Learning models in the transition towards complexity as a challenge to simplicity

Modelos de aprendizaje en la transición hacia la complejidad como un desafío a la simplicidad

Jefferson Alexander Moreno Guaicha*
Universidad de Investigación de Tecnología Experimental Yachay, Urcuquí, Ecuador
Universidad de Investigación e Innovación de México, Morelos, México
jmorenog@yachaytech.edu.ec
http://orcid.org/0000-0002-0380-4739

Alexis Alberto Mena Zamora**
Educational Unit Santa Juana de Arco La Salle, Cariamanga, Ecuador
alexismena3@gmail.com
https://orcid.org/0000-0001-5974-386X

Levis Ignacio Zerpa Morloy***
Universidad de Investigación de Tecnología Experimental Yachay, Urcuquí, Ecuador
Universidad Pontificia Bolivariana, Medellín-Colombia
lzerpa@yachaytech.edu.ec
https://orcid.org/0000-0002-8744-7440

*   PhD (c) in Education and Innovation, Master in Philosophy and Values, Master in Social Development, Bachelor of Philosophy and Pedagogy. Is a professor-researcher and coordinator of the Human Development Department of the Yachay Research University of Experimental Technology.
**   Master in Social Development, degree in Philosophy and Pedagogy. He is a member of the Research Group on Philosophy of Education (GIFE) and rector of the Educational Unit Santa Juana de Arco La Salle.
***   PhD in Philosophy, Master in Logic and Philosophy of Science. He is the author of articles on pure and applied symbolic logic, philosophy of science and didactics of logic and mathematics; as well as the books *Logical foundations of artificial neural networks* and *Computability & Computational Complexity*. He works as a professor-researcher in the Human Development Department of the Yachay Research University of Experimental Technology.

Abstract

This research is motivated by the need to unravel the progression of learning models, which have been adapting to meet the demands of society in its constant dynamics of fluctuation and transformation. The aim of this work is to systematically examine the evolution of learning models, highlighting the paradigmatic changes that have favored the transition from traditional learning approaches to more innovative and transdisciplinary proposals. To achieve this, a bibliographic analysis is carried out, supported by the hermeneutic method for the contextual interpretation of literature and discourses, in order to unravel the complexities inherent in the evolution of learning models. The results highlight the limiting influence of the simplicity paradigm in traditional educational formation and the need for a shift towards dialogicity and disciplinary collaboration and integration to advance towards complexity. It concludes by arguing in favor of adopting the complexity paradigm, advocating for a transdisciplinary epistemology and an interstructuring approach to learning, which allow for integral human development. Recognizing human complexity in teaching and learning demands a radical transformation of education towards more holistic and transformative practices, essential for building an equitable and just society.

Keywords

Learning, complexity, dialogicity, epistemology, paradigm, transdisciplinarity.

Resumen

Esta investigación se emprende motivada por la necesidad de desentrañar la progresión de los modelos de aprendizaje, los cuales se han ido adaptando para responder a las demandas de la sociedad en su dinámica constante de fluctuación y transformaciones. El objetivo de este trabajo es examinar de forma sistemática la evolución de los modelos de aprendizaje, destacando los cambios paradigmáticos que han favorecido la transición de enfoques de aprendizaje tradicionales hacia propuestas más innovadoras y transdisciplinarias. Para lograrlo, se lleva a cabo un análisis bibliográfico apoyado en el método hermenéutico para la interpretación contextual de la literatura y los discursos, a fin de desentrañar las complejidades inherentes en la evolución de los modelos de aprendizaje. Los resultados resaltan la influencia limitante del paradigma de la simplicidad en la formación educativa tradicional y la necesidad de un giro hacia la dialogicidad y la colaboración e integración disciplinaria para avanzar hacia la complejidad. Se concluye argumentando a favor de la adopción del paradigma de la complejidad, abogando por una epistemología transdisciplinaria y un enfoque de aprendizaje interestructurante, que permitan el desarrollo humano integral. El reconocimiento de la complejidad humana en la enseñanza y el aprendizaje exige una transformación radical de la educación hacia prácticas más holísticas y transformadoras, esenciales para construir una sociedad equitativa y justa.

Palabras clave

Aprendizaje, complejidad, dialogicidad, epistemología, paradigma, transdisciplinariedad.

Introduction

In an era characterized by global interconnectedness and the rapid evolution of knowledge, education systems face the challenge of preparing individuals for a world of constant change and increasing complexity. This situation has led to a critical reassessment of existing pedagogical methodologies, highlighting the urgency of adopting more flexible approaches. In this environment, the transition from conventional educa-

tional methods - often based on simplistic principles - to more complex learning models has become a pressing need, marking a turning point for contemporary educational philosophy.

The main challenge identified in this paper is the persistent adherence to traditional methods of teaching and learning, which are often insufficient to address the needs of a rapidly evolving world. This article defends the idea that embracing complexity in education transcends mere profit and becomes a necessity for the holistic development of both students and educational models. The importance of this topic is intensified in a context where adaptability and innovation are key to achieve educational success.

In the current educational context, marked by significant changes following the pandemic, the rapid digitization of education (IACHR, 2021) and the incorporation of advanced technologies such as artificial intelligence (Kim, 2022), there is an urgent need to evolve learning models. This transformation goes beyond a mere response to circumstantial challenges, rather it reflects a substantial change in the way we interact with knowledge and in the very conception of teaching. In this age of global interconnectedness and constant evolution, adapting education systems to prepare individuals for a changing world of increasing complexity is critical.

The aim of this article is to examine how the transition to complex and interstructuring learning models challenge and reconfigure traditional conceptions of simplicity in education, highlighting the importance of these transformations in contemporary educational practices and emphasizing the need for adaptation and flexibility to effectively address the new demands of educational reality.

The methodology used integrates the bibliographic analysis, focused on a critical review of relevant academic literature, including theoretical studies and reviews in the field of pedagogy and philosophy of education. At the same time, hermeneutics is used for the contextual interpretation of texts and discourses, in order to unravel the inherent complexities in the evolution of learning models.

This document is structured in three key sections. The first section, entitled "The dynamics of paradigms in educational configuration", analyzes how simplicity, dialogue and complexity have shaped the educational environment, highlighting its influence on the formulation and evolution of teaching and learning methods. The second section, "Epistemological Approaches that Support Learning Models", examines the transition in disciplinary integration from more traditional approaches

69

to transdisciplinarity, demonstrating the trajectory towards more inclusive and holistic teaching models. Finally, the third section delves into the "Learning models: heterostructuring, self-structuring and interstructuring", focusing on how their evolution challenges traditional notions of simplicity in education and guides pedagogical practices, adapting it to new needs and educational dynamics.

The dynamics of paradigms in educational configuration

At the beginning of the discussion in this section, it is essential to specify the meaning of "paradigm", a polysemy word in the academic field. From the Greek παρά (next to) and δειγμα (model, example), considered as examples to follow and serve as references in specific interpretative contexts (Ferrater, 1994). Over time, the concept has undergone a semantic evolution, extending its scope to include both theoretical and methodological frameworks, and, in the educational context, to designate the sets of practices, beliefs and methodologies that shape and define their educational models.

Paradigms, framed in epistemic and ontological contexts, are defined as conceptual structures that individuals use to interpret and understand reality, as Audi (2004) explains. The tendency to adopt common frames of reference stems from the social nature of the human being. Through linguistic interaction and communication, people not only assign meanings and generate meaning in their environment, but also contribute to the configuration of systems and structures of increasing complexity.

These systems are intertwined with the social fabric, exerting a significant influence on human interactions and on the multiple aspects that make up society. Acting as collective referents, paradigms not only model the individual perception of reality, but also play a crucial role in the configuration of human societies, adapting to their changing dynamics, as González (2005) points out. In education, their influence is particularly notable, as they contribute to the form and development of pedagogical practices.

In classical Greece, philosophers like Plato used the term "to designate an instrument of mediation between reality and its ideation" (p. 18), since in its dualist model this idea is present when referring to an "intelligible world", which becomes the ideal and perfect reference on how reality should be interpreted, and a "sensible world", material and imperfect, experienced by earthly man. With Plato's "Allegory of the Cave" (1998), the incidence of paradigms in the interpretation of reality and the orientation

of the human being's actions is revealed, as they are expressed in an episte-mological dualism between *episteme* (knowledge) and its separation from the simple *doxa* (opinion), as well as in ontological dualism with the al-ready mentioned world of ideas and its separation from the sensible world.

Within this framework, several thinkers have postulated their the-ories on how to constitute the horizons of interpretation, some focused on the construction of knowledge and truth from the correspondence between the sensitive element and its referentiality in consciousness, such as Aristotle (2003) and hilemorphism or Locke (2020) and Hume (2020) with the concept of impressions provided from material experience. Oth-ers, focused from the idealistic and rationalist tradition, interpret reality in reference to the logical development of consciousness as: Descartes (2012) and methodical doubt, the principle of sufficient reason in Leibniz (2022) or Hegel's idealism (2017), which describes it with the dialectic as the motor of social and cultural transformation.

71

Φ

Regardless of the position taken, various thinkers agree that the origin of all knowledge is in a specific referential framework, which facili-tates the understanding of the world in different ways. These frameworks are fundamental for theoretical development and their evolution repre-sents an advance in the model that does not necessarily imply a greater truth, but a better adaptation to the dynamics and discourses of the time and society. In this context, González (2005) highlights Thomas Kuhn as a key figure in the scientific field for his development of the concept of paradigms, defining them as complex systems that include "beliefs, prin-ciples, values and premises, which are essential to shape the perception of reality of a specific scientific community" (p. 32).

In his review of *The Structure of Scientific Revolutions*, Masterman (1970) addresses how certain theoretical frameworks affect all aspects of human knowledge. It highlights the different ways in which "paradigm" is defined, making a definition of this term essential from one of its great-est exponents, Thomas Kuhn (1922-1996). In the concept proposed by Kuhn (2000), two types of scientific progress can be distinguished: the "normal" and the "revolutionary". Normal science, also called paradigm-based science, represents that time interval during which a scientific dis-cipline undergoes evolution, supported by community acceptance of a relevant scientific work (Kuhn, 2000). Emblematic examples of this sci-ence include the Newton´s *Principia* (1972), which lay the foundations of Newton-Euler mechanics, and the work of Carnot (1963) in classical thermodynamics, which establishes the framework of the thermodynam-ics of calorie.

The adoption of a paradigm in a period of normal science constitutes the premise or basis of scientific work, even defines the field of study, so that abandoning it "is to stop practicing the science that defines it" (Kuhn, 2019, p. 75). These ideas that Kuhn contributes in his conception of scientific development in periods of normal science, are later generalized in different directions, one of those directions is its extension to the educational field and the social field in general.

In contrast, revolutionary science occurs when dominant theories are rejected and replaced by others (Kuhn, 2000). A "scientific revolution" is the result of a "paradigm shift," which usually occurs when the scientific community identifies a set of "anomalies" in the prevailing theories, i.e., a set of phenomena that frames of reference should explain in a convincing way, but do not, or a set of failures that can take various forms including excessive complexity, paradoxes, ambiguities, or unresolved difficulties.

An anomaly, says Kuhn (2019), arises "recognizing that nature has somehow violated the expectations induced by the paradigm that governs normal science" (p. 103). This concept is illustrated by the transition from the anomaly-filled phlogiston theory to the oxygen combustion theory, proposed by Lavoisier around 1777. This change meant a scientific revolution in the understanding of combustion. Similarly, the discovery of X-rays defied the expectations rooted in the scientific community, despite not directly contravening the dominant theory of the time, evidencing the dynamism and contingency of scientific theories (Kuhn, 2019). Another example is the transition from Ptolemaic to Copernican astronomy (Copernicus, 1965), which shows how revolutionary developments can radically transform our understanding of the world.

As a theoretical framework in science dictates the focus and scope of study, a conceptual model in the social sphere exerts a comparable influence on the social fabric and community interactions (González, 2005). However, for a paradigm to consolidate as the essential archetype in a society, it must be shared and internalized either voluntarily or involuntarily by the whole community. From this adoption, various social, cultural, scientific and educational dynamics will be oriented.

In the context of the adoption and transmission of reference frameworks, the role of education is fundamental to the formation of the social fabric. It acts as a means of imparting the necessary concepts and tools to understand the complex matrix of meanings, values and perceptions inherent in a culture. It also plays a crucial role in strengthening collective identity and in the holistic development of society, paving the way for effective adaptation to future challenges and changes. Then, the

Sophia 36: 2024.

© Universidad Politécnica Salesiana del Ecuador

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 67-108.

determining paradigms in the evolution of education and learning models will be examined.

Paradigm of Simplicity

In the field of education, the influence of paradigms is essential to define the modes, design and construction of pedagogical approaches and methods. An example is simplicity, prevalent in the traditional educational model that, characterized by its preference for clear and sequential educational processes, deeply marks conventional pedagogical practices (Aguayo *et al.*, 2021). With its roots in positivism, the simplicity framework acts as a guide for both the structuring of disciplinary knowledge and the heterostructuring approach to learning.

Since positivism underlies this approach, its exploration is essential to understand its influence on the formation and evolution of educational models. The term "positivism" originated in the nineteenth century with Henri de Saint-Simon, but it started being used with Augusto Comte and his works *Course of positive philosophy* of 1830 and *Discourse on the positive spirit* of 1844. Comte uses it to refer to the way of analyzing physical facts in the field of science, alluding to empiricist studies and the conceptions of philosophers such as Bacon, Hume, Locke and Condillac, for whom all knowledge is understood as a product of the sensitive experience (Dos Santos, 2017).

Positivism will place special emphasis on all knowledge that comes from experience, and that is observable, manipulable and corroborable through the use of methodologies linked to the exact sciences, in order to dismantle mythical thought, given in theology or metaphysics, to reformulate it from human rationality that aspires to maximum objectivity (Marquisio, 2017).

As a philosophical trend, positivism aims to establish the determinant parameters of scientific knowledge, under a unified methodological criterion that includes and guides all disciplines and branches of knowledge (Guamán *et al.*, 2020; Hizmeri, 2011). For Comte and Sanguineti (1987), the disciplines will be questioned by the scientific-positivist character, as long as they clarify an object of study (gnoseological question) and a concrete way to address it (methodological question). From this conception, says Malinowski (2007), any attempt to base the knowledge methodologically must be based on:

> The analytical principle described by Descartes in the Discourse of the Method, and summarized two centuries earlier by the English scholastic

73

Φ

philosopher William of Ockham by the principle of parsimony, or of "Knife of Ockham" in the explanation and construction of theories: between two explanations, the best is the most simplified or the smallest (p. 30).

The epistemological foundation of positivism proposes a separation between the relationship of the subject with the object, a "dualism and objectivism, where the researcher and the study objective are totally independent" (Ramos, 2015, p. 11), seeking to control this interaction in order to provide generalizations that objectify and simplify scientific knowledge. In addition to this, it is important to emphasize that positivism is based on the principle of simplicity, which, in line with the scientific vision, promotes decomposition or reduction processes of the extensive and complex issues to its more individual components to better understand them. In the words of Morin (1998), simplicity is understood as:

> A paradigm that brings order to the universe, and pursues disorder. Order comes down to a law, to a principle. Simplicity looks at the one and sees the multiple, but cannot see that the One can, at the same time, be Multiple. The principle of simplicity either separates what is bound (disjunction), or unifies what is diverse (reduction) (p. 55).

In this order of ideas, simplicity adopts a practical and accessible approach to knowledge, partially relying on the traditional notion of "analysis" as "decomposition", as exposed by Beaney (2014). This paradigm is also based on the application of principles of reasoning that do not necessarily require the development of deep or abstract ideas. According *to* Aguayo *et al.* (2021), it promotes a method of thinking and problem solving that favors simplification and reduction. In education, this approach not only accelerates results, but also facilitates students' learning of basic concepts, as a concise principle is easier to understand than a complex analysis.

> Teaching and learning based on concepts originated from a mechanical paradigm have dominated the Western educational tradition since the first industrial revolution. This type of educational tradition is characterized, among other things, by its reductionist and linear mentality, which has led to an isolated and disconnected generation of knowledge (p. 368).

The decomposition of information and complex topics into their unique components (an essential feature of the traditional conception of analysis) has its own limitations, especially in the scientific and academic field, due to its propensity — in many cases — towards disciplinary isolation and — ultimately — the fragmentation of knowledge (Aguilar *et al.*, 2019). The separation and/or reduction of knowledge in plots prevents

students from understanding the interconnection between different disciplines and their applications (Balietti *et al.*, 2015). This, in turn, can lead to a loss of holistic understanding of knowledge and reduce their understanding to fundamental and pragmatic principles.

Dialogic Paradigm

This paradigm has emerged, essentially, as a movement of exchange of ideas "between various conscious subjects, flowing between, within and through [sciences]" (Hernández and Quintana, 2018, p. 26), which enables the transmission of beliefs and knowledge, facilitating the search for truth and the construction of knowledge in a participatory, collaborative and democratic dynamic. The main point of this approach is that frames of reference, through which we interpret reality, are collaborative constructions that evolve with social discourse (Leistyna, 2001). This dialogic process has led to the development of epistemological approaches such as multi-, and interdisciplinary, which, adapting to the changing needs and dynamics of knowledge and society, give way to the educational model of self-structuring learning.

Dialogicity manifests itself as a teaching method in the education of classical Greece, particularly in the philosophies of Socrates and Plato. Both philosophers used dialogue as an essential means for the search for knowledge or truth, identifying in its dynamics the "false beliefs and knowledge to eradicate them and undertake a search for truth" (Molina, 2021, p. 39). Socrates called this dialogical method "maieutical" (giving birth), since, through the confrontation that emerged through the interaction of questions and answers in the dialogue, it was possible to reveal the truth.

For his part, Plato used in his famous *Dialogs* the dialogical resource for the construction of philosophical categories such as "kindness, temperance, courage, love, wisdom, his vision on politics, wars, economics, religion, etc." (Hernández and Quintana, 2018, p. 28), useful for social education as the construction of self-knowledge in his apprentices.

The paradigm of dialogicity also has its roots in the *Topics* of Aristotle, which constitute a key contribution in this approach to argumentation and reasoning. An interesting later confluence occurs with the emergence of interrogative logic (Zerpa, 2011), the strategic analysis by mathematical game theory in the 40's, the constructivist approach in philosophy of mathematics and the pragmatic approach in semantics (associated with Wittgenstein). Such a confluence gives rise to "*dialogical logic*" (Clerbout And McConaughey, 2022).

75

The importance of dialogue has evolved throughout history, deepening in essential aspects related to the generation of knowledge, science, social structuring and education. It has matured this approach to incorporate its structures and principles in the theoretical developments of influential thinkers such as Martin Buber (1973), in the nineteenth century, who conceptualized human existence as intrinsically dialogic and relational:

> It is neither the individual as such nor the collectivity as such. Both of these things, considered in themselves, are no more than formidable abstractions. The individual is a fact of existence insofar as he enters into living relationships with other individuals; collectivity is a fact of existence insofar as it is built with living units of relationship (p. 146).

The relationship units identified by Buber (1973) are inscribed within the dialogic, which implies an understanding of the self and the other as interconnected and mutually dependent entities, both in the process of knowledge and in the process of existence. The relevance of dialogue with other individuals lies in their potential to promote personal growth and understanding of the world. This approach, as Vázquez points out (2013), is outlined as "the only human possibility of access to Being" (p. 144), underlining its crucial role in understanding and human development.

In this way, it emphasizes how dialogic dynamics promote an effective understanding of the interaction between people and their process of knowledge construction. In the ontological realm of language, dialogue is defined as "the space where human interactions converge" (Sánchez, 1984, p. 133). An area where participants communicate and influence each other in order to build and understand themselves.

In the vision of this paradigm, the contribution of Lévinas (2002) on dialogue as an experience through otherness appears. It is in the dialogic experience that the other is understood, moving from the interiority of the being to the outward, since "in the relationship with the face in the fraternity in which another appears in turn as a solidarity of all others, constitutes the social order, in reference to all dialogue with the third" (p. 287), which means that individualities meet to transcend individuality. Lévinas suggests that through dialogue one can conceive a universal ethics, understanding that "the universality of reason arises from the overcoming of the subjectivity enclosed in itself, something that is evidently achieved through the relations of otherness" (Acosta, 2016, p. 276) produced through dialogical dynamics.

Through dialog, one can understand the other, going from the interior to the exterior of the being. In this process, solidarity between indi-

viduals is manifested, giving rise to a social order based on the relationship with others and their transcendence.

Following this reasoning, dialogicity offers an interpretation of the world based on interpersonal relations, an idea that Lévinas (2002) expands by integrating a universal ethics and rationality that transcend simple communicative interaction. In this vision, rationality extends beyond the subjectivity of the individual, enriching itself in the dialogic process with others (Crowell, 2012). The paradigm of dialogue has been established as a meeting space, facilitating the recognition and integration of diverse points of view that arise from individual thought. This approach promotes an understanding of knowledge and a way of interacting with the world that prioritizes diversity, as opposed to homogeneity and simplicity.

Regarding the characteristics of the dynamics of dialogicity to transcend homogeneity, it is relevant to turn to the thought of Hans-Georg Gadamer (1900-2002), for whom dialogicity generates in the encounter between subjects and the world, which he called "fusion of horizons". Gadamer (1993) argues that this fusion is an essential dialogical experience in which participants expand their understanding of the world and of themselves through a mutual exchange of conceptions. In his words, "in this form of dialogue the other becomes understandable in his opinions from the moment his position and horizon have been recognized" (p. 189). This process makes it possible to overcome homogeneity, as it facilitates the incorporation of different points of view and fosters a deeper and enriching understanding of the subject.

Considering this perspective, it can be inferred that the structure of dialogicity is established by combining horizons that emerge from the dialogic dynamics. These dynamics are not static or inflexible, on the contrary, they constitute an active reality that transforms and evolves as the dialogue develops, since "it may happen that the horizon does not move, but this depends on whether the person is willing to walk; while a person walks, his horizon will change" (Demon 2013, p. 53). In this way, the subject approaches new worlds and unknown horizons in which dialogue acts as an integrating agent, merging the different generated horizons.

When approaching this paradigm in the field of the philosophy of education and its practical applications, it is relevant to mention Paulo Freire (1921-1997), who emphasizes the dialogic action centered on the question as a liberating instrument and catalyst of changes in human education. The dialogic action caused by the question will be an instrument of liberation from the traditionalist education, which seeks to reproduce

knowledge without questioning or validating it. The question, in this context, generates this meeting of peers, in which:

> The subject ceases to be a mere object, since it is no longer an empty vessel to be filled, but, as a subject, is going to be subjected to challenge in order to achieve a critical knowledge of his situation as an active subject of praxis and a transformer of social reality (Velasco and González, 2008, p. 464).

Dialogue for Freire (2005) humanizes the subject, since, in the dialogue, there is "an encounter that sympathizes the reflection and action of its subjects channeled towards the world that must be transformed and humanized" (p. 108) in the search for the other, not as an imposition or conquest of an idea over another, but as paths that open in the pronunciation of the world as acts of freedom.

De Zubiría (2010), highlights the importance of dialogic dynamics in the formation of the human being as an essential condition for its integral development. These dynamics not only contribute to the humanization of the individual by enabling him to understand the world around him, but also aim to "ensure higher levels of thought, affection and action" (p. 216). By fostering a critical mindset, emotional development, and the ability to act with responsibility and awareness, dialogic dynamics enable human beings to cope and adapt to a context characterized by diversity and complexity.

Dialogy not only enriches understanding of knowledge and promotes the exchange of ideas, but also fosters more human and collaborative learning. By embracing dialogue, education becomes a dynamic space where multiple perspectives are valued and a deeper understanding of the world and ourselves is cultivated. In this environment, teaching and learning transcend the mere transmission of information, becoming an interactive and enriching process that prepares individuals to participate actively in an increasingly diverse society.

Paradigm of Complexity

Complexity has emerged as an alternative to the inherent limitations of traditional and simplified approaches that prevail in the scientific and educational field. When talking about complexity, it refers to a network of interconnected and multidimensional processes that demand a holistic and contextualized approach to adequately address the challenges of reality (Capra and Luisi, 2014). This approach is opposed to reductionism

and linear thinking that characterize paradigms based on simplicity and single-dimensionality.

Edgar Morin (2003) is a fundamental figure in the development and promotion of complexity in the philosophical field. According to this author, complex thought "is a thought that does not separate, that does not dissociate, that does not fragment, that does not simplify, but integrates, relates, contextualizes and, above all, that does not lose sight of globality" (p. 30). This involves developing skills to recognize and address the uncertainty, ambiguity and interconnectedness present in the real world, and for this, he suggests seven essential knowledge that must be taught in 21st century education (Morin, 1999), including the ability to contextualize, question, relate and connect different knowledge.

Complexity drives an interpretive approach that encourages the generation of integrative and relational knowledge. These enable individuals to address the phenomena of reality in its entirety, maintaining a constant process of conceptual review and enrichment, driven by the environment and transformations of the changing world. As Moreno Guaicha (2023) points out, "it does not pose a schematic and rigid model with irrefutable knowledge, since it understands that knowledge is built at the same time as the subject does" (p. 158). Reflecting this flexibility and adaptability, the paradigm of complexity establishes a learning framework that dynamically evolves with growth and individual experiences.

Another outstanding theorist to understand complexity theory is Basarab Nicolescu (2010), a prestigious Romanian theoretical physicist and philosopher, who has played a fundamental role in the promotion and development of the transdisciplinary approach in order to transcend disciplinary boundaries and foster the creation of integrated and holistic knowledge. In line with Morin, Nicolescu (2002) characterizes complex thought as "a thought that is not satisfied with partial knowledge or with limited vision, but strives to integrate the totality of reality, overcome dichotomies and glimpse the deep unity underlying apparent diversity" (p. 10).

Nicolescu (2002) introduces the term "transdisciplinarity" as a methodology designed to transcend disciplinary boundaries and address the complexity of contemporary challenges from a complex perspective. This approach conceives reality as an intricate network of interrelated levels and dimensions that interact and influence each other, which requires a deep appreciation of the interconnections between the different areas of knowledge. The goal is to highlight the unity implicit in apparent diversity, understanding the complementary dynamics of opposites.

In addition, the specialist in interdisciplinary studies Julie Thompson Klein (2004) has carried out extensive studies on the integration of knowledge and interdisciplinary teaching, expanding the discussion in relation to the "systematic use of multiple methods from various disciplines [in order to] generate different and alternative perspectives" (p. 34). According to Klein (2008), an effective solution goes beyond the mere combination of its individual components, implying the need for a change of approach that addresses in a more holistic and coherent way the different parties involved in the process. Complex thinking involves:

> A paradigm shift that challenges traditional conceptions of knowledge and reality, and requires an openness to new ways of thinking and addressing problems. This paradigm shift involves a transformation not only in knowledge, but also in the way it is produced and shared (p. 12).

In this framework, Klein (2008) defends the need to implement educational programs that promote collaboration between different disciplines, uniting different theories and methodologies, and promoting the integration of knowledge. This approach emphasizes the importance of developing critical-reflective thinking skills and of stimulating creativity and innovation to successfully address the complex challenges of contemporary society. In line with this idea, Chesley *et al.* (2018) highlight the importance of:

> Apply essential skills and concepts from the humanities and STEM fields to realistic global problems in an effort to provide students with a grounded, context-based experience that practices empathetic, human-centered design and critical thinking (p. 3).

In this way, it seeks to prepare students to address effectively and coherently the intricate challenges presented by the contemporary world.

By understanding the paradigm of complexity, we obtain a clearer view of its influence on the transdisciplinary education model, recognizing that it addresses in a coherent and comprehensive way the diverse and constantly evolving nature of the human being (Morin, 1998). The implementation of this approach in the educational field is presented as an adequate response to the multidimensional challenges of today's society. However, it entails a review of pedagogical practices, curricular structures and learning evaluation, emphasizing the promotion of collaborative environments, the adoption of adaptive teaching strategies and the incorporation of content from various disciplines.

With this understanding of complexity and its relevance in the current educational context, this segment of the analysis is concluded. Then, the epistemological models of learning will be addressed, deepening their influence on the evolution and adaptation of pedagogical practices, as well as their role in the promotion of learning models.

Epistemological approaches that support learning models

This section focuses on heterostructuring, self-structuring and interstructuring learning models. We will analyze how different epistemological approaches -from the monodisciplinary level to more integrative ones such as multi- and interdisciplinarity- contribute to the conformation of these models, since they reflect the varied ways of understanding and structuring knowledge, demonstrating how the transition to more complex and holistic approaches constitutes a challenge for traditional simplistic conceptions.

Monodisciplinary epistemological approach

In the disciplinary or monodisciplinary approach, a single scientific discipline offers its unique set of methods, theories and conceptual frameworks to address specific fields of knowledge. This methodology, by focusing on detailed specialization, promotes a rigorous and methodical understanding, reflecting its influence on both pedagogical paradigms and the construction of knowledge (Quintanilla, 2013). Through this approach, focused and specialized learning is facilitated, although with the implication that it can limit the openness towards a more inclusive vision of knowledge.

According to Moreno (2014), a practical example of this type of disciplinary organization is found in universities, whose distribution is "by areas and departments, and their quality control systems are internal, i.e., by peer review and based on the publication system in specialized journals" (p. 7). In addition, it can be useful in situations where a specific problem must be solved through specialized knowledge and the application of specific techniques of a single discipline, as observed in the diagnoses of medical disciplines, calculations of statistics, analysis of components of chemistry, among others.

It should be noted that although the monodisciplinary approach has certain advantages, it also has some limitations (Figure 1):

81

Φ

Figure 1
Limitations of the Disciplinary Epistemological Level
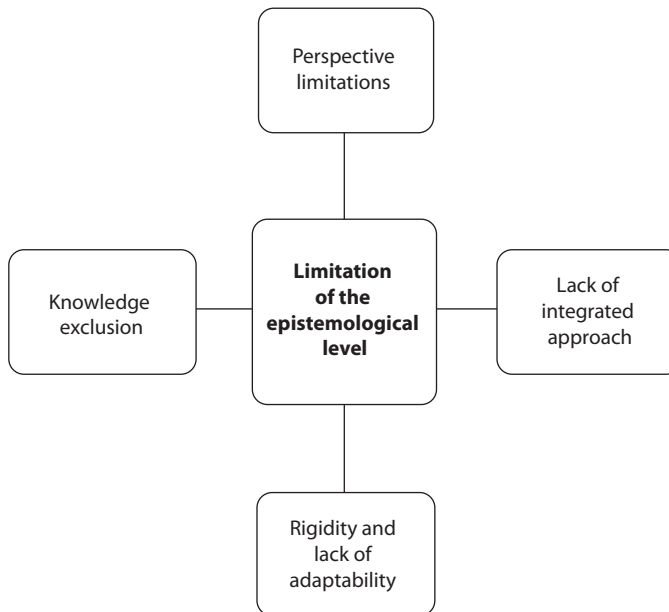
Source: own elaborated based on Beaney (2014).

First, "perspective limitation" hinders a full understanding of complex subjects, as it is confined to a single disciplinary field, restricting the possibility of reaching new understandings (Beaney, 2014). Second, the "lack of an integrated approach" limits the exploration of topics that require a holistic view or collaboration across disciplines (Moreno, 2014). Third, "knowledge exclusion" omits other forms of knowledge or skills that are not strictly aligned with a specific discipline, which can result in a partial view of knowledge. Finally, the "rigidity and lack of adaptability" of this approach prevents the incorporation of new methods, changes or innovative ideas. This last aspect translates into a tendency to strictly adhere to the processes, methods and approaches of a particular discipline, even when these may be obsolete or inadequate to address current or emerging problems (Quintanilla, 2013). Rigid adherence to a single disciplinary framework can therefore significantly limit the scope and relevance of the knowledge generated.

On these limitations, Morin points out (1998), the monodisciplinary practices oriented towards a "blind intelligence", which "destroys the sets and the totality, isolates all its objects from their environments"

Sophia 36: 2024.

© Universidad Politécnica Salesiana del Ecuador

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 67-108.

82

(p. 17). The monodisciplinary epistemological level entails several restrictions on holistic understanding, as it excludes certain types of knowledge and skills, and is rigid and intransigent in addressing complexity and emerging dynamics that require a more integrated and adaptive approach.

Epistemological approaches to integration: multi- and interdisciplinarity

As previously mentioned, dialogicity challenges the tendency to homogenize knowledge and fragmentation of knowledge, by promoting the integration of diverse epistemic approaches that allow reaching the levels of multi-and interdisciplinarity (Moreno Guaicha, 2023). This entails transcending simplicity and the epistemological model of discipline, giving way to an alternative view of rationality. According to Candioti (2009), it implies embracing epistemic reality in its complexity and interconnectedness, recognizing the importance of communicative and discursive dimensions for the construction and transmission of knowledge.

Pérez Wicht (2013) points out that dialogic reconsideration significantly expands the possibilities of knowledge exploration, transcending the limits of a single isolated science. Instead, diverse epistemic approaches are adopted that promote the integration of diverse disciplines. This interdisciplinary approach requires a communicative and intersubjective dialogue that can overcome the barriers of its own specialization and dialogue with other fields of knowledge in the search for truth (Aguilar *et al.*, 2023). In fact, as mentioned above, the fusion of formal reasoning into symbolic logic, strategic analysis in game theory and argumentation in natural language, illustrates the disciplinary integration. In areas such as logic-based artificial intelligence, Zerpa (2000) identifies a similar integration of disciplines, demonstrating the versatility and depth of this approach.

The opening towards integration leads to the construction of bridges between fields of knowledge that, in a more traditional approach, could remain separate and isolated (Morin, 1999). More innovative and holistic solutions can be generated through collaboration and dialogue across disciplines to meet the challenges of today's world. By recognizing the importance of communication and discourse in the construction of knowledge, it fosters a greater understanding and appreciation of the diversity of approaches to enrich and strengthen scientific and academic progress.

83

Φ

In order to identify the specific characteristics of each level of disciplinary integration, authors such as Quintanilla (2013), Fuentes and Collado (2019) and Moreno Guaicha (2023) have conducted detailed analyzes of the main models of interdisciplinary collaboration. These include multi-, inter- and transdisciplinarity. In relation to the disciplinary model -characteristic of traditional education and positivist scientism- it is not included in the levels of integration due to its fragmentary configuration. This exclusion is due to their resistance to the collaborative construction of knowledge and their focus on hyper-specialization and fragmentation of knowledge in areas that do not maintain a connection with each other.

In relation to multidisciplinarity, Paoli Bolio (2019) and Moreno Guaicha (2023) argue that this approach promotes collaboration between different disciplines that address a common theme, although participants remain within the methodological and epistemic boundaries of their respective disciplines. At the educational level, this model presents limitations due to the need to have experts from each discipline and the ability of individuals to assimilate and integrate new knowledge.

Regarding multidisciplinarity, Fuentes Canosa and Collado Ruano (2019) state that this approach promotes convergence between two or more disciplines, establishing networks of collaboration and complementarity, although without achieving complete integration. Multidisciplinarity preserves the methods and procedures specific to the disciplines involved.

On the other hand, interdisciplinarity, which is one of the highest levels of collaboration, differs from multidisciplinarity by pursuing deeper integration, reaching agreements on common theoretical and methodological aspects among the disciplines involved (Perez Wicht, 2013). This approach requires a greater degree of conceptual integration, moving and developing in the shared borders of the participating disciplines.

As an epistemological approach, interdisciplinarity defends an innovative and holistic view of the generation and understanding of knowledge, rejecting the idea that knowledge is confined to the boundaries of individual disciplines; instead, it postulates the need for disciplinary integration to address complex problems (Repko, 2008; Klein, 1990). From this perspective, knowledge is considered as a dynamic and constantly evolving entity, fueled by synergy between different disciplines. Interdisciplinarity provides a theoretical framework for analyzing disciplinary collaboration, facilitating the construction of knowledge that transcends disciplinary boundaries and traditional paradigms, promoting a more inclusive and diverse academic practice, capable of effectively addressing complex and multifaceted challenges of contemporaneity.

Figure 2
Levels of Disciplinary Integration and Paradigm Overcoming
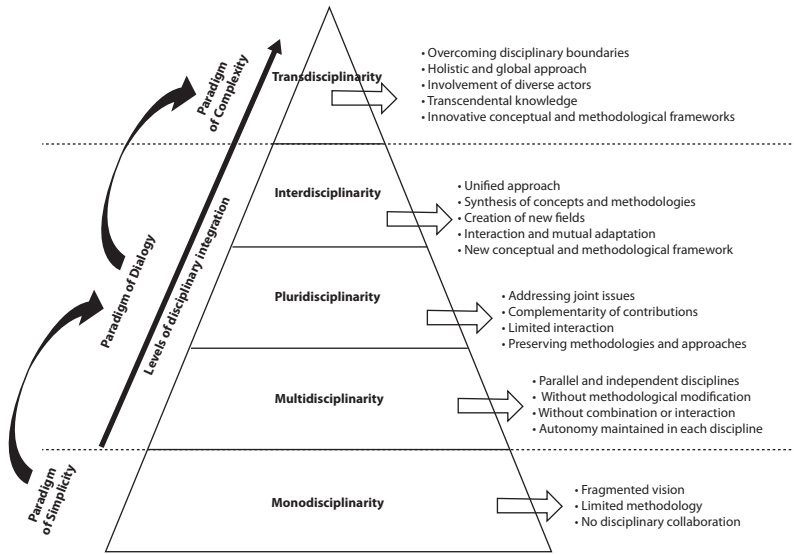
Source: own production from Aquino *et al*., (2016) and Fuentes and Collado (2019).

Undoubtedly, both dialogue and the various levels of multidisciplinary and interdisciplinary integration offer valuable interpretations useful to address complex challenges and build knowledge holistically. By recognizing the importance of communication, discourse, and interdisciplinary interaction, a more inclusive and enriching vision is promoted in the search for truth. Therefore, it is essential that educators, researchers and professionals use these approaches, and collaborate in the construction of a deeper, more holistic and contextualized knowledge, able to effectively address the challenges of today's world.

Transdisciplinary epistemological approach

The imperative of challenging traditional paradigms is an inherent reality of scientific and social progress, which, incidentally, postulates academia and education in general as actors in this process of improvement. To do this, a first step is to recognize that certain topics exceed the capacity of a monodisciplinary approach, and to make way for collaboration in the construction of knowledge, which promotes disciplinary integration and embraces innovative proposals such as transdisciplinarity. In this way, as-

pects that might otherwise remain hidden or inaccessible from separate disciplines can be revealed.

The transdisciplinary proposal emerges as an epistemological innovation that seeks to transcend the conventional boundaries of science and, simultaneously, reveal new knowledge that intertwine transversally in the various fields of knowledge. By promoting an understanding based on reciprocal interdependence and the systemic structuring of knowledge, the understanding of complex phenomena is enriched, allowing a rigorous and integrative epistemological approach.

Transdisciplinarity promotes collaboration and synergy between different disciplines and areas of knowledge, overcoming disciplinary limitations and integrating emerging conceptions of multiple academic, cultural, social, economic and political contexts, among others (Aguilar *et al.*, 2023). This comprehensive and cooperative approach enriches understanding of complexity, while promoting the development of more comprehensive and effective solutions in a rapidly changing world.

There is a close relationship between transdisciplinarity and complexity (Morin, 1999; Nicolescu, 2010), since both approaches advocate an integrative and contextualized view of knowledge. Transdisciplinarity provides an epistemological basis for tackling complex problems from a broader and holistic perspective, while complexity provides a theoretical and philosophical framework for the transdisciplinary approach, highlighting the importance of recognizing and addressing interconnectedness, uncertainty, emergence and self-organization in reality (Morin, 2008; Cilliers, 1998; Capra and Luisi, 2014).

Morin (2019) argues that transdisciplinarity should be kept responsive to the dialogue of knowledge and complex thought, in order to achieve relational and integrative knowledge that enable individuals to understand reality in its entirety. Following this line of thinking, Moreno Guaicha (2023) and Aguilar *et al.* (2019) emphasize that the epistemology of complexity must be dialogic, establishing bridges between scientific knowledge and unconventional knowledge, such as those of ancestral, transcendental, emotional or cultural nature.

Faced with the challenges and complexity of contemporary society, the transdisciplinary epistemological approach stands as a solution to address the fragmentation and lack of integration of knowledge (Nicolescu, 2002; Gibbons *et al.*, 1994; Klein, 2010). Under this idea, the generation of knowledge is transformed into a process enriched by its complexity, since it integrates models such as constructivist, cognitivist and conceptual, and is based on a dialogue dynamic between being, knowing and acting.

Sophia 36: 2024.

© Universidad Politécnica Salesiana del Ecuador

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 67-108.

In this way, the approach leads to meaningful, memorable and practical learning for everyday life.

Figure 3
Transdisciplinary Dialogical Integration Scheme
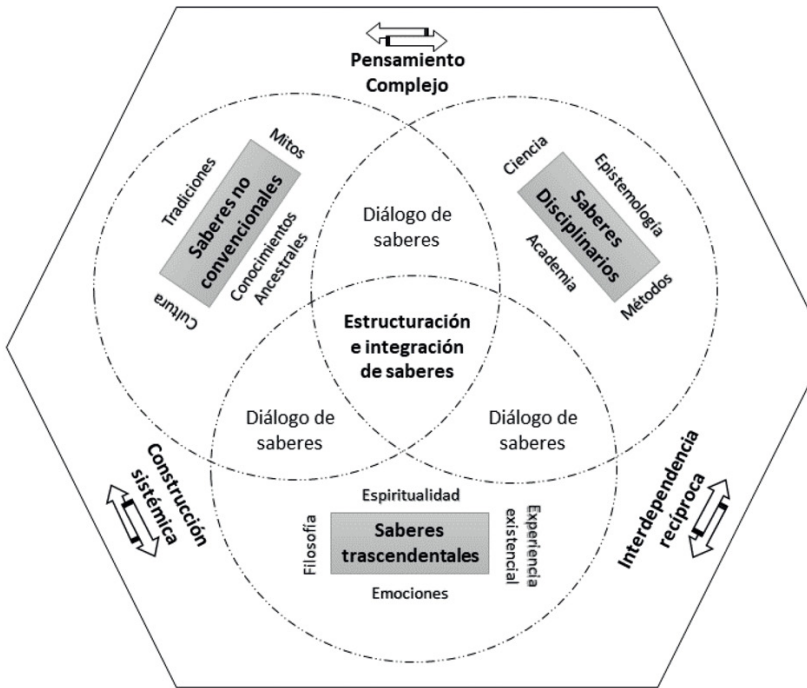
Source: own production from Morin (2019), Aguilar *et al.* (2019), Pérez Wicht (2013) and Moreno Guaicha (2023).

Referring to the constructivist model proposed by Piaget and Vygotsky, it emphasizes the figure of the individual as an active protagonist in his own "construction of knowledge, based on schemes, whether innate or acquired, that guide learning" (Casañas, 2011, p. 224). In the constructivist vision, both the advance of knowledge and the understanding of educational phenomena emerge from the structures inherent to the individual, considering essential aspects such as the skills of the subject, the context around him and the levels of maturity achieved in his development process.

Under this premise, the argument of Garrido and Alvarado (2007), who contemplate constructivist epistemology as an element "dissident against paradigms that quantify reality" (p. 487), stands out. Such under-

standing invites to examine the dialogic interactions between individuals and how they interpret their circumstances to build their knowledge. On the other hand, Casañas (2011) argues that the dialogic dynamics of constructivism grants individuals nonlinear dynamic processes, which allow addressing social complexity from the singularity of each actor within the educational process. Knowledge of the real world is therefore built through social and representational interactionism processes, which is intertwined with the dialogical dynamics that conceive knowledge as a continuous, progressive and constantly evolving phenomenon (Berger and Luckman, 2003).

Regarding the incorporation of the cognitivist model, it emerges as an essential epistemic pillar to examine how knowledge is generated and how the learning process of the individual develops. Placing particular emphasis on "changes in the structural content and organization of the mind" (Mila and Martínez, 1991, p. 149) and giving primary importance to cognitive structures. This implies a revaluation of the mind as a dynamic and adaptable entity, able to reconfigure itself in response to the cognitive challenges that emerge in the path of learning.

According to Bruner (1991), cognitivist epistemology seeks to "vindicate the study of the mind in the human sciences after a long period dominated by rigorous objectivism" (p. 22). This approach does not limit learning only to process information or to resolve conflicts, but rather aims to make the individual understand the world and himself, through a constant rediscovery of new meanings and meanings in collaboration with others and in different cultural contexts (Vázquez Gómez and Bárcena Orbe, 2011). In this framework, cognitive epistemology, by integrating dialogicity into its interactions, "allows to manifest the dialectical character that the conscious subject gives to his perceptions" (Meza, 2015, p. 5). This attribute enables the individual to interpret and model reality in a process that embraces the complexity of the context, moving away from reductionism or simplicity.

Following the line of reflection inherent to cognitive pedagogy, the inclusion of the model of conceptual pedagogy is contemplated, whose approach assumes a significant importance in the field of training. Here, dialogue stands as a primary element in the relationships between the student, the knowledge and the educator, and which focuses its efforts on ensuring that students "acquire the fundamental concepts and conceptual networks of the sciences and the arts. It is necessary to equip them with concepts, which are the foundations of the entire academic structure of sciences" (De Zubiría, 2010, p. 227).

The same author emphasizes that dialogue "is an essential condition to ensure effective mediation by the teacher, intentionally, mediated and transcendent facilitating the integral development of the student" (p. 196). This approach allows us to avoid the tendency to focus the training process purely on learning, redirecting it towards a meaningful interaction with the environment, the community and the appreciation of the social repercussions derived from such interactions. For this purpose, De Zubiría (2010) says that conceptual epistemology must be developed in three dimensions of competencies that favor and promote the integral development of the human being: cognitive or analytical competencies, socio-affective competencies and praxeological or evaluative competencies.

> The first dimension is linked to thought, the second to affection, sociability and feelings; and the last, to praxis and action, depending on the subject who feels, acts and thinks [...]. In everyday language, we would say that the human being thinks, loves and acts; and that it is the duty of the school to teach us to think better, harp better and act better (p. 197).

89

Φ

The evolution of these dimensions, through dialogic interactions, aspires that the knowledge acquired in learning is not merely implanted in the minds, as if it were a deposit. Instead, it seeks that knowledge interacts and coexists with the values and emotions of each individual. The aim is to ensure that training is contextualized according to the conditions of its development, both individually and socially.

In summary, the confluence of constructivist, cognitive and conceptual approaches makes it possible to face complexity using dialogic interactions in an integrative approach that combines the structuring of mental operations with the social interaction provided by language. According to Guerrero and Henao (2019), this leads the individual to "manage, represent and reproduce new information, causing a modification in cognitive structures" (p. 23). In this way, the transition from the thought of simplicity to the complex thought is facilitated.

Undoubtedly, dialogue is consolidated as the key foundation in the development of complex structures, giving rise to an "interdependence [which is presented as] a principle by virtue of which elements and events are closely integrated and organized in an interrelated process" (De Zubiría, 2010, p. 198), which is structured and developed both individually and socially, allowing a deeper and more holistic understanding of the phenomena of study.

In summary, the transition from the precision of monodisciplinarity to the collaborative and holistic wealth of transdisciplinarity illus-

trates a fundamental change in learning models. This progress, essential in an era defined by its complexity and intertwining, highlights the need to overcome disciplinary barriers and to value epistemological diversity. Thus, the relevance of adapting to an educational and scientific environment in constant transformation, where epistemological integration and flexibility are presented not only as options, but as essential requirements for development and advancement in multiple spheres of society.

Moving forward in this discussion, the following section will delve into heterogeneous-, self- and interstructuring learning models, exploring how these modalities reflect and feed on epistemological evolution, offering practical approaches to address educational challenges.

Learning models: hetero-, auto- and interstructuring

This section expands the understanding of how epistemological paradigms and approaches materialize in specific learning models and pedagogical practices. Here we explore how heterogeneous, self- and interstructuring learning models reflect different ways of interaction between the educator and the educator, the structure of information and the process of knowledge construction. Through this, the impact of each model on the deepening and enrichment of learning is examined, evidencing its relevance and applicability in different educational contexts.

Heterostructuring Learning Model

The educational model that is in line with the framework of simplicity is traditional and heterostructuring, which, in the words of Zubiría (2010), is typical of an education in which the role of the teacher is "privileged and is considered the central axis in all educational process" (p. 16), being the student a passive entity in the learning process. Traditionally, this student was perceived as an *a-lumine*, an individual "without self-light" or "off", an empty vessel or *tabula rasa*, ready to be filled with knowledge. In this conception, the teacher was considered the absolute holder of an unquestionable and immutable knowledge.

According to García and Fabila (2011), the heterostructuring learning model refers to repetition and memory, "incited by extrinsic motivators, which seeks to equate learning with behavior" (p. 4). Disciplinary tactics, such as the use of external incentives (rewards or punishments) to stimulate students, are common in this model, whose main purpose is to encourage the adoption of specific behaviors, shaping the way students

Sophia 36: 2024.

© Universidad Politécnica Salesiana del Ecuador

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 67-108.

90

interact with information. Additionally, this learning model emphasizes the use of analytical reasoning in the process of knowledge acquisition. Although this approach seeks to uncomplicate the learning process, it also harbors inherent limitations; as Besteiro (1994) argues, these reasonings "are purely explanatory and, in relation to content, do not provide anything additional" (p. 135).

Heterostructuring learning, despite facilitating an initial understanding of the content, may prove insufficient in terms of depth and richness of knowledge (Fischetti, 2019). This model, focused on the memorization and organization of information, does not guarantee a significant enrichment of learning. Therefore, it can limit the ability of students to critically analyze information, relate concepts and generate well-grounded conclusions.

The convenience of using receptive methods becomes the basis of the learning model, making the master class its default methodological strategy. In line with its methodological proposal, "it presupposes that teaching, authoritarianism and instruction must be used to ensure the assimilation of the cultural heritage in the classroom" (De Zubiría, 2010, p. 16). This guarantees that learning goes beyond simple conceptual content, promoting and reinforcing rules and structures of the prevailing system. What is being pursued is an equation between learning and student behavior, in such a way that the objectives established by the imposed pedagogical model are achieved.

García and Fabila (2011) also emphasize that heterostructuring teaching models emphasize the teaching process and the transmission of information and standards, using techniques such as repetition and copying to strengthen knowledge. Regarding the roles played by educational agents, it is highlighted that students become passive and receptive agents, a matter that has already been highly criticized, as it restricts creativity, critical thinking and student participation in the construction of knowledge. Likewise, the role of the teacher is criticized in this model, since its pedagogical approach places the teacher at the center of the educational process, as the mere transmitter of knowledge and holder of the truth (De Zubiría, 2010), excluding the needs and skills of the student.

In short, it can be argued that this model lacks flexibility to adjust to the specific demands of each student, which ends up hindering their ability to learn effectively. A teacher-centered approach based on repetition is not the most appropriate for the current educational landscape. This is why teaching models are adapted to the characteristics and needs of students, only in this way can significant and memorable learning be achieved.

Figure 4
Characteristics of the Heterostructuring Learning Model
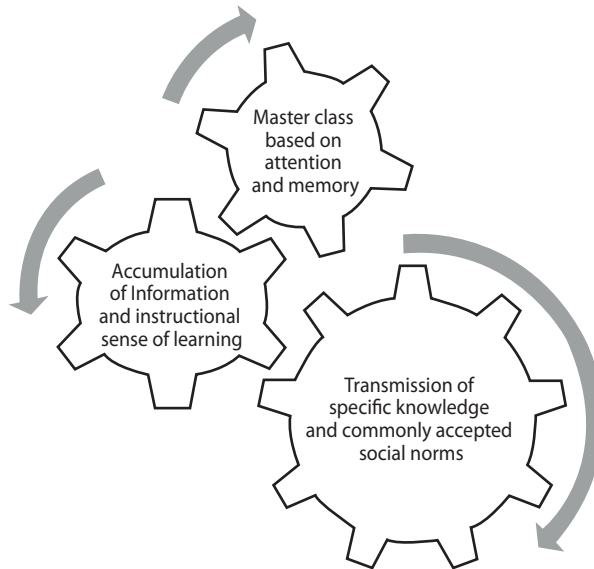
Source: own elaboration from García and Fabila (2011).

Self-Structuring Learning Model

The self-structuring model emerges as an innovative pedagogical proposal, in line with the principles of the paradigm of dialogue and disciplinary integration approaches. Its essential purpose is to transcend the limitations of simplicity, disciplinarity and heterostructuring learning, giving students an active and autonomous role in the acquisition and construction of knowledge from experience and its centers of interest (Dewey, 1938; Montessori, 2003).

In accordance with this idea, Gómez (2013) argues that the self-structuring pedagogical approach is based on the idea that learning is an active, individualized and self-organized process, in which the objective of education is to move from an "intellectual teaching guided from the outside to a project where the student becomes the active element of a set of processes in which he has to ensure the direction" (p. 9).

This idea is supported by Biesta (2015), who argues that self-structuring education should focus on creating spaces for students to "explore, experiment and build knowledge autonomously and collaboratively"

Sophia 36: 2024.

© Universidad Politécnica Salesiana del Ecuador

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 67-108.

(p. 45). Therefore, the importance of fostering flexible and dynamic learning environments is emphasized, since they allow students to develop skills and competences to face real challenges and problems in their specific contexts.

Regarding the process that guides the educational action between teacher and student, it is worth mentioning the didactic transposition (Mejía *et al.*, 2021), which stands as one of the main elements in the self-structuring theories, because the educational process focuses on the student, taking into account its particularities, nuances and meanings, which places the student in the very core of such transposition. As a result, the teacher has the responsibility to adapt his pedagogical approach to the individual profile of the student, seeking to optimize the assimilation of knowledge.

In the context of the self-structuring approach, it is essential to emphasize that the student becomes the main agent of his own learning process, assuming a self-regulation role. This model encourages students to organize their learning autonomously, guided by their specific interests, needs and contexts. In fact, the spirit that characterizes dialogic pedagogy, according to Moreno Guaicha *et al.* (2022), permeates the essence of self-structuring learning, recovering the key slogan of the Enlightenment: "Thinking for itself", the *sapere aude*, which seeks to question all kinds of institutions that hinder the development of human potential. This bond with the Enlightenment underlines the emphasis of the self-structuring approach on the empowerment of the individual and the use of reason as a learning tool.
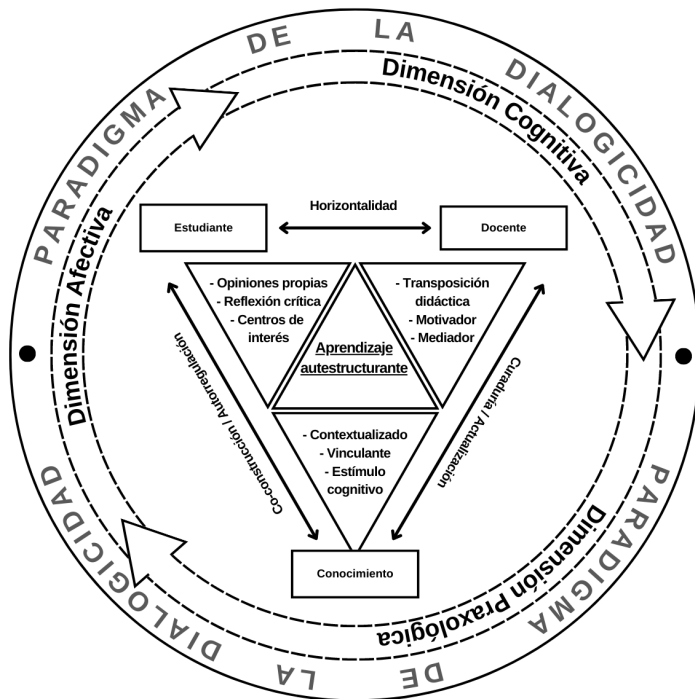
Self-structured learning is enriched by integrating and leveraging a variety of recognized pedagogical frameworks. These include active pedagogy, constructivism, cognitive pedagogy, student-centered approach and dialogic pedagogy. These approaches, which have been strengthened and shaped by the contribution of notable educational psychologists and pedagogues such as Montessori (1870-1952), Lev Vygotsky (1896-1934), Jean Piaget (1896-1980), David Ausubel (1918-2008), Carl Rogers (1902-1987) and De Zubiría (1951-), expand and extend the reach to the depth and the possibilities offered by self-structuring learning, in a holistic pedagogical framework that promotes the growth and individual development of students.

In the development of self-structuring learning, De Zubiría (2010) says that it is important to deepen the dialogic activity to give students opportunities in decision-making, goal-setting and critical reflection about their own learning process, promoting responsibility and commitment in their personal and academic development. In doing so, it promotes

93

students' ability to listen to and value their peers' views, contributing to an environment of respect, inclusion and diversity in education.

Dialogic pedagogy not only promotes responsibility and commitment in academic development, but also promotes their integral formation, as critical and reflective individuals, able to face the challenges of a world in constant change. This approach "emphasizes the construction of structures through the practical, affective and cognitive dimensions, based on the cognitive modifiability theory of Reuven Feuerstein, who considers that intelligence is dynamic, relativistic, optimistic and contextual" (Contreras *et al.*, 2019, p. 174) and highlights the role of culture as an intermediary, which enables the plasticity and malleability of knowledge, as well as its progress.

94

Figure 5
Key Relationships and Functions
in the Self-Structuring Learning Model

Source: own elaboration from De Zubiría (2010) and De Zubiría and De Zubiría (2019).

Sophia 36: 2024.

© Universidad Politécnica Salesiana del Ecuador

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 67-108.

In this direction, it is appropriate to highlight the close relationship between self-structuring learning and the development of reasoning within the structuring of synthetic judgments for self-discovery and induction learning, processes in line with Kant's vision (1977). Here the truth is not merely contained in the concept of the subject, as it happens in the analytical judgments used in the reasonings of the heterostructuring model, but extends beyond, providing new information and propitiating the active participation of the subject in the process of knowing:

> There are two possibilities in synthetic judgments: they can be *a priori* if they arise from pure understanding and pure reason and therefore their truth is necessary, or they can be *a posteriori* and their value is determined by appealing to other types of instances such as experience. For this reason, the truth of a synthetic judgment *a posteriori* will be contingent on depending on factors that may or may not be the case (Castro, 2015, p. 8).

95

In the educational field, students do not limit themselves to assimilating pre-existing knowledge, they also actively contribute to its construction through their own exploration and analysis, based on their personal experiences. According to De Zubiría (2010), this approach, which promotes a deeper and more meaningful learning, faithfully reflects the spirit inherent in dialogic pedagogy.

The conception of the student as an active subject and participant in his learning resonates in different disciplines and establishes a link with dialogic logic, which -being a subdiscipline of symbolic logic rooted in game theory and mathematical constructivism (Clerbout and McConaughey, 2022)- provides an adequate conceptual framework to deepen the understanding of the dynamics of self-structuring learning, strengthening the guiding thread of this discourse.

Regarding the interaction between the model of self-structuring learning and the paradigm of dialogicity, it is clear that both approaches promote collaboration, communication and intersubjective understanding in different areas of knowledge (Contreras *et al.*, 2019). On the one hand, dialogicity favors the development of relational and discursive skills in students, who become active agents of their own learning process, assuming the responsibility of building their knowledge through dialogue and reflection. On the other hand, the levels of multidisciplinary and interdisciplinary integration provide an epistemological framework that allows students to explore and connect knowledge from different disciplines. This approach encourages the construction of an integral and

contextualized knowledge, which is adapted to the needs and interests of each student.

Ultimately, the self-structuring learning model emerges as an integral pedagogical methodology, effectively fusing dialogicity with an epistemological approach that prioritizes the integration of diverse disciplines, including multi- and interdisciplinary aspects. This approach promotes not only autonomy and self-reflection, but also the collaborative construction of knowledge (Hernández and Quintana, 2018). Here, students are encouraged to actively participate in the search for truth, through dialogue and collaboration across disciplines, and by valuing epistemic diversity in educational settings.

Interstructuring Learning Model

The interstructuring learning model is based on the conceptual pedagogy proposed by Miguel de Zubiría (2006), whose approach aims to promote an integral development of the student, covering affective, cognitive and praxological aspects. Villegas (2017) mentions that this model is built on "three interrelated factors: thinking (cognitive); emotional or socio-affective (feelings, sociability), and praxis (action)" (p. 3). Learning is conceived as a dynamic and versatile process, where students have the opportunity to structure and restructure their knowledge in a continuous way, promoting critical thinking skills, creativity and adaptability to different contexts and situations.

Interstructuring learning is distinguished by the importance it has to dialogue in education. De Zubiría (2010) stresses that "a dialogic and interstructuring model must prevail that, in addition to accepting the active role of the student in learning, recognizes the essential role of mediators in this process; a model that provides a dialectical synthesis" (p. 15). This approach involves close communication and collaboration between students, teachers and other educational and social actors, promoting the exchange of knowledge, innovation and the enrichment of knowledge through reciprocity, which culminates in a more comprehensive and effective learning (Aguirre and Godoy, 2020).

Interstructuring learning has a significant affinity with complexity and the transdisciplinary epistemological approach—as already stated—promoting awareness of the intricate network of connections that make up reality and urging to address challenges from a systemic and transdisciplinary approach (Morin, 2008; Nicolescu, 2002). In this way, the development of a wide and penetrating understanding of the phenomena

that students face is fostered, equipping them to make informed decisions and act responsibly and ethically in a world of increasing complexity and interconnectedness.

Contrasting with the hetero- and self-structuring models, interstructuring learning emerges as a more holistic educational approach, designed to meet the challenges of the 21st century (Aguirre and Godoy, 2020). Heterostructuring learning, marked by its fragmented and simplified nature, differs from self-structuring, which emphasizes disciplinary integration and the construction of significant knowledge. However, interstructuring learning transcends these approaches, since it focuses on the integral development of the human being and is not limited only to academic learning, encompassing "cognitive, valuative and practical contents, which obliges the school to define purposes and contents that guarantee higher levels of intra and interpersonal intelligence" (De Zubiría, 2006, p. 7).

97

Φ

Consequently, learning transcends the classroom and the school context, incorporating a construction of knowledge that occurs actively and interrelated, both within and outside the educational areas. According to Benítez (2019), this knowledge is built:

> Outside the school, but it is reconstructed in an active and interstructured way from the pedagogical dialogue between the student, the knowledge and the teacher. Taking into account the development of human dimensions, such as thought; affection, sociability and feelings; praxis and action, according to a subject who feels, acts and thinks (p. 103).

For an effective implementation of transdisciplinary pedagogy in the classroom context, it is necessary to cultivate students' sensitivity and commitment to the importance of a comprehensive education. This education is in tune and reflects the different needs and educational contexts, but also takes into account the particularities and respects the points of interest of the subject in the process of knowledge construction.

According to Aguirre and Godoy (2020), the interstructuring learning model constitutes a significant advance in the way the individual interacts with elements of his or her environment that are relevant to his or her learning. Knowledge acquires meaning and value insofar as it can be directly associated with their existence and personal experiences. For this reason, the process must begin with the awareness of the protagonist role of the student in the process of knowledge construction, integrating the different constitutive dimensions that make it up, followed by the

active involvement of educational agents in the task of transcending traditional practices and the different challenges that persist in education.

Interstructuring learning establishes a constant pedagogical dialogue between the student, the knowledge and the teacher, which contributes to an active construction and reconstruction of knowledge (García and Fabila, 2011). A process in which "mediators and students fulfill essential but differentiated roles; learning is an active and mediated process in which a variety of strategies must be used to ensure reflection, learning and dialogue" (p. 14). In this way, the approach not only makes possible the understanding of the challenges that characterize this era, but also promotes effective strategies to face the changing dynamics and constant transformations of contemporary reality.

Interstructuring learning definitely represents a significant evolution in education, whose approach seeks to create a dynamic and versatile learning environment that allows students to structure and continually restructure their knowledge, promoting critical thinking skills, creativity and adaptability in various contexts and situations (Aguirre and Godoy, 2020; Benítez, 2019). Throughout this discussion, the relevance of dialogue in the learning process has been underlined, which translates into close communication and collaboration in the exchange of knowledge.

In this context, teaching methodologies that complement and enhance interstructuring learning emerge. These include Problem Based Learning (PBL) and the STEAM method, to illustrate two. As Mena Zamora (2023) points out, "in order to conceive an appropriate use of one or more methodologies [...], which allow transdisciplinarity to be addressed, it is necessary that these show an integrating position of knowledge with a critical and contextualized vision" (p. 319). For this reason, pedagogical methods -integrating multiple fields of knowledge- encourage the active participation of students in their learning, promoting collaboration, creativity and innovation. This develops in them transversal skills and competencies such as critical thinking, problem solving and effective communication (Thomas, 2000).

The methodology of the PBL focuses on the interests and experiences of students, thus achieving more meaningful and timely learning for conflict resolution through active participation. The purpose of the PBL is to "base knowledge from the epistemology of complexity for the approach and analysis, so that all aspects that compose it are considered, to transcend the limits of specific knowledge" (Mena Zamora, 2023, p. 334).

Sophia 36: 2024.

© Universidad Politécnica Salesiana del Ecuador

Print ISSN:1390-3861 / Electronic ISSN: 1390-8626, pp. 67-108.

Likewise, the STEAM methodology is inserted, centered on "sciences (S), technology (T), engineering (E), arts (A) and mathematics (M)" (García Fuentes *et al*., 2023, p. 192) and which emerges as an interdisciplinary proposal with transversal potential, which favors an integrated and creative educational process. According to Yakman (2008), STEAM seeks to produce results with a solid and complete training in critical thinking, creativity and - as in the previous approach - conflict resolution in various areas of knowledge.

These types of methodologies allow students to see and understand the world in an integrated and sustainable way, addressing challenges from multiple disciplines (Stevenson *et al*., 2007). For these authors, these methodologies provide a propitious scenario to apply the philosophy of interstructuring learning. In this context, students are encouraged to explore and understand the complexity of natural and human systems, using their skills and knowledge acquired in various disciplines to propose and evaluate solutions that may be required in a given context.

Interstructuring learning, aligned with the principles of transdisciplinarity, is established as an innovative and relevant educational proposal that intertwines dialogicity with that of complexity and the higher epistemological level of disciplinary integration (Aguirre and Godoy, 2020; García and Fabila, 2011). This approach gives students the competencies and skills needed to address and solve complex challenges, promoting inclusive knowledge building, adaptability, and ethical responsibility.

With the purpose of forming holistic individuals, able to interact and thrive in a world of increasing complexity and interdependence, the interstructuring approach seeks to generate learning that transcends the physical boundaries of the classroom, to become an integral part of the daily existence of the student. This learning satisfies current educational needs and the skills and competencies needed for the future, providing a solid and versatile framework for comprehensive student growth in an increasingly interconnected and complex world.

To conclude this analysis of learning models, the article highlights their essential contribution to questioning simplicity in contemporary pedagogy. Compared to traditional models, rooted in linear and reductionist approaches, emerging models such as interstructuring and transdisciplinary models represent a paradigm shift. These new models challenge conventional methods by promoting deeper integration and connection among diverse areas of knowledge, reflecting the inherent complexity of today's world. They foster more enriched analytical and

99
Φ

critical thinking, equipping students not only to store information, but also to synthesize, question and apply it in a practical way.

The transition to these more complex and holistic learning models is essential, not only as a challenge to simplistic approaches, but as a necessary and strategic response to prepare students to thrive in an increasingly interconnected and complex world. This change represents a fundamental stage in the evolution of education, laying the basis for the conclusions of this study and underlining the importance of adapting practices to the demands of an ever-changing educational environment.

Conclusions

100

This exploration has highlighted the transcendental evolution of learning models, from traditional approaches anchored in the paradigm of simplicity to more complex and transdisciplinary models, marking a paradigmatic change in the philosophy of education. The transition to these emerging models reflects a response to the needs of a dynamic society, recognizing the interconnectedness and multidimensionality of knowledge in an increasingly interconnected world.

This analysis suggests that the contemporary educational landscape, still rooted in the primacy of instrumental reason, techno-scientific knowledge and the paradigm of simplicity, needs a critical reflection on the reference frameworks that underlie current educational practices and structures, and an orientation towards approaches that value human complexity and its learning processes.

Following the transcendental evolution of learning models, the domain of simplicity in the configuration of monodisciplinary epistemology and heterostructuring learning models has been analyzed. Although this paradigm has laid the foundations of many conventional educational practices, it is observed that its approach, centered on isolated elements of knowledge, presents considerable challenges in the context of a society that demands a more integral and connected learning. The exploration of these practices reveals that, despite its historical usefulness, it falls short of the need to address the increasing complexity and interconnectedness of current knowledge.

In the progress towards more integrated learning models, dialogicity emerges as a crucial step, giving way to self-structuring forms of learning. This paradigm emphasizes collaboration, dialogue and disciplinary integration, and recognizes the students as an active protagonist in their

educational process. However, despite representing a significant advance compared to simplicity, dialogue still does not fully reach the depth required to comprehensively address the complexity and multifaceted challenges of human learning.

Ultimately, it highlights the need to move beyond dialogism into the realm of complexity. Adopting this approach implies embracing a transdisciplinary epistemology and an interstructuring learning model, which promote a comprehensive and multidimensional educational development. This orientation favors an education that transcends the limits of the purely academic, considering the individual in its entirety -his cognitive abilities, values and practices- and aiming at a formation that is holistic and transformative. Given the pace of advances in science and the emerging challenges in society, the paradigm of complexity is not only relevant, but also essential for an education adapted to the realities of the current and future world.

This review highlights the potential impact of these paradigm changes on scientific advancement, social welfare and human development, advocating for a vision of education not as a simple product of consumption, but as a fundamental foundation for the construction of a more equitable society.

In conclusion, it is emphasized that, although the transition to more complex and inclusive learning models represents certain challenges, it is a necessary and achievable evolution within the educational field. Education plays a crucial role in this change, not only adapting to the new realities, but also leading the transformation towards pedagogical practices that foster comprehensive learning and deeply connected with human experience. Therefore, it becomes evident the need to redefine and restructure current educational models, so that learning becomes a transcendental and humanly enriching experience.

References

ACOSTA, Olga
    2016   La educación sentimental: del paso de la ética Lévinas a la pedagogía del aprendizaje. *Revista Palabra*, *16*(16), 276-282. https://doi.org/10.32997/2346-2884-vol.16-num.16-2016-1441
AGUAYO, Claudio, TAHERI, Ali & STEAGALL, Marcos
    2021   Diseño inmersivo encarnado para el aprendizaje basado en la experiencia y la autoiluminación. *Link Symposium Abstracts*, *2*(1). https://doi.org/10.24135/link2021.v2i1.72

AGUILAR, Floralba, COLLADO, Javier, TOURIÑÁN LÓPEZ, José, BOLAÑOS VIVAS, Robert, MORENO GUAICHA, Jefferson, ESTRADA GARCÍA, Alex *et al.*

2023   *Formación docente desde la filosofía educativa transdisciplinaria.* Quito: Abya-Yala. https://bit.ly/3TQFXqy

AGUILAR, Floralba, BOLAÑOS, Robert, VILLAMAR, Jessica & MORENO GUAICHA, Jefferson

2019   Diálogo de saberes en las ciencias humanas. *Artyhum, Revista Digital de Artes y Humanidades*, (64), 62-99. https://bit.ly/41VqzuP

AGUIRRE, Lorena & GODOY, Diana

2020   *La pedagogía interestructurante dialogante y el modelo de aula invertida* [tesis de pregrado]. Bogotá: Facultad de Artes Plásticas y Visuales, Universidad Santo Tomás. https://bit.ly/3RMPBaW

ANTHONY, Glenda

1996   When Mathematics Students Fail to Use Appropriate Learning Strategies. *Mathematics Education Research Journal*, *8*, 23-37. https://doi.org/10.1007/BF03217287

AQUINO, José, CORONA, Leonel & FERNÁNDEZ, Cecilia

2016   *Reduciendo la cantidad de asignaturas en la docencia de las nuevas ramas de la ingeniería (en su transitar de lo interdisciplinar a lo transdiciplinar).* I Congreso Nacional de Investigación Interdisciplinaria, UPIICSA-IPN, México. https://bit.ly/47oSZ1A

ARISTÓTELES

2003   *Acerca del alma.* Madrid: Gredos. https://bit.ly/47kOhBS

AUDI, Robert

2004   *Diccionario Akal de filosofía* (vol. 35). Madrid: Akal. https://bit.ly/3TRd2m3

BALIETTI, Stefano, MÄS, Michael & HELBING, Dirk

2015   On Disciplinary Fragmentation and Scientific Progress. *PLoS ONE*, *10*. https://doi.org/10.1371/journal.pone.0118747

BEANEY, Michael

2014   Positivismo, dialéctica materialista y fenomenología: tres enfoques filosóficos del método científico y la investigación educativa. *Actualidades Investigativas en Educación*, *14*(3), 502-523.

BENÍTEZ, Amado

2019   *Historias que hacen historia: memorias del Simposio sobre la Enseñanza de la Historia.* Bogotá: IDEP. https://bit.ly/3TVY5zj

BERGER, Peter & LUCKMAN, Thomas

2003   *La construcción social de la realidad.* Buenos Aires: Amorrortu.

BESTEIRO, Julián

1994   *Los juicios sintéticos 'a priori'.* México DF: Porra.

BIESTA, Gert

2015   *Beautiful Risk of Education.* Taylor & Francis. https://bit.ly/3vjda3q

BOLIO, Paoli

2019   Multi- Inter-, and Transdisciplinarity. *Revista de Filosofía y Teoría del Derecho*, (13), 347-357. http://dx.doi.org/10.22201/iij.24487937e.2019.13

BRUNER, Jerome

1991   *Actos de significado: más allá de la revolución cognitiva.* Madrid: Alianza.

BUBER, Martin

1973   *¿Qué es el hombre?* México: FCE.

102
Φ

CANDIOTI, María
    2009   *Significado y validez: la incidencia del giro pragmático en la epistemología actual*. Paraná: UNER.

CAPRA, Fritjob & LUISI, Pier
    2014   *The Systems View of Life: A Unifying Vision*. Cambridge University Press.

CARNOT, Sadi
    1963   *Reflexiones sobre la potencia motriz del fuego y sobre las máquinas aptas para desarrollar esta potencia*. México DF: Instituto Politécnico Nacional; Subsecretaría de Enseñanza Técnica y Superior; Comisión del Libro de Texto.

CASAÑAS, Mirta
    2011   Bases epistémicas de la educación. *Revista Integra Educativa*, *4*(1), 219-249. https://bit.ly/48lb7KX

CASTRO, Ignacio
    2015   *La distinción analítico/sintético y sus implicaciones para la semántica*. Santiago: Facultad de Filosofía y Humanidades de la Universidad de Chile.

CHESLEY, Amelia, PARUPUDI, Tejasvi, HOLTAN, Aidan, FARRINGTON, Shawn, EDEN, Christi, BANIYA, Sweta, MENTZER, Nathan & LAUX, Dawn
    2018   *Interdisciplinary Pedagogy, Integrated Curriculum, and Professional Development*. *ASEE IL-IN*, *4*. https://bit.ly/48oVIcD

CILLIERS, Paul
    1998   *Complexity and Postmodernism: Understanding Complex Systems*. Routledge.

CLERBOUT, Nicolas & ZOE, McConaughey
    2022   Dialogical Logic. En E. N. Zalta & U. Nodelman (eds.), *The Stanford Encyclopedia of Philosophy*. https://plato.stanford.edu/archives/fall2022/entries/logic-dialogical https://stanford.io/4aLIXu8

CIDH
    2021   *¿Cómo promover el acceso universal a internet durante la pandemia de COVID-19?* OEA; CIDH. https://bit.ly/48LPPpL

COMTE, August & SANGUINETI, Juan
    1987   *Augusto Comte: curso de filosofía positiva*. Madrid: Magisterio Español.

CONTRERAS, Jennifer, BERMÚDEZ, Liliana & TORRES, Cristian
    2019   Caracterización de los modelos pedagógicos y su pertinencia en una educación contable crítica. *Revista Entramado*, *15*(1), 164-189. https://doi.org/10.18041/1900-3803/entramado.1.5428

COPERNICUS, Nicolaus
    1965   *De revolutionibus orbium coelestium*. Nueva York: Johnson Reprint Corporation.

CROWELL, Steven
    2012   Why is Ethics First Philosophy? Lévinas in Phenomenological Context. *European journal of philosophy*, *23*(3), 564-588. https://doi.org/10.1111/j.1468-0378.2012.00550.x

DEMON, Hermanus
    2013   La hermenéutica según Hans-Georg Gadamer y su aporte a la educación. *Sophia, Colección de Filosofía de la Educación*, (15), 33-84. https://bit.ly/3tFCLDn

DESCARTES, René
    2012   *Discurso del método* (vol. 1). Madrid: EDAF.

DEWEY, Jhon
    1938   *Experience and Education*. Nueva York: Macmillan.

103
Φ

DE ZUBIRIA, Julian

2010 *Los modelos pedagógicos: hacia una pedagogía dialogante* (3ª ed). Bogotá: Aula Abierta Magisterio.

DE ZUBIRIA, Miguel

2006 *Pedagogía conceptual: los modelos internacional de pedagogía conceptual.* Bogotá: Fundación Alberto Merani.

DE ZUBIRÍA, Alejandro & DE ZUBIRÍA, Miguel

2019 *Pedagogía conceptual: una puerta al futuro de la educación*. Bogotá: Ediciones de la U.

DOS SANTOS, José

2017 El iusnaturalismo y el positivismo jurídico. *Investigación en Ciencias Jurídicas y Sociales*, (3), 11-33. https://bit.ly/3Hamn0L

FERRATER, José

1994 *Diccionario de filosofía* (tomo III). Madrid: Ariel.

FISCHETTI, John

2019 A Different Kind of Teacher for a Different Kind of School. En Reginald Monyai (ed.), *Teacher Education in the 21st Century*. Ciudad del Cabo: University of South Africa.

FREIRE, Paulo

2005 *Pedagogía del oprimido*. México DF: Siglo XXI.

FUENTES CANOSA, Adela & COLLADO RUANO, Javier

2019 Fundamentos epistemológicos transdisciplinares de educación y neurociencia. *Sophia, Colección de Filosofía de la Educación*, (26), 83-113. https://doi.org/10.17163/soph.n26.2019.02

GADAMER, Hans-Georg

1993 *Verdad y método*. Salamanca: Sígueme.

GARCÍA, Verónica & FABILA, Angélica

2011 Modelos pedagógicos y teorías del aprendizaje en la educación a distancia. *Apertura*, *3*(2). https://bit.ly/41MwhyW

GARCÍA FUENTES, Olalla, RAPOSO RIVAS, Manuela & MARTÍNEZ FIGUEIRA, María

2023 STEAM Education: Review of Literature. *Revista Complutense de Educación*, *34*(1), 191-202. https://doi.org/10.5209/rced.77261

GARRIDO, Alicia & ÁLVARO, José

2007 *Psicología social*. Madrid: McGraw-Hill.

GIBBONS, Michael & LOMOGES, Camille

1994 *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. Nueva York: Sage Publications.

GÓMEZ, Elena

2013 *El aprendizaje activo como mejora de las actitudes de los estudiantes hacia el aprendizaje*. Pamplona: Universidad Politécnica de Navarra.

GONZÁLEZ, Fredy

2005 *¿Qué es un paradigma? Análisis teórico, conceptual y psicolingüístico del término. Investigación y Postgrado*, *20*(1), 13-54. https://bit.ly/3NQwV8Q

GUAMÁN, Klever, HERNÁNDEZ, Eduardo & LLOAY, Stalin

2020 El positivismo y el positivismo jurídico. *Universidad y Sociedad*, *12*(4), 265-269. https://bit.ly/3vr8Xel

GUERRERO, Camilo & HENAO, Luz

2019   *Desarrollo de operaciones mentales en personas con discapacidad cognitiva síndrome de Down mediante un ambiente computacional educativo*. Bogotá: Universidad Pedagógica Nacional.

HEGEL, Georg Wilhelm Friedrich

2017   *Fenomenología del espíritu*. México DF: FCE.

HERNÁNDEZ, Elmer & QUINTANA, David

2018   *Modelo pedagógico dialógico institucional*. San Salvador: ULS.

HIZMERI, Julio

2011   Paradigma de la complejidad como ideal de racionalidad transclásico. *Pequén*, *1*(1), 27- 37. https://bit.ly/3TXy5Dk

HUME, David

2020   *Tratado de la naturaleza humana*. Madrid: Verbum.

KANT, Immanuel

1977   *Crítica de la razón pura*. México DF: Porrúa.

KIM, Minjeong

2022   Early Childhood Teachers' Core Competency in the era of Artificial Intelligence. *Korean Journal of Teacher Education*, *38*(5), 27-49. https://doi.org/10.14333/kjte.2022.38.5.02

KLEIN, Julie

1990   *Interdisciplinarity: History, Theory, and Practice*. Detroit, MI: Wayne State University Press.

2004   Transdisciplinariedad: discurso, integración y evaluación. En L. Carrizo, M. Espina & J. Klein (eds.), *Transdisciplinariedad y complejidad en el análisis social* (pp. 30-45). París: UNESCO.

2008   Evaluation of Interdisciplinary and Transdisciplinary Research: A Literature Review. *American Journal of Preventive Medicine*, *35*(2), S116-S123. https://doi.org/10.1016/j.amepre.2008.05.010

2010   *Creating Interdisciplinary Campus Cultures: A Model for Strength and Sustainability*. Hoboken, NJ: Jossey-Bass.

KUHN, Thomas

2000   *The Road Since Structure*. Chicago: The University of Chicago Press.

2019   *La estructura de las revoluciones científicas*. México DF: FCE.

LEIBNIZ, Gottfried Wilhelm

2022   *Monadología*. Italia: Cuorlibri.

LEISTYNA, Pepi

2001   Discourse in Late Modernity: Rethinking Critical Discourse Analysis. *Journal of English Linguistics*, *29*, 183-189. https://doi.org/10.1177/00754240122005305

LÉVINAS, Emmanuel

2002   *Totalidad e infinito*. Salamanca: Sígueme.

LOCKE, John

2020   *Ensayo sobre el entendimiento humano*. Madrid: Verbum.

MALINOWSKI, Nicolás

2007   La contribución del pensamiento complejo a la reforma de la inteligencia humana Perspectiva histórico-comparativa, a partir de Edgar Morin. *Ethos Educativo*, (40). https://bit.ly/3tzDRAF

105

Φ

MARQUISIO, Ricardo

    2017   Tres modelos de pos positivismo jurídico. *Revista Anales de la Facultad de Ciencias Jurídicas y Sociales*, *14*(47), 865-883. https://bit.ly/4aJI0CC

MASTERMAN, Margaret

    1970   The Nature of a Paradigm. En I. Lakatos & A. Musgrave (eds.), *Criticism and the Growth of Knowledge*. Proceedings of the International Colloquium in the Philosophy of Science, London, 1965. Cambridge University Press.

MEJÍA, Fabio, PARRA, Mercedes & CÁTICA, José

    2021   El modelo pedagógico: una reflexión desde la dimensión didáctica en los procesos de enseñanza y aprendizaje en administración. *Revista Espacios*, *42*(5). https://doi.org/10.48082/espacios-a21v42n05p01

MENA ZAMORA, Alexis

    2023   Propuestas metodológicas de la filosofía para una educación transdisciplinar. En F. Aguilar & J. Collado (eds.), *Formación docente desde la filosofía educativa transdisciplinaria* (pp. 315-342). Quito: Abya-Yala.

MEZA, Luis

    2015   El paradigma positivista y la concepción dialéctica del conocimiento. *Revista Digital Matemática, Educación e Internet*, *4*(2). https://doi.org/10.18845/rdmei.v4i2.2296

MILA, Merce & MARTÍNEZ, Miquel

    1991   Ciencia cognitiva, habilidades del pensar y pedagogía de la ciencia. *Revista Española de Pedagogía*, *49*(188), 147-164.

MOLINA, Juan

    2021   Los principales rasgos de la pedagogía socrática. *Stylos*, *30*(30), 36-43. https://doi.org/10.46553/sty.30.30.2021.p36-43

MONTESSORI, María

    2003   *El método Montessori de la pedagogía científica aplicado a la educación de la infancia*. Madrid: Biblioteca Nueva.

MORENO, Leandro

    2014   Complejidad, diseño e indisciplina: nuevas miradas en la práctica y el saber. *Taller Servicio 24 Horas*, *10*(20). https://bit.ly/4aNkMeJ

MORENO GUAICHA, Jefferson

    2023   Filosofía de la educación, transdisciplinariedad y formación docente. En F. Aguilar & J. Collado (eds.), *Formación docente desde la filosofía educativa transdisciplinaria* (pp. 151-172). Quito: Abya-Yala.

MORENO GUAICHA, Jefferson, HEREDIA, Andrés & AGUILAR, Floralba

    2022   El ideal de progreso y sus implicaciones en una educación cosmopolita desde el pensamiento kantiano. *Revista de Humanidades de Valparaíso*, (20), 311-334. https://doi.org/10.22370/rhv2022iss20pp311-334

MORIN, Edgar

    1998   *Introducción al pensamiento complejo*. Barcelona: Gedisa.

    1999   *Los siete saberes necesarios para la educación del futuro*. París: UNESCO.

    2003   *El método 6: ética*. Madrid: Cátedra.

    2008   *Introducción al pensamiento complejo*. Barcelona: Gedisa.

    2019   *¿Qué es transdisciplinariedad?* Multiversidad Mundo Real. https://bit.ly/3HadcNW

106

NEWTON, Isaac
    1972   *Philosophiae Naturalis Principia Mathematica.*
NICOLESCU, Basarab
    2002   *La transdisciplinariedad: manifiesto.* México DF: Ediciones Coyoacán.
    2010   Methodology of Transdisciplinarity: Levels of Reality, Logic of the Included Middle and Complexity. *Transdisciplinary Journal of Engineering & Science*, *1*, 19-38. https://doi.org/10.22545/2010/0009
PÉREZ WICHT, Pablo
    2013   *La enseñanza transdisciplinar en las humanidades.* Lima: PUCP. https://bit.ly/3S7GF13
PLATÓN
    1998   *La república* (M. Fernández Galiano & J. M. Pabón, eds./trad.). Madrid: Centro de Estudios Políticos y Constitucionales.
QUINTANILLA, Pablo
    2013   Interpretation, Triangulation and Meaning. *Analítica, Revista de Filosofía*, (7), 11-46. https://bit.ly/4aJNq0u
RAMOS, Carlos Alberto
    2015   Los paradigmas de la investigación científica. *Avances en Psicología*, *23*(1), 9-17. https://doi.org/10.33539/avpsicol.2015.v23n1.167
REPKO, Allen
    2008   *Interdisciplinary Research: Process and Theory.* Nueva York: Sage Publications.
SÁNCHEZ, Diego
    1984   *Martin Buber: fundamento existencial.* Barcelona: Herder.
STEVENSON, Robert, BRODY, Michael, Dillon, Justin & WALS, Arjen
    2007   *International Handbook of Research on Environmental Education.* Routledge.
THOMAS, Jhon
    2000   *A Review of Research on Project-Based Learning.* San Francisco, CA: Autodesk Foundation.
VÁZQUEZ, Victoria
    2013   Martin Buber y sus aportaciones a la manera actual de entender la educación para el cuidado. *Educació i Història*, (21), 143-158. https://bit.ly/41Vsn7e
VÁZQUEZ GÓMEZ, Gonzalo & BÁRCENA ORBE, Fernando
    2016   Pedagogía cognitiva: la educación y el estudio de la mente en la sociedad de la información. *Education in the Knowledge Society*, *1*(1). https://doi.org/10.14201/eks.14032
VELASCO, José & GONZÁLEZ, Leonor
    2008   Sobre la teoría de la educación dialógica. *Educere*, *12*(42), 461-470. https://bit.ly/41Mwx0U
VILLEGAS, Luis
    2017   *El aprendizaje por proyectos basado en el modelo pedagógico interestructurante, en el Programa de Ingeniería Ambiental de la Unidad Central del Valle del Cauca, UCEVA.* Encuentro Internacional de Educación en Ingeniería, Cartagena, Colombia, 26-29 de septiembre. https://bit.ly/4aEryn4
YAKMAN, Georgette
    2008   *STEAM Education: An Overview of Creating a Model of Integrative Education.* Pupils' Attitudes Towards Technology. https://bit.ly/3NTVvWJ

107

ZERPA, Levis

2000 Fundamentos lógicos de las redes neurales artificiales. *Humanitas*, *20*(1), 107-126. https://bit.ly/424JiEx

2011 *The Interrogative Approach to Inquiry: A Defense of Moderate Contextualism in the Theory of Questions* [Tesis doctoral, University of Kentucky]. Pro-Quest Dissertations Publishing, UMI 3579365.

108