of existing "theories without practices, knowledge without actions, knowledge without rootedness in actors in their subjectivity". Now, many times the theories learned in initial training courses do not account for all the demands that teachers will encounter in their professional path. It is in practice that new paths are tested and traced.

The third consequence refers to the importance of rethinking practices, policies and teacher training itself. Once again, Tardif (2014, p. 243) reinforces the need to see the teacher as a subject of knowledge, but highlights that teachers "will only be recognized as subjects of knowledge when we grant them [...] the *status* of true actors, and not that of simple [...] executors of education reforms conceived on the basis of a '*top and down*' bureaucratic logic". Under this bias, it is necessary to give voice to educators, so that they can contribute to the development of methods and policies that reflect and meet the demands found *in loco*, in the classroom, in the pedagogical experience.

DICTS AND ARTIFICIAL INTELLIGENCE AS PEDAGOGICAL TOOLS

The presence of Digital Information and Communication Technologies (DICTs), already well-established in contemporary society, has necessitated new attitudes and competencies among teachers (Cantini et al., 2006; Costa et al., 2012). In the educational field, the need to understand technology not as an end but as a means of developing teaching and learning processes is highlighted. In this context, it is essential to recognize that digital resources expand possibilities for interaction, investigation, and knowledge construction, mobilizing new pedagogical practices and demanding greater protagonism from the subjects involved in educational action.

It is impossible to deny the presence of DICTs and other technological devices in contemporary society. Since the Industrial Revolution, society has been moving towards the modernization of all processes, and Education, as a social practice, cannot ignore this context. That said, it is worth questioning the teacher's role in this scenario. In this regard, Cantini et al. (2006) point out that teachers often end up assuming passive postures in the face of the incorporation of technological artifacts in their classes. According to the authors, this issue is due to several factors, including a lack of technical and pedagogical support in educational environments and a deficit in the appropriation of this knowledge during their academic careers. In this way, some educators end up finding barriers to making DICTs an ally in the pedagogical process.

However, as Cantini et al. (2006, p. 876) point out:

"The teacher, as a mediating agent in the process of forming a citizen able to act in this society of constant innovations, has the challenges of incorporating technological tools in the teaching and learning process, seeking continuing education, as well as exchange mechanisms and partnerships regarding their use."

However, it is understood here that the responsibility for incorporating technologies in Education should not be delegated only to the teacher, since this issue should cover all agents involved in the teaching-learning process, such as teaching and research institutions and, mainly, the government, which needs to offer subsidies for technological support. Nevertheless, the teacher, as an agent of his praxis, is faced with this challenge, which requires him to rethink and readjust his methods and his own perception of his role in the educational process, because the digital context requires a professional provocateur and mediator of knowledge (Costa et al., 2012; Cortella, 2014; Leite et al., 2009).

In turn, Schuartz and Sarmiento (2020, p. 431) point out that "updating and the continuous search for knowledge become watchwords in this society permeated by information and knowledge in which education is expected to make significant contributions to the preparation of future professionals". Thus, it is a fact that most students have mastery over technologies, but do not always make use of them in favor of their own knowledge construction. The fact that some teachers have used DICTs in a limited way in educational processes may favor this situation.

From this perspective, the growing evolution of technologies provides a context in which the potential of using these artifacts in favor of learning can no longer be ignored. As Schuartz and Sarmiento (2020, p. 431) point out, "they [DICTs] should be seen as

resources that can enrich the class, enhance reflective processes, thus contributing to the (re)elaboration of new knowledge, as they allow today to immediately aggregate information that was previously unavailable".

From this understanding, it is understood that, more than the simple presence of devices or applications, the focus should fall on pedagogical intentionality: how can such resources favor processes of research, analysis, creation and dialogue in the classroom? It is in this direction that Artificial Intelligence (AI) presents itself as an articulating element of DICTs, enhancing teaching practices through the production of materials, the systematization of information and the monitoring of educational initiatives.

In this expanded context, AI is a central component of the digital ecosystem. Among its possibilities, support for creating materials, analyzing information, organizing activities, and monitoring learning trajectories stands out. According to Costa et al. (2012), such technologies can expand the pedagogical reach, as long as they are mediated by teachers who understand their limits and possible uses.

However, the presence of AI in education requires ethical attention. Lopes (2025) points out that the relationship between AI and ethics has gained relevance, as it involves decisions about privacy, security, and justice. Fernandes et al. (2024) reinforce that the use of AI in school must consider its impacts on subjects, in order to ensure respect for basic ethical principles.

In addition, AI systems can simulate cognitive processes, such as perception and analysis (Russell; Norvig, 2016). Still, there are challenges, such as the continuous maintenance of systems, the possibility of reproducing biases, and the risk of inappropriate use of sensitive data (Picão et al., 2023).

The UNESCO Recommendation (2021) presents principles that guide the development and use of AI systems, highlighting social justice, respect for human rights, inclusion, and responsibility. In the educational sphere, these guidelines highlight the need for practices that expand access, reduce inequalities, and ensure fair learning conditions. The responsibility for this mediation involves institutions, teachers, and managers, in dialogue with their real contexts.

Considering this scenario, the teaching work assumes great relevance. Giraffa and Kohls-Santos (2023) argue that pedagogical mediation with emerging technologies requires sensitivity and attention to educational objectives. Santaella (2021) highlights that algorithms often operate invisibly, which reinforces the importance of subjects understanding their effects. Freire's thought (2021; 2022) contributes to this debate by

recognizing that teaching is an ethical and political act, guided by an investigative posture, the possibility of choice, and respect for students. Thus, the use of technologies dialogues with practices that value curiosity, reflection, and the development of autonomy.

The perspective of planetary ethics proposed by Morin (2000) broadens this debate by indicating that life, society and technologies are part of the same system. Thus, thinking about AI in education involves considering its relationship with social, environmental, and cultural aspects.

Thus, it is understood that the use of AI goes beyond the technical dimension. It involves careful planning, choices aligned with the context, dialogue and active participation of the subjects involved. When used critically and contextually, AI can contribute to pedagogical practices that value analytical thinking, expression, research, and dialogue, fostering broader and more inclusive educational experiences.

METHODOLOGICAL PATHS

For the development of the present study, an exploratory investigation was chosen, understood as a preliminary study whose purpose is to become familiar with the phenomenon and delimit analytical paths for subsequent deepening, aiming at greater interpretative precision (Theodorson; Theodorson, 1970). In view of this, the methodological procedures adopted in teacher training are presented, contemplating context, participants, instrument, data collection, data analysis and study limits.

The study was carried out in the context of a training action on digital technologies and artificial intelligence in education, promoted for teachers from the municipal network of a municipality in the North of Paraná. Teachers of Early Childhood Education and the early years of Elementary School (1st to 5th grade) participated in the training, totaling 32 teachers present. Of these, 22 responded to the research instrument, constituting the analytical corpus of this chapter. The inclusion criteria considered: working as a teacher in the municipal network, participation in training and agreement to answer the questionnaire. Blank or incomplete records were excluded. Some participants reported not being able to send their answers due to difficulties in accessing the internet, which explains the difference between the number of attendees and the total number of respondents.

As an instrument for data production, a mixed questionnaire was used, available in an electronic form (Google Forms). According to Richardson (1999), this type of instrument can combine closed questions, aimed at characterizing the participants, and open questions, aimed at deepening opinions, perceptions and experiences. Within the

scope of this analysis, the focus was on the open question "What surprised you the most about AI?", elaborated with the objective of capturing meanings attributed by teachers to artificial intelligence, as well as their initial impressions on the subject after the formative experience.

Access to the form took place through a QR code projected during the training and, additionally, through a link shared with the group of teachers. Participants were able to complete the questionnaire using their own mobile devices or computers available on site. Participation was voluntary and there was no nominal identification of the professors, ensuring confidentiality of the information.

The data were organized in a spreadsheet for later systematization and analysis. Content analysis was adopted as a systematic procedure for describing, categorizing and interpreting messages (Bardin, 2011). The analytical process included the stages of pre-analysis, exploration of the material and treatment of the results. In the pre-analysis, the 22 answers were read fluctuatingly, seeking familiarity with the set of utterances and identification of initial recurrences. Then, in the exploration stage, the coding of the recording units and the construction of nuclei of meaning were carried out, grouping excerpts of speech around similar themes. Finally, in the treatment and interpretation, thematic categories were elaborated and these categories were articulated with the theoretical framework on DICTs, FI and teaching work in the early years of Basic Education.

The categories were constructed in an emergent way, from the empirical material itself, resulting in the following interpretative axes: agility and practicality, content creation, support for teaching practice, humanization of AI, and resistance or criticism. This analytical movement sought to preserve the uniqueness of the answers, while allowing to highlight collective trends in the perceptions of Early Childhood Education and 1st to 5th grade teachers about artificial intelligence.

The research observed ethical principles consistent with studies in education. The invitation to participate was made at the end of the training, with clarification of the academic objectives of the study, the voluntary nature of participation and the guarantee of confidentiality. No personal data were collected that would allow the individual identification of the participants. The answers are presented in a grouped manner, avoiding direct associations between statements and subjects.

From this perspective, the transferability of the findings is tied to the specific educational context analyzed, and statistical generalizations are not intended. However, the

data produced offer relevant evidence about how teachers of Early Childhood Education and the early years of Elementary School, in a municipal network, have been meaning artificial intelligence in their daily professional lives. Among the limitations of the study, the number of responses was limited by connectivity barriers at the time of form submission, and the use of a single open question, which favors the density of the speeches but restricts thematic breadth, stand out. Considering these limitations, the following section presents the research results, organized into thematic axes and accompanied by interpretative considerations.

RESULTS: SOME CONSIDERATIONS

As discussed in the previous sections, one of the objectives of the training on digital technologies and artificial intelligence in education was to provoke critical reflection on AI's role in everyday school life. At the end of the meeting, the online questionnaire was applied with the open question "What surprised you the most about AI?". The answers of 22 teachers constitute the corpus of this section and allow us to glimpse how these subjects have been constructing meanings about AI based on their professional experiences and the discussions held in the training.

In general, the manifestations show a mixture of enchantment, curiosity and caution. Many teachers are surprised by how quickly AI can write texts, suggest activities, synthesize information, or organize ideas based on simple commands. Others highlight the possibility of using AI as a support for the construction of teaching materials, the preparation of classes, and the planning of pedagogical interventions, especially in the face of the intense workload that characterizes daily school life. There are also those who emphasize the impression of "intelligence" or "humanity" in the systems' responses, explaining a certain strangeness in the face of these tools' capacity for dialogue.

The content analysis of the answers enabled the organization of the data into five thematic axes, derived from the statements of the participants, identified as P1 to P22. To make this analytical movement more evident to the reader, **Table 1 below** summarizes the emerging categories and their respective descriptions.

Table 1 – Thematic categories emerging from the teachers' answers

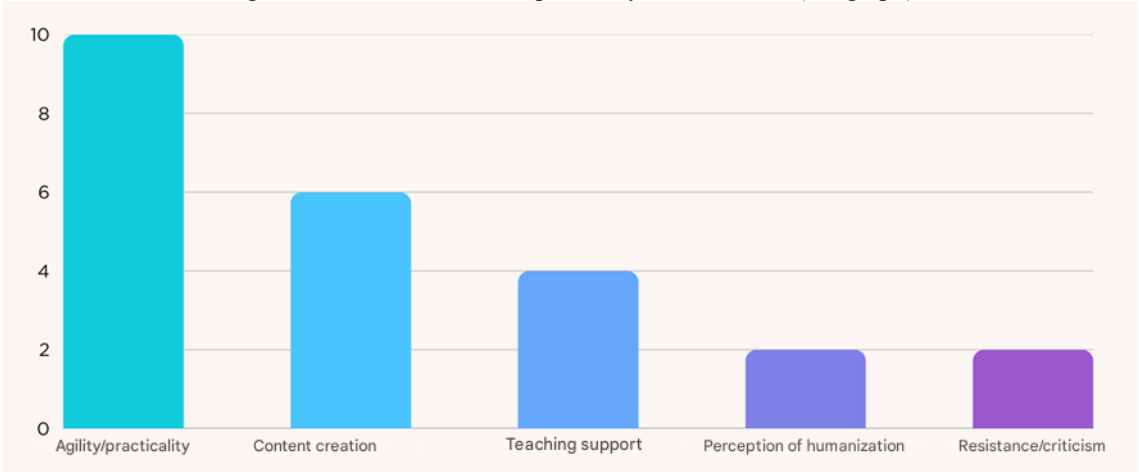
Category	Description
Agility and practicality	Speed in searching, synthesizing, and organizing information; saving time in the pedagogical routine.
Content creation	Generation of lesson plans, reports, activities, support texts, and personalized materials.

Support for teaching practice	Assistance in writing, planning, communication, and organization of the school routine.
Perception of humanization	Impressions that the AI presents responses with a sensitive, welcoming, or creative tone.
Resistance or criticism	Distrust, ethical fears, perception of imperfections, and concerns about inappropriate use.

Source: The authors, based on collected data (2025).

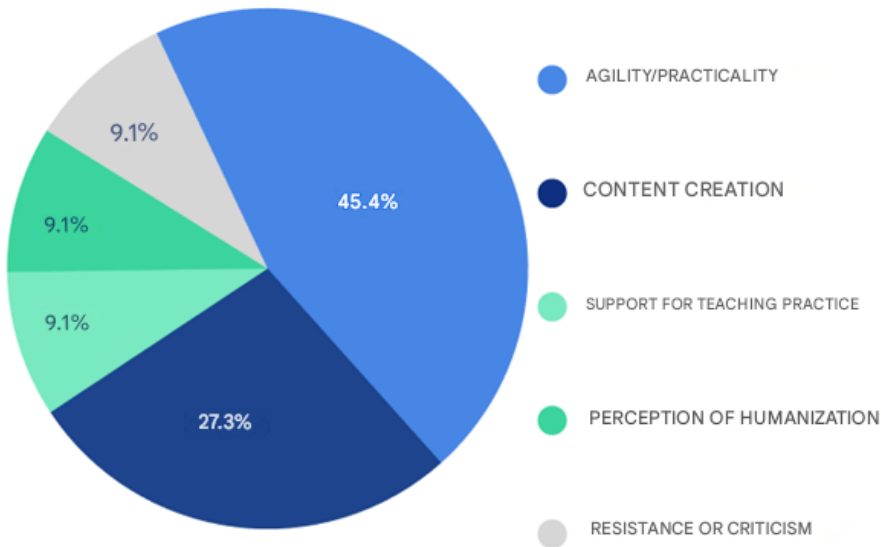
To enhance understanding of this categorical table, two graphs were created. These graphs illustrate the distribution of responses by thematic axis: Figure 1 displays the absolute frequency of each manifestation, while Figure 2 presents the percentage proportion of each category relative to the total responses.

Figure 1 – Distribution of responses by thematic axis (bar graph)



Source: survey data (2025).

Figure 2 – Manifestations on AI: main categories (pie chart)



Source: survey data (2025).

The graphs show the predominance of the categories "Agility and practicality" and "Content creation", followed by "Support for teaching practice", "Perception of humanization" and "Resistance or criticism". This numerical distribution dialogues with the excerpts presented in the following subsections, in which the meaning attributed by the teachers to each of these axes is deepened.

AGILITY AND PRACTICALITY

The first axis refers to agility and practicality. It concentrates speeches that highlight the speed with which AI locates, organizes, and presents information considered pertinent to the teaching work. Participants indicate that, in a few seconds, it is possible to obtain syntheses, examples, step-by-step guidelines or proposals for activities that would otherwise require more time for research and elaboration. This aspect is often associated with the overload of tasks at school, making AI a resource for optimizing available time.

The perception of agility and practicality appears to be predominant among teachers. The answers show that AI is seen as a resource that accelerates processes of searching, synthesizing, and creating information. Table 2 below presents a summary of the manifestations that make up this axis:

Table 2 – Examples of responses associated with the category "Agility and practicality."

Participant	Answers
P1	"The ability to elaborate, research, and create what was requested with such agility."
P4	"Agility and practicality."
P5	"Time optimization and data analysis."
P7	"The agility and ease of its use."
P8	"Practicality of developing tasks."
P12	"The ease of solving problems and quickly thinking of answers that favor our daily lives."
P13	"The speed in receiving answers to doubts."
P15	"Agility and practicality."
P16	"The speed with which information [...] are returned."
P18	"The ease of use."

Source: The authors, based on the data collected (2025).

The statements show that the perception of agility is articulated with a vision of AI as a tool that reduces the time spent on tasks of searching, organizing and synthesizing information, opening space for the teacher to dedicate himself to other dimensions of pedagogical work.

CONTENT CREATION

The second axis concerns content creation. In this group, teachers highlight AI's ability to suggest lesson plans, didactic sequences, exercise lists, support texts, and activities adapted to different age groups or learning levels. In some responses, this potentiality is seen as a possibility for expanding the pedagogical repertoire; in others, it appears to be associated with concerns about teacher authorship and the risk that the teacher will become excessively dependent on automated responses. **To make these perceptions more visible, Table 3 presents examples of statements in this category.**

Table 3 – Examples of speeches from the "Content creation" category

Participant	Answers
P3	"The speed with which the responses arrive [...] AI comes to support us in these times of distress."
P6	"Discovering how useful she can be in my profession as a nursery teacher [...] activities, lesson plans, reports, and personalized materials."
P9	"I didn't know about AI, creating reports, classes [...] in a humanized way."
P14	"The possibilities not only to ask questions, but to create personalized activities."
P19	"The detailed lesson plans."
P20	"Chatgpt."

Source: The authors, based on the data collected (2025).

These manifestations indicate that teachers recognize AI as a fertile field for expanding ideas, diversifying work proposals, and adapting materials to the needs of specific classes and age groups. At the same time, they point to the importance of this use taking place in a critical way, preserving the authorial and reflective role of the teacher.

SUPPORT FOR TEACHING PRACTICE

The third axis corresponds to support for teaching practice. Here are grouped reports that indicate AI as an aid in organizing the school routine, whether in writing texts, formulating justifications, revising documents, or orienting strategies for dealing with situations experienced in the classroom. **To illustrate these perceptions, Table 4 presents representative excerpts from the statements of the participants in this category.**

Table 4 – Examples of statements from the category "Teacher support"

Participant	Answers
P11	"The connection of understanding what I need to write or the information I need."
P17	"What surprised me most about artificial intelligence was realizing that it goes beyond technology: it can be sensitive, functional and help me grow personally, spiritually and emotionally, as a constant and realistic support."

Source: The authors, based on the data collected (2025).

These statements suggest that some teachers perceive AI as a partner in the planning and monitoring of their actions, even extrapolating the strictly pedagogical scope by mentioning personal and emotional dimensions.

PERCEPTION OF HUMANIZATION IN AI

The fourth axis concerns the perception of humanization in AI. Some teachers report surprise at the tone of the answers, which seem to them close to the human way of writing or speaking, especially when the systems assume a welcoming, explanatory or creative style. **To explain these perceptions, Table 5 presents excerpts from statements that illustrate this category.**

Table 5 – Examples of speeches from the category "Perception of humanization in AI"

Participant	Answers
P10	"Important. It's surprising."
P21	"1. Understanding of natural language, including slang and irony. 2. Creation of creative content, such as poems, stories, and songs. 3. Accurate translations in multiple languages. 4. Applications in health, such as diagnostics and analysis of exams. 5. Generation of images, videos and codes, based on simple descriptions. These abilities are impressive because they seem very human, even without real awareness."

Source: The authors, based on the data collected (2025).

The presence of this type of speech reveals that some participants tend to interpret the quality of the answers as an indication of a certain "humanity" of the systems, which reinforces the need to work, in formative processes, on the understanding that these are algorithmic models, even if they can simulate sophisticated interactions.

RESISTANCE OR CRITICISM

Finally, the fifth axis brings together manifestations of resistance or criticism. Although fewer in number, some responses indicate fears about the use of AI, either due to distrust in the veracity of the information or due to concerns about the replacement of functions traditionally assigned to the teacher. To highlight these perceptions, Table 6 presents representative excerpts from the statements in this category.

Table 6 – Examples of statements from the category "Resistance/criticism"

Participant	Answers
P2	"Knowing that with it people can develop activities and create techniques to surpass humans."
P22	"That it's not perfect, that it still needs to improve a lot."

Source: The authors, based on the data collected (2025).

Such positions reveal important tensions and point to the relevance of formative approaches that explicitly address the ethical, pedagogical, and social dimensions associated with AI, problematizing deterministic discourses and opening space for critical debate.

In summary, the participating teachers recognize artificial intelligence as a valuable resource capable of supporting pedagogical tasks, especially in organizing ideas, preparing materials, and saving time on school activities. However, they also have concerns about authorship, potential technological dependence, answer reliability, and the effects these tools may have on student learning. When examined within the theoretical framework, these perceptions highlight the need for teacher training that not only covers practical AI use but also promotes critical, context-aware, and ethically grounded understanding. This approach enables educators to make informed decisions that truly meet the needs of their pedagogical practice.

FINAL CONSIDERATIONS

This chapter aimed to understand how teachers of Early Childhood Education and the early years of Elementary School perceive artificial intelligence within the context of training on DICTs and AI in education. Analyzing responses to "What surprised you most about AI?" revealed a scenario marked by enthusiasm, pragmatism, and caution. Teachers see AI as a tool to save time, diversify activities, produce materials, and organize routines. However, they also express concerns about the teacher's central role, information accuracy, ethical limits, and students using AI uncritically.

This indicates that DICTs are already an unavoidable part of education, prompting debates that go beyond tools and challenge schools to rethink practices and training. It emphasizes the need to update teacher education to meet modern demands, preparing teachers to handle digital technologies—especially AI—critically, creatively, and ethically. Such updates should value teachers' practical experience, recognizing them as active agents in their development and profession.

The findings reaffirm the importance of policies and initiatives that promote teacher training on the technical, epistemological, and ethical foundations of AI, fostering a critical digital culture in schools. AI can support pedagogical work responsibly, with principles of social justice, inclusion, and respect for autonomy. Effective integration depends on connecting technological innovation, experiential knowledge, and pedagogical reflection to develop more dynamic, interactive, and contextualized educational practices.

Finally, this research is just a small contribution to the vast field exploring DICTs and AI as integral to education in Brazil. Nonetheless, it highlights emerging issues and provides elements to expand the debate on building an education system where digital technologies are fundamental to pedagogical action—without losing sight of the human, ethical, and relational aspects that underpin teaching.

REFERENCES

- BARDIN, L. *Análise de conteúdo*. São Paulo: Edições 70, 2011.
- CANTINI, M. C.; CORDENONZI, C.; LARA, E. O desafio do professor frente às novas tecnologias. In: EDUCERE – Congresso Nacional de Educação. Curitiba: PUCPR, 2006.
- CORTELLA, M. S. *Educação, escola e docência: novos tempos, novas atitudes*. São Paulo: Cortez, 2014.
- COSTA, F. A. et al. *Repensar as TDIC na educação: o professor como agente transformador*. Santillana, 2012.
- FERNANDES, J. P. et al. *Implicações éticas do uso da Inteligência Artificial na educação*. Revista Brasileira de Estudos Educacionais, 2024.
- FREIRE, P. *Pedagogia da autonomia*. São Paulo: Paz e Terra, 2021.
- FREIRE, P. *Educação e mudança*. Rio de Janeiro: Paz e Terra, 2022.
- GIRAFFA, L.; KOHLS-SANTOS, P. *Docência e tecnologias emergentes*. Cadernos de Educação, 2023.
- LEITE, L. S.; et al. *Tecnologia educacional*. Petrópolis: Vozes, 2009.
- LOPES, A. L. *Inteligência artificial e ética*. Revista Brasileira de Tecnologia e Sociedade, 2025.
- MORIN, E. *Os sete saberes necessários à educação do futuro*. São Paulo: Cortez, 2000.
- PICÃO, A. et al. *Riscos da IA na educação*. Revista Educação & Tecnologia, 2023.
- RICHARDSON, R. J. *Pesquisa social: métodos e técnicas*. São Paulo: Atlas, 1999.
- RUSSELL, S.; NORVIG, P. *Inteligência artificial*. 3. ed. Rio de Janeiro: LTC, 2016.
- SANTAELLA, L. *Cultura e artes do pós-humano*. São Paulo: Paulus, 2021.
- SCHUARTZ, A. S.; SARMENTO, H. B. M. *Tecnologias digitais de informação e comunicação e processos educativos*. Revista Katálisis, v. 23, n. 3, 2020.
- THEODORSON, G. A.; THEODORSON, A. G. *A modern dictionary of sociology*. London: Methuen, 1970.
- UNESCO. *Recomendação sobre a ética da inteligência artificial*. Paris: UNESCO, 2021.

THE CONTEMPORARY SCHOOL MANAGER: TECHNOLOGY MANAGEMENT IN THE EDUCATIONAL ENVIRONMENT

  10.56238/livrosindi202668-009

Geovana Ribeiro Bone

Pedagogue and Master's student in Education
Pontificia Universidade Católica do Paraná
E-mail: geovana.ribeiro@pucpr.edu.br

Melissa Tarasiuk Naufel Garcia

Pedagogue and Master's student in Education
Pontificia Universidade Católica do Paraná
E-mail: garcia.melissa@pucpr.edu.br

Patrícia Fonseca Ferreira Fleury

Dr. in Education, Career and Ethics
Pontificia Universidade Católica do Paraná
E-mail: patricia.ffleury@pucpr.br

INTRODUCTION

The successful execution of DICTs in education triggers the confrontation of several challenges by school management, which include the need for technical, structural, and financial investments, in addition to strategic educational planning.

In this sense, the gateway of DICTs into the educational environment permeates school management, and one of the main subjects of this process is the manager. From this perspective, the central question was developed: What is the role of the contemporary school manager in the management of technologies in the educational environment?

This work aims to theoretically analyze the management of technologies in the educational environment and indicate the role of a contemporary school manager in the face of this technological reality.

The relevance of this work lies in the intention to contribute to the dialogue and the improvement of the management practices of technologies in the educational context. By promoting a theoretical-critical debate on the management of technologies in education, this study seeks to assist managers, teachers, students and the community in general in the creation of more innovative educational environments.

To meet the proposed objectives, the work was developed of a theoretical nature and is based on a qualitative approach,

[...] The qualitative approach delves into the world of meanings. This level of reality is not visible, it needs to be exposed and interpreted, in the first instance, by the researched themselves [...] and, in the second instance, by a contextualized comprehensive and interpretative process (Minayo, 2016, p. 7).

With a bibliographic research, which "allows the researcher to have access to the knowledge already produced on a given subject" (Brito, Oliveira e Silva, 2021, p. 6), this study is characterized by the analysis and synthesis of concepts related to the theme of school management and digital technologies, focusing on the protagonism of the school manager.

For the development of the theoretical framework and later the reflections, articles, books and digital versions of works (e-books) were consulted. The databases were the Biblioteca On-line of the Pontifical Catholic University of Paraná (PUCPR) and the SciELO platform.

SCHOOL MANAGEMENT

School management is understood in different ways, as it involves the organization and administration of the physical structure of the school, in addition to being attentive to teaching, to ensure the advancement of the teaching-learning process and to manage the institution.

In principle, normative infidelity, in the theme of school management, is a way for principals and vice-principals, considering the conditions of the school, students, teachers and all those who work in it, to respond autonomously to external norms, opposing the possible mechanical relations that could be imposed on them, as actors in the schools (Werle and Fonseca, 2025, p. 5).

In the field of school management, the concept of normative infidelity refers to the ability of managers to critically interpret and adapt external norms to the specificities of the institution. This practice implies the exercise of responsible autonomy, which seeks to avoid the mechanical application of guidelines that often do not contemplate the complexity of daily school life.

This work depends on the view that its managers have over it, and can be configured as centralized management, in which individuals are passive and mere observers of the educational process, with a predominance of hierarchization of the functions assigned to the positions. Or, on the contrary, it can be understood as a democratic space, whose environment is collectively constructed and knowledge is shared, so that everyone is active

and participating, and everyone works together for the same goal. In a socio-critical perspective of school management, Libâneo (2013, p. 32) observes that:

[...] The school is seen as an educational space, a learning community built by its components, a place where professionals can decide about their work and learn more about their profession. The organization and management of the school acquires a much broader meaning, beyond referring only to administrative and bureaucratic issues.

The school should be understood as a dynamic and collaborative organism, and not as a physical and static structure. The construction of knowledge and experiences in this environment is a collective process, continuously shaped by the interactions between students, teachers, managers, employees, and also by the external community. The essence of this perspective is the emphasis on collectivity and collaboration as fundamental foundations of the educational process.

The concept of participation is based on the principle of autonomy, which means the capacity of people and groups to freely determine their own lives. As autonomy is opposed to authoritarian forms of decision-making, its concrete realization in institutions occurs through free participation in the choice of objectives and work processes and in the joint construction of the work environment (Libâneo, Oliveira and Toschi, 2003, p. 328).

Thus, it is essential to have the participation of all segments of the school in decision-making processes to better understand teachers' perceptions of students' needs and difficulties. In the same way, the encouragement of participatory practices in the construction of planning, organization, and execution of pedagogical work contributes to the deepening of the understanding of institutional functions and goals and, consequently, to the strengthening of the interaction between the management and pedagogical team, teachers and students, families, and the community.

School principals and managers must act to apply practices and manage actions that consider these perspectives, taking into account that participatory and democratic school management is a guiding principle for the effectiveness of teaching, according to Law No. 9,394, of December 20, 1996, which establishes the Guidelines and Bases of National Education (LDB), in its 14th Article it provides:

The law of the respective States and Municipalities and of the Federal District shall define the norms of the democratic management of public education in basic education, according to its peculiarities and in accordance with the following principles: I - participation of education professionals in the elaboration of the

school's pedagogical project; II – participation of the school and local communities in School Councils and in School Council Forums or equivalent (BRASIL, 1996).

In this sense, the LDB becomes a key pillar by establishing the obligation of democratic management in public schools (private schools do not need to follow the public-school model but must align with and follow the legislation's principles). Thus, the Union grants autonomy to the States and Municipalities to organize their management democratically, respecting the realities of each segment and region. This makes it possible, for example, for an educational institution in a rural area to establish a different school management model than one in an urban center.

With the school management exercising this leadership factor in promoting the participation of all, when taking the lead in the institution's initiatives, Heloisa Lück (2014, p. 97) mentions that:

The concept of management does not diverge from the proposed understanding of leadership. On the contrary, it has many ideas in common with it, since management is indicated as a process through which human talent is mobilized and coordinated, collectively organized, so that people, as a team, can promote desired results.

Leadership exercises decentralization of decision-making and promotes autonomy, enabling the democratic process (Lück, 2013). However, the participation of all those involved in the school environment is necessary, especially in decision-making actions, because defining objectives and seeking solutions to problems should not be an exclusive attribution of the management team, but a collective process that integrates the contributions of the faculty, students and civil society, in a coordinated way, so that each function within the institution is carried out as part of an articulated whole.

MANAGEMENT OF DIGITAL TECHNOLOGIES IN THE SCHOOL ENVIRONMENT

Digital Information and Communication Technologies (DICTs) are characterized by the manipulation and creation of network connectivity, such as the use of the *internet*, digital media, such as videos, audios, interactive texts, virtual environments, etc., going beyond just computers and devices, encompassing systems, processes and mass communication, being social resources and practices that circulate through the digital space, and for human history (Kenski, 2014; Bates, 2017).

Reflecting on the concept of DICTs helps us understand their depth and impact on society, including education. Technologies are not neutral instruments (Kenski, 2010), it is human creation that modifies the way we live and interact with the world, reconfiguring the relationship between subject, knowledge, and environment.

In the educational context, DICTs mediate and transform learning; they reorganize space and time, not only in a single space like the classroom, but also in the availability of knowledge and learning processes anywhere (Moran, 2022). DICTs redefine roles, the figure in the centrality of the teacher changes to the mediation and orientation of knowledge, and the student becomes an active subject, who seeks and promotes his own learning (Kenski, 2013).

Education with technologies, especially digital ones, should prepare students not only to use tools, but to develop critical thinking, creativity, collaboration, and essential skills in the face of a digital culture.

It is important that the school has the autonomy to make decisions about its pedagogical project, integrating the use of available DICT, so that this use can be incorporated into its daily life and culture, its pedagogical and management activities, and its relations with different social spaces of culture and knowledge production (Santos, 2012, p. 128).

The author emphasizes the importance of strategic planning, and, as mentioned earlier, collective decisions are part of implementing DICTs in the educational environment in an intentional and articulated way, considering the realities of the school's surroundings as well as the needs and objectives of each learner.

Technology in education should not be just for transmitting content, but rather for helping the construction of knowledge, where culture and collective and individual history begin to contribute and grow together. And to build a welcoming and transformative environment, it is necessary to listen attentively and engage in dialogue with the professionals who work in the school, as well as with the students who are part of this environment. With this thought, Paro (2007, p. 25) points out that:

If true democracy is characterized, among other things, by the active participation of citizens in public life, considered not only as "holders of rights", but also as "creators of new rights", it is necessary that education be concerned with providing them with the cultural capacities required to exercise these attributions, thus justifying the need for public schools to take care of the in a planned and not just diffuse way, of an authentic formation of the democrat.

The school must carry out important actions for the consolidation of participatory actions and autonomy, because it is in the educational space that critical citizens are formed, aware and capable of intervening in the reality in which they are inserted. By promoting values such as dialogue, cooperation and respect for diversity, the school institution contributes not only to the construction of knowledge, but also to the integral strengthening of the subject, creating conditions for each individual to participate actively and transformatively in society.

To implement plans that integrate DICT in Education, it is essential to know the school, its spaces, the maturity in terms of DICT knowledge of the actors (teachers, managers, and students) of the educational process and, not least, the social context of the community (Schuhmacher, Oliveira, Schuhmacher, 2024, p. 13).

Thus, it is essential that the school management acts as a facilitator in the promotion of essential knowledge to improve the teaching and learning process, observing the reality of the institution and listening to individuals and the community to understand what the greatest needs of these young people are. With the use of DICT, it is possible to integrate these desires in a more effective and meaningful way, contributing to teaching actions and making classes more dynamic, interactive and shared with the school's surroundings.

It is necessary to train both students and teachers, so that they can make the most of the possibilities of collaborative and interactive learning provided by these digital devices, as well as develop materials compatible with their propitiations or possibilities (Azzari; Lopes, 2013, p. 207).

It is up to school management to ensure the necessary conditions for students and teachers to use digital technologies effectively. This includes promoting continuous training, guiding the development of pedagogical materials aligned with technological potential, and ensuring that such resources are incorporated into the school's daily life in a planned and intentional way. Thus, management strengthens its strategic role by promoting innovative practices and a school culture based on participation, collaboration, and meaningful learning, and by integrating digital technologies.

In this context, the integration of DICTs into school management is a fundamental element for enhancing educational practices aligned with contemporary demands. When incorporated in a planned and intentional way, technologies expand learning possibilities, favor communication between the different actors in the school community and promote greater student autonomy.

However, for these benefits to materialize, the management faces important challenges, such as the continuous training of teachers, the need for adequate infrastructure, and the commitment to ensure the ethical and responsible use of digital tools. In other words, it is essential to reflect on the specific needs of each institution, so that the training makes sense in that reality and so that the learning can be applied by teachers, not being just theoretical training, but allowing professionals to understand, in practice, its relevance.

Thus, it is incumbent on school managers to act strategically, democratically, and collaboratively, knowing and ensuring that DICTs effectively contribute to an innovative, equitable education committed to social transformation. For this, school management needs to promote, support, and manage training, listening, and participatory planning actions.

THE INTEGRATION OF DIGITAL TECHNOLOGIES AS ENHANCERS OF TEACHING WORK

The constant presence of intelligent devices, platforms, and systems transforms not only the modes of interaction, but also the ways of learning, working, and producing knowledge. In this context, discussing access to technologies and their implications for education requires a reflection that goes beyond instrumental use, recognizing their cultural, social, and cognitive dimensions.

In the meantime, universalizing access to digital technological resources is urgent, but not enough. This is because access to digital technologies cannot be understood only as the ability to use tools and applications. It is a deeper and more structured dimension of contemporary life, which involves the ability to understand, criticize, and transform the digital world in which we are immersed. In this sense, technology should be seen as a cultural, social, and epistemological phenomenon (Bellardo; Menezes, 2025, p. 73).

The technological inequalities that exist in Brazilian education are undeniable, especially in relation to the physical structure, availability of materials and investments necessary for inclusion and social justice. In this scenario, the mere availability of equipment does not guarantee overcoming these barriers, as the digital divide is also manifested in inadequate teacher training, the absence of sustained public policies, and the difficulty of integrating technology meaningfully into the curriculum.

Furthermore, it is essential to understand the power that technology exerts in human life, as it undergoes several transformations in society. Therefore, it is necessary to study and understand it in its entirety, because "it is a responsibility towards the new generations,

especially if one takes into account the fact that many do not understand what technology is and what place it should occupy in the lives of human beings" (Silva, 2013, p. 840).

In view of this, it is evident that teacher training needs to go beyond technical instrumentalization to incorporate a critical and reflective understanding of the role technology plays in society and, consequently, in schools. It is essential that teachers, managers, and coordinators recognize that technologies are not obstacles but powerful resources to enrich pedagogical practices, expand forms of expression, and foster more meaningful learning processes.

With a world increasingly incorporated by digital technologies, which demand knowledge and techniques, teacher training based on multiliteracy (The New London Group, 2006) and the development of digital skills, becomes a palpable path for the coherent use of technologies in education as enhancers of teaching, contributing to equity of access and information in a critical and collaborative way.

To account for contemporary realities, multiliteracy and digital skills expand the traditional idea of teaching. When implementing DICT, it is necessary to recognize that communication today is not just about words; students are immersed in videos, images, designs, and gestures that convey meaning in the digital environment (Ferro, Noronha, and Campos, 2025).

Our society is globalized and diverse, and the school, under the responsibility of managers and teachers, in its formation, consider cultural multiplicity (The New London Group, 2006), combined with multiliteracy and digital skills, recognizing must consider, in its formation, cultural multiplicity (The New London Group, 2006), combined with multiliteracy and digital skills, understanding that different cultures and social groups produce meanings in different ways. For example, when considering that its students use social networks, which require specific ways of acting, speaking, thinking, communicating and expressing ideas, it is necessary for the school to be able to promote debates, so as not to encourage inequalities, prejudice and misinformation.

To foster democratic and innovative management that adapts to technological and cultural changes, and provides teacher training aligned with available resources, school actors (managers, teachers, and students) need digital skills. These skills enable them to interpret data, combat disinformation, and use technological tools for collaborative problem solving. Developing digital skills in managers and teachers is crucial, as it involves applying new knowledge in response to specific demands (Silva and Behar, 2019). School management should strategically plan the use of DICTs by mapping existing

knowledge and identifying areas for development within their local context, considering internal and external demands from teachers, students, and the community. According to Bock, Oliveira, Sataradub, and Brito (2025, p. 103), "Thinking about technology in the educational field requires overcoming reductionist views that limit it to machines, software, or equipment." Instead of dismissing or viewing technology as an issue, schools and education professionals should embrace their possibilities, creating pedagogical approaches that align with students' realities and foster comprehensive, critical, and citizen education.

Therefore, establishing a dialogue and listening relationship between teachers and school management is essential so that the latter understands how teachers perceive technology, as "understanding how teachers conceptualize technology is important, as their perceptions directly influence pedagogical practices, the choice of resources, and their interaction with students" (Bock et al., 2025, p. 87).

Understanding teachers' perceptions of technologies helps us recognize their potential as well as their concerns, training gaps, and working conditions. When management listens to and values these perspectives, it creates opportunities for developing more practical, context-specific strategies that genuinely address the needs of the school and its community.

Another essential aspect is to recognize that the integration of technologies in the educational environment should not occur in an imposing way or disconnected from pedagogical practice. On the contrary, it needs to emerge from dialogical processes that consider teachers' knowledge, their experiences and the formative objectives that guide school work. Only in this way can technology be incorporated as an ally, and not as an obstacle, in the promotion of meaningful learning, encouraging more dynamic, collaborative methodologies aimed at student autonomy.

In this still nebulous scenario, in which doubts proliferate, there is at least one certainty – the one that underlines the relevance and centrality of teacher training for the pedagogical, ethical and critical use of new technologies and the potential of AI in personalizing learning and mitigating inequalities in access to knowledge. However, these are political choices, they go far beyond the technical (Bellardo; Menezes, 2025, p. 84).

It is evident that the effective integration of digital technologies in the educational environment depends, above all, on training projects and institutional decisions that recognize the complexity of these processes. It is not enough to provide tools; It is

necessary to build conditions so that teachers can critically understand their uses, question their limits and explore their pedagogical possibilities.

Thus, assuming that such political choices means recognizing that educational transformation requires intentionality, planning, and commitment to equity. Only through this perspective is it possible to ensure that technologies contribute, in fact, to a more humane, democratic and socially just education.

FINAL CONSIDERATIONS

For technologies to be allies and enhancers of student learning and to contribute to the school environment, they need management, strategic articulation, and, especially, clear objectives for their use.

It is concluded that school management, and especially the manager, becomes a contemporary manager in the face of the digital age and post-pandemic education. He assumes the role of agent responsible for the implementation of DICTs, not only in their application but also in their intentionality, resulting in innovative actions. He is also responsible for ensuring that the principles of educational processes are allied to digital technologies, through democratic and participatory management.

We have the role of the contemporary manager in educational management with practices that require the ability to communicate, solve problems, organize, creativity, and a sense of team (Rossi et al., 2021). His role is fundamental in the development of cooperative actions. In the face of the demands of the implementation of technologies, he becomes a leader in this process.

By intending to implement digital technologies in the school environment, the manager's presence is validated in the dialogue with students, teachers, and the community in the inclusion of DICTs in the school's Pedagogical Political Project (PPP), clearly and objectively outlining what they want to enable through these resources.

The search for the training of school subjects also permeates the manager, who must be aware of the demands regarding the use of TDICs, together with regulatory frameworks such as the BNCC when establishing the development of Digital Culture, and the National Digital Education Policy (Law No. 14,533/2023), which integrates digital technologies in teaching, promoting digital inclusion, computational thinking, and training for teachers and students.

To be a contemporary manager and insert DICTs in pedagogical actions, it is necessary to go beyond just managing the institution in bureaucratic issues, and it is usual

to analyze the challenges in the face of technological resources, such as materials, structure, financial, technical training, etc. Going above and beyond means taking on a role as an educational, community, and innovative leader.

Its intentionality must promote that technologies place students as important subjects for that space, that they articulate actions and proposals, so that they feel welcomed, included, and prepared for a technological future, through critical sense, ethics, and responsibility.

In an increasingly digital world, the contemporary manager is the agent of technological transformation, promoting the integration of DICTs in a meaningful, relevant way and as part of pedagogical strategies, presenting that they are enhancers of participatory work, promoting an educational and innovative environment.

REFERENCES

AZZARI, Eliane Fernandes; LOPES, Jezreel Gabriel. Interatividade e tecnologia. In: ROJO, R. (Org.). *Escol@ conectada: os multiletramentos e as TICs*. 1ª ed. São Paulo: Parábola, 2013.

BATES, Tony. *Educar na Era Digital: design, ensino e aprendizagem*. 1ª ed. São Paulo: Artesanato Educacional, 2017. Disponível em: <http://repositorio.asc.es.edu.br/handle/123456789/3167>

BELLARDO, Waldirene Sawozuk; MENEZES, Basileu Gomes de. *Tecnologia, Trabalho Docente e Desigualdades Educacionais: o que revelam os dados do censo escolar 2024*. Glaucia da Silva Brito. Luciano Frontino de Medeiros. Daniel Guimarães Tedesco (Org.). *Educação e tecnologias: entre desafios sociais e inovações pedagógicas*. 1ª ed. Curitiba: Editora Bagai, 2025. Disponível em: <https://editorabagai.com.br/product/educacao-e-tecnologias-entre-desafios-sociais-e-inovacoes-pedagogicas/>. Acesso em: 10 nov. 2025.

BOCK, Maria Lediane; OLIVEIRA, Rosilene Souza de; STARADUB, Samara; BRITO, Gláucia da Silva. *Concepções Docentes sobre Tecnologia: perspectivas de professores de diferentes níveis de ensino*. Glaucia da Silva Brito. Luciano Frontino de Medeiros. Daniel Guimarães Tedesco (Org.). *Educação e tecnologias: entre desafios sociais e inovações pedagógicas*. 1ª ed. Curitiba: Editora Bagai, 2025. Disponível em: <https://editorabagai.com.br/product/educacao-e-tecnologias-entre-desafios-sociais-e-inovacoes-pedagogicas/>. Acesso em: 10 nov. 2025. 2025.

BRASIL, Diário Oficial da União. Lei nº 14.533, de 11 de janeiro de 2023. Institui a Política Nacional de Educação Digital. Disponível em: https://www.planalto.gov.br/ccivil_03/_ato2023-2026/2023/lei/14533.htm. Acesso em: 10 nov. 2025.

BRASIL, Ministério da Educação. Lei nº 9.394, de 20 de dezembro de 1996. Dispõe sobre as Diretrizes e Bases da Educação Nacional. Disponível em: https://www.planalto.gov.br/ccivil_03/leis/19394.htm. Acesso em: 20 set. 2023.

BRITO, Ana Paula Gonçalves; OLIVEIRA, Guilherme Saramago de; SILVA, Brunna Alves da. A importância da pesquisa bibliográfica no desenvolvimento de pesquisas qualitativas na área da educação. *Cadernos Fucamp*, Minas Gerais, v. 20, n. 44, 2021. Disponível em: <https://revistas.fucamp.edu.br/index.php/cadernos/article/view/2354>. Acesso em 25 jul. 2025.

FERRO, Jeferson; NORONHA, Cássio Barbosa; CAMPOS, Marlise Viana da Nóbrega. *Competências Digitais e o Uso da Inteligência Artificial na Educação*. Glaucia da Silva Brito. Luciano Frontino de Medeiros. Daniel Guimarães Tedesco (Org.). *Educação e tecnologias: entre desafios sociais e inovações pedagógicas*. 1ª ed. Curitiba: Editora Bagai, 2025. Disponível em: <https://editorabagai.com.br/product/educacao-e-tecnologias-entre-desafios-sociais-e-inovacoes-pedagogicas/>. Acesso em: 10 nov. 2025.

KENSKI, Vani Moreira. *Educação e tecnologias: o novo ritmo da informação*. 7ª ed. Campinas, SP: Papyrus, 2010. E-book. Disponível em: <https://plataforma.bvirtual.com.br>. Acesso em: 25 jul. 2025.

KENSKI, Vani Moreira. Tecnologias e ensino presencial e a distância. Campinas, SP: Papirus, 2013. E-book. Disponível em: <https://plataforma.bvirtual.com.br>. Acesso em: 03 ago. 2025.

KENSKI, Vani Moreira. Tecnologias e tempo docente. Campinas, SP: Papirus, 2014. E-book. Disponível em: <https://plataforma.bvirtual.com.br>. Acesso em: 02 ago. 2025.

LIBÂNEO, José Carlos. Organização e Gestão da Escola: Teoria e Prática. 6ª ed. São Paulo: Heccus, 2013.

LIBÂNEO, José Carlos; OLIVEIRA, João Ferreira de; TOSCHI, Mirza Seabra. Educação escolar: políticas, estrutura e organização. 3ª ed. São Paulo: Cortez, 2003.

LÜCK, Heloísa. A gestão participativa na escola. 1. ed. São Paulo: Vozes, 2013. E- book. Disponível em: <https://plataforma.bvirtual.com.br>. Acesso em: 10 ago. 2025.

LÜCK, Heloísa. Liderança em gestão escolar. 1. ed. São Paulo: Vozes, 2014. E- book. Disponível em: <https://plataforma.bvirtual.com.br>. Acesso em: 10 ago. 2025.

MINAYO, Maria Cecília de Souza. Pesquisa social: teoria, método e criatividade. 1ª ed. Petrópolis: Vozes, 2016. E-book. Disponível em: <https://plataforma.bvirtual.com.br>. Acesso em: 25 jul. 2025.

MORAN, José Manuel. A educação que desejamos: novos desafios e como chegar lá. 1ª ed. Campinas, São Paulo: Papirus, 2013. E-book. Disponível em: <https://plataforma.bvirtual.com.br>. Acesso em: 07 jul. 2025.

MORAN, José Manuel; MASETTO, Marcos T.; BEHRENS, Marilda Aparecida. Novas tecnologias e mediação pedagógica. 1ª ed. Campinas, SP: Papirus, 2022. E-book. Disponível em: <https://plataforma.bvirtual.com.br>. Acesso em: 05 jul. 2025.

PARO, Vitor Henrique. Gestão escolar, democracia e qualidade de ensino. 1ª edição. São Paulo: Ártica, 2007.

ROSSI, Jéssica de Cássia; SCHOLZ, Robinson Henrique; MORESCO, Marcielly Cristina; SOUZA, Ana Clara Aparecida Alves de; STEFFEN, Janice; AFFONSO, Ligia Maria Fonseca; CRUZ, Livia da. Desenvolvimento Gerencial e Liderança. Sagah, PortoAlegre, 2021. E-book. Disponível em: <https://integrada.minhabiblioteca.com.br/#/books/9786556901183/>. Acesso em: 09 ago. 2025.

SANTOS, Edméa. Currículos - Teorias e Práticas. Rio de Janeiro, LCT, 2012. E-book. Disponível em: <https://app.minhabiblioteca.com.br/reader/books/978-85-216-2143-0/>. Acesso em: 06 ago. 2025.

SANTOS, Edméa. Série Educação - Currículos - Teorias e Práticas. Rio de Janeiro: LTC, 2012. E-book. p.128. Disponível em: <https://app.minhabiblioteca.com.br/reader/books/978-85-216-2143-0/>. Acesso em: 10 ago. 2025.

SCHUHMACHER, Vera Rejane Niedersberg; OLIVEIRA, Eliane Damian de Bona de; SCHUHMACHER, Elcio. A epistemologia do obstáculo docente no uso da Tecnologia Digital da Informação e Comunicação. *Ciência & Educação*, Bauru, v. 30, e24031, 2024. Disponível em: <https://doi.org/10.1590/1516-731320240031>. Acesso em: 31 ago. 2025.

SILVA, Gildemarks Costa e. Tecnologia, educação e tecnocentrismo: as contribuições de Álvaro Vieira Pinto. *Revista Brasileira de Estudos Pedagógicos*, Brasília, v. 94, n. 238, p. 839-857. Disponível em: <https://www.scielo.br/j/rbeped/a/8yzpyFXhFS3bHdpCRsgGRtH/abstract/?lang=pt>. Acesso em: 08 nov. 2025.

SILVA, Ketia Kellen Araújo da; BEHAR, Patricia Alejandra. Competências Digitais na Educação: uma discussão acerca do conceito. *Educar em Revista*, Rio Grande do Sul, v. 35, 2019. Disponível em: <https://www.scielo.br/j/edur/a/wPS3NwLTxtKgZBmpQyNfdVg/?lang=pt>. Acesso em: 10 nov. 2025.

THE NEW LONDON GROUP. A pedagogy of multiliteracies: Designing social futures. In: COPE, B.; KALANTZIS, M. (ed.). *Multiliteracies: Literacy learning and the design of social futures*. London: Routledge, 2006.

WERLE, Flávia Obino Côrrea; FONSECA, Jorge Alberto Lago. Gestão escolar: fundamentação e discussões acerca da gestão democrática. *Ensaio: aval. pol. públ. Educ.*, Rio de Janeiro, v.33, n.126, p. 1-20, jan./mar. 2025. Disponível em: <https://doi.org/10.1590/S0104-40362025003304968>. Acesso em: 10 set. 2025.

SEASONAL LEARNING SKILLS: EMERGING (DIGITAL) LITERACIES IN TEACHER TRAINING

  10.56238/livrosindi202668-010

Everson Luiz Oliveira Motta

Glaucia da Silva Brito

INTRODUCTION

Understanding literacy involves going beyond simple word recognition to include the ability to interpret and assign meaning to texts. Soares (2017, p. 17) states that "undoubtedly, literacy is a process of representing phonemes and graphemes, and vice versa, but it is also a process of understanding/expressing meanings through the written code." In this context, the concept of literacy is crucial, as it pertains to the social use of writing. According to Soares (2020, p. 27), literacy is the "ability to use writing to participate in social and personal practices involving written language," which encompasses skills such as reading for information, communication, imagination, and orientation.

Although related, literacy and literacy development are distinct processes that must occur simultaneously and in an integrated manner. As Soares (2020, p. 27) explains, "literacy and literacy are distinct cognitive and linguistic processes, [...] however, [...] they are simultaneous and interdependent processes." Therefore, children must learn to read and write while understanding the social functions of language. Literacy is a social competence that enables full participation in cultural and social practices involving reading and writing.

This is especially important in digital contexts, which require multifaceted skills of comprehension and analysis. Kleiman (2007, p. 16) emphasizes that literacy constructs, as an object of knowledge, reflect the impacts and social dimensions of language, showing how various forms of language relate to culture and social practice. When reading, writing, and creativity come into play, they transcend technical skills to become meaningful ways of understanding the world and society by engaging within their social context, allowing individuals to comprehend, critique, and interact with their surroundings and technological tools.

The idea that teachers do not need to master all technological mechanisms to use digital resources pedagogically rests on the notion that, even without complete technical

mastery, teachers can foster new forms of interaction and learning opportunities. As Kleiman (2014, p. 85) notes, "The multiple contemporary intersemiotic literacy practices demand from the reader and producer of texts more and more skills and abilities to read and approach information whose interpretation (and production) triggers a combination of media." Consequently, in contemporary times, literacy is a vital element in shaping independent and critical individuals capable of contributing to social change.

Kleiman (2014) critically highlights how the Brazilian educational system has historically prioritized literary canons and practices validated by prestigious institutions, often at the expense of functional, everyday reading essential to social life. He advocates that "This needs to be changed so that the school becomes less elitist, traditional and authoritarian and starts to embrace the goals of the contemporary school and to disseminate the literacy practices – in fact, of access to information in this society – to those who have been barred from school throughout Brazilian history." Moving away from elitism means recognizing that literacy is not limited to tradition but must expand as a right to full access to information and social participation.

This study addresses the challenge of rethinking teacher training and digital literacies amid the increasing integration of digital technologies and the innovations that artificial intelligence brings to the school environment. How can we prepare teachers to navigate these technological advancements critically and ethically without reducing knowledge to superficial or utilitarian practices? Silva and Behar (2019) organize, in an analytical table, relationships among literacy, fluency, and help us understand the complexity of contemporary formative processes.

It becomes clear that digital literacy is neither static nor simple; it is an evolving concept defined by strong meanings and generational societal influences. When extending this discussion to Distance Education (EAD), digital literacy emerges not only as a technical skill but also as a vital pedagogical area, with Behar's insights highlighting the practices and challenges of teaching and learning in the 21st century.

Traditional literacy is defined as the acquisition of basic reading and writing skills. Digital literacy, however, involves integrating technologies, recognizing that reading and writing are inseparable from digital tools, which must be viewed as complementary processes.

Literacy also refers to the ability to assert oneself and engage socially while maintaining a shared worldview and a strong cultural identity. Digital literacy expands this by emphasizing the ability to understand, use, and produce information through digital

technologies, engaging in reading and writing practices on screens, distinct from traditional paper-based methods.

Fluency, seen as a skill for spontaneous expression linked to information and communication technologies (ICT), pertains to an individual's competence in assessing, selecting, and effectively using digital tools in personal and professional contexts.

In this new context, digital literacy extends beyond mere device handling and involves the capacity to read, interpret, and interact across various languages and digital media—such as texts, images, videos, audios, hypermedia, and interactive interfaces. Each digital platform has its own logic for producing and sharing meaning, demanding not only technical skills but also reflective awareness of what users communicate and how. Developing an active approach to technological mediations, with an understanding of their social, cultural, and epistemological impacts, is crucial (Silva; Behar, 2019).

Integrating multiliteracies into teaching practices is crucial, as they recognize various forms of language and representation that shape modern communication. These include different media and the cultural, linguistic, and contextual factors involved in meaning-making (Rolim-Moura; De Castro, 2023). According to Schlemmer and Moreira (2020, p. 107), multimodality involves "the modality of education that hybridizes different modalities, combining electronic learning, mobile learning, pervasive learning, ubiquitous learning, immersive learning, gamification, and Game-Based Learning (GBL)." Understanding this complex landscape can significantly improve teacher training.

This paper critically examines how emerging digital literacies integrate with teacher training in the Onlife society. It explores the relationship between literacy, fluency, and learning skills, along with the challenges posed by digital technologies, usability issues, hyperconnection, and datafication. The goal is to understand how teachers can cultivate critical, ethical, and reflective pedagogical practices within a complex informational ecosystem—highlighting curatorial processes, network interaction, and lifelong learning—to develop teaching methods that meet the epistemological, sociotechnical, and curricular demands of the twenty-first century.

The research approach is qualitative and exploratory, grounded in theoretical and analytical methods. It combines a theoretical-integrative review of classical and contemporary educational and sociotechnical theories with a hermeneutic-critical analysis of concepts related to digital literacies, educational curatorship, and teacher training within the Onlife context (Alvarenga et al., 2024). Through this synthesis, foundational arguments are developed to understand how practices such as reading, writing, mediation, and

learning are being reshaped in hybrid informational ecosystems characterized by datafication, hyperconnectivity, and algorithmic mediation.

TECHNOLOGIES FOR LITERACIES

According to Álvaro Vieira Pinto's philosophy, technology is not merely a set of artifacts or instruments, but a concrete expression of human power to transform the world through applied knowledge. For Vieira Pinto (2005), technique is inseparable from the social consciousness that produces it, being a historical mediation between knowledge and action. Technique, in this context, gains value to the extent that it is critically appropriated by the subjects, becoming an instrument not of submission, but of liberation and epistemic sovereignty.

When we talk about technical usability, we refer to the functional capacity of digital tools, that is, how well a device or software meets operational requirements for its users, easily and efficiently. According to the ISO 9241:11 (1998) standard, usability is "the ability of a product to be used by specific users to achieve specific objectives effectively, efficiently, and satisfactorily in a specific context of use". This concept is essential in the integration of ICT in the educational context, since products with good technical usability favor technological adoption, even among those who are not familiar with certain digital resources.

For Margarida Farias Coelho, Martins Costa and Oliveira Motta (2021), technical usability refers to how functional and intuitive a technological tool is, making it easier for the teacher and the student to use their resources to achieve specific goals, without encountering obstacles in the operation of the device or software. On the other hand, pedagogical usability focuses on how these tools can be integrated into the educational context to enrich and improve teaching practice. Unlike technical usability, pedagogical usability is not restricted to human-machine interaction but broadens its scope to promote interpersonal relationships in the teaching process. This means that by integrating technologies with high pedagogical usability, the educational environment is enriched, enabling more meaningful interactions between teachers and students.

Thus, we conceptualize pedagogical usability as the potential of technological tools to facilitate teaching and stimulate critical thinking, respecting social dynamics and individual learning needs. It is this pedagogical dimension of usability that makes digital literacy not just a technical skill, but a key element for developing digital citizenship and critical autonomy in the educational process.

In the field of Human-Computer Interaction (HCI), the usability of a system is defined by fundamental criteria that aim to ensure satisfactory user experience. According to Preece, Rogers and Sharp (2005, p. 35), "the factor that ensures that products are easy to use, efficient and enjoyable, from the user's perspective," a system is considered usable when it has five main characteristics: **efficiency of use, safety, affordance, ease of learning, and ease of memorization**. These elements are essential, especially in the educational context, where technology should serve to facilitate learning rather than be an additional barrier to the pedagogical process.

Also in this context, the authors discuss an earlier proposal by Nelson (1980, apud Preece; Rogers; Sharp et al., 2005, p. 37), known as the "**ten-minute rule**", which suggested that software, in order to be considered truly effective, should be understood and used in all its functionality within ten minutes. However, the authors themselves criticize this rule, as it disregards the complexity of the cognitive processes involved in learning and the diversity of user profiles, especially among teachers, who often face challenges in fully exploiting available technological tools.

The ten-minute rule is a criterion for evaluating a system's ease of use. According to Nelson (1980), if a novice user can use the system in less than ten minutes, the system is considered effective. Otherwise, it fails in this regard. Rubinstein and Hersh (1984) argue that many computational systems do not meet this criterion. To create systems that are easier to use, designers should draw on people's knowledge. As an example, Rubinstein and Hersh state that a complex computing system, such as those used by architects, is not expected to be intuitive enough to operate quickly, unlike simpler systems. The ten-minute rule requires that the user already has some knowledge about the system, which is not always possible.

However, this criterion does not apply to more complex systems. For example, when thinking about what an airline pilot would need to learn, it is expected that he will spend a considerable amount of time learning to use all the controls and devices in the cockpit, not just ten minutes. The idea that ten minutes would be enough to master a complex system, such as those used by pilots or in systems with various functionalities (such as word processors or video games), is far from realistic.

In fact, in the educational context, this criticism is even more relevant. The premise that all users can quickly master a system overlooks the fact that education is a continuous process that requires time, experimentation, and adaptation. Thus, it is not reasonable to expect that teachers, often with limited training in digital technologies, will appropriate

complex software without adequate support and without a learning period. As Preece et al. (2005) point out, a system that offers multiple functionalities loses its value if they are not accessible or understandable to most of its users.

The concept of *affordances*, originally proposed by psychologist James Gibson in 1977, highlights the ability of an object or technology to provide the user with an intuitive perception of its functionality based on its visual and physical attributes, such as shape, size, and weight. This concept is essential in the context of digital literacy, as different platforms with distinct affordances allow teachers and students to deepen the pedagogical functions of these resources in the classroom.

In this sense, user¹ explores the role of datafication (Zuboff, 2021) that we are inserted in, when we lose a digital identity and are exposed to the social construction of being users, where language is used for types of addictions, in a way we are admitting that we become, users, when we place ourselves on this giant wheel of dataficated digital human capital, that identify themselves as a predatory instrument, which can be used to favor the undue, indirect and diverted exploitation of their real and intentions from the use of a strictly pedagogical educational nature.

HYPERCONNECTION

In a hyperconnected world (Floridi, 2019), but not always communicational, contemporary education is crossed by the contradictions of digital networks. Entanglement refers to the ambivalent dynamics of digital networks that, although designed to promote integration and meaningful exchanges, often result in isolation, social fragmentation, and algorithmic conditioning of users, creating limiting behavioral patterns and superficial relationships.

Ana Valéria Silva (2021) prompts us to consider this paradox, which she describes as entanglement: a seeming expansion of human connections that, in reality, can deepen feelings of isolation and weaken meaningful interactions. "We are in the clouds," she states, "but not floating beautifully." We communicate extensively, yet are we truly being listened to? Do we listen authentically and with presence? And do we genuinely understand others

¹ The term "user", although widely used in the fields of technology and design to refer to those who interact with digital systems, carries significant ambivalence. Its use also refers to the vocabulary of drugs – "substance user" – which is not mere semantic chance. In the logic of surveillance capitalism (Zuboff, 2020), the subject is reduced to an agent of consumption and data extraction, losing his condition as a citizen or author. Therefore, in this work, it is chosen to recognize the "user" as the one who makes conscious, critical and situated use of technologies, recognizing their affordances and intentionalities, and not as a mere passive receiver of algorithmic systems or an automated consumer.

when they communicate with us? These questions aim to provoke thought about the present and the future, focusing on the importance of self-worth in living within a network as a community of exchange and mutual support (Silva, 2021, p. 84).

This state of self-connection highlights the ambivalent nature of the digital subject: while it is globally connected, it is also caught in algorithmic circuits that influence its actions, beliefs, and relationships. The ideals of dialogue, community, and participation are mediated and often distorted by surveillance, performativity, and consumption logics. Instead of supportive networks, we form reinforcement bubbles. Instead of meaningful bonds, we have superficial relationships.

Torres, Alcantara, and Irala (2004) note that while cooperation and collaboration are distinct in theory and practice, both refer to forms of collective work aimed at a shared goal. They both oppose authoritarian, top-down pedagogical models and emphasize active socialization during learning. Cooperative learning is more structured, with specific techniques and a focus on interdependence and mutual accountability, whereas collaborative learning features more open interactions, involving less experienced partners and co-constructing knowledge within communities of practice.

In this context, "collaborative learning is understood as the process of reacculturation that helps students become members of knowledge communities whose common ownership is different from those communities they already belong to." Participants in these exchanges: "Community members build the knowledge that is their common property. It presupposes that knowledge is socially constructed and that learning is a sociolinguistic process (BRUFFEE, 1993, 1999)" (Torres, Alcântara, Irala, 2004, p. 06).

Collaborative educational environments, mediated by digital technologies, foster the creation of learning communities in which knowledge is continuously reconfigured through interactions among subjects, languages, and devices. Overcoming entanglement does not mean rejecting technology, but recreating with it new ways of existing, teaching and learning that are more authentic, more ethical, more human.

In this scenario, education needs to intervene with critical intentionality. The contemporary curricular challenge is to break with the limiting forms of communication imposed by technical systems and propose formative experiences that rescue the authenticity of human interactions. To do so, it is necessary to move from the simple use of technologies to an ethical and critical understanding of their implications, in the search

to recognize that we are embedded in an increasingly interdependent infosphere, in which the digital is not an accessory but constitutive of life.

By connecting the concept of *infosphere* (Floridi, 2014) to the *Onlife* experience, we understand that the educational experience today takes place in a weave of simultaneous presences: physical, digital, symbolic. This entanglement requires the creation of pedagogical practices that not only recognize this critical hybrid reality but also mobilize it as an opportunity for reinvention. At this point, connectivism (Siemens) emerges as a potent theory: by valuing collaborative and distributed learning, it recognizes that knowledge is not only in individuals, but in the networks they build.

The Onlife Manifesto (Floridi, 2015) argues that digital technologies are not merely tools but environmental forces that profoundly shape who we are, our social relationships, teaching-learning practices, and the very notion of reality. In discussing the ethics of artificial intelligence, Floridi (2025) emphasizes that automated decisions and algorithmic systems must be designed with accountability, transparency, and benevolence.

Ethical curatorship, therefore, entails an urgent commitment to access to knowledge, grounded not only in technical competence but primarily in a philosophical and political commitment to social and educational emancipation in an increasingly connected reality.

This transformation marks what Luciano Floridi calls the Fourth Revolution, succeeding those of Copernicus, Darwin, and Freud, historical moments when humanity needed to revise its self-image. In the Fourth Revolution, the loss of the human monopoly over the processing and mediation of information gives way to autonomous artificial systems that reorganize reality and call into question the boundaries between the human and the technological.

For Floridi, the infosphere not only modifies our environment but also ontologically reconfigures our identity as informational subjects. "The infosphere becomes not only the space where we are connected, but the very reality in which we live, interact and constitute ourselves as informational subjects — inforgs" (Floridi, 2014, p. 59-60). Thus, "Information and Communication Technologies (ICT) have become environmental, anthropological, social and interpretative forces" (Floridi, 2014, p. vi), where human-machine dialogue is inevitable and will be constant in our lives and in our education.

According to Floridi (2014), we live in a radical transition from history to hyper-history, in which our personal and collective well-being no longer depends only on natural and energy resources and starts to depend critically on the information processed by digital

technologies. This new era is possible because we inhabit the infosphere, but it is only fully realized in the Onlife condition. "Onlife" is a neologism created to express the dissolution of the separation between online and offline. We no longer live part of the time connected, we are constantly immersed in digital networks, which shape our cognition, communication, work, education, and affections.

For Moreira and Schlemmer (2020, p. 07), Onlife is presented as a new concept and paradigm of digital education, opening up as Remote Teaching, Distance Learning, Distance Education, or eLearning, among others, which are often used in an undifferentiated way without conceptual rigor. On the other hand, it also presents the proposition of a new concept and paradigm that we consider to adjust to the complexity of the social and educational reality of the 21st century and that we have designated as Onlife Digital Education. From then on, the aim is to break the barrier of face-to-face and investigate the interaction with the content.

The school has always played a central role in the education of students, guiding the learning process towards the development of skills and competencies. For Zabala and Arnau (2020, p. 12), "The learning of competencies: in order to be able to establish the most appropriate teaching methods for the development of competencies, it is first necessary to resort to the existing knowledge about how people learn". Acting competently is configured by a set of components that are integrated in different ways in the cognitive structures, according to the particularities of each individual.

Skills that prepare students to face the challenges of society. In the construction of the Nation and the understanding of the accumulation of knowledge, it starts with the self, the individual, and expands to the past and the future, nesting in the present. In the search for emancipation, it passes through the school, as the guardian of these educational times and spaces. The wealth of discussions and research ennoble the place of teachers' legacy.

For Zabala and Arnau (2020, p. 29), competencies (factual, conceptual, procedural, and attitudinal) can be developed in the classroom through globalized methods. The process begins with the motivating presentation and understanding of concepts, moving on to the application of coherent behaviors and attitudes. Depending on the type of competence, the path can lead to memorization, application in new contexts, exercise, or analysis and reflection on rules of coexistence. This movement culminates in the workshops, which function as practical and integrating spaces, where the student mobilizes knowledge, skills, and attitudes in an articulated way, overcoming the traditional fragmentation of teaching.

From the reading of the (in)precise language of common sense, knowledge germinates, which, through criticism and systematization, is transformed into science. Thus, all science has its roots in the place where the people listen, but it only flourishes when submitted to the rigor of critical thinking. Judging the past anachronistically for the present. The school and the universities start from a status quo of common-sense knowledge and elaborate their critiques, techniques, and technologies that, fused into unique complementarities, become the hidden, formal, and prescribed social curriculum. (Sacristán, 2013)

Aligned with knowledge of the tools that enable teaching and learning by providing forms of interaction to access and prepare teachers in a connected face-to-face (Brito; Frontino, Motta, in press), ICT is not only technological support but also a catalyst for pedagogical change that enables learning in plural curricular contexts. In this sense, the educator acts as a seeker of knowledge who encourages autonomy and self-reflection, while fostering the construction of seasonal learning skills and nurturing their own learning curiosities.

Thus, we can coin the so-called seasonal learning competencies, that is, sets of skills that manifest more intensely in certain phases of professional life, allowing the teacher to maintain a flexible and adaptable posture in the face of the challenges of contemporary education.

The applicability of knowledge can be understood through the specific skills that young teachers need to mobilize at different times in their trajectory. The teaching function, throughout life, can be divided into decades-long cycles, in which distinct phases of learning and performance are evidenced. This process, understood as: Time of acquisition of seasonal learning skills - sazonalization of lifelong learning - reveals how teachers, supported by brain plasticity, are able to elaborate, undo, recreate, and continuously apply their knowledge according to the historical, pedagogical, and technological demands of the time in which they live.

In this scenario, digital technologies are becoming increasingly ubiquitous, as developed by the concept of invisibles – the chalk board, is there. (Scherer; Brito, 2020). Following Sánchez (2003), Scherer and Brito (2020) identify three stages of integrating digital technologies into the curriculum — preparation, use, and integration — that reflect different levels of maturity in teaching practice. In the preparation stage, the teacher seeks to understand how technologies function and are managed in the classroom, exploring resources such as computers, projectors, digital whiteboards, and software. In the stage of

use, technologies begin to appear in pedagogical practice, but still in a superficial way: the focus remains on the technological resource rather than on the activity or learning. In the integration stage, the teacher plans activities guided by learning objectives in which technologies become invisible: the center is the pedagogical proposal, not the device. Although this level represents greater maturity, the integration process does not end at it, given the complexity of the curriculum, the technological diversity, and the multiple ways of articulating digital practices that meet the needs of different students and contexts.

The imperative of the incessant search for the new reinforces technological haste, which threatens to subvert the slower, more reflective logic of education. The school runs the risk of becoming hostage to technological fads that do not align with its essential function: the integral formation of the subject. Therefore, the criticism of the technological rush becomes a condition for preserving the epistemological density of education (Almeida, 2025)

It is necessary to recognize that it is not possible to linearly follow advances in digital technologies. Its accelerated advancement creates an inevitable gap between what is created and what the school can absorb within curricular realities. This mismatch should not be seen as a weakness, but as an opportunity for education to reinforce its spatial-temporal function, resisting the immediacy of the market. Instead of competing with the speed of innovation, the school must establish itself as a space for pause, reflection, and the production of more lasting meanings – a pedagogical pause.

In view of this, the need for critical digital literacy is evident, understood not as mere technical literacy but as the ability to understand, evaluate, and intervene in how technologies shape social and educational life. This literacy is not reduced to the operational domain of resources; it encompasses an understanding of the ethical, political, and epistemological implications of digital practices. It is about preparing the teacher to see himself as a lifelong learner: a lifelong learner in the midst of the infosphere, not just a passive user of these systems.

Educating in *lifelong learning* according to Conrado Schlochauer is not a passing fad, but an existential calling. He reminds us that "continuous learning is no longer a choice, but a vital necessity to stay relevant in an ever-changing world" (Schlochauer, 2019, p. 27). In teaching, this echoes as an ontological mission: the teacher who does not learn throughout life loses not only relevance, but the very condition of reinventing himself as a pedagogical subject.

The teacher who assumes lifelong learning is not ashamed of his doubts. On the contrary, he makes them an engine. It is in incompleteness that the power of education flourishes. This view also repositions teacher training within the register of the collectivity. It is not a solitary journey but a journey in networks. Teaching communities, research groups, digital networks, all of this materialize the idea that "we learn more and better when we are connected to communities of practice" (Schlochauer, 2019, p. 133). The teacher is the subject of a collective plot, of this entanglement.

More than ever, the concept of lifelong learning becomes a strategic horizon for contemporary pedagogy. It requires a new ethics of time, in which learning is not a one-off event but a continuous flow. Teacher training needs to be thought of as an open work, in constant revision, made up of pauses and accelerations, of unlearning and relearning. Teaching is a process. This is the pedagogy that transcends utilitarianism and assumes the "unprecedented-viable" (Freire, 2014) teacher training as an art of remaining human in the midst of the speed of the twenty-first century. Lifelong learning is not just a professional strategy but an existential posture.

Our role in education hinges on balancing the humanist tradition with digital demands. Technology should not be viewed as an adversary to teaching, nor as its cure-all. Instead, a sustainable teaching approach emerges from the interplay between tradition and innovation, memory and creativity. This balanced perspective encourages teaching practices that resist rushing into technology and instead focus on critical, reflective learning. Teachers, recognizing technology as an extension of their work, affirm their role as protectors of pedagogical time, emphasizing pauses and reflection within the learning process.

REFERENCES

ALMEIDA, Fernando José. Licença para criticar escolas e suas tencologias. Ed. Cajuina, SP. 2025

ALVARENGA, Eldaronice; BATISTA, Maria Clarice; NIITSUMA, Eyleen Nabylla; OLIVEIRA, Rosimar. A revisão integrativa nos estudos das políticas públicas educacionais: potencialidades e aplicabilidade do método. Revista Brasileira de Educação. V. 29, e290111, 2024.

BRITO, Glaucia da Silva. Por uma pedagogia da pergunta em tempos de inteligência artificial. Notícias, Revista Docência e Cibercultura, março de 2025, online. ISSN: 2594-9004. Disponível em: <>. Acesso em: 23 Mar. 2025.

FREIRE, Paulo. Pedagogia da esperança: um reencontro com a Pedagogia do oprimido. Rio de Janeiro: Paz e Terra, 2013 [original de 1992].

FLORIDI, Luciano. A Ética da inteligência artificial. PucPress, 2025.

MARGARIDA FARIAS COELHO, Patrícia; MARTINS COSTA, Marcos Rogério; OLIVEIRA MOTTA, Everson Luiz. Formação de professores e integração pedagógica das Tecnologias da Informação e da Comunicação (TIC): da usabilidade técnica ao letramento digital. EccoS – Revista Científica, [S. l.], n. 58, p. e11014, 2021. DOI: 10.5585/eccos.n58.11014. Disponível em: <https://periodicos.uninove.br/eccos/article/view/11014>. Acesso em: 21 set. 2025.

FLORIDI, Luciano. “A era do Onlife, onde real e virtual se (com)fundem”. Entrevista concedida a Jaime D’Alessandro. La Repubblica, set/2019. Tradução: Luisa Rabolini. Disponível em: <http://www.ihu.unisinos.br/78-noticias/593095-luciano--floridi-vou-explicar-a-era-do-Onlife-onde-real-e--virtual-se-com-fundem>. Acesso em: 22 jan. 2021

FLORIDI, Luciano. The Fourth Revolution: How the Infosphere is Reshaping Human Reality. Oxford: Oxford University Press, 2014.

KLEIMAN, Angela. Letramento e suas implicações para o ensino de língua materna. Signo, [S. l.], v. 32, n. 53, p. 1–25, 2007. DOI: 10.17058/signo.v32i53.242. Disponível em: <https://seer.unisc.br/index.php/signo/article/view/242>. Acesso em: 21 set. 2025.

MOREIRA, J. A. .; SCHLEMMER, E. Por um novo conceito e paradigma de educação digital Onlife. Revista UFG, Goiânia, v. 20, n. 26, 2020. DOI: 10.5216/revufg.v20.63438. Disponível em: <https://revistas.ufg.br/revistaufg/article/view/63438>. Acesso em: 17 jun. 2025.

PREECE, J.; ROGERS, Y.; SHARP, H. Design de interação: além da interação homem-computador. Porto Alegre: Bookman, 2005.

ROLIM-MOURA, Adriana Sidralle; DE CASTRO, Luciana Parnaíba. LETRAMENTO (S) E MULTILETRAMENTOS: SURGIMENTO, CONCEPÇÕES, APROXIMAÇÕES E DISTANCIAMENTOS. Revista Sapiência: sociedade, saberes e práticas educacionais (2238-3565), v. 12, n. 3, p. 161-177, 2023.

SCRISTÁN, Gimeno José, (org). Saberes e Incertezas sobre o Currículo. Porto Alegre, Artmed Editora, 2013

SILVA, Ketia Kellen Araújo da; BEHAR, Patricia Alejandra. Competências digitais na educação. In BEHAR, Patrícia Alejandra.; SILVA, Katia Kellen Araújo da. Competências digitais em Educação: do conceito à prática. São Paulo: Artesanato Educacional, 2022.

SILVA, Kétia Kellen Araújo da; BEHAR, Patrícia Alejandra. Competências digitais na educação: uma discussão acerca do conceito. Educação em revista, v. 35, p. e209940, 2019. Disponível em: < <https://www.scielo.br/j/edur/a/wPS3NwLTxtKgZBmpQyNfdVg/?lang=pt> > Acesso em: 25/11/2024

Scherer, Suely, da Silva Brito Gláucia . Integração de tecnologias digitais ao currículo: diálogos sobre desafios e dificuldades. Educar em Revista [en linea]. 2020, 36(), 1-22[fecha de Consulta 23 de Septiembre de 2025]. ISSN: 0104-4060. Disponible en: <https://www.redalyc.org/articulo.oa?id=155063059055>

SOARES, Magda. Alfabetização e letramento: caminhos e descaminhos. Porto Alegre, 2020

SILVA, A. V. B. Em redes ou enredados? a universidade na adversidade. In Nuvens e redes : “quantos nós, dentro de nós”? / Fernando José de Almeida, Maria Elizabeth B. de Almeida, Maria da Graça Moreira da Silva (orgs). - São Paulo : EDUC, 2021.

TORRES, Patrícia Lupion; ALCANTARA, Paulo; FREITAS IRLA., Esrom Adriano. GRUPOS DE CONSENSO: UMA PROPOSTA DE APRENDIZAGEM COLABORATIVA PARA O PROCESSO DE ENSINO-APRENDIZAGEM. Revista Diálogo Educacional, [S. l.], v. 4, n. 13, p. 129–145, 2004. DOI: 10.7213/rde.v4i13.7052. Disponível em: <https://periodicos.pucpr.br/dialogoeducacional/article/view/7052>. Acesso em: 30 jun. 2025.

VIEIRA PINTO, Álvaro. O conceito de tecnologia. Vol. I. Rio de Janeiro: Contraponto, 2005.

ZABALA, Antoni; ARNAU, Laia. Como aprender e ensinar competências. Porto Alegre: Penso, 2014. Ebook. ISBN 9788584290178. Disponível em: <https://integrada.minhabiblioteca.com.br/#/books/9788584290178>.

ZUBOFF, Shoshana. A era do capitalismo de vigilância. São Paulo: Intrínseca, 2021.

ARTICULATION STRATEGIES AS A LEARNING FACTOR IN NURSING TECHNICIAN STUDENTS

  10.56238/livrosindi202668-011

Gabriela Condeza Zuñiga

Universidad Andrés Bello, Facultad de Educación y Ciencias Sociales
Chile

E-mail: gabriela.condezazuniga@gmail.com

Orcid: <https://orcid.org/0009-0009-6346-0892>

Alejandro Pérez Carvajal

Universidad Andrés Bello, Facultad de Educación y Ciencias Sociales
Chile

E-mail: alejandroperez@unab.cl

Orcid: <https://orcid.org/0000-0002-2536-9088>

ABSTRACT

This article proposes a compilation of active, participatory strategies as a teaching innovation project designed to enhance collaboration between teachers and student tutors and foster pedagogical skills essential to a successful educational process. Accompaniment involves ongoing advice during classroom activities through observation, dialogue, and critical reflection, aimed at improving teaching performance by strengthening competencies, attitudes, and knowledge. The research uses a qualitative case study approach. Data were gathered using two validated tools: a Google Forms questionnaire and a paper form, targeting students in the relevant program and course. The findings led to the creation of an interactive dossier featuring active, participatory strategies intended to train teachers and students in their roles as tutors to build pedagogical competencies. The conclusions highlight that this innovation offers valuable insight into the importance of integrating teacher support and pedagogical coordination in higher education.

Keywords: Active participatory strategies. Teacher accompaniment. Teaching articulation. Pedagogical competencies. Educational process.

INTRODUCTION

A high-quality educational process enables us to provide an inclusive and equitable education that offers excellent training for the holistic development of all students. It also promotes deep, meaningful, and lifelong learning. According to UNESCO (2016), this is essential. In Chile, education is defined as "the process of lifelong learning that spans different life stages and aims for spiritual, ethical, moral, affective, intellectual, artistic, and physical growth" (Law No. 20,370, 2009). The Framework for Good School Management and Leadership (MDBLE) published by Mineduc (2015) emphasizes practices where management teams effectively guide, direct, and oversee teaching and learning processes

within their institutions (p. 24). It highlights the need for an implementation model that develops pedagogical skills to ensure quality through ongoing monitoring and support of plans, programs, methodologies, and teaching tools, while also maintaining coherence, continuity, and relevance across all educational elements.

In particular, in Higher Education, there is a continuous reference to the need to safeguard quality and equity, and it is worth asking what each concept refers to. Quality, on the other hand, is the result of a timely, meaningful, relevant, up-to-date, flexible, and sufficient educational process that develops competencies to efficiently face and solve challenges in the world of work and daily life (Pérez, 2024). On the other hand, equity creates the necessary conditions for all students, regardless of their origin, culture, political ideals, rhythms, and learning styles, to develop the full range of capacities to face daily, academic, and work challenges with fullness and dignity in their formative results (Ministry of Education, 2020, p. 12). Consequently, to guarantee the implementation of these elements, the Quality Assurance System (SAC) was created, which, through evaluation, supervision, guidance, support, and continuous and collaborative accompaniment among ministerial entities, administrative institutional directors, teachers, tutors, students, and the educational community in general, concentrates the maximum efforts to generate professional and institutional conditions that allow them to develop tools for improvement in a virtuous relationship of autonomy, evolution, diversity, accompaniment, participation, articulation, and relevance (Ministry of Education, 2020, p. 9-11).

Currently, Higher Education has become a great challenge in this changing, diverse world, as this diversity calls for new projects and pedagogical skills to address educational reality. As Morejón (2021) states, "in order to provide effective attention to students, the educational community must be aware of the importance of having material, personal, and didactic resources, while facilitating access to them" (p.3). Based on the analysis of the teaching practice of the Primary Workshop subject, of the Nursing Technician career of the Santo Tomás Technical Training Center, Concepción campus, there is evidence of an important deficiency of pedagogical competence in formal teachers and students who tutor, directly associated with the lack of a model that promotes accompaniment and articulation between tenured teachers and tutors of the subject. the latter being in their majority students of the last semester of the career, academically outstanding; however, with the need to develop sufficient pedagogical competencies to support an articulated and relevant pedagogical process.

This can be seen in the first instance, through a semi-structured interview where they directly express the difficulties and fears in their teaching performance due to not having sufficient pedagogical skills in terms of the application of teaching-learning methodologies relevant to the context, equitable evaluation criteria and instruments, as well as opportunities for feedback from experienced teachers (Catalán et al., 2024). On the other hand, they show a lack of coordination across sections regarding the correlation and continuity of content, methods, and evaluation systems among tenured teachers of the subject, formal teachers, and student tutors. This situation directly hinders the achievement of an educational process that is relevant, cohesive, and equitable, which promotes significant, deep learning outcomes and supports the acquisition of generic and specific competencies aligned with the graduation profile.

Although there is currently an institutional strategic plan aimed at strengthening the educational project of the CFT Santo Tomás, offered by the Learning Center under the guidelines of curricular articulation and continuous training, the first, through the realization of courses and diplomas in the field of pedagogical management that reinforce the capacity to implement participatory active learning strategies, didactic and evaluative curricular designs according to the institutional approach. And the second, through the delivery of methodological and technological tools that allow for the improvement of teaching practice through classroom accompaniment, applying direct observation of academic work to provide feedback and improve learning and teaching processes. However, at the institutional level, it is necessary to establish a model that includes not only teachers who formally teach subjects, but also students who serve as tutor-teachers and need to develop pedagogical skills.

TEACHING ROLE

Higher education in the twenty-first century is undergoing a new model that positions the student as a central, active, and creative subject of his or her own learning, shifting away from traditional teaching toward constructivist-based instruction. (Roy et al., 2024). This new model has been evolving continuously to meet the needs and demands of a complex, globalized society, which requires trained individuals with generic and disciplinary competencies that respond to the challenges of the new era. (Araya & Pérez, 2023). In this context, the teacher, a training actor, experiences a transformation from his or her work and pedagogical practice, modifying his or her visualization of being the transmitter of

knowledge and the highest authority to be imitated and obeyed; to assume a new role, of guide, guide of knowledge, and mediator of learning.

ROLE OF THE TUTOR

The development of knowledge, scientific and technological advances has posed an enormous challenge to education in general, to teaching and learning. New technological resources force teachers to review their methodologies, learning strategies, and approaches to teaching. Today, more than ever, information is available in an enormous number of networks and moves rapidly from one place to another. This makes it necessary to review the characteristics that the teacher should have in general, as well as for those who participate in extracurricular training and tutorials. In this sense, with few variations, the work of the tutor was maintained until the last years of the nineteenth century, when the tutor shifted attention from religious and moral aspects, in line with the evolution of education, and emphasized the production of knowledge in a pragmatic way. The tutor's role as a counselor for scientific work is currently being extended to undergraduate and graduate education (Salazar et al., 2022).

For their part, Espinoza et al., (2019) institute the figure of the tutor as a complementary and synergistic modeler to the role played by the teacher, since he or she must always be aware of the particular ways in which each and every one of those who make up the faculties of teaching practice exert their educational influence, carefully observing, how these influences configure the different positions that students assume in the face of their learning experience.

STUDENT TUTOR

When developing the tutelary activities in any teaching scenario, career, subject, or program of study, the tutor must keep in mind the missions that correspond to him as observer, supervisor, guide, and evaluator of the activity, while the student has the role of executing and learning from the different teaching-care tasks that he must undertake. There is no doubt that tutoring is the most complete and complex form of education, but is there any ideal method of tutoring teaching? There is no ideal or universal teaching method for this. Its selection and application depend on the material, human, and professional preparation conditions that exist for learning. It should not be intended to elaborate on schematic rules for its implementation, but rather to offer guidance and experience for its

development. In addition to some flexibility, skills, and support techniques on the part of the tutor are required to carry out adequate tutoring. (Salazar et al., 2022)

CURRICULAR AND PEDAGOGICAL ARTICULATION

Articulating in the educational field is highly complex. The action of joining or combining two or more elements; Programs, policies, and/or projects involve complex splicing. In the area of teaching, the management of articulation refers broadly to various dimensions, including academic, administrative, curricular, and pedagogical perspectives. It points out that the dimension of academic articulation implies new forms of organization for academic units and coordination among them. The administrative one focuses on the flexibility of rules, procedures, regulations, planning, and evaluation (Pérez, 2022), the curricular one refers to the process of opening and reorganizing the various elements that make up the curriculum, allowing a certain internal mobility of resources and diversification in access and opportunity to education. In addition, pedagogical articulation aims to achieve the same professional and institutional objectives from the perspective of educational improvement. (Marino, 2022).

Specifically, implementing a pedagogical articulation involves assessing the relevance of the knowledge generated and the ambitions to be achieved in developing generic and disciplinary competencies for each graduate profile proposed by the institutions.

TEACHING ACCOMPANIMENT AND REFLECTION

In recent years, research has consistently found that among the multiple internal variables that affect the improvement of educational quality, teacher performance is a high-impact factor. (Pérez & Catalán, 2021). This is directly associated with the results of academic achievement in student learning, that is, greater autonomy and permanent self-regulation in the construction of meaning to adopt strategic behavior when carrying out pedagogical activities. (Leiva & Vásquez., 2019).

Teachers need theories that provide instruments for analysis and reflection on pedagogical practice and their participation in the learning process, which allow them to prioritize objectives, plan what to teach, and decide on the most appropriate materials. Morejón (2021).

Teachers are mainly responsible for offering quality education and must have explanatory frameworks that allow them to make correct decisions in the curricular, organizational, and evaluative areas. In addition, each educational component, in its various units, must

establish objectives and work plans aligned with a constructivist conception. (Catalán & Pérez, 2021).

In this context, the objective of the project is to implement a dossier of active participatory strategies that strengthen the accompaniment and articulation between formal teachers and student tutors, for the development of pedagogical competencies that contribute to the achievement of an educational process through a training system through synchronous online practical sessions in the subject Primary Caregiver Workshop of the Nursing Technician career. of the Santo Tomás Technical Training Center in Concepción.

METHODOLOGY

The methodological approach is qualitative, using a case study design. (Flick, 2015) since there is evidence of a significant deficiency of pedagogical competence in formal teachers and students who tutor, directly associated with the lack of a model that promotes accompaniment and articulation between tenured teachers and tutors of the subject, (Catalán, 2021). In a first stage, two questionnaire-type diagnostic instruments were developed using the Google Forms platform, and one physical, which was applied both to the students of the career and subject, as well as to the teachers who tutor in the course, in order to assess the perception of both in terms of pedagogical practices in this component. In addition to applying a semi-structured interview to teachers, tutors, professionals, and students by identifying their appreciations regarding the satisfaction of the educational model with respect to instances of accompaniment and articulation in the achievement of strengthening pedagogical competencies, and a training process of coherence and relevance.

Based on the methods used and the problems analyzed, a teaching innovation project was developed. For the project's implementation, an online training system will be deployed; it is important to note that the Technical Training Center has the necessary infrastructure and services to establish direct communication with teachers via videoconference. As it is online training, it offers greater flexibility in connecting, allowing teachers to join from wherever they deem appropriate, using their cell phones or other devices. Finally, content analysis is conducted to design an improvement proposal that promotes an educational trajectory articulated between the two levels. (Flores, 2013).

Table 1 - Methodological relevance

Methodological aspect	Description
Approach	Qualitative. It allows us to understand the perceptions and experiences of teachers and students regarding pedagogical practices and the existing accompaniment model.
Design	Case study. It focuses on analyzing a particular educational situation where deficiencies in pedagogical competencies and lack of articulation between tenured teachers and tutors are evident.
Problem detected	Deficiency of pedagogical competencies in formal teachers and tutors, associated with the absence of a model of accompaniment and articulation between both roles.
Data collection tools	a) Diagnostic questionnaires (Google Forms and physical version) applied to students and tutors. b) Semi-structured interviews with teachers, tutors, professionals and students to identify assessments of the satisfaction and coherence of the educational model.
Purpose of collection	Assess the perceptions of the actors about pedagogical practices, satisfaction with the accompaniment model and opportunities for strengthening competencies.
Intervention stage	Design and implementation of a teaching innovation project based on diagnostic findings.
Intervention strategy	Online training system for tutors and tenured teachers, using the institutional videoconferencing infrastructure to promote pedagogical accompaniment and articulation.
Advantages of the online system	Flexibility of connection, accessibility from different devices and strengthening of communication between teaching levels.
Data analysis	Content analysis of the responses obtained is carried out, in order to design a coherent and pertinent improvement proposal.
Final product	Proposal for an articulated educational trajectory that promotes the strengthening of pedagogical competencies and coherence between teaching levels.

Source: Authors' Creation

RESULTS AND DISCUSSION

The focus was on developing the interactive dossier using the CANVA platform, designed based on the statistical analysis of the diagnostic questionnaire results described in the methodology. In addition, theoretical and practical online training in both synchronous and asynchronous modalities was developed for the subject's teachers to provide them with the tools and guide them in using the dossier. It is relevant to mention that in each session activities were developed in a formative way in relation to the dossier. The subject teacher was able to review his or her evaluation with the correct answers for each activity. At the end, feedback was given on both the dossier and the activities carried out.

First, the application of the questionnaire and semi-structured interviews has allowed a deep understanding of the pedagogical needs of students and tutors. This diagnosis has provided valuable information about the specific challenges they face in the subject, serving as a fundamental basis for subsequent interventions.

Meanwhile, the creation of the dossier has been a collaborative process integrating active, participatory strategies. This resource provides a solid framework to strengthen the instances of accompaniment and pedagogical articulation between formal teachers and

student tutors. An effective alignment of competencies and methodologies has been achieved that promotes a more meaningful and in-depth teaching-learning process.

On the other hand, the conduct of online training sessions was a crucial step in implementing the dossier. These theoretical-practical sessions also allowed for active interaction among participants, encouraging the practical application of the proposed strategies. Adapting to the online environment has proven effective, providing flexibility and accessibility for teachers.

The results reinforce the idea that close collaboration between teachers and tutors not only improves the teaching-learning experience of students but also enhances the outcomes of a quality educational process. On the one hand, the effective link between classes and tutorials has proven to be a key factor in the integral development of students, while the implementation of accompaniment strategies has enabled a more personalized approach, adapted to the individual needs of each student. Likewise, pedagogical articulation has facilitated the integration of theoretical concepts with practical applications, creating a significant bridge between theory and practice.

Table 2 - Core elements of the results

Axis of analysis	Description of results	Observed impacts
Initial diagnosis	The questionnaire and semi-structured interviews allowed us to identify the main pedagogical needs of teachers and tutors, as well as the difficulties in articulation and accompaniment.	It generated a solid basis for designing the dossier and guiding the training, aligning the strategies with the real needs detected.
Design of the interactive dossier (CANVA)	Prepared from the descriptive analysis of the diagnostic questionnaires. The dossier integrates active and collaborative strategies to strengthen the pedagogical articulation between teachers and tutors.	It promotes meaningful learning, the co-construction of knowledge, and coherence between theory and practice.
Online teacher training (synchronous and asynchronous)	Theoretical-practical sessions were held to guide the use of the dossier, with training activities and continuous feedback.	It favored flexibility, active participation, and appropriation of the resource by the tutors.
Formative assessment	The activities in each session were evaluated with immediate feedback; The teachers reviewed their results and correct answers.	It strengthened the self-regulation of learning and pedagogical reflection on one's own practices.
Teacher-tutor collaboration	There was evidence of an improvement in communication, coordination and joint work between tenured teachers and tutors.	Increase in pedagogical coherence and strengthening of educational accompaniment and mediation skills.
Pedagogical articulation	The dossier allowed theory and practice to be integrated, facilitating a more contextualized and meaningful teaching.	He consolidated an articulated training career, with coherent methodologies between classes and tutorials.
Satisfaction and perception of effectiveness	The tutor teachers expressed high satisfaction with the strategies implemented and greater confidence in their pedagogical abilities.	Increase in teacher motivation and improvement in tutorial performance.

Student results	Improvement in the understanding of content and in the link between classes and tutorials; students perceive greater accompaniment.	Positive impact on academic performance and motivation for learning.
Inclusive pedagogical practices	Active and collaborative strategies promoted joint adjustments in classes and tutorials.	Promotion of more inclusive, relevant and contextualized pedagogical practices.
Final summary	The project strengthened the relationship between formal teaching and tutoring, improved pedagogical coherence, and promoted a collaborative and reflective learning environment.	Consolidation of an articulated and sustainable support model for continuous improvement.

Source: Authors' Creation

Positive feedback from participants, both teachers and students, supports the idea that integrating quality tutorial sessions within a subject strengthens content understanding and promotes a more collaborative learning environment. In addition, a positive impact has been observed on students' academic performance and motivation, as they feel more supported and closely guided.

The active participatory strategies implemented through the dossier seek to generate a positive impact on inclusive pedagogical practices articulated between formal teachers and student tutors. This allows teachers to make joint adjustments in classes and tutoring, with the aim of generating a synchronized and relevant educational process in terms of the application of methodologies, use of didactic resources, evaluation, and decision-making instruments: it is also an opportunity to promote instances of accompaniment, observation, and feedback that contribute to the development and strengthening of fundamental competencies in pedagogical practice.

Finally, survey-based evaluation has provided essential data on the effectiveness and satisfaction levels of tutoring teachers. Positive responses indicate a favorable reception of the proposed strategies, as well as increased confidence and skills for practical application in tutoring.

CONCLUSIONS

The changes in society's cultural evolution over the years have paved the way for a new paradigm in higher education in the twenty-first century. As a result, the meaning of education, the roles of teachers and students, and the methods of the teaching-learning process have been reconsidered and redefined, with a focus on developing competencies that align with an established graduation profile. Simultaneously, updates and reforms in public education policies have introduced mandatory indicators to ensure and safeguard the quality of the educational process, grounded in principles such as equity, autonomy,

innovation, relevance, articulation, academic freedom, diversity, inclusion, participation, respect for and promotion of human rights, access, and civic engagement.

One of the challenges that teachers currently face is related to diversity in the classroom, which has led to an analysis and reflection on the pedagogical practices used, the characteristics of the students, the way in which they achieve learning and how the classroom environment impacts this training process; All this has led teachers to orient their pedagogical practices in the inclusion of new learning methodologies and active participatory strategies that incorporate adaptations that facilitate and favor the teaching-learning process of all learners.

In the same way, it is based on the achievement of an equitable educational process, which promotes the mobility of resources, collaborative work, and active and effective linkage among the student community, and on the ambition of the pillars of articulation and teaching accompaniment, which guarantee a relevant and articulated training process.

The execution of this teaching innovation project has provided an enriching perspective on the vital importance of incorporating teacher accompaniment and pedagogical articulation in higher education teaching, specifically in strengthening the link between formal classes and tutorials of the same subject.

The success in the implementation of the project could promote new lines of research in the field of inclusive and articulated education; For example, the relevance of the integrality between formal teaching and tutorials, the continuous modification of active participatory strategies, the adaptability of the interactive dossier in different educational contexts, or the application of specific technologies to improve accessibility, could become topics of interest for future research, as a form of progress and evolution.

It is recommended to explore different options to ensure continuity and maintain the sustainability of the Teaching Innovation Project. One possibility would be to incorporate the strategies into other subjects or careers within higher education institutions, or to establish a continuous training program for teachers, to ensure a lasting impact over time. It is recommended to disseminate the project's results and successful practices through conferences, publications, or academic events. Sharing lessons learned and good practices can inspire other educational institutions to implement similar initiatives.

ACKNOWLEDGMENTS

To the Faculty of Education and Social Sciences of the Andrés Bello University of Chile, for the training in the master's degree in teaching for Higher Education.

REFERENCES

- Araya-Morales, C., & Pérez-Carvajal, A. (2023). Rediseño del programa de Tutorías Académicas para el acompañamiento de estudiantes de la Universidad de Tarapacá, Chile. *Revista Ciencia & Sociedad*, 3(2), 112–121.
<https://cienciaysociedaduatf.com/index.php/ciesocieuatf/article/view/74>
- Catalán Ahumada, J. (2021). *Análisis de Investigación Educacional Cualitativa*. Universidad de la Serena.
- Catalán, Juan Pablo., y Pérez Carvajal, A., (2021) Competencias Docentes para el Siglo XXI, una propuesta reflexiva en contextos de virtualización. (pp. 67 – 90). En Muñoz, I. y Roys, D. (Edt). *Desafíos para la Docencia Universitaria en Entornos Virtuales*. RIL Editores.
<https://educacioncontinuafece.unab.cl/publicacion/desafios-para-la-docencia-universitaria-en-la-era-digital/>
- Catalán, JP., Roy, D., y Pérez Carvajal., A. (2024). Competencias pedagógicas desde la innovación en docencia para la educación superior transferibles a Iberoamérica. En (edit.) Mario Martín Bris, Juan Pablo Catalán Cueto y Jairo Steffan Acosta Vargas. *Aprendizaje y gestión de la educación en Iberoamérica: perspectivas y experiencias* (pp 171 – 181). Edit.. Dykinson, S.A. <https://www.dykinson.com/libros/aprendizaje-y-gestion-de-la-educacion-en-iberoamerica-perspectivas-y-experiencias/9788410702684/>
- Espinoza, E., Ley, N., y Guamán, V. (2019). Papel del tutor en la formación docente. *Revista de Ciencias Sociales*, 25 (3), 230-241.
<https://www.redalyc.org/journal/280/28060161020/html/>
- Flick, U. (2015). *El diseño de la Investigación Cualitativa*. Edt. Morata
- Flores, R. (2013). *Observando observadores: una introducción a las técnicas cualitativas de investigación social*. Ediciones Universidad Católica de Chile.
- González García, V. (2018). La coherencia curricular en la Educación Superior: algunas reflexiones. *Revista Educación*, 42(2), 771–787. <https://doi.org/10.15517/revedu.v42i2.28515>
- Leiva-Guerrero, M., & Vásquez, C. (2019). Liderazgo pedagógico: De la supervisión al acompañamiento docente. *Calidad en la Educación*, 51, 225-251.
<https://www.scielo.cl/pdf/caledu/n51/0718-4565-caledu-51-225.pdf>
- Ley General de Educación. (LGE). 20.370. 12 septiembre 2009.
- Marino, C. (2022). *La articulación como proceso en el sistema educativo. La concepción de proceso en las propuestas de articulación del colectivo docente de los niveles inicial y primario*. (Tesis de maestría). Universidad Nacional de Quilmes, Bernal, Argentina. Disponible en RIDAA-UNQ Repositorio Institucional Digital de Acceso Abierto de la Universidad Nacional de Quilmes <http://ridaa.unq.edu.ar/handle/20.500.11807/3840>
- Mineduc, (2015). *Marco para la Buena Dirección y el Liderazgo Escolar (MDBLE)*. CPEIP.
- Ministerio de Educación de Chile. (2018). *Manual para la o el profesor tutor*.
<https://tecnicoprofesional.mineduc.cl/wp-content/uploads/2018/03/DUAL-manual-tutor-final.pdf>

Ministerio de Educación de Chile (2020). Plan de aseguramiento de la calidad de la educación. Sistema de Aseguramiento de la Calidad. https://www.mineduc.cl/wp-content/uploads/sites/19/2020/07/SAC-2020-2023_vf.pdf

Morejón, L. (2021). Comprensión de la diversidad desde la centralidad del estudiante en la Educación Superior [apunte]. UNAB.

Pérez Carvajal, A., (2024) Consideraciones para la docencia de calidad desde los criterios y estándares del subsector universitario en Chile. en Aravena, M., Marambio, C., Gárate, F. & Ruete, D. (Comp.) Co-construyendo aprendizajes integrales (pp. 22 - 30). Editorial Universidad Andrés Bello (UNAB) Chile.

Pérez Carvajal, A. (2022). Articulación de las Políticas Públicas Educativas con el Currículo Escolar Chileno. REVISIÓN VISUAL. Revista Internacional de Cultura Visual, 9 (Monográfico), 1–11. <https://doi.org/10.37467/revvisual.v9.3785>

Pérez, A. y Valenzuela, M. (2021). Fundamentos de la docencia en educación superior desde la centralidad en el estudiante y la perspectiva en el aprendizaje. Universidad Andrés Bello.

Pérez Carvajal, A., y Catalán, Juan Pablo. (2021). Competencias docentes en contextos de contingencia y virtualización. Una propuesta reflexiva. Anuario Digital De Investigación Educativa, 4. <https://revistas.bibdigital.uccor.edu.ar/index.php/adiv/article/view/4939>

Roy Sadradín, D., Chacana, C., Catalán, JP., y Pérez Carvajal., A. (2024). Innovación docente. Metodología de proyectos para el desarrollo del aprendizaje en educación superior. En (edit.). Fernández Campoy, JM., Catalán Cueto, JP., Muñoz Sánchez, CA y Ayllón Salas, P. Investigación educativa para la innovación de las TIC aplicadas a la enseñanza de la sociedad del conocimiento. (pp 185 – 193). Edit. Dykinson, S.A. <https://dialnet.unirioja.es/servlet/libro?codigo=978237>

Salazar, Z., Cardoso, L., & Panesso, V. (2022). El tutor, eslabón fundamental en el proceso formativo: una mirada desde la educación avanzada. Medisur, 20(1), 18-24. <https://medisur.sld.cu/index.php/medisur/article/view/5338>

UNESCO. (2016). Marco de Acción para la realización del Objetivo de Desarrollo Sostenible 4. Declaración de Incheon y Marco de Acción ODS 4 – Educación 2030.

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