



THEORETICAL-PHILOSOPHICAL PERSPECTIVES ON ARTIFICIAL INTELLIGENCE IN THE LIGHT OF PIERRE LÉVY

PERSPECTIVAS TEÓRICO-FILOSÓFICAS SOBRE A INTELIGÊNCIA ARTIFICIAL À LUZ DE PIERRE LÉVY

Sônia de Souza e Silva¹

Marco Aurélio Kalinke²

Abstract: This article reports on research carried out and aims to present the theoretical-philosophical perspectives on artificial intelligence in the light of Pierre Lévy from ontology, development and possibilities in educational processes. To this end, the work had Lévy's notions as one of the main objects of analysis, which proposes theoretical reflections on AI from educational and theoretical-philosophical perspectives. These perspectives, in general, point out the conditions of possibility in which the use of AI can have an impact. As final considerations on the researched subject, we sought to establish relationships with his work, pointing out the understandings and connections between the ontological, epistemological and axiological aspects in the trajectory of AI as a way of presenting considerations about the possibilities of its implications in the public sphere, which is also digital and relates to the transformations and implications in educational processes.

Keywords: Qualitative research; Artificial intelligence; Theoretical-philosophical perspectives; Educational processes.

Resumo: O presente artigo traz o relato de uma pesquisa realizada que tem por objetivo apresentar as perspectivas teórico-filosóficas sobre a Inteligência Artificial à luz de Pierre Lévy desde a ontologia, desenvolvimento e possibilidades em processos educacionais. Para tanto, o trabalho teve como um dos principais objetos de análise as noções de Lévy, que propõe reflexões de ordem teórica deste campo a partir das perspectivas educacionais e teórico-filosóficas. Essas perspectivas, em linhas gerais, apontam as condições de possibilidade em que a utilização da Inteligência Artificial pode causar impacto. Como considerações finais sobre o assunto pesquisado procurou-se estabelecer relações com sua obra, apontando as compreensões e conexões entre os aspectos ontológicos, epistemológicos e axiológicos na trajetória da IA como forma de apresentar as considerações sobre as possibilidades de suas implicações na esfera pública, que também é digital e que se relaciona com as transformações e implicações nos processos educacionais.

Palavras-chave: Pesquisa qualitativa; Inteligência artificial; Perspectivas teórico-filosóficas; Processos educacionais.

1 Introduction

¹ PhD student in Philosophy from the Postgraduate Program in Philosophy (PGFILOS) at the Federal University of Paraná (UFPR). Master in Science and Mathematics Teaching from the Postgraduate Program in Scientific, Educational and Technological Training (PPGCET) at the Federal Technological University of Paraná (UTFPR). Teacher at Sion College. Curitiba, PR, Brazil. Email: letrephilos@gmail.com.

² Doctor in Mathematics Education, Pontifical Catholic University of São Paulo (PUC-SP). Faculty member at the Federal Technological University of Paraná (UTFPR), Curitiba, Paraná, Brazil. E-mail: kalinke@utfpr.edu.br.



The research presented in this article is part of Macro project composed by research focused in artificial intelligence (AI) and its insertion in educational processes, as well as the use of Learning Objects (LO) in Mathematics Education. The research are connected to the proposal of development of GenIA platform to construct LO in mathematics. The platform uses intuitive programming and it is assisted by AI

In order to collaborate with the macro project we start at the assumption that the perspectives of philosophy, Science and technology open a dialogical space in the academia – The technique, as element of reality transformation becomes the amalgama which brings such perspectives, reflecting the differences, not only when regarding the methodological patterns to be adopted, but also to the list of problems the a philosophical reflection about AI may occupy with.

The research follows a qualitative method and seeks comprehensions about the existing approaches in AI field. Under this panorama, the central goal is to present theoretical-philosophical perspectives in the field of AI and to expose analysis of ontological, epistemological and axiological aspects approach assumed during the development of the research and that in some way may promote discussions and comprehensions about the theme and its insertion in educational processes. Facing the challenge of integrating the areas of philosophy, education and technology in the teaching of science and mathematics with wide range, the following question of research is presented: What theoretical philosophical approaches emerge in the work of Pierre Lévy published in Brazil and may enlighten the reflection to the insertion of AI in educational processes?

The theoretical philosophical perspectives of AI enlightened by the ideas of Pierre Lévy were adopted. For being a thinker of technical question, that uses Technologies of intelligence to represent languages, signs, its uses and logical resources as instruments to give sense to representation and significance. The author presents his ideas and anthropological views about the transformation of the technical phenomena and its range, which may possibilitate proposals of democratic and collective proposals of in course transformation. His problematization of the theoretical and pragmatic meaning of technique and technology ran throughout his work and his discussions have permeated the communication and information scenario since the 1980s.

The analysis of conceptions of knowledge and approaches related to AI and technologies of intelligence, according to the proposed by Lévy (2010a), as well as its implications in the field of education, bring reflections and concepts such as interactivity,



critical thinking, collective intelligence, cognitive ecology, space of knowledge among others. This demonstrates the active involvement of Lévy in the promotion of debates, discussions and probabilities related to the use of computers for educational purposes.

This way, the connection with the author's thoughts and its interlocutors seek to establish a connection between teaching and learning processes with constant reflexion on the pedagogical praxis and world interpretation, making possible a cognitive democracy construction centered analysis, starting with the perspective of the construction of a technodemocracy as understood by Lévy (2010a).

This way the analysis of the dialogical transmission provided by collective and its transformations that occur in the space of knowing described by Lévy (2010a), pointed elements of problematic here discussed elaboration. The contemporary scene, characterized by the wide exploration of AI, configures as a fertile land to deliberation of questionings of philosophical order designed to foment a synergetic productive relation between humanity and emerging technologies.

It is assumed that AI has the potential to transform societies, being characterized as one of the most strategic technologies of XXI century. The subjects related to the digital Revolution and migration from the analogical universe to the digital suggest that devices that use AI technologies has become a predominant aspect of the present and will be, according to Russell (2021), the dominant technology of the future, due to its possibilities of speed and reach.

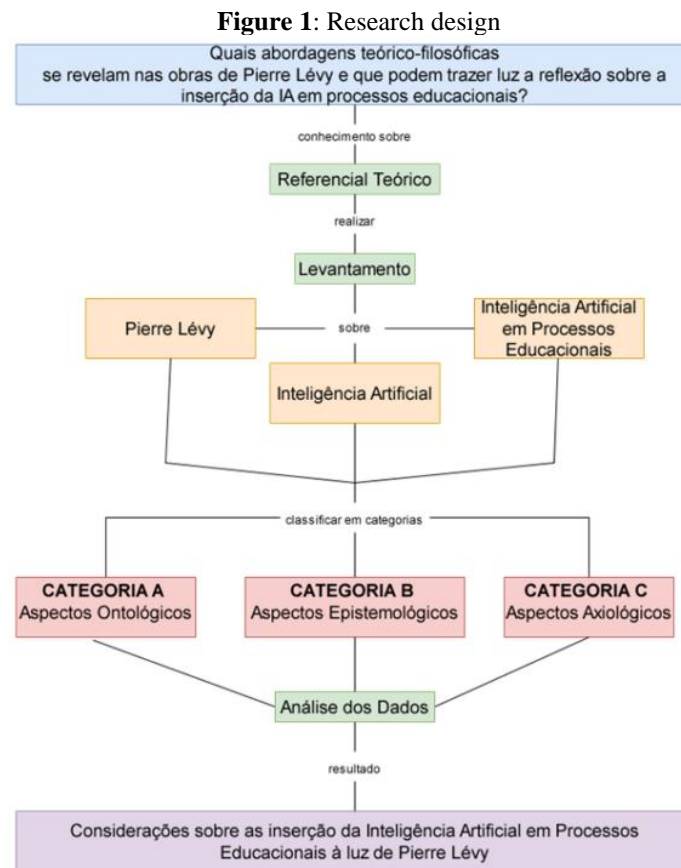
In this perspective, the speed of change implied with the use and insertion of AI makes possible debates related to its development and evolution, the axiological discussions around moral, ethics and machine ethics provide reflection about technical productions and human sustainability thinking in an age of man-machine symbiosis. Hiperconection, provided by broadband and mobility, stablished availability and access to content making possible the advance in AI and also modifying the way people acquire and Exchange information.

In the field of mathematics education, research and studies that approach the role, definition, division, object and methodology of technologies of approach of mathematics represent one of the most prominent perspectives (Borba; Silva; Gadanidis, 2018). These studies have provided a deeper understanding of the implication of its integration in the processes of teaching and learning. Therefore, by selecting one topic of research about such a wide field as AI conditions of possibility for a diversity of secondary studies are opened. They may enrich their investigative propositions. Besides, the possibility that

emergent Technologies with Digital Technologies (DT) present in the educative relation may create trajectories of teaching and learning in virtual environment also suggest that incorporation and development of this technological resources imply the construction of conceptual models with applications in educational field.

2 Methodological tracks

The methodology used may be visualized in Figure 1, which presents the summarized structure of the research regarding the presented problem.



Fonte: Author (2023)

The general purpose of this study was created with the intention of presenting the theoretical-philosophical perspectives about AI under the light of Pierre Lévy starting at the ontology, development and possibilities in educational processes. The possibilities of analyzing the pertinence of these concepts were considered, also its implications and tendencies which relate to mathematics education.



At first a bibliographical review was performed based on the Productions from author which compose the theoretical basis adopted in the research³. The seek for deeply comprehending the topics, aiming a wide range view of what had been produced, focusing on 1987 to 2022 Lévy's work published in Brazil, through literature review (LR) on the theme). The works are in Board 1. Choosing LR as methodological procedure was motivated by its attendance to the scope of this study for providing an approach which enables the development of critical thinking regarding the previously identified questions (Creswell, 2021).

Board 1: Selected works

Selected works	Original publication in french	Consulted edition
<i>La machine univers Création, cognition et culture informatique, Paris: La Découverte, 1987.</i> A máquina universo: criação, cognição e cultura informática. São Paulo: ARTMED, 1998.	1987	1998a
<i>Les technologies de l'intelligence. L'Avenir de la pensée à l'ère informatique, Paris: La Découverte, 1990.</i> As tecnologias da inteligência. O futuro do pensamento na era da informática. 2010. 2 ed. Rio de Janeiro: Editora 34.	1990	2010a
<i>L'idéographie dynamique. Vers une imagination artificielle? Paris: La Découverte, 1992.</i> A ideografia dinâmica: rumo a uma imaginação artificial? (1992). São Paulo: Loyola, 1998.	1991	1998b
<i>Les arbres de connaissances, Paris: La Découverte. 1993.</i> As árvores de conhecimentos (1992). São Paulo: Escuta, 2008. 188 p. (em coautoria com Michel Authier).	1992	2002
<i>L'intelligence collective. Pour une anthropologie du cyberspace. Paris: La Découverte, 1994.</i> A inteligência coletiva: por uma antropologia do ciberespaço. Tradução de Luiz Paulo Rouanet. 10. ed. São Paulo: Edições Loyola, 2015.	1994	2015
<i>Qu'est-ce que le virtuel? Paris: La Découverte, 1998.</i> O que é virtual? São Paulo: Editora 34, 2011.	1995	2011
<i>Cyberculture. Paris: Odile Jacob, 1997.</i> Cibercultura. 3 ed. Trad. Carlos Irineu da Costa. São Paulo. Editora 34, 2010b.	1997	2010b
<i>World Philosophie (le marché, le cyberspace, la conscience). Paris: Odile Jacob, 2000.</i> A Conexão Planetária: o mercado, o ciberespaço, a consciência.	2000	2001
<i>Le feu Libérateur. Paris, Arlea, 2006.</i> O Fogo Liberador. São Paulo: Iluminuras, 2000.	2000	2006
<i>Cyberdémocratie (Essai de philosophie politique). Paris: Odile Jacob, 2002.</i> O Futuro da internet: em direção à uma ciberdemocracia planetária. São Paulo: Paulus, 2010. (em co-autoria com André Lemos).	2002	2010c
<i>La sphère sémantique - Tome 1, Computation, cognition, économie de l'information. Paris: Hermès, 2011.</i>	2011	2014

³All information regarding history of AI and its curiosities and paradigms are supported by the classical works of Minsky (1968), Russell (2021), Russell e Norvig (2013) e Simondon (1989).



Selected works	Original publication in french	Consulted edition
A esfera semântica – tomo I: computação, cognição e economia da informação. São Paulo: Annablume, 2014.		

Fonte: Autoria própria (2023)

The LR process was divided in five steps, presenting a path to find in the selected literature the answers for the proposed questions. According to Creswell (2021), a map of the literature can visually summarize the previous research, because it may be organized in different ways. A hierarchical structure was chosen, starting by the question and extending to the specific literature already gathered.

Following, a script with criteria that enables the construction of systematized information was created to specify the investigation. The multiplicity of references and information about different aspects of specific projects on the insertion of AI in educational processes reassured the need of a LR to perform a wide review of primary research.

According to Creswell (2021), reviewing literature means to find and summarize studies on a topic and highlights there is not only a single way to conduct a LR, however, it is necessary to use a systematic procedure to find, categorize, evaluate and analyze the works. The same method was Applied also to digital books from the author indicating the main ideas present in each work, as well as the Evolution of the terms.

The gathering was made, as understood by Fiorentini and Lorenzato (2012) in works relevant to this study. An exploratory research in the work of Lévy was performed with the intention of identify citations, using the expression “artificial intelligence”.

As result, forty registers were identified. Since Lévy’s arguments for the same theme or concept may present differences from one work to other, we chose to analyze chronologically according to the original publication and not to the translation date of publishing in Brazil.

The bibliographical review, data gathering and considerations about AI were performed in different moments. Furthermore, direct references to the term “artificial intelligence” were then gatherer. In order to stablish the goal of relating the trajectory of AI in educational processes the next step of the research was to categorize the data found in the author’s corpus.

After analyzing the categories, was then established a relation between the, emphasizing the possibilities of integration with AI and possessing intent of enlighten possibilities of solving the problem presented in this research. The relation is presented



in order to highlight the inter-relations which are contained within the categories, starting from the categorization between: Pierre Lévy; Educational Processes and AI.

After the classification and organization, the categories were triangulated intending to verify the convergences found during the research and to produce consistent results and conclusions related to the investigation (Fiorentini; Lorenzato, 2012, p. 136). The triangulation of common aspects between the exposed groups may indicate possible relations to be considered When using AI as resource in educational processes.

3 Theoretical background and possible philosophical approaches in the universe of artificial intelligence

In this section we propose to discuss as authors and interlocutors of Pierre Lévy describe the different paths through where technological knowledge and its creation influence the society in which they are inserted. This implies in highlighting the transforming role that Technologies have and exercise in culture.

A reflection about the relation between man and digital technologies is presented. According to the ontology, AI refers the idea of an intelligence of an autonomous machine that resembles human intelligence in order to simulate, power or overcome. Such propositions regarding relations between AI and mankind are discussed by the author and is dated from the exploration of a problem that has become one of the crucial problems from the XXI century: the adaptation of the digital era started by the advance of informatic in the XX century, presenting a theoretical dimension that presents itself as atemporal.

3.1 Physical and technical reality: Nomads of earth

Human beings have lived, since beggining of history, a physical reality, the categorical landmark of the species in the trajectory of reality until reaching mixed reality, which is permeated by both the physical, material world and the digital world. Considering that originally the word techne proposes an extensive philosophical debate referring to the Greek origins of Philosophy and Mathematics, its historical progression shows how the natural human disposition became relevant in the modern era, as knowledge was transformed into one of the dimensions of power, and which comprises information and knowledge. The technology approaches step by step a technical vision and it is capable of absorvng the nature of the technique.



In the beginning of human trajectory, a physical reality was experienced and the conditions for survival consisted inside the material environment were composed by the geosphere, biosphere and atmosphere. The primal step of physical reality produced a psychic reality in which the subject and the world are part of the same reality - the primal man, therefore, did not recognize himself as a subject, nor understood his existence apart from the world. This manner, the concept of reality acquired, through the existence of the nomads of Earth, new conceptual layers, expanding human lives beyond tangible and touchable material. Cities, States, Economies, legislation, commerce and other emerged. The so far new set of conceptual layers of reality was named by Chardin⁴ (1998), as Noosphere, and differentiate the human experience from other living species.

However, in Lévy (2015) approach are considered different aspects of developments from the first great anthropological mutation that happened in the Neolithic and opened new spaces to the systematic use of tools. Agriculture, livestock, commerce, the cities, the estate and writing, in a certain way, mobilized, mobilize and partially coordinate the experience, the intelligence, wisdom, imagination and way of living of human beings.

Earth, the nomad planet, became the world of significations, a cosmos Where humans are communicating with animals, plants and landscapes elaborating the human world. The subject and the world establish the conditions of possibility to highlight the objects, different from the world and from the subjects, the natural objects O subject and the world establish conditions of possibility of highlight objects, different from the world, subjects or natural objects. Nevertheless, in this continuous process of abstraction, of what can determine experiences, existence and the way of living, the technologies have always been present. The cognitive enables accrued from Technologies in nomad space, today favors the communication and thinking. The transformation of the contemporary nomad reality is not Only geographic territory anymore, but incognita land, described by the author (Lévy, 2015) as an invisible space of knowledge, knowing, potentials thoughts that emerge and transform the qualities of the being and the means of constitution of society and its technical objects.

⁴ Pierre Chardin (1998) establishes a representation of the evolutive phenomena interpreted in a unique board, with meaning, is a big synthesis of “becoming” of the natural history of thinking, which resulted in the conception of the Noosphere. Noosphere may be understood as the layer of thinking on the planet determined by the level of experience. It is a continuous process of growing abstraction from what reality determines. Under this perspective, human being may be understood as a technospecies in which Evolution will get confused with technology.



An immemorial time-space, for many times abstract, known as qualitative, dynamic, alive in humanity and in the way of constant self-invention, controlling the technological systems in the attempt of producing its own world in its way according to its needs and interests, creating layers of reality inserted in different spaces. Technical reality, objects and digital objects permeate the notions of knowledge in present times. Technologies, mainly the cognitive which favor communication and thinking presented in the Inosphere, are located in the space of knowledge, conceived by the author in a historical, anthropological and virtual dimension that relates with other existing spaces in human's journey in the planet, space of territory and space of merchandise.

3.2 Land Spaces and technologies

The distinct Spaces communicate and establish new models of public sphere. The land space represents civilizations and their relations with physical environment, including the control of nature and its relation to the physical environment and territorial supremacy. The space of merchandise is connected to capitalism, globalization and circulation of goods and Money, at last, the space of knowing is an abstract space which range all the others and is related to acquisition of knowledge and information, influenced by technical and scientific advance that powers knowledge as knowing.

The space of knowledge represents the fourth space, that etymologically does not exist, nevertheless utopically pervades and moves all the others. Such space is present virtually, producing rhizomes and plateaus of knowledge. The practices of acquisition of information and knowledge do not escape the dynamics of the virtual, the access to different modalities of signification of networks that extend into systems of systems moving data, memories, actions, concepts and differentiated languages that constitute the so called Informational Society and as human trait, produces knowledge.

According to the author, it may be understood as a space of anthropological dimension, apart from the other spaces (Lévy, 2015). This way, the space of knowledge is marked by the physical constitutions of nature composing materiality of earth, of the territory space that allows the inscription of the idea of civilization with all the flow provided by merchandise space reorganizing according to its projects speeches and interests, submitted, to capital demands.

The digital era, which marks the beginning of the XXI century, can be compared to the transition of the Neolithic period, known as "stone age of the spirit". As the old



nomads of Earth that, while stablishing constitute cities and states, dedicating collectively to different activities seeking better quality of life, the digital era represents a new chapter in the evolution of society. The analogy between representation of stone, as defended by Lévy (2010a), and the silicon present in the microcomputers of optic fiber is intriguing. The old nomads used the rock as base for their achievements, as well as contemporary human beings used silicon as bedrock for developing DT. This implies that the digital era is a period of significative transformation, in which technology performs a central role in reorganizing human activities and in the seek for a better quality of life.

Under this context, it is fundamental to analyze the DT not Only as technological tools but as an autonomous space with its own characteristics and implications. The comprehension of this potential and challenges is essential to guide political actions related to the digital era to ensure benefits to the society. Therefore, the reflection about the relation between DT and other social spaces is fundamental to plainly comprehend the evolutions of contemporary society, space where this abstraction Journey reaches new stages and DT open possibilities of expansion of bodies and minds to beyond the biological and organic, amplifying the possibilities of new realities.

Searching for comprehensions about the process and how human beings are affected by it, a historical reflection of the technical reality present in the intelligent hybrid system (human-technological) that movements the transformation is necessary, even before the digital processes and artificial memories. Lévy (2010b, p. 22) questions: Would the technology be an autonomous actor, apart from society and culture, that would be only passive entities stroke by an external agent.

To Simondon (1989), technology carries an ontogenetical vision, that be, a vision capable of organize technical objects not by their functions but by their nature. The concern of the author is justified by the lack of understandings of the technological world by the cultural world. According to Cupani (2017), the machine as element of technical group becomes what increases the quantity of information, what increases the negentropy, what is capable of integrate and organize systems that oppose to entropy or degradation of energy so valued in the modern period.

Simondon (1989) considers the machine as a work of organization, information and a technical element in constant transformation, and it is philosophy's duty to stablish elements to comprehend the intent of the technical objects in its different representations and materiality. Such change in the philosophical perspective over the technical object (something that beholds within itself its evolution) and evolves in the constitution of



technical species and its uses, announces the possibility of an introduction of the technical being in the culture. This integration, that could not be definitely operationalized neither in the element level nor in the individual's, will be able to, with more probability, operate in the level of groups; the technical reality made regulating will be able to integrate culture, regulative by essence.

The technique participates actively in the cultural, symbolic, ontological or axiological. Lévy (2010a) defends that there are not sides or opposition between such things and the techniques versus the man. It is possible, however, to consider aspects conditioned by time, culture and circumstances, “highlight the difference between them in their utilitarian materiality and the narratives, symbols, imaginary structures and ways of knowing that make them look like what they are to the eye of members of the different societies considered” (Lévy, 2010a, p. 15).

The technical object exists in a mixed environment, technical-geographical, and evolves according to the technicity involved and the bond to life, also the human needs. The machine is not only a technology, but a complex system composed by various interconnected components, that operate together to produce a specific result. Simondon (1989) argues that the machine should not be seen as an isolated object but as part of an wider technological ecosystem, which includes other machines, technical systems and even nature. Lévy (1998) refers to machine (computer) as a fundamental instrument to the Evolution of Society and culture, since it allows the creation of new forms of knowledge and reinforces access to information.

Lévy (2010a, p. 15) reinforces that “an Entity may be, in the same time, object of experience and instituting source, particularly if it refers to technique”. Lévy (2010b) argues about the social implications of AI as a theoretical reference to the Reading of enunciations of meaning of cultural changes. He states that:

o ideal mobilizador da informática não é mais a inteligência artificial (tornar uma máquina tão inteligente quanto, talvez mais inteligente que um homem), mas sim a inteligência coletiva, a saber, a valorização, a utilização otimizada e a criação de sinergia entre as competências, as imaginações e as energias intelectuais, qualquer que seja sua diversidade qualitativa e onde quer que esta se situe (Lévy, 2010b, p. 171).

Such reflections contribute to the debate regarding taking the same referencial to the production of this research. To do so, the existent possibilities between technique, culture and Society must be considered instead of emphasizing to the impact of technologies assisted by the AI without recognizing that it is part of the system of basis



of knowledge.⁵ (Lévy, 2010b), and that the Technologies are products of a Society and its current culture.

Não há nenhum ator, nenhuma “causa” realmente independente que corresponda a ela. Encaramos as tendências intelectuais como atores porque há grupos bastante reais que se organizam ao redor destes recortes verbais (ministérios, disciplinas científicas, departamentos de universidades, laboratórios de pesquisa) ou então determinadas forças estão interessadas em nos fazer crer que determinado problema é “puramente técnico” ou “puramente cultural” ou ainda “puramente econômico” (Lévy, 2010b, p. 22).

Following, the author completes the reflection localize the process, through which the techniques bring differentiated cultural and social implications, “but the distinction between culture (dynamic of representation) society, (people, bonds, exchanges and relations of strength) and technique (effective artefacts) can only be conceptual”. (Lévy, 2010b, p. 22). Ponders the social and cultural aspects of civilization. culture, to Lévy (2008) presents concrete possibilities to effective the technologies of intelligence as operators of a cognitive democracy present in the basis of citizenship of the contemporary world.

The constitution of an intelligent collective becomes possible. In it the individual may have real time access, the guidance of the device and freely pervade the space of knowledge sharing knowledge, skills and competence. Informatics culture compose the reality that englobes physical and digital world. Collective intellectuals create new forms of communication, different languages and build virtual universes in cyberculture’s cyberspace.

The concepts of technique and technology in contemporary society are a portrait of different powers: technologically sharpened instruments, different languages and a symbolic universe of representation. Technique, intellectual technologies (Lévy, 2010a) and other manifestations of technology offer contributions over different relations about the subject-object and thought-object. Understood as one of the essential characteristics of man, technique would have in its essence technical thought (Simondon, 1989).

Inside cultural context, human being classifies artifacts according to its specific utility. In this sense, machine represents categorization of an artificial Entity. The relations of incorporation are presented in the context of culture, anthropological space

⁵ The nature and the tasks of AI are polemical since its creation and, according to Russell (2021, p. 20) “started since its definition, therefor, establishing a reasonable definition of intelligence is one of the first factors to the creation of intelligent machines”.



Where technology transforms into an extension of reality. In this context, a contemporary element emerges: the techno digital object.

3.3 Considerations about technical objects and artificial intelligence

It is possible to question if digital objects constitute a new ontological category of technical objects. An affirmative answer may be justified enlightened by the philosophical basis of thinkers as Yuk Hui (2017), who goes beyond considering a new class of technical objects, categorizing them as an independent class. His reflections range themes related to cybernetics, approaching AI, machine learning and cosmotechnique.

O que chamo de objetos digitais são simplesmente objetos na web, tais como vídeos no YouTube, perfis de Facebook, imagens no Flickr, e além disso que são compostos de dados e formalizados por esquemas ou ontologias que podem generalizar-se como metadados. Esses objetos permeiam a nossa vida cotidiana online ao ponto de que já é muito difícil separar o online do offline [...] (Hui, 2017, p. 82).

By proposing this characterization, the author considers that the description of the digital object ranges a distinctive element regarding the conventional technical object as put by Simondon (1989). Digital objects are not simple isolated unities which reveal themselves as discrete substances; they also constitute a manner through which human beings interact with internet. This focus is fundamental to the reflection over digital, natural and technical objects, since there is a tight connection between ontology and the conception of the being in the context of digital objects that can be elaborated by different digital components simultaneously.

This way, Hui (2017) points the limitations of ontology⁶ in categorizing technical digital objects and highlights the importance of relations between beings while forming the cosmotechnique. In cognitive ecology development, Lévy (2010a) highlights the place of thematic of the relation of technique and technical objects, similar to, for example, biology did categorizing its objects.

This classification may be given by network in order to achieve a technology, a thought about the technique that consider the nature of the technical objects and enables an interconnection space, managing of interactive subjects, constitutive relations where individual, institutional and technical cognitive possibilities are defined and redefined.

⁶ Hui here refers to specific ontology, categorized by computation may be Applied in knowledge based systems that use AI to collect and process information, helping during the collection and classification of data in a more efficient manner. Ex: WEB semantics, software engineering and information architecture.



Technical objects possess a reality that is also psychosocial. It is starting from this philosophical reflection that technique will be able to, then, restore its citizenship in the universe of significance of culture. It enables man to remake lost connections between thought and object, between culture and technique.

Mediation between object and culture may point to us and dimensions of a collective becoming, with differentiated structures⁷, composed by elements or parts of different natures, complex as the cosmopolitan dimension of the world as put by the author. The affirmation that technique is nor good nor evil nor neutral nor necessary nor invincible (Lévy, 2010a) reveals, therefore, that critical thinking and the relations established with culture are possibilities opened to go beyond, avoiding alienation under the effective of the technical object. Yet, technical knowledge acquisition makes amplification of Horizons in relation to what intellectual Technologies offer possible.

Quanto valeria um pensamento que nunca fosse transformado por seu objeto? Talvez escutando as coisas, os sonhos que as precedem, os delicados mecanismos que as animam, as utopias que elas trazem atrás de si, possamos aproximar-nos ao mesmo tempo dos seres que as produzem, usam e trocam, tecendo assim o coletivo misto, impuro, sujeito-objeto que forma o meio e a condição de possibilidade de toda comunicação e todo pensamento (Lévy, 2010a, p. 11).

The transformation the technical object may operate, the place it occupies and the seek for meaning inserts it as mediator between man and nature. The Project of technical democracy considers it and is based in a cosmopolitan anthropology and not in a deterministic vision or technicaly unilateral.

For Lévy (2010a, p. 12), “there is not a technique behind technique, nor technical system under industrial movement but one situable and datable concrete individuals who deliberately operate the technical making”. To consider the possibility that effective technique agents are not situated in time, technique and technodemocracy to live in contemporary scene.

⁷ It is necessary to, initially, explore the definition of AI and what is its end while compared to human intelligence. AI is a field of knowing that began in labs of academical research and military secret projects. Theoretical, technical advance and exponential growth in this area are present in daily life of Society through apps, personal assistants, sites, networks and the most different forms of automation. Thus, AI has become a great field (Russell; Norvig, 2013). The mold of general design for smart assistants, apps and other devices supported by AI evolve knowledge and human and scientific improvement, perceptions and conceptions and the capacity to extract information of human activities. Learning, for humans means to improve the performance based in experience (Russell, 2021). Considering a system of visual perception, this may have the meaning of learning, recognize and categorize objects with reference to known objects of this category.



The technique that actively participates of the symbolical, epistemological, ontological or axiological natural order in any time is not the a-historical. The technique is the bedrock of human condition, a condition to not have a natural essence, but is also made of history. Human condition refers to human existence and living forms man imposes himself to survive and have *vita activa*⁸. Even after centuries, different philosophical propositions offer as fundamental reference both to criticize present and elaborate a reflection in the construction of a cosmopolitan civilization. The dimensions or aspects of technologies reveal themselves in social life when creating objects and systems founded in culture.

Notwithstanding constituted by a different background of rationality and own necessities and historical moments, the thinking that pervades every age or culture reflects the way humans exist in the world. Since man performs his life Project, what understanding he has of the world. how he contributes to its construction and for the future of mankind and how he makes science are questions presented in each philosophical age (Mocrosky; Bicudo, 2013). The specificical knowledges about different activities related to the tools and artifacts built by man as: Project, build, assemble, repair, use demonstrate the atitude and the attempts of control of reality submitting it to human power.

In the contemporary educational scenario, disruptive, there are a lot of theoretical references that associate innovation to the insertion of artifacts, applications, software and supported resources supported by AI. Based on this conclusion and the contemporary reality about the possibilities of governance of systems managed by AI, in this section we seek to comprehend and discuss about the relation of innovations and trajectory performed by insertion of technologies and changes and paradigm** through the transformations of human history. According to Salles e Kenski (2021), technological innovation conquered space in the popular imagination as positive expression of something to be valued or desired.

The intersection between innovation and technology is relevant, although it is essential to recognize that this relation is more complex than presented, non linear and more dynamic than simple plug-and-play analogies may suggest. It is important to point that apparently promising solutions may cause dangerous non intentional consequences. Therefore, it may be necessary to create conditions of probability of redirecting the traditional approach of solving problems isolated from an approach that will allow to

⁸ ARENDT, H. A Condição Humana. Trad. Roberto Raposo. Rev. Adriano Correia. 11 .ed. Rio de Janeiro: Forense Universitária, 2010.



navigate in multidimensional scenarios, interconnected and more universal everyday (PNUD, 2020).

The introduction of Technologies in education, with AI support, implies the inclusion of new actors with a variety of objectives and interests. Therefore, it is crucial to recognize the technological and human dimensions are entangled in this process, with the human dimension developing a central role throughout the development of DT in education. D'Ambrósio (2011) argues that the reckoning system created by humanity throughout history does not properly approach the fundamental question of its own survivance.

The development of science and technology, which holds a symbiotic relation, originated the so called technoscience. D'Ambrósio (2011) observes its growth and emphasize the importance of Sustainability, indicating society is walking a path in the direction of a planetary and cosmic reality. In this context, technical reality positions as a bridge between man and the world, demanding a reorientation of sciences and technology. This reorientation is based on the integration of multiple modes of knowledge, transcending cultural and disciplinary barriers and adopts a transdisciplinary approach (D'Ambrósio, 2011).

Under Mathematics Education perspective, D'Ambrósio (2011, p. 6) states that: “transdisciplinarity may be a necessary answer to sustainability in the perspective of universal education”. Knowledge in contemporary Society is put, in this case, in a privileged and democratic place, shared through the dominant means of information, the technical objects and its range would reach various dimension in the individual reality.

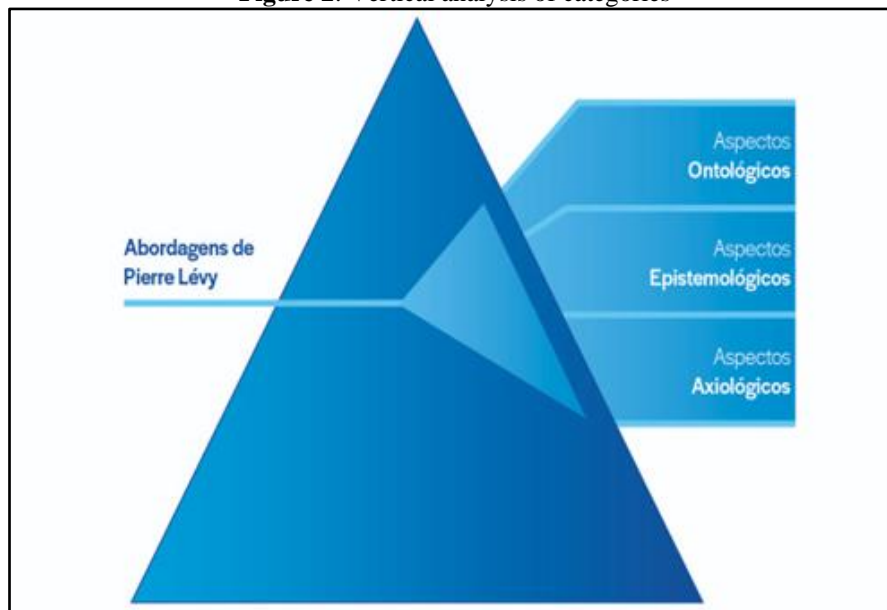
Therefore, delimitating the subjacent structure of research and establish the means and supports for argumentation around the problematic, as well as connecting the areas and educational processes related to mathematics education, is a duty here given to the theoretical basis, since, through it, the core of axis of the research was established in an attempt of seeking conditions of possibilities to establish relations between them under the light of Pierre Lévy.

4 A possible categorization of AI in the work of Pierre Lévy

In this section we present the localized categories regarding the relation of theoretical-philosophical aspects of AI found in the corpus of Pierre Lévy. Figure 2 presents a possibility of categorization according to the criteria of vertical analysis. The specific

goal of this process was to investigate the main aspects found in each (identify what categories are revealed through the analysis).

Figure 2: Vertical analysis of categories



Fonte: Author (2023)

The choice for this approach allowed the exploration of the presented theoretical basis and develop bases to comprehend the vision of the author about DT and AI usage in current society, making possible the analysis of what conceptions mobilized during the analysis of the resources assisted by AI and in the decision-making in the establishment of perspectives and possibilities of its insertion in the learning and teaching processes. These bases are present in the interpretation and making of Board 2, allowing the creation of categories.

Board 2: identified categories

Categoria A – Ontological aspects

Inteligente systems capeble of performing the categorization:

- of beings
- be na object
- technical objects
- the world for reality organization
- cyberspace as object
- extension of cyberspace as inductive object of the collective intelligence
- of specificities of concepts about a certain field of knowledge and relations
- controlo f the semantic level and sintaxis for representing the meaning of its terms
- linguistic generalization presente ia AI algoritms



Category B – Epistemological aspects

Confirm existing technical knowledge through:

- theoretical systematized notions
- comprehension that human communication is historical and socially situated.
- natural language and symbolical manipulation
- linguistic transformer: pre trained or generative
- scientific knowledge
- cognition through simulators
- personalization of knowledge
- creativity-challenge of existing knowledge
- logic
- autonomy
- memory
- solution presentation of complex problems
- AI system and algorithmical models that execute cognitive functions or world perceptions
- abstraction, meaning and translations

Category C - axiological aspects

Ethics of responsibility regarding man and AI devices

- necessity of international policies for safety and data managing. Creation of a global memory (interoperable, cumulative, integrable, exchangeable and distributed).
- regulating laws of AI support that consider human rights and sustainability.
- transhumanism
- technoscience
- technodemocracy
- technophobia
- technocracy
- cosmotechnique

Source: the author (2023)

The choice for approaching ontological and axiological aspects that characterize the elements present in Board 2 corroborate to the central idea of the author that language make possible a dynamic coordination between networks of concepts maintained by the members of a community and also allows to tell stories, dialogue, question and think. Build digital memories. With the invention of supports assisted by AI, reflexions about ontological aspects stablishing relations with non human intelligent entities, the artificial beings, emerge.

Moreover, historical questions about mechanical beings, automats, robots, cyborgs, bionics, living forms structured by organic and cyber parts and intelligent machines reemerge in the same treadmill, once they demonstrate obscure points of the materiality of the technical making, knowledge of the machine, its nature, essence and existence of technical objects in culture. In the case of artificial beings, the possibilities of configurations are infinite, regarding machines and the other artificial beings, its signification is related to its use. By attributing interiority to the machine we consider its autonomy and power of choice.



The aspects and epistemological questions about technology are present in the doubt and critic about world knowledge. Na epistemological yaw made possible for science and technology to rise to the category of technoscience horizon. In this aspect, we highlight elements about rationality and scientific progress, the autonomy of technology and the relation between scientific practices and dimensions of society. Language supports not only communication but also thinking as well as conceptual organization of memory, complementary to its emotional and motion-sensorial organization. Thus, inaccessible signification in translation and writing may risk veracity of information.

Axiological aspects and questions are found in the center of the debate and expression of ethical, aesthetic or even political values, in this sense they approach tensions between technology, science and ethics, questions that compose the social imaginary, identity and moral values. In the aesthetic perspective, the difference between Natural and artistic beauty in the function of technical objects and the design combined with sociotechnical usage of technical objects, once they possess their own nature.

The creation of a semantic level idea is connected to aspects described and to the philosophical thinking of the author regarding AI. Lévy (2014, p. 32) himself, states that it is specially connected to the readers interested by cognitive sciences, linguistics, “global brain”, collective intelligence and artificial intelligence. Lévy (2014) believes that internet and other digital technologies may be used to create virtual environments that promote collective intelligence, allowing individuals to learn in a personalized and cooperative way.

In this sense, Lévy (2014) focus in the analysis of cognitive processes and in the creation of tools that may help manage knowledge more effectively, what is fundamental to the development of systems assisted by AI, capable of learning, reason and take more and more complex decisions. Lévy (2022) proposition for the creation of an Information Economy Metalanguage – IEMML involves a mathematical language whose main goal is to formalize the description of concepts and its connections. It shall be used to produce data models, systems of semantical metadata, ontologies, knowledge graphs and other semantic networks.

Lévy (2010a) indicates the protagonism of different ontologies and how they can help responding to the negative effects and problems that affect maintenance of life in the human relation with non human beings. Ontological plurality of AI may be explained by various ontologies and by different ways of relating what is human to what is not.



5 Considerations

This paper had as objective present the theoretical-philosophical perspectives about artificial intelligence according to Pierre Lévy since the ontology, development and possibilities in educational processes. To fulfill the goal a bibliographical review of the main authors who approach the theme was presented. The considerations about the research point that Technologies supported by AI may be important allies to the teaching and learning processes. AI may provide interactive and personalized activities which will increase the possibilities of intelligent and cognitive collectives.

Nevertheless, it is important to highlight that technology is not a magical solution to educational problems. It should be used as a responsible and conscious form, in order to complement the work of the teacher and not substitute them. It is crucial to remember that independently from the field of AI, all systems have their limitations and cannot fully substitute human intelligence. Besides, it is highly important to consider the social and ethical implications of AI usage and assure it is responsibly used.

Besides those limitations, AI has a huge potential to improve the efficiency and precision of different tasks, besides contributing to the solution of complex problems.

In order to achieve such potential, it is necessary to keep investing in research and development, seeking to improve Ai system's capacities and expand its applications. It is also fundamental to continue discussing and stablishing patterns to assure safety and sustainability of humanity as we advance developing AIs.

AI is a field in constant evolution, with great potential, but also with important limitations and ethical and social questions to be considered (Russell, 2021). Its incorporation in educational systems have the potential to cause a big impact in the processes of learning and teaching in short, medium terms, once there is already a symbiotic relation between man and technological aspects, requiring a careful analysis of its management, foundings, possibilities, legitimities, values and limitations.

Besides that, knowledge and democratization of data and software avoid the semantical interruption between metadata systems. Thinking about a world by technodemocracy⁹ prism and cosmotechnique¹⁰ is essential to assure the communication

⁹ It is the availability of contemporary technique as possibility of assuring digital citizenship. When we better understand the "essence of technique", more it becomes clear there is space to technodemocracy, that a wide space remains open to critics and to intervention, here and now. (Lévy, 2010a, p. 120)

¹⁰ The cosmopolitan vision of the world may find contemporary elements in the concept of cosmotechnique (HUI, 2020) with intent of representing the question of technology as exteriorizing the



between different applications and systems, independent from the file formats or programming language. This is an area of research and development in constant evolutions, essential to technological progress. In a final analysis, comprehending implications of AI and developing semantical interoperability, pattern development, protocols, technologies and mechanisms which possibilities data to be shared between many systems with a minimum of human intervention. Establishing ways for different systems to talk to each other and share information in real time. Fundamental steps in the journey in the direction of an inclusive, responsible and beneficial use of technology to people's life and the educational system.

References

ARENDDT, H. **A Condição Humana**. Trad. Roberto Raposo. Rev. Adriano Correia. 11. ed. Rio de Janeiro: Forense Universitária, 2010.

BORBA, M. C.; SILVA, R. R. S.; GADANIDIS, G. Fases das tecnologias digitais em Educação Matemática: sala de aula e internet em movimento. 2. ed.; 2. reimp. Belo Horizonte: Autêntica, 2018.

CHARDIN, T. **O lugar do homem na natureza**. Lisboa: Instituto Piaget, 1998.

CRESWELL, J. W. **Projeto de Pesquisa: Métodos Qualitativo, Quantitativo e misto**. 5. ed. Porto Alegre: Penso, 2021.

CUPANI, A. **Filosofia da tecnologia: um convite**. 3. ed. Florianópolis: Editora da UFSC, 2017.

D'AMBRÓSIO, U. A transdisciplinaridade como uma resposta à sustentabilidade. *Revista Terceiro Incluído*, Goiânia, v. 1, n. 1, p. 1-13, 2011.

FIORENTINI, D.; LORENZATO, S. **Investigação em Educação Matemática: percursos teóricos e metodológicos**. 3. ed. Campinas: Autores Associados, 2012.

HUI, Y.? Qué es um objeto digital? *Revista Virtualis*, Monterrey, v. 8, n. 15, p. 81-96, 2017.

HUI, Y. **Tecnodiversidade**. São Paulo: Ubu, 2020.

LÉVY, P. **A máquina universo: criação, cognição e cultura informática**. São Paulo: ARTMED, 1998a.

LÉVY, P. **A ideografia dinâmica: rumo a uma imaginação artificial?** São Paulo: Loyola, 1998b.

LÉVY, P. **O Fogo Liberador**. 2. ed. São Paulo: Iluminuras, 2000.

memory and overcoming the dependance of organs. Technology is not anthropologically universal, once it is connected to different patterns, its function is unlimited by particular cosmologies of each culture that go beyond mere functionality and utility Hui (2020). This way, there is not a single technology but multiplicity of cosmotechniques.



LÉVY, P. **A Conexão Planetária**: o mercado, o ciberespaço, a consciência. São Paulo: Editora 34, 2001.

LÉVY, P. A inteligência possível do século XXI. **Revista FAMECOS**, Porto Alegre, v. 14, n. 33, p. 13-20, abr. 2007.

LÉVY, P.; AUTHIER, M. **As árvores de conhecimentos**. 3. ed. São Paulo: Escuta, 2008.

LÉVY, P. **As tecnologias da inteligência**. O futuro do pensamento na era da informática. 2. ed. Rio de Janeiro: Editora 34. 2010a.

LÉVY, P. **Cibercultura**. Trad. Carlos Irineu da Costa. 3 ed. São Paulo. Editora 34, 2010b.

LÉVY, P; LEMOS, A. **O Futuro da internet**: em direção a uma ciberdemocracia planetária. São Paulo: Paulus, 2010c.

LÉVY, P. **O que é virtual?** 2. ed. São Paulo: Editora 34, 2011.

LÉVY, P. **A esfera semântica – tomo I**: computação, cognição e economia da informação. São Paulo: Annablume, 2014.

LÉVY, P. **A inteligência coletiva**: por uma antropologia do ciberespaço. Tradução de Luiz Paulo Rouanet. 10. ed. São Paulo: Edições Loyola, 2015.

LÉVY, P. IEML: rumo a uma mudança de paradigma na Inteligência Artificial. **Matrizes**, [S. l.], v. 16, n. 1, p. 11-34. 2022. Disponível em:

<https://www.revistas.usp.br/matrizes/article/view/197482>. Acesso em: 30 set. 2023.

MINSKY, M. L. **Semantic Information Processing**. Massachusetts: VV. AA, Mit Press, 1968.

MOCROSKY, L. F.; BICUDO, M. A. V. Um estudo filosófico-histórico da ciência e da tecnologia sustentando a compreensão de educação científico-tecnológica. **Acta Scientiae** Canoas, v. 15, p. 406-419. 2013.

PNUD: Programa das Nações Unidas para o Desenvolvimento. **A próxima fronteira**: desenvolvimento humano e o Antropoceno: Relatório do Desenvolvimento Humano. New York: PNUD, 2020. Disponível em: <https://hdr.undp.org/system/files/documents/global-report-document/hdr2020ptpdf.pdf>. Acesso em: 30 set. 2023.

RUSSELL, S.; NORVIG, P. Learning from examples. In: RUSSELL, S.; NORVIG, P. (org.) **Artificial Intelligence: A Modern Approach**. 3. ed. New Jersey: Pearson, 2013, p. 6-67.

RUSSELL, S. **Inteligência Artificial a nosso favor**: como manter o controle sobre a tecnologia. São Paulo: Companhia das Letras, 2021.

SALES, M. V. S.; KENSKI, V. M. Sentidos da inovação em suas relações com a educação e as tecnologias. **Revista da FAEBA**: Educação e Contemporaneidade, Salvador, v. 30, n. 64, p. 19-35, 2021.

SIMONDON, G. **Du mode d'existence des objets techniques** [1958]. 3. ed. Paris: Aubier, 1989.

Received on: October 15, 2023.

Accepted on: April 1, 2024.