

TOWARDS A DISCONTINUIST APPROACH TO SCIENTIFIC LITERACY

Hacia un enfoque discontinuista de la alfabetización científica

KARINA SILVANA GIOMI*

Universidad Nacional de Tierra del Fuego, Río Grande, Argentina

<https://ror.org/021wj5r76>

kgiomi@untdf.edu.ar

<https://orcid.org/0000-0001-7786-9001>

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Abstract

This paper problematizes scientific literacy by analyzing the debate between continuist science (progressive accumulation) and discontinuist science (ruptures and incommensurability). It is posited that hegemonic models of scientific literacy render invisible the continuist image of science they implicitly transmit by relying on cognitivist assumptions. This operates as an epistemological obstacle to the appropriation of a discontinuist approach to science. Drawing upon the post-foundationalist influence of Bachelard, Badiou, and Lacan, among others, in the educational field, the objective is to contribute to the construction of a discontinuist approach to scientific literacy. The methodology involves the analysis of educational practices with first-year university epistemology students. As a result, obstacles to both scientific literacy and a discontinuist vision of science are identified. Furthermore, a distinction is made between a process of knowledge reception and a process of knowledge appropriation (rupture between knowledge and truth). Appropriation implies a supplementary logic that resignifies the notions of epistemological obstacle and rupture (subtraction) by asserting the materiality of language and postulating a new theory of the body. In this view, the body acts as a subtraction from prior knowledge, undergoing alteration through its incorporation into a new body of truth (subjectivation, transformation into a subject of science). Unlike the language of Generative Artificial Intelligence, science as a truth procedure demands the capacity to unlearn and to create.

Keywords

Higher Education, Literacy, Epistemology, Science, Reading, Writing.

* Full-time Assistant Research Professor at the Institute of Culture, Society, and the State at the National University of Tierra del Fuego. Professor of Philosophy (National University of Rosario), specialist in Epistemologies of the South (CLACSO), holder of a master's degree in Methodologies and Strategies for Interdisciplinary Research in the Social Sciences (National University of Southern Patagonia), and Ph.D. candidate in Philosophy (University of Buenos Aires), specializing in post-foundational thought.
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Resumen

Este trabajo problematiza la alfabetización científica y analiza el debate entre la ciencia continuista (acumulación progresiva) y discontinuista (rupturas e inconmensurabilidad). Se postula que los modelos hegemónicos de alfabetización científica invisibilizan la imagen de ciencia continuista que transmiten de modo implícito al apoyarse en supuestos cognitivistas. Esto opera como obstáculo epistemológico para la apropiación de un enfoque de ciencia discontinuista. Desde la influencia posfundacionalista en el campo educativo de Bachelard, Badiou, Lacan, entre otros, el objetivo es aportar a la construcción de un enfoque discontinuista para la alfabetización científica. La metodología empleada es el análisis de prácticas educativas con estudiantes de epistemología ingresantes universitarios. Como resultado se identifican obstáculos para la alfabetización científica y la visión discontinuista de la ciencia. Asimismo, se diferencia un proceso de recepción de saberes y un proceso de apropiación de saberes (ruptura entre saber y verdad). La apropiación implica una lógica suplementaria que resignifica las nociones de obstáculo epistemológico y ruptura (sustracción) al plantear la materialidad del lenguaje y postular una nueva teoría del cuerpo como sustracción al saber y alteración por la incorporación a un nuevo cuerpo de verdad (subjativación, transformación en sujeto de la ciencia). A diferencia del lenguaje en las inteligencias artificiales generativas, la ciencia como procedimiento de verdad exige la capacidad de desaprender y crear.

Palabras clave

Enseñanza superior, alfabetización, epistemología, ciencia, lectura, escritura.

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Introduction

This paper examines scientific literacy from a post-foundationalist framework and contrasts the continuist view of science with the discontinuist view, exploring how each gives rise to a particular approach to teaching reading and writing in science education practices in higher education. Since the analysis is limited to science education at the university entrance level, the concepts of academic literacy and scientific literacy overlap in this case; therefore, this article will treat them as convergent concepts.

The continuist scientific approach corresponds to the consolidation of a model of science known as the orthodox naturalist consensus during the first half of the twentieth century. It is characterized by positing a single linear and progressive rationality in which scientific knowledge advances through trial and error toward a truth that functions as an epistemic value, albeit an unattainable one. Likewise, it presupposes a foundational cognitive nature of humanity, according to which the validation of statements relies on the so-called context of justification: logical coherence and empirical verification (truth as correspondence or the semantic conception of truth between a metalanguage and an object language), among other characteristics (Klimovsky, 1994).

In contrast, during the second half of the twentieth century, discontinuist currents gained momentum, sparking a debate regarding the previous consensus. Among these were hermeneutic and historical-crit-

ical approaches, structuralist and post-structuralist positions, as well as various types of pragmatist and materialist approaches. What they have in common, beyond their many differences, is their rejection of the assumption that the primary relationship with the world is one of knowledge; therefore, they do not start from the premise of a cognitive human nature as the ultimate foundation. Their anti-humanism is purely theoretical insofar as they do not abandon the idea of the human condition in its bodily, material, and historical dimensions.

Transformations in the scientific field are linked to the field of scientific-academic literacy, which is gaining increasing importance and institutionalization in higher education. In this context, the problem identified is that hegemonic approaches to scientific-academic literacy are underpinned by cognitive assumptions that are characteristic of a continuist and cumulative model of science, and that these assumptions are not sufficiently made explicit or visible; as a result, they are effectively transmitted through the practices of this field, albeit “unconsciously” to those involved in the educational setting. Consequently, the predominance of a cognitive approach to scientific-academic literacy acts as an epistemological obstacle to the teaching of a non-continuist conception of science.

Various systematic reviews in the field of academic literacy point to the predominance of two approaches. Calle Arango and Ávila Reyes (2020) argue that “previous studies’ findings regarding two major research trends —one cognitive and the other sociocognitive— were corroborated” (p. 455). Similarly, Guzmán Simón and García Jiménez (2015) identify a model known as “language for academic purposes” (focused on the student’s individual and cognitive abilities) and a model of “academic literacy” which they associate with the concept of “academic socialization” (emphasizing the situated, discursive, and contextual literacy process), highlighting the possibility of integrating these approaches. Likewise, another way to express the hegemony of two models (distinct yet articulable) is based on the distinction between form and content: “In the first case, the aim is to train students to read and write as specialists do; in the second, it is about teaching students to read and write to appropriate the knowledge produced by specialists” (Carlino, 2013, p. 370, cited in Pérez et al., 2018, p. 313). When the rules and forms used by specialists are involved, the focus is on the contextual and sociocognitive discursive approach; when the study of content is emphasized, the analysis falls under the cognitive model. Thus, while it is acknowledged that integration is possible, the distinction between these processes remains: “It involves two objectives that, although related, should be distinguished” (p. 313).

Cognitive approaches to scientific-academic literacy maintain that there is a continuum in the degree of complexity, scope, and adherence to the source, depending on the type of discursive operation required, which organizes a taxonomy of varying degrees of cognitive complexity involved (Pérez et al., 2018). Thus, they argue that one can be close to or distant from a text depending on whether the skills involved are analyzing, classifying, comparing, synthesizing, and so forth. This is consistent with sociocognitive approaches that incorporate an understanding of context and literacy practices as a situated social process. However, it does not alter the cognitive assumptions underlying reading and writing. The analysis reintroduces a separation: subject (in terms of the rational consciousness that reads), object (written text), and context or communicative situation (interaction).

In light of this problem, the objective is to contribute to the conceptualization of how to teach and learn to read and write in higher education based on the assumptions of a discontinuist view of science. The thesis defended here is that the discontinuist approach to science involves teaching the scientific-academic genre by distinguishing between a process of reception and a process of appropriation of knowledge, which requires positing the materiality of the process through a dialectic that redefines the way we understand the relationship between knowledge and truth. Furthermore, this is part of the search for a different conceptualization of the body in the field of scientific-academic literacy, understood through the line of research on the process of (in)corporating individuals into the subject-thought of a truth (García Puchades, 2021).

This is relevant because cognitively based theories focused on the mental processing of information neglect material processes, thereby creating a tension between what could be expressed as “a language without a body” versus “a body traversed by language.” This is important in the context of the question of how to read and write using generative artificial intelligence (GAI), since the inductivist, cumulative, continuist, and probabilistic view of science underlying that practice (Han, 2014; Sadin, 2020) could act as an epistemological obstacle to other visions of science and should be problematized in terms of what it conveys as a hidden curriculum: “The mass of data and information, which grows without limits, today distances science from theory and from thought” (Han, 2014, p. 76). Milner (2022) summarizes the critique of cognitivism regarding language as follows: “If it were discovered that, when it comes to language, neither the notion of information processing nor the notion of rules [characteristic of the computational framework] is appropriate, then the cognitivist program would lose the essence of its justifications” (p. 258).



This research is qualitative in nature. It consisted of an intervention (Badiou, 1999; Lewkowicz, 2007) based on the analysis of practices (Foucault, 1994; Agamben, 2009) in the educational context of the course “Epistemology of the Social Sciences” for first-year university students in social science programs. The methodology of the intervention involves theorizing practical trajectories by identifying effective processes that are not explicitly articulated in the discourse of that context, thereby leading to the generation of new knowledge.

The topic is relevant insofar as there are sufficient critical reviews of the continuist view of science; however, analyses of a persistence that occurs implicitly are scarcer. Therefore, changing the way we think about scientific and academic reading and writing practices will also transform the view of science that is transmitted. The epistemological debate regarding educational practices is important in the context of current social, scientific, and technological transformations (López, 2021; Rodríguez Mancilla et al., 2018).

This paper is structured as follows. The “State of the Art” section justifies the problem outlined in this introduction from a philosophical perspective. The second section describes the methodology employed. The third section analyzes the results, highlighting the epistemological obstacles identified for a discontinuist view of science and the contribution of two distinct categories —reception and appropriation— theorized based on classroom situations and presented using a paradigmatic case (“María”) in accordance with the methodology employed. The fourth section is devoted to theoretical discussions of the above. Finally, brief conclusions from the analysis are highlighted, and new questions are raised.

State of the Art

In the history of science, a tradition of continuity is often identified, characteristic of what is known as the “orthodox consensus” or “naturalism” (Klimovsky, 1994), which remained dominant until the 1960s. Influential works such as *The Structure of Scientific Revolutions* (Kuhn, 1990) and *The Order of Things* (Foucault, 2005) gave new impetus to a discontinuist tradition that had already been inaugurated by Bachelard decades earlier (Becerra Batán, 2021; Díaz, 2005). Furthermore, various revolutions in the field of formal science —such as the formalization of set theory, among others— had an impact on and influenced the debate over conceptions of science both in philosophy and in the Lacanian-

oriented psychoanalytic field (Badiou, 1999). This allowed for a reassessment of contributions from Bachelard's discontinuist tradition (2000): "Mathematism is no longer descriptive, but formative [...]. Once a geometric law is grasped, an astonishing spiritual inversion takes place [...]: curiosity gives rise to the hope of creating" (p. 8).

What do "curiosity" and "creating" refer to in this context? Curiosity responds to the discovery of what is supposed to have been there in some way (traditional ontology), while "creating" points to science by emphasizing its process of invention (the ontological turn of the *mathema*) and the axiomatic nature of thought (Badiou, 1999, 2008). The continuist perspective on science is grounded in traditional ontology, whereas the second perspective is rooted in the discontinuist tradition of science.

For a traditional ontology, truth is not distinct from knowledge; rather, it is a form of grounded knowledge or serves as a condition of possibility. For the discontinuist tradition, the relationship between knowledge and truth is redefined. Heidegger (1996) characterized the modern representation of the world as a process of objectivity grounded in calculation, to which he opposed an incalculable excess that cannot be captured by the former model, allowing him to establish a distinction between knowledge and truth grounded in the horizon of language. Badiou (1999 and 2010) revisits the problem of the difference between knowledge and truth, but in a different way. From an ontology of the mathem (Badiou, 1999), truth does not imply interpretation but rather rupture. In this way, he proposes a subtractive conception of truth: truth is a procedure that involves a radical novelty that alters—and pierces through—prior knowledge. This explains why Bachelard said, "to give way to creation."

These ontological and philosophical considerations have clear epistemological consequences. Badiou (2004) analyzes this through Kant, whose philosophy forms the basis of modern empirical sciences. For Kant, the phenomenon involves a sensible limit (knowledge) to the unknowable but intelligible noumenon (thought). The dichotomies of the sensible and the intelligible, the body and thought, and so forth, found in the ontological tradition are reexamined by Badiou (2004) in a different way: "The previous question was what limits the body imposes on the intelligible, whereas the new question, the new inquiry, is of what intelligible the body is the result" (p. 35). And he adds: "If one wishes to understand how the sensible arises from the intelligible, one must understand the operations of transformation [...]. Modern thought is an operative thought. That is why it is no longer exactly a theory of knowledge" (p. 36).



One of the operations of transformation in thought is how the same becomes something else; in other words, it concerns the alteration of what exists. For this reason, the author points out that “thought is a creation” (p. 37). This resonates with the notion of the epistemological obstacle in Bachelard (2000 and 2003)—a condition of possibility for the epistemological rupture implied by learning: the same (the obstacle) becomes something else (learning) through a rupture. In Badiou’s (1999) terms, this is called “supplementary logic”: something that was impossible to represent within the regime of knowledge appears; that something bursts in and, through a naming, re-signifies the regime of representation; thus, something that was impossible begins to exist (radical novelty).

It is necessary to alter the regime of representation (the symbolic ordering of prior knowledge) based on an impossibility intrinsic to its formalization; i.e., that which is an excess within that knowledge bursts forth, and to be explained requires a new form of knowledge. We are faced with a limit, but this is not the limit between phenomenon and noumenon in Kant, for whom the thought of the totality of the real is noumenal (in other words, that which is excess or incalculable remained on the side of the noumenal). Badiou (2016) offers another definition of the real, which he drew from Lacan: “The real is the impasse of a formalization” (p. 36), in the sense described above. Since novelty does not add new knowledge in a cumulative manner but rather revolutionizes knowledge, it is said to be a subtractive process or procedure of truth. For Badiou (2016), science as a procedure of truth implies creation, since the real is that which cannot be represented in a formalization and will require a new formalization to be represented—although this new formalization will also encounter a new intrinsic limit, insofar as no symbolic order is total or closed.

In Lacanian terms, one might say that truth persists insofar as it never ceases to inscribe itself, and the real persists insofar as it never ceases to fail to inscribe itself. A post-foundationalist (there are no ultimate foundations) and discontinuist framework has thus been outlined. Within this framework, the present study draws on non-clinical readings of Lacanian psychoanalysis in the field of education (Milner, 2003; Sanabria, 2014; Cuomo and Danelinck, 2017), as well as from the perspective of Bachelardian and Badiouian science, to explore new theoretical frameworks emerging from heuristic explorations in situated educational practices.

In summary, the new dialectic between knowledge and truth is as follows: representational knowledge is de-totalized by the presentation of something that could not be classified by the previous representation.



This can produce a rupture or event that gives rise to the subject-thought of a truth, which in turn generates a radical change and the production of new knowledge.

In light of the above, the question posed in this paper takes on meaning: What appears but cannot be represented within the cognitivist and continuist framework of hegemonic academic literacy theories? The body. Therefore, if previous knowledge did not sufficiently theorize the body in the teaching of academic reading and writing, a new conceptualization of the body is required to allow for its consideration in the literacy practices under discussion. The previous conceptualization of the body involved two registers: the sensible and the intelligible. The new conceptualization of the body introduces three registers: the sensible, the intelligible, and subtraction.

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While the continuist approach operates with two registers—the sensible (empirical) and the intelligible (transcendental)—the discontinuist tradition, for its part, requires adding the dimension of the real. Lacanian psychoanalysis proposes conceiving the subtractive through a letter, which it calls the “object *a*”, allowing it to conceive of the body as an entanglement among three registers: the imaginary, the symbolic, and the real (Lacan, 1992). For Badiou (2021), the body takes on the meaning of a body of truth, a subjectivizable body (incorporation and subjectivation): “These are bodies for a new subject-form, which will be the subject of truth” (p. 81). He adds: “These bodies will be the material bearers of the subject-forms that will emerge under the condition of an event, and these forms, in turn, will bear the processes of truth” (p. 81).

It is worth noting that this work draws on a substantial body of prior research, given Badiou’s growing influence on thinking about the field of education, which has supported the articulation of ontological, philosophical, epistemological, and pedagogical levels (Cerletti, 2008; Lewkowicz, 1999; García Puchades, 2021; Cho and Tyson, 2005). Likewise, it raises questions regarding the challenges of GenAI in education (Galli and Kanobel, 2023). This context encompasses the tension between scientific discontinuity and continuity, as well as between the materiality of language and traditional cognitive positions.

It should be clarified that regarding the terminology “reception” and “appropriation,” there is prior research, albeit with differences: Corea and Lewkowicz (2010) distinguish between reception as communication and reception as subjectivation; Bigot et al. (2010) use these terms within the framework of the complexity paradigm.

As indicated, the methodology employed posits theorizations based on situational trajectories; therefore, the purpose of this paper addresses the need for mediations to provide a practical and operational grounding for these conceptualizations. How can we teach reading and writing by incorporating what constitutes the body or excess in cognitive representation: the mortal body, the sexualized body, the speaking and desiring body? These are human conditions (Alemán, 2019); therefore, what, then, is reading and writing from these premises? Are they involved in the image of science as discontinuity? This justifies the methodology of this research, which must be consistent with the non-exteriority between form and content and introduce procedures that engage with the real.

Methodology

This research is a qualitative study that employs a situational intervention research design from an immanent perspective (Lewkowicz, 2007). An epistemological analysis is conducted on the set of situated practices, producing knowledge based on the internal rationality of the observed educational situation by “transforming a practical journey into a theoretical experience” (p. 34). It is assumed that “the situational meaning of an idea lies in the network of practices in which it is carried out” (p. 64). Therefore, this methodology does not apply preexisting theories or generalize regularities: “To move beyond the opposition between empiricism and theorism, let us say that it is not a matter of grounding a theory in a practice or of grounding a practice in a theory through deduction: it is a matter of interpreting practices” (p. 34).

Regarding the notion of practices in methodological terms, a conceptual clarification drawn from Foucault (1994) is relevant. Castro (2011) points out that Foucault made an operational use of the notion without defining it, and thus proposes the following reconstruction:

In summary [...] Foucault understands “practices” to be the rationality or regularity that organizes what people do [...] which has a systematic (knowledge, power, ethics) and general (recurrent) character, and which therefore constitutes an “experience” or a “thought” (p. 428).

Regarding the data collection procedure, the analyzed corpus included records of reading and writing practices in the course Epistemology of the Social Sciences (class notes, assignments, midterms, final exams, and seminars) and a documentary corpus of current theories of academic literacy. The latter were included in the theoretical framework and ana-



lyzed as practices of knowledge in the Foucauldian archaeological sense, identifying their conditions of enunciation (Foucault, 1994). Through this procedure, the persistence of cognitive assumptions was observed in the two predominant and explicitly recognized models: the cognitive model and the sociocognitive model.

In the context shaped by the aforementioned practical framework, the methodology of intervention (Badiou, 1999; Lewkowicz, 1996 and 1999) stands out for involving an operation within immanence. Lewkowicz (1996) clarifies that “when a discipline is one of intervention, then the effective presence of the one who operates produces the phenomena they observe” (p. 3). Thus, in the practical situation, a point of excess—the real—was identified; i.e., that which “presents itself” in the educational situation but is not “represented” by established knowledge. The aim was to identify discrepancies: “What is said through discourse conceals what discourse does” (1999, p. 114).

The intervention consisted of making explicit, naming, and theorizing the ideas that operate unconsciously in the analyzed practices. In this case, we proceeded to make visible the continuist view of science that remained latent in reading and writing practices centered on cognitive approaches and lacking engagement with the bodily dimension. Likewise, we proceeded to articulate, in terms of epistemological obstacles, the assumptions that clashed with a discontinuist view of science. Furthermore, two theoretical categories—reception and appropriation—were proposed to account for, or make visible, operational logics present in the practices but not sufficiently articulated discursively.

In this sense, the intervention’s methodology involves a supplementary logic, as it introduces an assertion that names or theorizes to alter prior knowledge and bring to light—from a new regime of visibility—what had previously operated unconsciously: “Supplementation does not consist in adding to a term what it lacks to constitute a whole, but rather in introducing into a whole an extra element that de-totalizes it” (1996, p. 4). Tools for thinking are constructed within the situation that can alter what becomes visible in that situation.

To make visible the differential logic between a process of reception and a process of appropriation in classroom practices, we proceeded to construct a paradigmatic case following Agamben (2009), who takes up and explains the Foucauldian methodology as follows: “The paradigm is a singular case that is isolated from the context of which it is part only to the extent that, by exhibiting its own singularity, it renders intelligible a new set, whose homogeneity it itself must constitute” (p. 25). The María



Case is a specific instance that provides intelligibility or makes visible two distinct processes in scientific-academic literacy. A well-known example of paradigmatic logic is the famous panopticon, which, although analyzed by Foucault in the context of the prison, allows us to understand the disciplinary apparatus in other institutions such as schools, hospitals, or factories.

Regarding the criteria for scientific validation, a distinction must be made between the methodology of intervention—which involves the act of rupture and theoretical novelty—and the formalization of new knowledge. In the first case, validity corresponds to “practical efficacy” in altering prior knowledge; i.e., what was operating blindly begins to be made visible, and thus what was previously known is altered. In this case, the research has succeeded in showing that cognitively based scientific literacy did not sufficiently make explicit the continuist view of science that it blindly transmits.

In the second case, the new knowledge requires the criterion of validity based on theoretical coherence. Thus, Foucault (1994) points out that the analysis of practices requires “work carried out through diverse inquiries. These have their methodological coherence [...]. They have their theoretical coherence [...]. They have their practical coherence in the care taken to subject historical-critical reflection to the test of concrete practices” (p. 9). This theoretical coherence is transformed into the testing of situational practices and requires new interventions; in this regard, Lewkowicz (1999) emphasizes that for intervention, “the parameter of validity is not the theoretical consistency of the system but the situational efficacy of thought” (p. 110).

In this way, we can understand the dialectic that arises in a process of situational thought. The difference from the traditional view of representational knowledge—which was based on an external distance between a presupposed subject and object—is striking. This thought process continues in various classroom situations in which other teachers are involved and can transform categories operationally as tools for intervention: “The only thing that orders and hierarchizes theories and their concepts is their function as a tool, as a clinical operator, as a transformer of the world, within a practical field of engagement” (p. 112).

This rationality of engagement and intervention is a tool that alters the way we understand the traditional methodological approach to representational knowledge; as such, it also highlights and provides a tool for teachers: “The mutation of discursive realities also involves the mutation of the instruments of thought involved [...] there is no change in realities



without a change in the reality of the thought schemes that is part of that reality” (p. 106).

Lewkowicz’s (1999, 2007) major contribution lies in having applied the Badiou-based methodology of intervention to social situations. For Badiou (2021), a novelty—in this case, a conceptual one—implies the emergence of a subject-thought embedded in that truth; i.e., it implies a process of subjectivation through truths. Lewkowicz (1996) would put it another way: “There is no transformation of situations without a transformation of the strategies, tools, and agents of transformation. It is not possible to transform without transforming oneself” (p. 105).

Analysis and Results

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In the reading and writing practices within the analyzed science teaching context, assumptions reflecting a continuist view of science were identified; these assumptions operated among students as epistemological obstacles to the adoption of a discontinuist view of science. The finding was that these assumptions—identified as obstacles in the task of science teaching—converge with the assumptions of cognitive approaches to scientific-academic literacy. Thus, the way in which reading and writing practices are carried out in the classroom is not innocuous in science teaching, as they can tacitly reinforce the very obstacles that were intended to be overcome. Various obstacles were identified that intersect with reading and writing practices focused on study skills and mental processes. They are grouped into six categories:

- Prior concepts regarding the notion of representation and the notion of science as certainty: These stem from a traditional view of knowledge understood as a relationship between a preexisting subject and a given object, where words represent things. This adds a linguistic obstacle that assigns unambiguous meanings to terms. When reading and writing practices emphasize extracting information from a text, these assumptions—which are characteristic of a common-sense view of science as synonymous with truth or absolute certainty—are reinforced. Consequently, this creates an obstacle to understanding that the categories of analysis are constitutive of the phenomena under study, making it difficult for incoming students to recognize the need to make methodological constructs explicit as a capacity or skill required by the scientific discursive genre

and by scientific know-how. This creates an obstacle to understanding the contingency of scientific knowledge construction as an intrinsic, non-dogmatic characteristic subject to provisionality. Furthermore, this leads to the obstacle of instrumental positions that disregard conceptual debates, as these are not understood as the foundation of scientific know-how.

- Scientific neutrality and abstract scenarios: The assumption that science is neutral poses an obstacle that is reinforced by the centrality of reading and writing techniques that require the erasure of conditions of enunciation and subjective markers to achieve expository objectivity. This can give rise to essentialist assumptions, rendering invisible the conditions of enunciation, value judgments, power relations, and the corpogeopolitics of knowledge that underlie the production of scientific knowledge. Furthermore, neutrality is reinforced when these techniques require identifying time and space in texts as an abstract setting or mere “backdrop” that does not influence the analysis, rather than as endogenous variables capable of constructing multiple time-spaces, scales, and levels.
- Reductionism of autonomous founding consciousness: The assumption that reduces knowledge to a cognitive action or mental processing creates an obstacle that disregards the material, symbolic, and historical conditions shaping the subject. This fosters a view of concepts as abstractions of universal essences (for instance, recognizing that childhood and madness are not given universal concepts), preventing an understanding of their genealogy within social practices of knowledge-power and as constructs that transform through different practical trajectories.
- Assumptions about reading and writing as codes (encoding-decoding): It is an obstacle to take the way a generative artificial intelligence (GAI) reads and writes as a model for humans. GAI is “an artificial intelligence (AI) technology that automatically generates content in response to written instructions in natural-language conversational interfaces known as prompts” (UNESCO, 2024, p. 8). However, GAI does not understand “real objects or the social relationships that underpin language” (p. 10). If the aim is to teach reading and writing according to the grammar of GAI, this would overlook the relational and situated ways in which humans read and write.



- Prioritizing knowledge as an end and holding a negative view of error: By downplaying the process of constructing scientific knowledge, the role of error—as part of the contingency that characterizes such knowledge—is rendered invisible. Scientific knowledge is presented primarily as a finished product or end, thereby obscuring its nature as an open, provisional process constantly subject to transformation. This creates an obstacle to understanding the epistemic value of error, as a punitive view with negative connotations is prioritized in school assessment. This hinders or obstructs student participation in class—a skill required to develop a scientific attitude capable of asking questions that go beyond what is already known, without any guarantee that there will be no error.
- Disciplinary fragmentation and institutional obstacles: The preconceived notion that disciplines correspond to fragmentations of reality hinders understanding them as constructions of objects resulting from interpretive frameworks or even from different paradigms arising from historical ruptures. This can be observed in the institutional gap between secondary education and entry into higher or university education, since at the secondary level, the presentation of isolated subjects is often prioritized over interdisciplinary dynamics. Consequently, the deep-rooted nature of this preconceived belief can act as an obstacle at the higher education level and hinder comprehensive approaches and conceptual articulation associated with concrete problem-posing—practices inherent to the construction of scientific knowledge. The type of instruction that seeks to emphasize the exercise of mental operations on a text can lead to a decontextualization of reading in practical contexts and those associated with the scientific approach to problems of social reality.

These obstacles were identified in real-world situations and help demonstrate that teaching reading and writing is not immune to reproducing assumptions rooted in a particular view of knowledge and science. Based on this framework, we proceeded to analyze an operational distinction between a process of knowledge reception and a process of knowledge appropriation, which will be illustrated through a paradigmatic case study.

Process of Receiving or Repeating Knowledge

Orthodox consensus science presupposes a cognitive human nature. Beyond variations resulting from diverse contexts, objective knowledge is determined by a structure that unifies phenomena objectively based on the assumption of the unity of consciousness. This is the basic framework of truth as correspondence in the empirical sciences, where truth is a matter of judgment—i.e., it is based on representation. Various studies on language during the twentieth century introduced variations to this framework while maintaining the core correlation. The modern version of the traditional correspondence theory of truth is the so-called “semantic conception of truth,” which establishes the correlation between a metalanguage and an object language (Klimovsky, 1994).

In the field of scientific and academic literacy, the expression “to be close to a text” is often used when students are asked to extract basic information or to paraphrase content in some way. Thus, “Freire is a Brazilian educator” is a true statement if and only if Freire is a Brazilian educator in the object language. In university assessment practices, this type of correspondence is frequently used with the set of valid statements provided within the course. This set allows statements to be classified as true or false.

From the perspective of modern institutions, planning serves the function of aligning the course with the institutional plan, and within the course itself, “it is used by the professor to carry out their role (to discipline, monitor, and assess students’ mastery of the subject). Changes may be made to the lesson plans, but they must be justified” (Corea and Lewkowicz, 2010, p. 25). In turn, the exam serves as the monitoring mechanism to ensure the alignment of this transfer of knowledge between teachers and students.

Corea and Lewkowicz (2010) point out that “this idea of access to culture or education for all is characteristic of modernity: underlying this conception is the idea of human knowledge [...] a knowable human essence” (p. 24). Within this framework, however, they propose that contemporary education can no longer be based on a cognitive essence but rather requires a practical concept of what it means to be human, grounded in thinking about it in terms of subjectivation in specific situations.

As emerged from the literature review and articulated in the theoretical framework (Calle Arango and Ávila Reyes, 2020; Guzmán Simón and García Jiménez, 2015; Pérez et al., 2018), there are two hegemonic models in the field of academic literacy: the cognitive model (in which the schema consists of the reading subject and the text as object) and



the sociocognitive model (which frames the former within a communicational context). In both models, the cognitive basis for reading and writing remains.

Likewise, continuity theories in science share assumptions with education in the modern tradition, given that knowledge is inscribed within the aforementioned consciousness-world schema. From another perspective, this research has raised the issue that cognitive models exclude the human condition of speakers as mortal, sexualized, and desiring beings. To paraphrase the psychoanalyst Gómez Camarena (2011), one might ask: Are reading and writing not permeated by these “remnants” that traditional university knowledge leaves out?

The Process of Appropriating Knowledge from the Knowledge-Truth Division

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To understand processes of appropriation, the framework of reading and writing does not correspond to a traditional communicational model involving a reading subject, a text as object, and a context that presupposes intersubjectivity. Instead, a transferential framework—or social bond—is proposed, in which the act of reading co-determines an effect of subjectivity-objectivity that does not pre-exist that act.

Below, we present a paradigmatic case study developed in the classroom to illustrate this new theoretical framework for scientific-academic literacy. “María,” a thirty-five-year-old student, is a freshman in the Sociology program. She received a score of “4” on her first midterm exam, a grade derived from “truth” as a semantic concept —i.e., based on the assumption of a metalanguage and an object language. However, for the second midterm, she was required to give an oral presentation to the group on a written assignment she and her peers had submitted. The topics for this midterm on the Epistemology of the Social Sciences included dialectical and hermeneutic perspectives, as well as critical epistemologies.

During her presentation, María offered an example from her personal life. Her teenage son had told her that a classmate was behaving poorly and aggressively. She asked her son how he understood his classmate, and since his answers tended to disparage, degrade, or pathologize the boy, she suggested that he ask himself other questions. At that point in the classroom presentation, other students chimed in with analytical queries: “What did the family or the school do?,” “What social class does he belong to?,” “What neighborhood does he live in (because that behavior would be normal in my neighborhood)?,” “What mental illness does

he have?” Freire and Faúndez (2013) criticize this type of non-existent or superficial questioning: Today, teaching—knowledge—is an answer, not a question (p. 69).

They distinguish between apparent questions—those asked based on prior knowledge, such as answers dictated by the curriculum of a course—and another type of question that touches on the human condition: “The beginning of knowledge [...] is to ask” (p. 69). If one analyzes the students’ questions, there is an underlying body of knowledge required to answer them; for example, if a question is asked about the family, it is because the family is assumed to play a definitive role in socialization; if a question is asked about pathology, it is based on an assumption of medical normality, and so on. Therefore, it can be said that there is a question, but there is no enigma.

However, María recounted that she invited her son to ask himself a fundamentally different question: “From whom else does he seek recognition? With whom else does he link his existence?” To ask these kinds of questions, María had to set aside her prior knowledge while simultaneously demonstrating an active engagement with topics from the midterm exam, such as Hegel’s concept of recognition, Foucault’s notion of the subject-subjected, the idea that “we are spoken,” and her choice not to start from a founding individual. Thus, these kinds of questions are not underpinned by the answer that would arise from a mere particular case that can be subsumed under an already known law.

These questions generate an enigma, an unknown, because they involve thinking about that teenager within the specific context of the situation —reflecting on the truth of that situation— and not approaching it from the perspective of prior knowledge, where one asks nothing for which one does not already have a pre-existing answer (as an artificial intelligence would also do). María had internalized both knowledge and know-how. The evaluators were able to observe in real time —through the subjective effects on María and the shift in her way of thinking— that, in retrospect, there had been an appropriation of knowledge. This had not occurred with Juan, another student, even though he had earned a perfect score of ten on the midterm. Thus, María, with a four, demonstrated a greater degree of appropriation than Juan with a ten. This appropriation was evident in her ability to set aside prior knowledge to formulate a new question. In this sense, appropriation is the way in which subjectivation manifests itself in the educational context.

The bureaucratic system encourages traditional forms of assessment (Corea and Lewkowicz, 2010); however, it is important for teach-



ers to interpret classroom situations through the lens of subjectivation, to acknowledge that there is no total control over educational practice, and to avoid falling into a disempowering complaint where low grades are automatically interpreted as “how little they have learned.” Classifying students as capable or incapable based strictly on grades leads us to forget that the assessment system is neither neutral nor free of bias, and to overlook the fact that everyone is capable (Rancière, 2003; Cerletti, 2008).

On the second midterm, María raised her score to a nine. Beyond the grade that must be assigned under the current system, the evaluative reading process involved a non-bureaucratic form of assessment grounded in transfer. María formed a transferential bond with the subject and the discipline; she became “a” subject of the course Epistemology of the Social Sciences. This refers to a subject independent of the absolute number of people in a classroom; María incorporated herself into the symbolic order of that space of contingent and discontinuous thought.

To incorporate oneself is to become a subject, to form part of a “body of scientific truth” to which she was summoned in discontinuity with her prior knowledge. This structural shift moves the problem from reception (acquiring competencies) to appropriation (becoming a subject of science). The appropriation of knowledge operates as an alteration; that is why it summoned science in its dimension of invention, transmitting know-how and the most important scientific attitude: the contingency of what is not determined and could be otherwise. In that very act, María altered the class’s entire body of knowledge by interrupting the repetition of knowledge with a truth.

Finally, it is worth noting that the body, within the traditional framework, is precisely what modern knowledge has sought to normalize, classify, and serialize. From the discontinuist framework, it must be understood as that which, when removed from knowledge—since the body is what resists serialization and de-totalizes the structure—gives rise to a genuine question about the unknown and, in that process, enables the possibility of questioning a truth.

Discussion

It is important to discuss the concept of “interpretation” that emerges from the preceding findings. Following the contributions of the philosopher and psychoanalyst Lutereau (2014), interpretation is understood by situating it between the “quotation” and the “enigma”: “If this ‘in-between’ character is worth highlighting, it is because we consider that it is not a



matter of seeing the quotation and the enigma as two modes of interpretation, but rather as two conditions of interpretation” (p. 111). A quotation implies a propositional statement of knowledge with a manifest referent; i.e., something was said. In that statement, however, there is a “beyond” that can be explored and that reveals the conditions of enunciation.

Within the conditions of enunciation, there was an “act of speaking” that was later fixed in writing as “what was said,” which allows for the investigation of those traces that are partially preserved in the text. The conditions of enunciation point to the locus of truth of that act of speaking. This comes into play in scientific and academic reading and writing insofar as students are taught to recognize the historical constraints of a text’s context of emergence, biographical details of authorship, and other such markers. Since one reads both what is said (the utterance) and what is not said (the conditions of enunciation that can be reconstructed), there is an intrinsic discrepancy that prevents linear encoding and decoding. What is not said within the quoted utterance constitutes one of the conditions of interpretation.

Unlike the quotation, from which references that contribute meaning can be drawn, the enigma leaves it open for the reader to determine the meaning at that very moment of reading, within the act of speaking itself (Lutereau, 2014). For the enigma, the conditions of enunciation are indeterminate; thus, they are defined or determined by the act of reading in that new situation. Consequently, one must read and speak anew; reading a text is, in essence, to rewrite it.

The enigma is a way of formulating an utterance that does not correspond to a statement of knowledge: “In other words, the enigma is truth without knowledge [...]. Producing the utterance is left to the listener” (Solter, 1984, p. 18, cited in Lutereau, 2014). In the written context, the listener is replaced by the reader. The enigma implies that a new utterance must be produced between that text and that reader in that particular situation—i.e., within that specific act and new condition of enunciation. That is why it can be said that interpretation arises “between” the quotation of knowledge and the enigma. Interpretation is a new act of reading that occurs between knowledge and truth. In psychoanalytic terms, truth is “half-spoken” between the quotation (knowledge) and the enigma (truth). In conclusion, the quotation and the enigma are conditions of interpretation, and interpretation occurs situationally as an interpretive effect (Lutereau, 2014).

In the classroom setting, the reader does not preexist the act of reading, as the reader does not window a closed or given consciousness; nor does the written text preexist in a finished form, since the text is not closed but possesses a beyond, an excess. Both reader and text possess a



kind of consistency that intrinsically includes indeterminacy. Therefore, interpretation from a discontinuist approach to scientific-academic literacy involves positing a reading operation based on “codetermination” (Lewkowicz, 2007 and 2024).

For the continuist approach, the framework involves a sequence: it allows us to assume that, given text A, someone then reads and reproduces text B. This way of understanding the process responds to a linear and teleological rationality. In contrast, from the discontinuist perspective, there is no sequence, but rather an act of reading that simultaneously co-determines text A and text B. The first act is never witnessed; it is only through the act of reading—which produces text B (the second text, that of the reader)—that text A (the first, the written one) is realized. There is no access to the origin, since it will have as many versions as there are readers, but only to an “in-between.” Text A is not determined prior to its reading by the production of text B; text A means nothing in and of itself unless it evokes text B. Therefore, logically, B accounts for A retrospectively. In the words of Lewkowicz (2007):

The situation we study and the situation from which we study [...] we turn into an object situation and a subject situation; but that is not the case, because they are not determined separately [...] these two openings only come together in a codetermination (p. 104).

It is possible to analyze the situation in María's case in terms of codetermination. In the act of interpretation, María and the text code-terminate one another. Likewise, in retrospect, it is possible to account for the fact that appropriation took place because in the act of interpretation—the evaluative reading—there is also codetermination: teachers can observe that María has altered her thinking through an event and can ask questions in a way she did not before. María became a thinking subject within the course Epistemology of the Social Sciences, capable of the scientific attitude of creating and inquiring beyond what is already known or beyond mere repetition. In other words, she became part of a thinking subject that upholds a scientific truth.

Psychoanalysis's contribution to a discontinuist rationality of reading and writing practices requires starting from different assumptions. Language is a flawed and contingent structure that cannot say everything: the “—ontological gap’ between discourse and reality is irreducible and impossible to bridge” (Alemán, 2019, p. 28). Through language, human beings lose nature (total *jouissance*) and enter into culture, where their *jouissance* is always partial. Discourse is a symbolic order that is intrinsi-



cally incomplete; therefore, all discourse involves an excess that it cannot name. Psychoanalysis formalizes this excess as the “object *a*” or “remnant.”

Through these conceptualizations, psychoanalysis is not reduced to a hermeneutic of meanings, senses, cognitions, or imaginaries; rather, this serves to postulate an intelligibility of the body. For Lacanian psychoanalysis, the “object *a*”—the impossibility of discourse to say everything—can operate within rationality as:

- Surplus of jouissance: It is the body linked to the malaise in culture that produces a division and a clash between representations, giving rise to conflicts and symptoms.
- The cause of desire: It is the anguished and desiring body, when the impossible becomes an enigma that produces a rupture in knowledge and drives us to create and produce new codes and orders.

These conceptualizations point the way toward problematizing the idea that difficulties in learning are not cognitive deficits, but rather can be interpreted as a symptom or a particular mode of a subjective response within the material and symbolic relationships of educational practices.

It is important to note that, according to Alemán (2019), it is useful to distinguish between a structural and a historical sense of the materiality of language. In the former, “the speaking, sexed, and mortal being, made a subject by language, never finds in it a signifying representation that fully encompasses it” (p. 58). In the latter, the languages of socio-historical domination that produce subjectivities, although they oppress and control, cannot completely determine: “They never exhaust the subject in its openness to the possibilities of a transformation yet to come” (p. 58).

At this point, we turn to Badiou (2010). The way of conceiving the excess that prevents any closure implies a new conceptualization of the body. It should be clarified that “body” here does not refer to a biological organism but to the dimension of the real that is excess and cannot be captured by language. The body, in terms of what eludes knowledge, is what makes it possible to propose that reading and writing occur as open processes that require codetermination, and this is what enables the possibility of novelty, creation, and an event. Unlike perspectives that focus on a linguistic turn and rely on the dispersion of meaning, the discontinuist approach demands a rupture of meaning to make alteration and the new possible. In summary, what is subtracted from knowledge, what leaves it incomplete, what maintains openness, and what simultaneously makes the new possible is what is termed “body” in this theorization of scientific-academic literacy.



The continuist approach implies a complementary logic; in contrast, the discontinuist approach involves a supplementary logic. The former is cumulative: new meanings are added to what is already known, and new knowledge is combined and created based on what came before. This aligns with the reading and writing practices of GenAIs, which process large volumes of data.

In contrast, the supplementary logic functions as follows: within the knowledge of a given situation, there is an unrepresented excess; therefore, a naming—a creation—involves introducing an assertion of something that was impossible to articulate based on prior knowledge. By naming what was impossible, prior knowledge is de-totalized; it is a subtractive rupture that pierces it, revealing its incompleteness, and compelling it to alter itself to go further and transform itself. While repetition suffices for the reception of knowledge, the appropriation of knowledge requires alteration through a rupture.

The continuist approach involves upholding a foundational, closed-off, or essentialist cognitive assumption. In contrast, post-foundationalist criticism (Marchant, 2009) is based on the premise that there is no ultimate or essential foundation as an origin point. Without an origin, what exists is a contingent beginning—whether historical or axiomatic—and if other beginnings are possible, there is discontinuity. This is consistent with the view of science as a social practice and with contemporary theories of the subject (Palti and Polo Bonilla, 2021). Table 1 is organized to illustrate the conceptual articulations made regarding views of science, a stance toward language, and a stance toward the real.

Table 1

Categorical Framework of the Materiality of Language, Views of Science, and Scientific-Academic Literacy

Materiality of language for scientific-academic literacy		
(Discursive) Reality		Real
Imaginary register (representations)	Symbolic Register (Conditions of Representation)	Real (unrepresentable) register, (<i>impasse</i> of formalization)
Statements Knowledge	Enunciation Truth (half-spoken)	Event (presentation) Gap or rupture “Division between knowledge and truth”
Naturalistic science + GAI	Science of the linguistic turn	Science of the ontological turn or science of the real

Materiality of language for scientific-academic literacy		
(Discursive) Reality		Real
Knowledge-knowledge	Knowledge-conditions	Knowledge-truth (creation)
Closure and totalization	Coextensiveness of utterance and enunciation	Openness and incommensurability (rejects totalization and coextensivity)
Referral: apparent knowledge refers to grounded knowledge; or to metalinguage; or to the GAI database	Remission: apparent knowledge refers to its historical conditions. The beginning of theories of the non-transparency of language and power	Immanence: materialism and division within appearance
Truth is unattainable; it is an aspirational epistemic value achieved through accumulation. It includes variants: skepticism; nihilism; etc.	Truth manifests itself in every era; as an absolute, it becomes ineffable. It is the future; it is sanctified	Truth depends on an event (in science, art, politics, or love). Truth persists by producing effects or consequences
The claim of cognitive perspectives to a single rationality, disregarding the conditions of enunciation, which contributes to their claim of technical neutrality It is the body that is rendered invisible or denied. It is learning through accumulation	A symbolic order is incomplete and includes an "impossible" or "remnant" (Lacan refers to this as "object a"). The body is that of the word, traversed by the materiality of signifiers There are symptoms or conflicts between representations; if these are denied, one is led back to thinking of them in the traditional way as deficits or difficulties of an individual	The "remainder" or impossible takes the place of agency and becomes the "object cause" of desire The body is that of anxiety, the only affect without representation (an enigma) and one that gives account of a desire. It is the body that faces the possibility of alteration (learning as appropriation) This gives rise to the possibility of a new symbolization: new encodings, new rewritings. It gives rise to speaking out
From these scientific perspectives, theory and practice are separate realms, as are form and content		No separation between theory and practice, nor between form and content



In accordance with the above, teaching interventions related to reading and writing practices do not lead back to an abstract interpretive

framework, but rather to a rigorous reflection on the materiality of educational practices. Reading and writing from the materiality of language implies reading from the tight interweaving of the imaginary, symbolic, and real dimensions.

Consequently, scientific-academic literacy should not be conceived solely as a knowledge-knowledge relationship—i.e., as the mere reception of knowledge—but as a strategic subjective positioning based on the knowledge-truth divide, which enables the genuine appropriation of knowledge or the incorporation of a truth into the thinking subject.

Conclusions

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Through theorization grounded in practice, we have sought to make a conceptual contribution toward developing new interpretive frameworks for scientific-academic literacy. It is argued that the distinction between a “process of reception” (linked to a continuist view of science) and a “process of appropriation” of knowledge (linked to a discontinuist view of science), when used as an interpretive framework, can lead to variations in the types of reading and writing practices proposed in the classroom, specifically for science education in terms of its creative practice. It was proposed that, in the current state of the field of scientific-academic literacy, there is a predominance of assumptions underpinning a cumulative and neutral view of science. In seeking ways to promote science education from discontinuist perspectives, it was concluded that it is also necessary to alter the way in which reading and writing practices are understood in the classroom.

It was shown that there is a definitive relationship between the obstacles to constructing a new concept of science and the obstacles to acquiring literacy skills in the scientific-academic genre. Looking back on the discussion, it can be noted that, from the perspective of cognitive theories, saying that one can read and write “closer to the text” points to a repetition—to a form of knowledge that is not grounded in truth—and is practically a pure series. The series is a repetition of what is already known, which can act as an obstacle to the new. This would amount to an inability to appropriate learning—to follow Bachelard, for whom such appropriation would occur only by breaking with that series.

On the contrary, when the impossible takes the place of agency, it operates to produce something that no longer forms a series. It is not a matter of a subject repeating knowledge; rather, in the place of knowledge lies division. Consequently, the subject is exposed in their not-knowing,

and this gives rise to a search for new knowledge and a new ordering. The subject is not rendered powerless, nor are they condemned to a repeating machine; rather, knowledge comes into contact with the site of truth. The subject is restored to their symbolic capacity to produce new knowledge that reconfigures what came before, thus opening up the possibility of creating oneself through the text.

When cognitive theory speaks of “moving beyond the text” —from a discontinuist perspective— we are no longer dealing with repetition but rather with a transmission of the rupture with knowledge to alter it through a process of truth. García Puchades (2021), following Badiou, has termed this process “subjectivation through truths” in the field of education. Although this study succeeded in constructing a problematization that made the implicit visible, the conceptual approaches developed are likely still insufficient to assert that a new approach has been successfully established; nevertheless, they contribute to defining a line of research that requires further study. This line of research involves delving deeper into literacy models that recognize the materiality of their processes—and not merely the processing of information.

In light of the above, it is worth questioning whether it is reductionist to believe that humans read or write exactly the same way as a generative artificial intelligence (GenAI). GenAI works with knowledge as a series rather than as an alteration. Strictly speaking, the machine cannot read or write on behalf of a human, but only in an apparent sense and as a tool of knowledge. From our condition as mortal, sexed, speaking, and desiring beings, reading and writing means creating from an excess that creates a void in prior knowledge: we read and write to forge a self, a “we,” and to make ourselves into bodies and worlds. This contrast leaves avenues open for future inquiries that have become urgent in the current context.

In short, the division between knowledge and truth implies a dialectic that is not one of totalizing overcoming, but rather a dialectic required for an epistemology compatible with an open process; thus, these theoretical frameworks may be relevant for formalizing teaching and learning processes that do not promote logics that close off knowledge. The ultimate aim is to construct a theory of scientific literacy grounded in a materialist, contingent, immanentist, situational, and event-based epistemology—and, since it does not start from the essentialist and deterministic assumption of a cognitive human nature, one that is also eminently political and emancipatory.



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The author, Karina Silvana Gioni, declares that the article titled “Toward a Discontinuist Approach to Scientific Literacy” was not produced with the assistance of artificial intelligence (AI).

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