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Education and cognition in dispute: What does the research published in this issue tell us and what does it leave out?

Educación y cognición en disputa: ¿Qué nos dicen y qué omiten las investigaciones publicadas en este número?

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The United Nations Educational Scientific and Cultural Organization (UNESCO) (2016), in its *Incheon Declaration and Framework for Action for the implementation of Sustainable Development 2030* established the fundamental right to education for all citizens, regarding education as a determining factor for sustainable development and a culture of peace in the world. Moreover, it is equally important that such education be of enough quality to produce comprehensive, pertinent, and effective learning at all levels and in multiple contexts.

Quality education requires fostering higher cognitive competencies, which involve critical, analytical, reflexive and creative thought, and are needed to make decisions and deal with different kinds of problems in everyday, academic, and professional contexts.

Hence the need for empirical studies that allow us to understand and implement the teaching and learning of higher cognitive skills in education. Higher cognitive skills play an important role not only in school achievement but also in daily life to solve different types of problems as well as make well-thought decisions.

Scientists study concept and category learning, language acquisition, sense of similarity, representativeness, randomness, judgement, and causal relationship apprehension, among similar problems. They are interested in learning how our mind is able to make inferences that go beyond available data (Tenenbaum *et al*., 2011). Reflexive and systemic thinking (Budak, Ceyhan, 2024; Evagorou *et al*., 2009), for instance, implies understanding how things are and how they work. In the understanding of complex structures, Aristotle (n.d.) stated that "the whole is more

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than the sum of its parts"; that is, understanding complex systems or artifacts shaped by the interaction of their components requires understanding unique properties that are not reduced to properties of any of their parts. A reflexive and critical capacity allows us to contemplate a complex structure or system by identifying patterns rather than static states. This cognitive capacity helps us understand natural and social phenomena such as climate change, violence and criminality, systems in the human body, and metabolism.

A capacity for reflection allows people to understand the world through a holistic approach in its interconnections, observe interrelated phenomena and levels from the natural to the social and the other way around, and assess the consequences of every human action in terms of sustainable development (Rieckmann, 2019), since critical, reflexive thought allows us to deal with complex challenges at a local, regional and global level though a sustainable development perspective.

Formal education at all its levels already aims at that goal (Assaraf *et al.*, 2013). It intends to foster the student's ability to make connections between the parts of a system to be known, and to develop a contextualized understanding of the relationships between the parts of several complex systems found in daily life. This ability is one of the expectations of scientific education: helping students to have the competencies required to work out connections between parts and understand a whole system, as well as the interrelationships of the components within and without the system and the effects they may have. This is linked to conceptual understanding, which is why it is important to include activities at all levels of education that promote conceptual understanding when teaching complex systems (phenomena).

A general, albeit not systematic review of two data bases, *Scopus* and *Web of Science,* reveals trends in some areas of the research of thinking processes in education sciences. In the last 25 years research has progressively increased, especially in the United States and Germany. We also found that many of the studies focus on middle and high school, followed by those of college and preschool. An important problem in this area, according to Budak and Ceyhan's (2024) meta-analysis, is the indiscriminate and equivalent use of different categories of the study of thinking such as competencies, cognitive abilities and skills, critical thought, reflexive or complex thought, and thinking systems. This interchangeable use generates confusion due to its theoretical and practical implications.

While the expansion of studies of higher cognitive processes is evident, there is still the problem of establishing in a coherent way the nature of thought and point out possible reliable and valid strategies to measure what distinguishes "good", "critical", "reflexive" or "productive" thinking (Galotti, 1989).

Thinking in this way has been defined as "going beyond the information given" or "doing anything with evidence" (Bruner, 1957), filling the gaps left by incomplete information (Bartlett, 1958), or the "search through a space of problems" (Newell, Simon, 1972), underscoring the essen-

tial structure of a problem (Wertheimer, 1945), or more recently, the ability to integrate different ideas that *a priori* might seem disconnected, but that may eventually end up being connected (Baena, Suárez, López, 2023). Some scholars try to distinguish between good and "biased" thinking, between productive and unproductive thinking, and between critical and non-critical thinking. However, the boundaries are blurry. When describing reflexive thinking, Dewey (1933) defined it as a process employed when there is no pre-existing formula or rule to reach a goal, solve a state of doubt, or decide on a course of action. Ennis (1987), likewise, defined critical thinking as "reasonable reflexive thinking focused on deciding what to believe or do". Both for Ennis and Dewey, reflexive/critical thinking involves dispositions (for example, being open-minded) and know-how abilities.

Lastly, it is legitimate to start to reflect on the daily use of the word *thinking* and what we mean by *thought*. This has to do with where we locate thinking: in the mind, in the brain, or merely in the body itself which, together with the brain, is needed for thinking, understanding that thinking is a capacity of the thinking person, a complex human activity that depends on language, culture, and way of life, which manifests itself on how we speak, how we behave, and how we relate with the world. Therefore, we must start by discussing thinking in its human and linguistic context (Hacker, 2013).

Some polemical issues about the texts published in this issue of *Diálogos sobre Educación*

The development of thinking, cognitive regulation and learning have been widely studied by different disciplines, but their application in education is still a challenge. The articles reviewed address key issues such as empathy in the classroom, the teaching of self-regulation in reading, myths about ADHD, and the link between executive functions and categorization in children with that disorder. Although each study offers relevant evidence, it is fundamental to problematize their findings and consider complementary or critical perspectives that allow for broader discussion on education and cognition.

One of the main points of tension lies in how research papers delimit the role of biological, emotional and contextual factors in learning. While some texts underscore the importance of neuroscience to understand processes such as empathy or cognitive regulation, others set aside the influence of the environment, teaching, and the social construction of knowledge. Likewise, the link between emotions and cognitive skills is a recurrent topic, but the way it is addressed varies.

Another axis of debate is the way in which pedagogical strategies can be designed to take into account cognitive diversity without falling into reductionist approaches. To what extent can the teaching of empathy or the development of critical thinking be integrated without becoming merely moralizing or mechanical exercises? How can stereotypes be avoided in the

education of children with ADHD so that didactic strategies not only make up for their difficulties, but also boost their strengths?

Let us review the articles in this issue one by one in order to take a critical look at a number of points and debate their implications, theoretical assumptions, what they leave out, and what they do address.

"Statistical reasoning, conditional reasoning, and prior knowledge in statistics: assessment and covariation"

This study reveals significant correlations between conditional reasoning and previous knowledge in statistics, but a paradox arises when it finds a negative correlation between this knowledge and abstract reasoning. This leads to questions about the nature of statistics learning and its impact on cognition. Could it be the case that the teaching of statistics emphasizes procedural rules without fostering critical, flexible thinking? From the standpoint of neuroscience, conditional reasoning processing involves areas such as the dorsolateral prefrontal cortex, linked to the inhibition of automatic responses and cognitive control. This suggests that previous knowledge in statistics might facilitate abstract reasoning or make it more difficult depending on how mental representations of statistical concepts are structured.

Furthermore, an overall low performance underscores the urgent need of integrated pedagogical strategies. Instead of teaching statistics as a set of rules, what would be the result of incorporating methodologies that foster metacognitive development and reflection upon the reasoning processes themselves? An explicit teaching of self-regulation strategies might improve both performance in statistics and cognitive flexibility.

Finally, we must consider the role of emotions in these tasks. Math anxiety is a factor that may have a negative effect on abstract reasoning by generating cognitive overload (Moore, McAuley, Allred, Ashcraft, 2014) that interferes with logical processing. If the negative correlation between knowledge about statistics and abstract reasoning is due to a cognitive overload, then the key to improve this outcome might be interventions that reduce anxiety and promote a more intuitive and less threatening approach to statistical reasoning.

"Higher Cognitive Skills in Education: A Systematic Review of the Literature"

Although the systematic review about higher cognitive skills in offers a valuable theoretical framework, it might be pertinent to inquire whether metacognitive and self-regulation strategies are, by themselves, sufficient to generate a significant change in educational practices (Mahdavi, 2014). The heterogeneity of educational environments suggests that generalized methodologies might not be equally effective for all students. How can these strategies be adapted to contexts with limited resources or with populations that que present particular cognitive and socio-emotional barriers?

The study also emphasizes critical thinking and metacognition, but to what extent does it consider the influence of emotional factors in learning? Motivation and anxiety are key determiners in the acquisition of higher cognitive skills, and their integration into pedagogical approaches continues to be an overlooked challenge. Could an instructional design that contemplates emotional regulation foster these processes?

Lastly, technology is presented as a key tool to personalize learning, but its implementation is not always equitable or effective. The digitalization of learning, although it promises to provide greater accessibility, may also deepen inequality if it is not accompanied by adequate teacher training and an approach focused on the students' individual needs. How can we guarantee that the use of technology in the teaching of higher cognitive skills does not become the privilege of a few?

"The formation of the university student and its relationship with higher-order cognitive skills"

Although college formation seeks to develop higher cognitive skills to respond to the challenges of the twenty-first century, a gap remains between the institutional intentions and their effective instrumentation in the classroom. Teachers face multiple challenges when they try to foster these skills. The administrative burden, the lack of specific training, and resistance to change methodologies limit their ability to transform teaching. Is it possible to overcome these obstacles without a structural reform in higher education that prioritizes cognitive development over the transmission of contents?

Moreover, the article does not delve into the crucial role of emotions in college learning. Self-efficacy, for example, is a key factor in the disposition of students to tackle complex problems, but it is seldom integrated explicitly in the curricula (Cera, Mancini, Antonietti, 2013). How can universities foster an environment that motivates cognitive exploration without generating anxiety or demotivation?

On the other hand, the inclusion of neurosciences in the design of the curricula might offer more accurate tools to foster these skills. However, many proposals based on neuroscience have not managed to go beyond the theoretical and become concrete didactic strategies. How can we translate the findings of neuroscience into pedagogical practices that can be accessible and applicable for teachers?

"Analysis of the Learning to Learn competency in Nursing college students"

The study about the Learning to Learn competency in Nursing college students exposes an educational paradox: while the strengths of self-regulated learning and problem solving are acknowledged, weaknesses persist in critical areas such as critical thinking, time management, and emotional wellbeing. This poses a fundamental question: how can the Nursing curricula foster autonomy in learning without neglecting the emotional and cognitive conditions that

sustain it? Anxiety, for instance, emerges as a significant obstacle, which suggests that any pedagogical strategy must integrate both cognitive tools and emotional regulation mechanisms.

Furthermore, the article mentions gender differences in the Learning to Learn competency, but does not explore how these disparities can be addressed in educational practice (Jamiah, Mahmud, Muhayyang, 2016). Is a uniform teaching sufficient, or is it necessary to design differentiated strategies that take into account each group's specific needs? Equality in education does not mean homogeneity, but the ability of adapting methods to the students' individual characteristics.

On the other hand, the gap in digital skills and communication in a second language puts into question the training of future health professionals in a globalized and technologically advanced world. Is it not contradictory that such a central competency in learning still shows deficiencies in areas that are still essentials? Integrating inter-disciplinary approaches and practical experiences might be key to turning Learning to Learn into something more than an educational ideal.

"The development of thinking skills in basic education: realities and challenges"

The development of thinking skills in basic education: realities and challenges is faced with a structural problem: although its importance is acknowledged, educational programs still do not offer clear and systematic strategies to foster it. Even though the essay does underscore the need of psycho-pedagogical interventions, it leaves out a key issue: why, despite the consensus on the relevance of these skills, no educational policies that integrate them effectively have been consolidated? It is not enough to point out the lack of materials and guidelines: it is fundamental to question the institutional inertia that perpetuates an educational model based on the transmission of knowledges rather than the active construction of thought (Murphy, Bianchi, McCullagh, Kerr, 2013).

Moreover, the essay mentions the stimulation of key intellectual functions, but does not delve into the role played by emotions in this process. Motivation and curiosity are not merely complementary factors, but essential elements for the full development of creativity and attention. Without a pedagogy that contemplates the affective dimension of learning, any attempt to strengthen critical thinking will be reduced to a mere accumulation of decontextualized techniques.

On the other hand, the lack of follow-up on the assessment of these skills exposes a fragmented approach to basic education. What use is it to diagnose levels of reasoning, memory, or creativity, if there are no institutional programs that accompany their development in a continuous way? Rather than isolated evaluations, what is needed is mechanisms that guarantee the application of effective strategies throughout the educational process, to ensure that critical thinking is not just an aim in academic discourse but a reality in classrooms.

"Development of Scientific Thinking in Indigenous Primary Students through the Link with their Community"

This study about the development of scientific thinking in indigenous students highlights the importance of the community context as a key educational resource. However, we must ask ourselves if this approach is sufficient to make up for the structural inequalities that have historically restricted access to scientific education in these communities. Linking the teaching of science to the students' daily life is a valuable strategy, but if it is not accompanied by adequate resources, specialized teacher training, and a broader rethinking of the curricula, its impact will be limited. How can we guarantee that these initiatives do not remain as isolated projects without a real transformation of the educational model?

Furthermore, the article does not delve into how the cognitive processes that underlie learning in these natural environments can be supported by a neuroscientific perspective. We know that scientific understanding involves skills such as abstraction and inference, but how do they take place in an environment where teaching is primarily experiential? Integrating the knowledge of neuroscience would allow us to design more efficient strategies to consolidate these skills, ensuring that the learning based on the community is not only relevant but also cognitively enriching (Beaty, Cortes, Merseal, Hardiman, Green, 2023).

Another crucial aspect is the role of emotions in this process. Curiosity and a sense of belonging may function as engines of learning, but it is not clear how these emotions are employed pedagogically in the didactic sequence proposed. If we really want to foster a solid scientific thought in these contexts, it is not enough to involve the community: we must design strategies that integrate the affective dimension of learning with the development of analytic and critical thinking skills. Otherwise, we run the risk of perpetuating an approach that values experience without strengthening the ability to systematize and transcend it.

"Metacognition in reading: the use of reading strategies in disciplinary contexts"

This study about the use of metacognitive strategies when reading college texts offers valuable findings but leaves fundamental questions open about how these strategies are developed and applied in different discipline contexts (Stewart, DeVore, Stewart, Michaluk, 2016). Although the article does acknowledge the existence of significant differences in their use according to the area of study, to what extent are these differences the product of the teaching or of pre-existing biases in the students' learning styles? Disciplinary literacy is key, but if it is not fostered from the early years of education, the lag in the use of self-regulation strategies might continue throughout the student's academic trajectory.

Moreover, the article does not explore in depth how emotional factors (such as anxiety or self-efficacy) may have an influence in the adoption of these strategies. Students with a high level of academic anxiety might avoid complex reading tasks, even if they do possess the me-

tacognitive skills required to tackle them. So how can we integrate an approach that not only teaches strategies but also addresses the emotional barriers that affect its application?

On the other hand, if the personalization of teaching is a key objective in higher education, why not consider a greater use of educational technologies to adapt the development of these strategies to individual needs? Some digital tools may offer guided reading models, adaptive feedback, and real-time analysis of reading comprehension. However, the implementation of these resources is still unequal among different disciplines, which widens the gap in the learning of essential academic competencies. Unless institutional strategies that consider these factors are promoted, the development of self-regulation in reading will be limited to isolated initiatives with no real impact on the students' education as a whole.

"Writing composition processes of high school students in different contexts"

An analysis of the processes of writing composition in high school students reveals a disturbing paradox: in-classroom writing, in theory designed to develop advanced skills, seems to be less structured and elaborate than writing in informal contexts. Could it be that school environments are limiting rather than fostering the development of writing competency? The rigidity of academic activities and evaluation centered in grammatical correction may be stifling the creative and reflexive exploration that takes place in more spontaneous spaces.

The article also fails to address a key aspect: the role of emotions in written production. Self-efficacy and motivation have a direct influence on the disposition of students to review, improve, and expand their ideas. If student perceive academic writing as a mechanical, non-motivating exercise, they are unlikely to develop advanced planning and reviewing strategies. Neuroscience has shown that emotional activation is linked to the consolidation of learning, so integrating emotional approaches into the teaching of writing might be key to improving their depth and quality.

Moreover, the gap between school writing and off-school writing poses a fundamental question: why have educational programs not integrated effectively the diversity of writing practices? Digital literacy, interactive narrative and the production of content for social networks may offer unique opportunities to develop critical thinking and complex discourse skills (Valdivia, 2021). However, if formal education continues to regard these formats as peripheral or irrelevant, it will miss the opportunity of taking advantage of resources with an enormous pedagogical potential. The teaching of writing must evolve, not only to reflect the cognitive wealth of informal contexts, but also to become a truly meaningful tool for students.

"Learning to put oneself in someone else's shoes: empathy and its link to socioemotional and cognitive development in the classroom"

Even though empathy is recognized as a pillar for personal and academic development, its integration into the classroom poses a fundamental dilemma: to what extent should its teaching

be given priority over other cognitive competencies? The emphasis on empathy as a protecting and facilitating factor of learning is valuable, but it runs the risk of blurring the importance of intellectual autonomy and critical thinking. It is not enough to teach students to "put themselves in someone else's shoes": they must also learn to evaluate critically other people's emotions as well as their own, avoiding an indiscriminate empathy that might lead them to biased judgements or decisions driven only by emotion.

Neuroscience has shown that empathy involves both emotion-processing networks as well as cognitive circuits linked to seeing things in perspective. However, there has not been enough discussion on how this interaction might impact the learning of higher cognitive skills (Ampuero, Miranda, Delgado, Goyen, Weaver, 2015). Does empathy really favor critical thinking or, to the contrary, can it hinder it when emotion prevails over rational analysis? Teaching empathy without an adequate education in emotional self-regulation might generate impulsive responses to other people's suffering instead of fomenting a profound and reflexive understanding of social problems.

Furthermore, the challenge of modeling empathy in the classroom without falling into moralizing is real. If empathy is introduced in a prescriptive manner, students might perceive it as an obligation rather than a tool for personal and academic development. Rather than imposing norms about how to "be empathetic", teachers should promote spaces of discussion where students question, analyze, and experience empathy in complex contexts. Only in this way will there be a genuine socio-emotional learning which does not sacrifice independent thinking for the sake of emotional sensitivity.

"ADHD Neuromyths in education: a critical review and factual refutations"

Although this article makes a valuable contribution by debunking neuromyths about ADHD, it overlooks a crucial issue: the persistent gap between scientific research and its application in the classroom. In spite of all the progress in neuroscience, teacher training still relies on traditional models that do not necessarily incorporate recent findings about cognitive variability. A simple refutation of myths is not enough if it is not followed by realistic and feasible pedagogical strategies within the current educational contexts, where the material conditions and work overload of teachers limit their capacity to individualize teaching.

Besides, scientific evidence is key but it must not be interpreted in a reductionist way. For instance, although it has been proven that ADHD does not disappear with age, its expression and consequences may vary drastically depending on the context, coping strategies, and support received.

On the other hand, the emotional dimension of the teacher in the management of ADHD is still a seldom explored issue. To what extent can the learning of evidence-based strategies mitigate the frustration and exhaustion of teachers when working with students with ADHD?

Empathy is important, but without concrete tools to manage diversity in the classroom, it might become an emotional burden rather than an effective solution (Anderson, Watt, Shanley, 2017). Instead of focusing exclusively in fighting neuromyths, the debate should be oriented towards the creation of educational environments that really integrate cognitive diversity with viable strategies and a better link between neuroscience and pedagogical practice.

"Links between categorical classification and executive functioning in children with ADHD"

Although this study underscores the impact of ADHD on categorization and abstraction, it opens the door to a fundamental question: to what extent are difficulties derived exclusively from the disorder, or are they also the result of non-adaptive educational environments? The tendency to attribute deficits in executive functions only to neurobiological factors may conceal the roles of teaching and the context in the way in which children with ADHD develop classification and organization skills. In this sense, rather than focusing only on cognitive limitations, the debate should address how pedagogical practices can make up for, or even optimize, these functions.

Another critical issue is the generalization of the difficulties in conceptualization. The research suggests there is a lower performance in semantic and visual classification tasks in children with ADHD, but does not sufficiently explore how teaching strategies may modulate these results. Instead of assuming that lower abstraction and categorization are inherent deficits, it might be productive to analyze what kind of support – such as the use of visual scaffolding, multisensorial coding strategies, or the explicit teaching of organizing strategies – might improve these children's performance (Mulligan, 2001).

Moreover, the link between emotions and executive function warrants further development. Frustration, demotivation and anxiety may exacerbate difficulties in categorization and conceptual learning, but this research often addresses them as a secondary issue. Designing interventions that consider both the cognitive and emotional dimensions of ADHD would allow for a more comprehensive approach to the problem by focusing not only on deficiencies but also on potentials and effective strategies for academic inclusion.

Final thoughts

The articles presented in this issue of *Diálogos sobre Educación* not only address crucial problems in the educational, social, and organizational fields, but also offer opportunities to generate a significant impact on their respective contexts. This debate invites us to consider new lines of research that integrate multidisciplinary approaches, foster the use of technology, and promote inclusive and sustainable strategies. Ultimately, academic discussion should aspire to making strides towards a more equitable and reflexive education that is better adapted to contemporary challenges.

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