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Table 1

Overcoming the "Moving Things Are Alive" Misconception in Biology Requires Inhibitory Control: Results from an EEG Study

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Digital Society

Overcoming the "Moving Things Are Alive" Misconception in Biology Requires Inhibitory Control: Results from an EEG Study

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Summary

Several researches point out that interacting with digital tools, such as digital games, can improve executive functions, and specifically inhibitory control (Homer et al., 2018; Ramos & Garcia, 2019), which is recognized as essential in the development of complex skills like reading, arithmetic, etc. Inhibitory control is also known to play a role in scientific reasoning by allowing to suppress a tempting but inaccurate answer (a misconception) in favor of a less intuitive but more scientific one, when the context requires it. An extensive research literature reveals that students hold misconceptions about various phenomena. These misconceptions are important to consider, since they interfere with the learning of scientific conceptions and can therefore make formal instruction less efficient. An example of such common misconception could be to believe that bigger or heavier objects sink more, which constitutes an obstacle in learning buoyancy (Unal, 2008). Furthermore, it has been shown that those misconceptions do not only interfere during learning; they also persist after being given formal instruction and make it hard to foster conceptual change, thus the need to inhibit. Recent neuroimaging and reaction time studies show that inhibitory control mechanisms are involved in understanding basic science concepts in mechanics, chemistry and electricity (see for example Brault Foisy et al., 2015). The present research investigates a common misconception in life sciences, specifically biology, which has been far less studied with inhibition-based frameworks. The well-documented misconception that "moving things are alive" is widespread and known to interfere with the conceptual learning of what is considered alive or not. Electroencephalography (EEG) measures were selected for this study, as they allow for the detection of brain signal variations over short time frames in ecologically valid tasks. Twenty-eight undergraduate students solved a classification task in which they had to select between two images which one represented a living thing, while their EEG signals were recorded. Results show that event-related potential

(ERP) signals differ at N200 and LPP (late positive potentials) locations between counter-intuitive stimuli (for which inhibition is presumably required) and intuitive ones (counter-intuitive>intuitive). These locations are commonly involved in distinct cognitive processes associated to inhibitory control, as the N200 component is considered to reflect cognitive processes such as error detection and conflict monitoring and while the LPP component would be related to conflict resolution and response selection (Zhu et al., 2019). Moreover, in order to get an idea of the developmental trajectory of the role of inhibition for this specific misconception, we also asked twenty-nine 5th graders to solve the same task. The undergoing analyses will allow us to present the first results for this age group at the conference. A greater understanding of the cerebral and cognitive mechanisms supporting biology learning at different ages could inform both classroom educational interventions in science education and the design of digital tools likely to influence the mobilization of inhibitory control. The implications of the empirical results will thus be presented and discussed in order to identify avenues for reflection and possible impacts on these two aspects.

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