

BRAZILIAN CONTEMPORARY CONTRIBUTIONS ON THE NEUROPSYCHOLOGICAL APPROACH OF MATHEMATICAL ACTIVITY

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This special issue of JIEEM, titled *Neuroscience and mathematical activity*, aimed to display Brazilian recent contributions on this research domain. Relevant data shared a common interest on difficulties in mathematical activity at school, approached from diverse topic subjects like general cognitive development, pathology (brain injury and functional troubles), socio-cultural prosthesis, brain structures.

Theoretical landmarks emerged from this set of contributions, the very first of these points being the relationship between brain structures and functional processes. Data based on recent advances in neuroimaging techniques have improved the knowledge-basis about brain structures involved in mathematical activity in general, but theoretical questions about the *unit of analysis* covering neuropsychological approaches of this research subject are still under debate. Should this approach consider good enough an analysis centered on individuals' brains and/or minds, or extracortical (as mentioned by historical-cultural psychology) should necessarily be taken into account? This “zero question” is important in order to properly address theoretical-empirical questions like the role of language (or verbal representations) and visuo-spatial abilities in mathematical conceptual building processes. Even if state-of-art techniques show that brain areas related to language are “silent” for many mathematical problem-solving tasks, it is not enough to dismiss the semiotic, culturally-based nature of mathematical activity (and cognitive activity in general). On the other hand, it is not acceptable to ignore the role of brain structures in the early development of concepts like space, time, numerosity and number, what can be evident in the context of pathology.

These relevant points were present in the set of contributions covered by this special issue. *Focusing on dyscalculia: contributions from a historical-cultural lens*, paper proposed by C.R. Kranz and L. Healy, offer empirical and theoretical support for the assumption that the development of mathematical abilities is mediated by cultural, historical and social resources, alongside biogenetic and neurological ones. For these authors dyscalculia should not be purely associated with a specific, congenital/individual brain-based disorder. Similarly, *Mathematical activity in epileptic children: from diagnosis to intervention*, proposed by I. Hazin and colleagues, offers empirical-clinical data showing that epileptic children benefit from the offer of cultural semiotic aids, which highlights the need of considering the neuropsychological foundations of mathematics activity in the context of culture. *Development of Numerical Cognition among Brazilian school-aged children*, paper proposed by F.H. dos Santos and colleagues, offers a similar theoretical approach of the relationship of working-memory and school education for the comprehension of the emergence of important cognitive conceptual systems, like Number Sense, Number Production and Number Comprehension.

Working-memory is also addressed by the paper titled *Working memory and mathematical thinking: a cognitive and affective neuroscience approach*, authored by J. Landeira-Fernandez and colleagues, but here a special emphasis is put on a working-memory model related to neural circuitries within the posterior parietal cortex and prefrontal regions, according to data issued from neuroimaging studies. A similar brain-based emphasis is present in the paper *Cognitive neuroscience and math education: teaching what kids don't learn by themselves*, proposed by V. Haase and colleagues, focusing on cognitive mechanisms underlying the development of mathematical activity; according to this author, if extra-cortical, environmental aspects cannot be excluded from the analysis of cognitive development and performance, the analysis of neuropsychological dissociations in performance of brain-injured or brain-dysfunctional individuals constitutes a valid approach to identify the semi-autonomous components that constitute the system. Finally, the paper titled *Neuropsychological and mathematical performance in children and adolescents with brain injury: a multiple-case study*, authored by S. Feldberg and C. Berlim, puts a clear emphasis on the role of cognitive skills, such as those related to problem-solving and visuospatial processing, for explaining both developmental and

dysfunctional aspects of mathematical school activity. Such cognitive skills are presented as depending primarily on variables such as the extent and location of cerebral lesions, which can be another example of the previously presented emphasis on individual brain structures on the comprehension of cognitive human processes.

Even though all papers assume the importance and interest of taking into account aspects ranging from brainly-cortical circuitry to social, cultural and historical levels, the reader will be able to realize that different theoretical baselines underlie these contributions, splitting them in almost two groups: a first one that builds up its unit of analysis encompassing different levels of complexity (from individual-neurological to socio-cultural and historical), and the second one, which seems to assume that brain structures must be seen as a primary, central aspect, upon which important (but NOT central) environmental variables will act empowering, aggravating, modulating a process that was already done. We, as editors, are very happy to realize that this important theoretical split, present in the historical and epistemological foundations of neuroscience in general and neuropsychology in particular, is also present in the set of productions that we present to those readers interested in the research domain of neuropsychological approach of mathematical activity. These readers won't find out the final answer to these dilemmas, but will instead have access to Brazilian state of art research data and theoretical contributions under the scope of this special issue. We would finally thanks JIEEM, on behalf of the community mentioned above, for making room for this relevant debate.