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TRAINING IN THE INHIBITION OF HEURISTICS IN PHYSICS EDUCATION

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Neurodidactics (Riopel et al., 2007) is the field studying the brain mechanisms related to the learning and teaching of disciplines such as physics. One of its most emblematic results (Potvin & Cyr, 2017) is that our brain tends, in a given context, to respond very quickly - too quickly sometimes - by mobilizing our most spontaneous ideas (our misconceptions). It also tends to induce the use of false reasoning when they should be inhibited. In fact, *logical* reasoning sometimes seems quite difficult. Some cognitive biases, beliefs and prior conceptions can indeed largely interfere with so-called logical reasoning and produce systematically false reasoning. This does not mean that the brain is not able to function properly, but rather that these biases and intuitions take over the reasoning that we usually call *scientific*. This is the hypothesis of Kahneman (2012): the brain works by using two systems of thought that coexist, *system 1* - which is fast, intuitive and emotional - and *system 2* - which is slow, logical and lazy.

To be able to inhibit a scientifically wrong strategy in favor of a correct and reliable, but slower one, is a real challenge. In order to achieve this, the brain must be able to call upon a different set of brain areas (system 2) than those usually used to perform a particular task (Houdé et al., 2000). At the same time, research in physics and education has shown that learners have initial misconceptions (Potvin, 2019) that coexist with scientific knowledge and that often bias their reasoning in learning situations. Learners may therefore have different conceptions that coexist, contradictory or not, correct or not, and that may even compete with each other (Taber, 2000). It is, therefore, important that these initial conceptions are taken into account in teaching in order to develop learning strategies.

Recent neuroscience studies have also highlighted the importance of executive functions (Diamond, 2013) in expertise in different topics of science (Potvin, 2019). More specifically, the ability to inhibit a heuristic constitutes one of the key mechanisms to overcome the systematic errors observed in the cognitive domain and thus to develop it (Houdé & Borst, 2014).

The objectives of this doctoral research are first to train teenagers and young adults to inhibit. Then, it proposes to analyze the impact of this training on the distancing of the spontaneous use of their intuition when solving problems related to the physical sciences. This presentation introduces the theoretical framework, the methodology and some of the first results. They could be useful in terms of diagnosis and differentiation in learning. From the outset, some gender differences seem to appear. There is a significant difference in the levels of cognitive development between boys and girls of the same age, from early to late adolescence. Moreover, the prevalence of some misconceptions recurrently appears according to previous studies in physics and education.

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