

Media ecology in education: an integrative literature review

Ecologia das mídias na educação: uma revisão integrativa da literatura

Ecología de los medios en la educación: una revisión integrativa de la literatura

Natana Lopes Pereira^I

Marcio Vieira de Souza^{II}

Fernando José Spanhol^{III}

ABSTRACT

Media ecology is a theory that studies the relationship between media and society, the impact that different technologies have on culture and human behavior. In education, it is not a recent approach; however, much of the research lacks in-depth theoretical discussions of this relationship. Therefore, due to the need to understand broader aspects related to its application, considering technological advancements in the educational context, the study aims to summarize the state of knowledge based on research on media ecology in education. To achieve this objective, an integrative literature review was conducted, which allowed synthesizing the selected works and analyzing the relationship between technological evolution and its impact on education, identifying several challenges. As a theoretical contribution, the research provides a synthesis of knowledge, consolidating existing understanding of media ecology in the educational context.

Keywords: Media Ecology. Education. Media. Technologies. Platforms.

RESUMO

A ecologia das mídias é uma teoria que estuda a relação entre as mídias e a sociedade, o impacto que diferentes tecnologias causam na cultura e no comportamento humano. Na educação não é uma abordagem recente; contudo, grande parte dos estudos não apresenta discussões teóricas profundas dessa relação. Assim, diante da necessidade de compreender aspectos mais amplos relacionados à sua aplicação e considerando a evolução tecnológica no contexto educacional, o estudo visa sumarizar o estado do conhecimento das pesquisas sobre ecologia das mídias na educação. Para atender a tal objetivo, realizou-se uma revisão integrativa da literatura, que possibilitou sintetizar os trabalhos selecionados e analisar a relação entre a evolução tecnológica e seu reflexo na educação, identificando alguns desafios. Como contribuição teórica, a pesquisa

^IUniversidade Federal de Santa Catarina, Florianópolis, SC, Brazil. Email: natanapereiralopes@hotmail.com  <https://orcid.org/0000-0002-2942-7011>

^{II}Universidade Federal de Santa Catarina, Florianópolis, SC, Brazil. Email: marcioveiradesouza@gmail.com  <https://orcid.org/0000-0002-0165-4036>

^{III}Universidade Federal de Santa Catarina, Florianópolis, SC, Brazil. Email: fernando.spanhol@ufcs.br  <https://orcid.org/0000-0003-0151-4671>

apresenta uma síntese do conhecimento, consolidando o conhecimento existente sobre ecologia das mídias no contexto educacional.

Palavras-chave: Ecologia das Mídias. Educação. Mídias. Tecnologias. Plataformas.

RESUMEN

La ecología de los medios es una teoría que estudia la relación entre los medios y la sociedad, el impacto que tienen las diferentes tecnologías en la cultura y el comportamiento humano. En educación, no es un enfoque reciente, sin embargo, la mayoría de los estudios no presentan discusiones teóricas profundas sobre esta relación. Así, debido a la necesidad de comprender aspectos más amplios relacionados con su aplicación, considerando la evolución tecnológica en el contexto educativo, el estudio tiene como objetivo resumir el estado del conocimiento de las investigaciones sobre ecología de los medios en educación. Para cumplir con este objetivo se realizó una Revisión Integrativa de la Literatura, que permitió sintetizar los trabajos seleccionados y analizar la relación entre la evolución tecnológica y su impacto en la educación, identificando algunos desafíos. Como aporte teórico, la investigación presenta una síntesis de conocimientos, consolidando los conocimientos existentes sobre la ecología de los medios en el contexto educativo.

Palabras clave: Ecología de los Medios. Educación. Medios de Comunicación. Tecnologías. Plataformas.

INTRODUCTION

Media ecology is a formally named and consolidated theory dating back to the 1970s (Strate *et al.*, 2019). It considers media as a social environment, similar to any other (Ruotsalainen and Heinonen, 2015). In this environment, taken as a complex system of messages, we influence and are influenced in our way of thinking, acting, and communicating (Strate *et al.*, 2019). Thus, using the environment constructed by the media as a line of investigation, it implies the study of its structure, content (and/or context), and its impact on people (Strate *et al.*, 2019).

With the advancement and evolution of technologies, our habits and behaviors have been redefined, as have social, economic, and political structures (Scolari, 2012; Poell *et al.*, 2019; Strate *et al.*, 2019). These environments have become increasingly ubiquitous in our lives (Scolari, 2012). Due to the technological immersion of our contemporary society, the media have gained greater power of influence, with global reach of communication through increasingly dynamic and complex digital environments (Poell *et al.*, 2019; Strate *et al.*, 2019).

Based on these complex environments formed by digital technologies and the need to investigate their effects, research on media ecology has been gaining ground in new areas of study (Strate *et al.*, 2019). In education, this theory has been the subject of investigations since the 1990s. However, much of the research on this topic only cites the theory to justify the integration of digital technologies in the classroom (Miranda and Pischetola, 2020). They focus on practical aspects of technological integration and do not consider the broader and systemic impacts on students' cognitive and social processes, based on the theory (Miranda and Pischetola, 2020).

When mapping the literature, few works address media ecology with well-founded and in-depth theoretical discussions within the educational context (Strate *et al.*, 2019; Miranda and Pischetola, 2020). One of the main reasons is related to technological evolution and the complexity of understanding the dynamic interactions between different technologies (Scolari, 2012; Strate *et al.*, 2019; Miranda and Pischetola, 2020). Monitoring its development has become a major problem,

since it is no longer thought of as a linear series of branching technologies, but rather as a network of intermediate relationships (Scolari, 2012; 2015). In this vein, Scolari (2012) highlights the need for new research that relates issues and challenges for media ecology from the perspective of the evolution and development of technologies (Scolari, 2012).

Considering the gap highlighted by Scolari (2012) in research linking the challenges of media ecology and technological evolution in the educational context, a series of questions arise: How has media ecology been used in the educational context? What definition do these studies address? Do the studies address aspects related to literacy or competence? What are the main media used? However, considering the complexity arising from technological development and integration, it is essential, initially, to synthesize how the theory of media ecology has been used in the educational context in order to identify its main challenges.

In this context, the research aimed to answer the following question: How is media ecology theory used in the educational setting? Based on this guiding research question, the main objective of this article is to summarize the current state of knowledge regarding media ecology research in education. In addition to its main objective, the research also intended to identify the main challenges regarding the integration of media ecology in this context.

Due to the technological immersion that contemporary society faces, understanding the effects of such exposure becomes paramount (Helmond, 2019; Mintz, 2019). In this regard, media ecology is a highly relevant theory (Strate *et al.*, 2019). Hence, the importance of this research lies in advancing studies on media ecology, since, in the educational context, this theory is explored superficially. Furthermore, it synthesizes such studies, enabling the mapping of the integration of media/technologies in the educational process and the identification of the main challenges in this area of study.

This research does not focus on measuring teaching and learning, nor on proposing models or strategies to integrate media ecology into education. Its central focus is on media ecology in education, synthesizing how this theory has been explored in the literature and identifying its main challenges. To this end, in addition to presenting the main topics and concepts of this theory, we describe the method adopted to achieve the stated objectives and summarize studies in the literature. We opted for an integrative literature review (ILR), as it allows for an integrated synthesis of the knowledge produced on a topic (Torraco, 2005). After selecting the works and based on the synthesis matrix developed, we used Braun and Clark's (2006) thematic analysis as a strategy for analyzing and discussing the results.

MEDIA ECOLOGY

The theory of media ecology is not a recent field of study. The literature has recorded studies directed towards an ecological view of media since the 1960s, notably the research of one of its main precursors, Marshall McLuhan (Scolari, 2015; Strate *et al.*, 2019). In 1968, this theory was consolidated and formally named by Neil Postman (Strate *et al.*, 2019).

The aphorism "the medium is the message" is one of the first premises of the theory of media ecology (Strate *et al.*, 2019). This famous phrase by McLuhan summarizes the approach of media ecology, in which the focus is tied to the medium, to the way the message is communicated, and not to its content (Strate *et al.*, 2019). According to this premise, the media is not a neutral channel; it has an ideological bias (Strate *et al.*, 2019).

Based on this investigative lens and considering the implicit characteristics and effects of media, in 1970 Neil Postman expanded and explored this theory from the "study of media as an environment" (Scolari, 2012; 2015). Media are studied as an environment, to do with how different technologies offer a social environment for people (Ruotsalainen and Heinonen, 2015). This theory

aims to investigate how these spaces created by the media, in which we are increasingly immersed, interfere with and influence aspects related to our cognition, perception, meaning, and values (Strate, 2004; Strate *et al.*, 2019).

Meanwhile, Neil Postman's line of research has made it possible to discover what roles the media forces us to play, its structure, what we are seeing or thinking, and why the media makes us feel and act as we do (Scolari, 2015). This theory investigates aspects related to the structure, context, and effects of the media. It aims to build an ecologically sound environment where everyone has access to information and this information meets people's needs (Strate *et al.*, 2019).

According to Strate *et al.* (2019), technological advancements and information and communication technologies (ICTs) have potentiated the construction of a complex and ecologically sound social system. These new forms of interaction and communication enabled by ICTs have transformed the media ecosystem, since, in order not to become extinct, they have had to adapt (Scolari, 2013). From these complex message environments formed by the media, this theory accepts at least two interpretations: media as environment and media as species (Scolari, 2013; 2015; Strate *et al.*, 2019).

The perception of media as an environment implies the study of the environment, its structure, content (or context), and its impact on people (Scolari, 2013; 2015; Strate *et al.*, 2019). In this approach, researchers analyze how technologies create environments that alter the patterns of perception and cognition of the subjects who use them (Scolari, 2013; 2015). Consequently, understanding modern media ecosystems requires a multidisciplinary perspective that interconnects technology, culture, and human cognition (Scolari, 2013; 2015).

Viewing media as a species that lives within the same ecosystem focuses on the relationship between media (Scolari, 2013; 2015). This approach investigates how media acquire meaning or existence through interaction with other media (Scolari, 2013; 2015). Media are compared to species that live in the same ecosystem and establish relationships with each other (Scolari, 2013; 2015). In this interpretation, no medium has meaning or existence in isolation, but rather through constant interaction with other media (Scolari, 2013; 2015).

Beyond these two approaches, and from the context of technological development and innovation, Marshall and Eric McLuhan predict four effects arising from the emergence of a new medium in the social context. These effects are termed by the authors as the McLuhan's tetrad of media effects, also known as the four laws of media (Strate *et al.*, 2019). They help in understanding, in addition to the obvious functions of media, its social, cultural, and environmental effects, and how media shapes and is shaped by society (Strate *et al.*, 2019; Scolari, 2022). They are (Strate *et al.*, 2019; Scolari, 2022):

- Extension: amplification of some aspects of society, if the media improves our lives;
- Obsolescence: the aging of aspects of the dominant media before the introduction of a new medium (which makes it obsolete);
- Recovery: highlighting previously obsolete features, recovering them from the past;
- Reversal: the revitalization of media as a consequence of the new medium, what it reverses.

Beyond the concepts, definitions, and lines of investigation, the literature points to the need for new research considering the change and transition from analog to digital media (Scolari, 2022). This transformation of media changes its environment, the species, and consequently society (Scolari, 2022). Therefore, studies on this theory record the explosion of new media and highlight the need for new theories, concepts, and categories of analysis (Scolari, 2022).

These transformations trigger new needs and, consequently, skills that encompass the critical interpretation of new interactive textual sets, the ability to use digital networks and participate

in virtual communities, among others (Scolari, 2022). In this vein, studies on media ecology in contemporary society begin to consider various aspects of environments structured based on the logic of platforms (Robinson, 2023). Conducting new studies on how these spaces are influenced by and influence human behavior and cultural practices is essential, interfering in all spheres of our lives (Quezada-Tello *et al.*, 2022; Robinson, 2023).

METHODOLOGICAL PROCEDURES

In the literature, there are several methods and techniques for literature review. To implement this research, an ILR was conducted. This form of research “reviews, critiques, and synthesizes the representative literature on a topic in an integrated way” (Torraco, 2005, p. 356). The application of this method is recommended in investigations that aim to identify how different areas approach the same topic (Torraco, 2005). Furthermore, it allows the researcher to review the literature on a broader scope and analyze both theoretical and empirical studies (Torraco, 2005). Hence, this type of review was chosen because our objective is to summarize the state of knowledge of research on media ecology in education, considering both empirical and theoretical studies in the literature.

To meet the research objective, we adopted the following guiding question: How is media ecology theory used in the educational setting? Based on this guiding question and the theme of this study, we highlight its interdisciplinary approach. Considering its interdisciplinarity, we used the following databases to implement the study: Scopus, Web of Science, Education Resources Information Center (ERIC), and Scientific Electronic Library Online (SciELO). We chose these databases due to their interdisciplinary status and broad coverage of periodicals, journals, and other diverse indexes of sources relevant to the research. Furthermore, they are widely recognized and used in academic research, ensuring the relevance and quality of the data obtained.

For database queries, we have created the search string (descriptor) described in Chart 1:

Chart 1 – Search string.

Databases	String
Scopus	("MEDIA ECOLOGY") AND ("EDUCATION" OR "LEARNING" OR "TEACHING")
Web of Science	
Eric	
SciELO	("MEDIA ECOLOGY" OR "ECOLOGIA DAS MÍDIAS") AND ("EDUCATION" OR "LEARNING" OR "TEACHING" OR "EDUCAÇÃO" OR "ENSINO" OR "APRENDIZAGEM")

Source: Authors (2024).

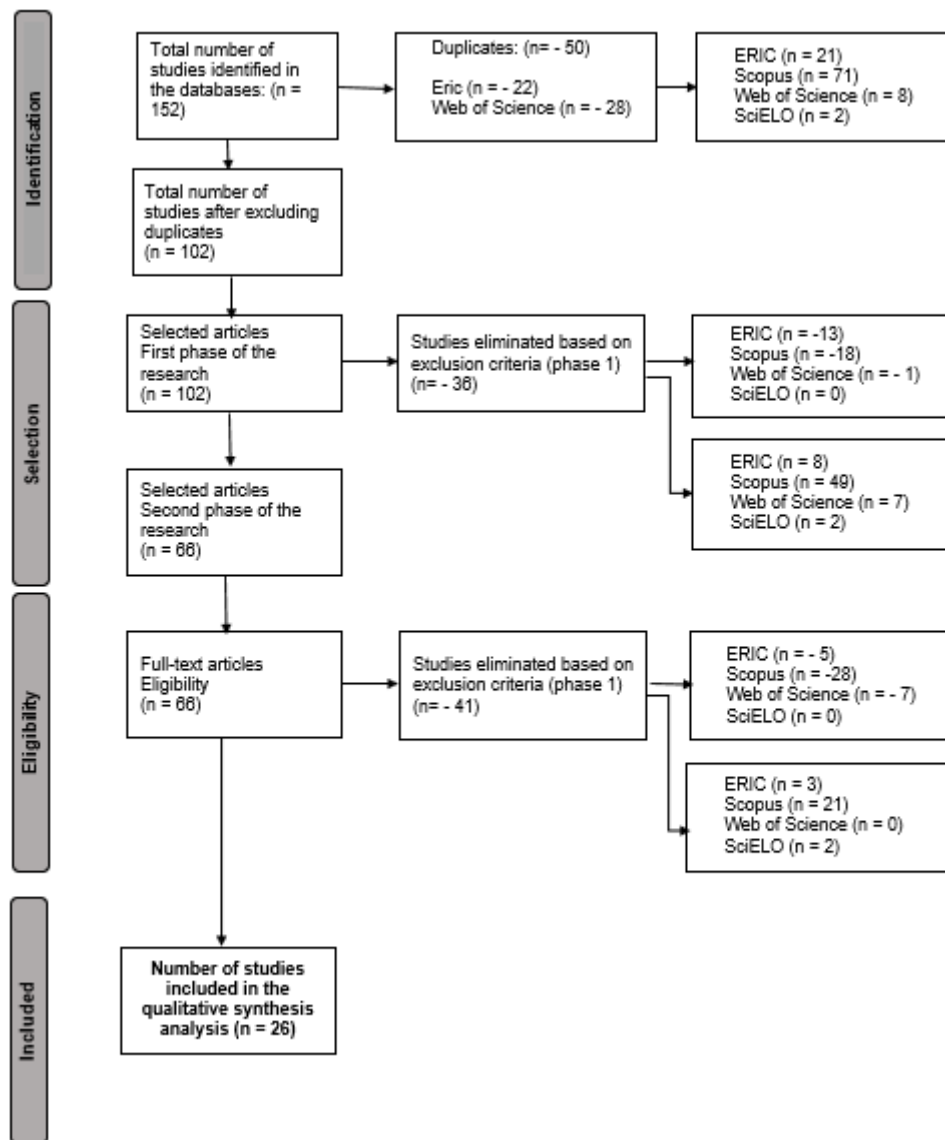
The database search (conducted on June 23, 2023) returned 152 review articles and/or peer reviews. After excluding 50 duplicate studies, 102 studies were selected, as illustrated in Figure 1. After performing the searches in the listed databases, we adopted inclusion and exclusion criteria previously defined in a clear and objective manner to better delimit the related works. The criteria were used in two phases:

- First phase: Reading the title, keywords, and abstract.

In this stage we used the following inclusion criteria (I):

- (I) contains search strings in the abstract, title, or keywords;
- (I) adheres to the theme, even without the strings.
- Second phase: Complete reading of the articles.

Figure 1 – Flowchart of the integrative literature review.



Source: Authors (2024).

In this stage, after a complete reading of the works approved in the previous phase, we selected 26 articles for the composition of the bibliographic portfolio illustrated in Table 2.

The works met the following inclusion criteria (I):

- (I) full access to the texts is available online through the Coordination for the Improvement of Higher Education Personnel (CAPES), Google Scholar, or sent to the authors via email;
- (I) they are written in English, Portuguese, or Spanish.

The following delimitations were proposed as exclusion criteria (E):

- (E) they only mention the term media ecology;
- (E) they display the strings, but it is outside the scope of the research topic;
- (E) the full texts are not available for free online access.

In the first phase, 66 articles were selected from 102 for full-text review. After applying the inclusion and exclusion criteria in the second phase, we selected 26 studies.

After defining the 26 selected works, we developed a synthesis matrix. It was constructed with the objective of assisting in summarizing and documenting the information obtained from the articles based on the following categories for reading and analysis:

- objective of the work;
- object of study (media used);
- methodological approach, research strategy, and data collection and analysis techniques;
- definition of media ecology;
- how it address media ecology in education;
- research results;
- contributions;
- future work.

After completing the matrix, we conducted a thorough analysis and interpretation of the data using thematic analysis by Braun and Clarke (2006) as our main strategy. We opted for this technique due to its accessible and theoretically flexible approach to the analysis of qualitative data (Braun and Clarke, 2006).

MEDIA ECOLOGY IN THE EDUCATIONAL SETTING: A SYNTHESIS OF STUDIES

The analysis of the 26 selected articles, as illustrated in the bibliographic portfolio below (Chart 2), made it possible to summarize the studies on media ecology in education. These studies reflect the evolution of media used in different periods of society within the educational setting.

Chart 2 – Bibliographic portfolio.

(Author, year)	Article Title	Type of Study
Robinson (2023)	Governance on, with, behind, and beyond the Discord platform: a study of platform practices in an informal learning context	Empirical
Cheyunski (2022)	Dealing with dystopia: Freire's Gnostic cycle and media ecology in a post-pandemic world	Theoretical
Siqueira (2022)	Educação Aberta, Letramento Midiático e MOOCs: questões para a prática docente, a partir da ecologia das mídias	Theoretical
Quezada-Tello <i>et al.</i> (2022)	Transmedia Narratives Applied by Communication Students in the Dissemination of Cultural Heritage	Empirical
Otchie <i>et al.</i> (2021)	Contextualizing social media ecology and its pedagogical affordances: The perspective of high school teachers	Empirical
Seraji <i>et al.</i> (2021)	Solutions for Social Media Harms: A Media ecological perspective	Theoretical
Nichols and Leblanc (2021)	Media education and the limits of "literacy": Ecological orientations to performative platforms	Theoretical
Lee <i>et al.</i> (2021)	Digital collaboration in design education: how online collaborative software changes the practices and places of learning	Empirical
Renó and Guimarães-Guedes (2021)	Fotografia, ecologia dos meios e o método de Paulo Freire: olhares para a contemporaneidade	Theoretical

Continue...

Chart 2 – Continuation.

(Author, year)	Article Title	Type of Study
Gislev <i>et al.</i> (2020)	The flexible meeting place: Connecting schools through networked learning	Empirical
Miranda and Pischetola (2020)	Teaching as the emergent event of an ecological process: Complexity and choices in one-to-one programmes	Empirical
McKee <i>et al.</i> (2018)	Locked down apps versus the social media ecology: Why do young people and educators disagree on the best delivery platform for digital sexual health entertainment education?	Empirical
Erixon (2017)	Necessity or Eccentricity — Teaching Writing in a New Media Ecology	Empirical
Forsler (2018)	Image ecologies: Infrastructures of visual art education in Sweden and Estonia	Empirical
Walck <i>et al.</i> (2015)	Mobile learning: Rethinking the future of journalism practice and pedagogy	Empirical
Lee and Kim (2014)	An exploratory study on the digital identity formation of Korean university EFL learners	Empirical
Örtegren (2014)	Digital media added on to the subject of Art in secondary schools	Empirical
Svensson (2014)	The media habits of young people in Sweden: The use of fictional texts in school and recreational contexts	
Erixon (2014)	On the remediation, relativisation and reflexivity of mother tongue education	Empirical
Marner (2013)	Digital media embedded in Swedish art education — A case study	Empirical
Nam (2013)	When New Media Meet the Strong Web of Connected Learning Environments: A New Vision of Progressive Education in the Digital Age	Empirical
Purg (2011)	Open versus closed forms of knowledge assessment in a blended learning ecosystem	Empirical
Säljö (2010)	Digital Tools and Challenges to Institutional Traditions of Learning: Technologies, Social Memory and the Performative Nature of Learning	Theoretical
D'arcy <i>et al.</i> (2009)	How Media Ecologies can Address Diverse Student Needs	Empirical
Erixon (2007)	The teaching of writing in the upper secondary school in the age of the internet and mass media culture	Empirical
Barnes and Strate (1996)	The Educational Implications of the Computer: A Media Ecology Critique.	Theoretical

Source: Authors (2024).

Based on the literature, initial research on the topic was identified starting in the 1990s. These studies address media ecology considering the initial insertion of electronic media in education, but only as a complementary resource in the teaching and learning process. In this vein, Barnes and Strate (1996) present reflections on the relationship between electronic and/or digital technologies

and learning in a broader cultural context. The theory of media ecology is used from the perspective of media as an environment that transforms daily activities and practices (Barnes and Strate, 1996).

Based on this concept of media influence and impact, the authors use media ecology to analyze the advantages and disadvantages of the computer as a medium in education (Barnes and Strate, 1996). To this end, they highlight that technology transforms our conception of what learning is and how we interact with collective resources (Barnes and Strate, 1996). Furthermore, Barnes and Strate (1996) highlight three approaches to media ecology applied to education: as an educational topic embedded in the curriculum; as a teaching method; as a product of specific media environments.

Studies conducted since the 2000s address the impact of screen culture on the teaching and learning process, although still as a complementary resource (Erixon, 2007). Based on this line of research, Erixon (2007) investigates, considering the theory of media ecology, how computers and media culture influence writing, writing instruction, and the curriculum. Media ecology is used as a strategy to understand the social changes associated with media, since students seem to develop new communicative practices involving various skills specific to each medium (Erixon, 2007).

From 2009 onwards, studies reflect the increasing use of interactive digital media, such as podcasts, videos, interactive websites, wikis, and others, for teaching and learning (D'arcy *et al.*, 2009). This diversity raises questions related to the use of digital media versus traditional media in the educational setting. Accordingly, D'arcy *et al.* (2009) examine how students with different learning styles perceive the learning opportunities offered by various media. The authors use the media ecology approach as an environment formed by media diversity, considering both traditional and digital media (D'arcy *et al.*, 2009).

In 2010, research on media ecology in education focused on the changes resulting from the use of digital technologies in the teaching and learning process. Säljö (2010) and Purg (2011) investigate what it means to learn in an educational context. To this end, the authors address changes in social practices and a new media ecology characterized by the use of digital technologies (Säljö, 2010; Purg, 2011). In this context, Säljö (2010) and Purg (2011) argue for the need for a new conceptual framework that allows the integration of technologies into teaching practices.

Another factor highlighted by the authors is related to the transformations linked to a new media ecology (Säljö, 2010; Purg, 2011). This so-called “new” ecology stems from the advancement and evolution of media and digital technologies, which construct a new social environment for the school (student/teacher) (Säljö, 2010; Purg, 2011). However, the careful and balanced use of the different media that make up this environment is essential, with a clearly defined learning objective (Säljö, 2010; Purg, 2011; Nam, 2013).

When considering the use of different media (traditional and digital) in teaching practices, Nam (2013) emphasizes that the synergistic relationship between the new media ecology and connected learning environments will make education even more effective in the digital age. Along the same lines of research, Marner (2013) highlights that the use of these new media environments requires more flexible teaching methods and problematizes how changes in the media world are impacting and modifying some aspects of education. Thus, Marner (2013) approaches media ecology from the idea that we are situated within media structures used for communicative purposes. These structures are not neutral and, considering their ideology, generate consequences in education (Marner, 2013).

Considering that the media has an ideological bias, studies from 2014 onwards have focused their research on informal learning environments (Svensson, 2014). Lee and Kim (2014) highlight that an increasingly diverse media ecology, formed outside the classroom, is causing changes in various aspects, such as the way of thinking, interacting, communicating, learning, among others. Thus, the authors investigate how the environment formed by digital media shapes the digital identity of students (Lee and Kim, 2014). To this end, they use the theory of media ecology to justify changes related to the perceptions, feelings, values, and actions of human beings (Lee and Kim, 2014).

Based on the formal and informal learning environments in which students are immersed, Erixon (2014), Örtengren (2014), and Svensson (2014), highlight a disparity between the media used in these spaces. Reflecting on this duality, Svensson (2014) points out that the school environment is characterized by print culture, while in the family environment students use various electronic and/or digital media. In this regard, to analyze how the technological development of media interferes with the teaching and learning process, Svensson (2014) uses the theory of media ecology.

Based on the evolution and impact of media, Örtengren (2014) aims to understand how different aspects of the implementation of digital media can be related to disciplinary paradigms and practices. The author uses the ecological perspective of media as a point of reference, considering its impact on our perception, feelings, and values. According to Örtengren (2014), digital media in education can be used as an artifact to replace analog media or as a potential tool that offers new areas of knowledge.

Continuing the exploration of the duality between traditional and digital media, Erixon (2014) investigates the use of physical books in education. The author highlights that, in relation to teaching content, the book becomes a more reliable and solid source; however, it is also associated with limited perspectives and restricted content. In this context, the use of various media facilitates the knowledge construction process (Erixon, 2014). To this end, media ecology is approached as a channel for information transmission, where physical structures and symbolic forms interfere with how information is encoded, transferred, and decoded (Erixon, 2014).

When considering how media have modified behaviors, culture, and media consumption, Walck *et al.* (2015) utilize the theory of media ecology. The authors study the advancement of technologies and the environment they create. In this space constructed by digital media, media ecology expands current capabilities and redefines the work routines of students and teachers. Therefore, they use this theory to understand the dynamics of new media, in which technology changes the way people access information (Walck *et al.*, 2015).

Along the same lines of investigation, Erixon (2017) discusses the reflexivity of media, developed from the ability to use various technologies based on several parameters arising from a new screen culture. The theory of media ecology is used in the research, based on the notion of a unique set of physical and symbolic characteristics that each medium carries an ideology (Erixon, 2017). In other words, the media influences aspects related to how we construct knowledge (Erixon, 2017).

From 2018 onwards, research began to consider digital social media in the educational setting as a line of investigation. In Forsler's research (2018), she analyzes the social networks of an online community and visually interprets the resulting media ecology. The author uses media ecology theory to externalize the dynamic relationships between groups and their environments. Hence, she develops a visual model to relate online collaboration and different forms of governance (Forsler, 2018).

Beyond the visual representation of relationships formed in online communities based on the ecological environment of media, McKee *et al.* (2018) address the use of applications and digital social media in education. The authors investigate the best way to reach their target audience based on specific content. To this end, they study a closed media ecology, with access restrictions (application), and an open media ecology, formed by social media. They use the social media ecology approach based on Van Dijck's (2013) framework of platform sociality or connectivity culture (McKee *et al.*, 2018).

Based on the culture of connectivity and considering learning as part of a co-evolutionary process, Miranda and Pischetola (2020) highlight that the ecological approach can offer a perspective that considers greater educational complexity. They use media ecology from the perspective of mutual dependence between the individual and the environment, and how this interaction modifies

the way we look at the process of knowledge production (Miranda and Pischetola, 2020). Thus, the authors focus on communication for teaching, that is, on how communicative choices shape the environment (Miranda and Pischetola, 2020).

Based on the need for an environment that enables the exchange of knowledge between geographically distant schools, Gislev *et al.* (2020) developed a structure called “The Flexible Meeting Place.” This model, created for distance education, combines networked learning and media ecology, aiming to propose alternatives for teacher-less subjects (Gislev *et al.*, 2020). It allows schools to expand their teaching and learning process to other schools, overcoming geographical barriers (Gislev *et al.*, 2020). To this end, the authors use an environment composed of various digital media for interaction and knowledge exchange between the institutions involved (Gislev *et al.*, 2020). Media ecology is used as a dynamic and constantly changing aggregation of media, in which existing practices transform or emerge (Gislev *et al.*, 2020).

Based on this scenario of constant transformation, evolution, and media diversity, Lee *et al.* (2021) investigate aspects related to media fragmentation and diversity in education. They evaluate the use of collaborative practices through online collaborative software in informal education. The authors relate media diversity, resulting from technological advancement, to the perspective of a broader media ecology. This perspective adopted on media ecology is characterized by the interactions between complex media systems, the infrastructures that support them, and the subjects who use them within cultural contexts (Lee *et al.*, 2021).

Meanwhile, considering the importance of informal learning for the development of literacy and skills, Otchie *et al.* (2021) investigate the use of social media in education from the perspective of teachers. According to the authors, teachers and students bring knowledge related to the use of social media into the classroom that is acquired outside of it. To this end, they argue that informal learning can fill the gap in the articulation of the contextual use of social media in education (Otchie *et al.*, 2021). From this perspective, the authors refer to social media as an ecology, since it is not used in isolation but rather comprises a broad network of interconnected connections (Otchie *et al.*, 2021).

Another study on the use of social media in education was conducted by Seraji *et al.* (2021), focusing on its negative effects and the harm it causes. Social media facilitates access to and sharing of information, encourages discussions and reflections, and its main purpose is self-evaluation and feedback (Seraji *et al.*, 2021). Despite the development and possibilities offered by Web 2.0, users still play a greater role in accessing and sharing information and act less as content producers (Seraji *et al.*, 2021).

The strong role that users play in content sharing can lead to: internet addiction; cognitive impairments; physical harm; family harm; theft and fraud; and the breakdown and weakening of social norms (Seraji *et al.*, 2021). Such harm exacerbates problems related to the “digital divide” or “usage gap” (Seraji *et al.*, 2021). Therefore, to understand this problem, it is necessary to consider social, cultural, economic, psychological, and personal characteristics. Accordingly, the perspective of media ecology can provide a comprehensive and systemic view of the complex system of relationships/interactions and communication among its users (Seraji *et al.*, 2021).

Therefore, considering new multiplatform forms and the concept of media ecology, Renó and Guimarães-Guedes (2021) address photography as a pedagogical instrument in the construction of knowledge in humanities disciplines. In addition to the theory of media ecology, the authors base their work on the studies of Paulo Freire. They propose the use of photographic practices as a didactic tool inside and outside the classroom, as an instrument for personal expression and the construction of citizenship. Considering the dynamic environment, laden with social and behavioral changes in many cases due to technological developments, they utilize the theory of media ecology (Renó and Guimarães-Guedes, 2021).

Still on the same object of study (digital social media), Nichols and Leblanc (2021) use the structure of the platforms as their analytical lens. They map the architectures and layers that constitute and animate specific digital contexts. This approach aims to combat and/or reduce the challenges related to the creation and sharing of fake news (Nichols and Leblanc, 2021). Hence, by analyzing the architecture of the platforms, it is possible to trace the broader relationships of human and non-human activities linked to practices in a given environment, anchored in the theory of media ecology (Nichols and Leblanc, 2021).

Meanwhile, Quezada-Tello *et al.* (2022) argue that studies conducted after the technological advancement of Web 3.0 address a new media ecology, influenced by the evolution of media. In this context, the authors discuss the use of transmedia storytelling in higher education through digital media platforms. The theory of media ecology is used as a framework for the study, as it allows for new educational contexts and new teaching and learning practices (Quezada-Tello *et al.*, 2022).

In the context of the pandemic, from a dystopian perspective, Cheyunski (2022) characterizes disruptive social occurrences and technological changes. The author uses media ecology and Paulo Freire's Gnostic cycle as a theoretical basis to discuss the disruptions in education that are beginning to emerge in a post-pandemic world. The author highlights the importance of using technologies in the classroom and involving students in a broader environment (ecology) (Cheyunski, 2022). In this way, he encourages students to become familiar with emerging technologies and to learn collaboratively about the impact of digital media after the pandemic (Cheyunski, 2022).

Thus, based on the importance of familiarization with emerging technologies, Siqueira (2022) portrays the transition in the teacher's role in the teaching and learning process. Furthermore, the author highlights the need for the development of new skills related to the use of digital media. The object of study is MOOCs, connecting the themes of open education and media literacy, in order to raise pertinent questions for teacher professional development (Siqueira, 2022). Media ecology is used as a conceptual basis for discussions on basic media and information literacy skills in education (Siqueira, 2022).

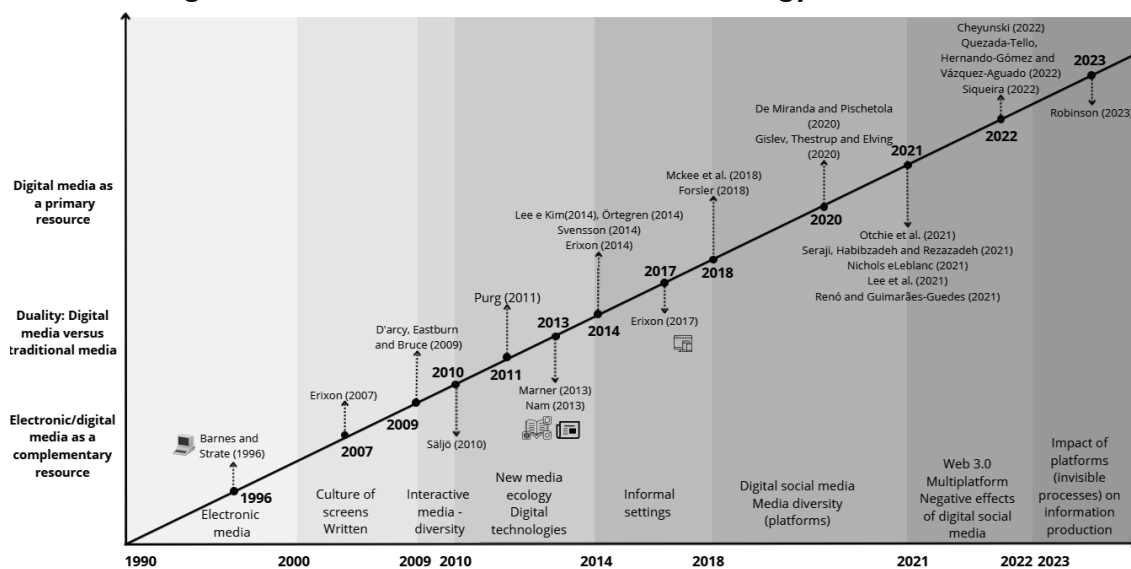
With a broader perspective, Robinson (2023) describes a new media ecology formed by platforms. In this ecology, the environment is composed of multiple interconnected platforms. Considering this context, the author uses the social media platform Discord as a case study. Based on the impact of digital platforms on social practices, the author investigates their relationship with literacy, exploring how learning and literacy can be platformized. In the research, the author focuses on studying the "invisible" part of the platform, on how its structure can influence learning in an informal context, considering issues related to governance and literacy (Robinson, 2023).

Therefore, the analysis of the summarized research made it possible to construct a timeline that relates the reflection of the evolution of media in the educational context, as illustrated in Figure 2.

We reiterate that, since the beginning of discussions on media ecology in education, the advantages and disadvantages of integrating electronic media, such as computers, into the classroom have been foreseen. Electronic/digital media were little used in teaching practices; however, with technological evolution, this scenario has been changing. The development of increasingly interactive and diverse environments has outlined a new media ecology, characterized by digital technologies. As a result, the need arose to integrate them into teaching practices, especially digital social media.

Meanwhile, in addition to digital social media, aspects related to Web 3.0 and multi-platforms are being discussed in the literature. However, the focus of research is on the negative effects of the omnipresence of these media, using media ecology approaches as strategies to mitigate them. The most recent studies investigate invisible processes, that is, what lies behind the ecology formed by the platforms. These environments built by the platforms become a major concern and challenge for ecologists, as we will discuss in the next section, since they influence students and impact the production of information.

Figure 2 – Timeline of research on media ecology in education.



Source: Authors (2024).

CHALLENGES OF MEDIA ECOLOGY IN EDUCATION

The study of media ecology theory in the educational setting is not a recent topic. However, even though it has been the subject of investigations since the 1990s, many studies address this theory superficially (Miranda and Pischetola, 2020). Researching media ecology does not mean transferring concepts and categories from biology to the universe of media (Scolari, 2012). It is essential to relate new issues and challenges arising from the scenario of technological evolution and development (Scolari, 2012). Accordingly, based on the mapping carried out, we highlight some challenges related to education that reflect the rise of technologies in society.

The obstacles identified since the 1990s reflect the impact of early approaches to the use of electronic media in the educational setting, considering them as a complementary resource (Barnes and Strate, 1996). These studies highlighted aspects related to digital exclusion and the skills necessary for the use of technologies (Barnes and Strate, 1996). Another important factor that was underlined prompted reflection on the synthesis of the necessary knowledge regarding computer use (Barnes and Strate, 1996). Initially, greater mastery of computer operation and programming aspects was required. However, over time, the necessary skills were limited to the basic knowledge of turning it on and using word processors (Barnes and Strate, 1996).

In 2000, research portrayed the difficulties and challenges related to changes in social practices resulting from the evolution of media and its impact on the educational landscape. These studies represent the first lines of investigation into informal media environments. Furthermore, they highlight some disparities between the knowledge and experience built from interaction in these environments and the pre-established knowledge in the educational setting (Erixon, 2007; Säljö, 2010). This necessitates some changes and the integration of digital media into education (D'arcy *et al.*, 2009; Säljö, 2010).

Literature since 2010 has highlighted the integration of digital media into teaching practices. The obstacles underscored by research addressing media diversity in education include: the careful and balanced use of the new media ecology and learning environments; the construction of knowledge that meets students' needs in terms of information processing and social skills; teaching methods that effectively integrate digital media; and the creation of an environment consistent with the social context (Purg, 2011; Marner, 2013; Nam, 2013).

With technological development and the evolution of media, discussions and issues reflecting aspects of a new media ecology have gained greater attention since 2014. As a result, the literature has focused on informal environments, and issues such as the duality between traditional and digital media are explored. Research reflects the use of traditional media as the main resources used in the classroom, creating a distance between the learning environment and the informal environments used by students outside of it. These environments, present in students' daily lives and in which they are increasingly immersed due to media diversity, can alter the experiences of those involved and their perceptions of reality (Walck *et al.*, 2015).

Considering the impact of media on aspects related to students' perception and cognition, since 2018, studies have focused on digital social media platforms. In this regard, the media used by students outside the classroom have become the focus of investigations (McKee *et al.*, 2018). The barriers encountered are linked to the integration and construction of a rich media ecology in teaching practices (McKee *et al.*, 2018; Gislev *et al.*, 2020; Miranda and Pischetola, 2020). Furthermore, it has been necessary to rethink communicative choices (Miranda and Pischetola, 2020).

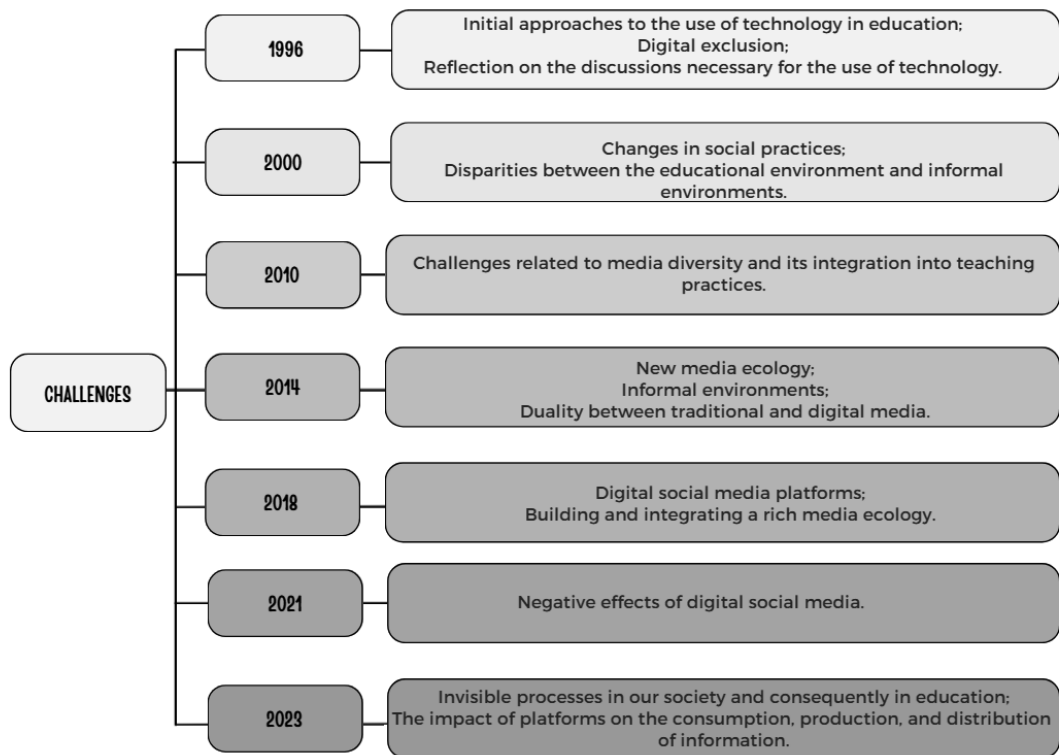
In 2021, the focus of studies on media ecology in education continued to be digital social media platforms. However, the analytical lens shifted to their negative effects, such as: the dissemination of fake news; misinformation; internet addiction; digital inequality; weakening of social norms; technological dystopia; social disruption; among others (Seraji *et al.*, 2021; Cheyunski, 2022). Media ecology became one of the main strategies to mitigate these damages, with education for and with digital social media being identified as the main mechanism to mitigate such obstacles (Nichols and Leblanc, 2021). However, challenges related to use and negative experiences (loss of control), mainly on the part of teachers, were major obstacles identified (McKee *et al.*, 2018).

Based on this scenario of connectivity and omnipresence of digital social media platforms, from 2023 onwards, research has focused on the so-called invisible part of the platformization movement in which contemporary society lives (Robinson, 2023). Hence, based on McLuhan's famous aphorism "the medium is the message" and the strong movement of platforms, some investigations reflect on invisible processes that permeate our society (Strate *et al.*, 2019). These investigations identify, as a challenge, the impact of platforms on the consumption, production, and distribution of information through media that are shaped by platform architectures (Robinson, 2023). As a reflection of this, people produce and are produced by these structures (Robinson, 2023).

Based on the challenges identified in studies on media ecology in education, as summarized in Figure 3, we can see that, currently, one of the main barriers faced is maintaining a balanced environment. For the theory of media ecology, an ecologically correct environment is one in which everyone can share and have access to information that meets their needs (Strate *et al.*, 2019). This issue is a key point for media ecology, a concern that has been addressed by researchers in the field for a long time, even before the current connectivity scenario of contemporary society (Strate *et al.*, 2019).

However, research from 2021 onwards has portrayed several factors that compromise the organization and balance of environments formed by digital media, such as: disinformation; the spread of fake news; digital exclusion; dystopia; among others (Barnes and Strate, 1996; Walck *et al.*, 2015; Nichols and Leblanc, 2021; Cheyunski, 2022). These problems are the result of invisible processes caused by platform logic (Robinson, 2023).

In these digital spaces, few possess knowledge regarding their structure, which directly impacts the distribution of information (Nichols and Leblanc, 2021). Meanwhile, students' lack of knowledge regarding the use and structure of this ecosystem is another aggravating factor (Nichols and Leblanc, 2021; Robinson, 2023). Often, users' information access skills are limited to research and vertical reading of information. It is necessary to expand their research and access skills across other websites and platforms (lateral reading) to verify the accuracy of information (Nichols and Leblanc, 2021).

Figure 3 – Challenges of media ecology in education related to technological evolution.

Source: Authors (2024).

We therefore emphasize the importance of education for and with media (Nichols and Leblanc, 2021). To this end, it is essential that young people feel they belong to the media ecosystem, in which the improvement of various skills, including digital skills, is essential (Pereira *et al.*, 2021; Renó and Guimarães-Guedes, 2021). Furthermore, considering our immersion in environments where we are both produced and produced by them, actions that encourage the improvement of knowledge in aspects related to: the interface and content of platforms; what is behind the platform, its structure, support and documentation; and beyond the platform, such as its governance and the media ecology formed by them (Robinson, 2023) are essential.

FINAL CONSIDERATIONS

The main objective of this study was to summarize the state of knowledge of research on media ecology in the educational context. To this end, through an ILR, a synthesis of selected works was carried out, allowing for an analysis of the relationship between technological evolution and its impact on education. Thus, based on the research gathered and analyzed, it was also possible to identify the main challenges related to the integration of this theory into education, considering the context of constant technological development and evolution.

As main results, the mapping carried out allowed us to identify the effects of the evolution of digital media on education. Initially, the use of digital media faced resistance from teachers, and discussions addressed the duality between the use of digital and traditional media. Currently, research reflects the negative effects of students' exposure and immersion in digital social media platforms and the influence of these resources on our lives, interfering in various aspects in an unnoticed way.

The influence of environments formed by digital media platforms is one of the main challenges for media ecology in maintaining an ecologically sound environment (Robinson, 2023). In these

environments, few people possess knowledge about the structure and logic of the platforms, triggering problems related to: misinformation; the spread of fake news; digital exclusion; dystopia, among others (Barnes and Strate, 1996; Walck *et al.*, 2015; Nichols and Leblanc, 2021; Cheyunski, 2022). This challenge highlights the need for education for and with media (Nichols and Leblanc, 2021), focusing on improving knowledge in various competencies, including digital ones.

As Robinson (2023) states, we produce and are produced by platforms; they influence various spheres of our lives. In this regard, it is essential that students are aware of the invisible processes caused by media. In addition to knowing how to use them effectively, it is essential to understand aspects related to the structure of these environments and how they function (Robinson, 2023). Encouraging knowledge about the use of media, focusing on the environment and the support, is the first step in contributing to the construction and organization of an ecologically sound environment.

We also highlight, as a theoretical contribution of this investigation, the synthesis of knowledge carried out, which enabled the gathering and synthesis of information from multiple studies on media ecology, consolidating existing knowledge. Media ecology is an interdisciplinary field, and the review conducted made it possible to connect the theory to the field of education, promoting a more complete understanding of how media affect the educational environment. In this respect, this investigation contributes to the advancement of studies in the area, by relating the evolution of media to education and by addressing how emerging media are treated in this field.

Through an ILR, we found that the theory of media ecology has been addressed superficially, often as a metaphor in the educational setting, which constituted a major limitation in the research. Many studies did not describe aspects relevant to understanding and synthesizing how the theory was applied. Although it is gaining ground in new areas of study, the theory has been used succinctly in the literature, and new studies are needed that consider changes, new perspectives, and paradigms in relation to the theory.

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ABOUT THE AUTHORS

NATANA LOPES PEREIRA is a doctoral candidate in the Postgraduate Program in Engineering and Knowledge Management at the Universidade Federal de Santa Catarina (UFSC).

MARCIO VIEIRA DE SOUZA holds a doctorate in Production Engineering from the Universidade Federal de Santa Catarina (UFSC). He is an associate professor in the Department of Engineering and Knowledge Management at the same institution.

FERNANDO JOSÉ SPANHOL holds a doctorate in Media and Knowledge from the Universidade Federal de Santa Catarina (UFSC). He is a professor in the Department of Engineering and Knowledge Management at the same institution.

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Responsible Editor: Fabiane Maia Garcia  <https://orcid.org/0000-0003-0121-0416>

