

### **Impact of pedagogy on the development of creative thinking and its neural networks**

The progression of artificial intelligence is a reality, and with it, the disappearance of certain execution-focused jobs. The repetitive tasks that have until now required human intervention will be gradually replaced by algorithms or robotic arms. It is therefore important to support the development of students' creative thinking, to enhance their agility and help them adapt to future jobs or invent new ones without difficulty.

Although genetics plays a role, creative thinking is shaped primarily by experiences during the development of the child and the adolescent. It is recognized that school experience plays an important role. In Montessori education, students actively experience school content (e.g., through self-correcting learning materials) and they develop greater creativity than students in traditional schools. Daily peer-to-peer work in multi-age classes without time or grade pressure plays an important role. However, until now, no study had been conducted on the influence of these different educational approaches on the brain mechanisms underlying creative thinking.

The present study published in the journal [\*Developmental Science\*](#) is focused on assessing creative thinking and, with the help of neuroimaging, the brain networks related to creativity. Seventy-five students (4-18 years old) from Montessori or traditional schools participated in the experiment at the Imaging Center of the CHUV, in Lausanne. Selection biases (social status, parents' income, etc.) were considered to allow for a comparison of these two groups of students based on their school experience.

The results speak for themselves. Not only did they confirm studies already showing that the Montessori pedagogy positively influences the creative performance of the students, but above all, it highlighted the difference at the level of neural networks.

Indeed, creative thinking relies on three important networks; a 'default mode' network that generates ideas, an 'executive' network that implements them, and a network that regulates the exchanges between the first two; the 'salience' network. A good discussion between the 'default' and 'executive' networks allows for fluid and creative thinking. However, if the alert network is too active, it interferes with the creative process.

In this study, it was observed that the alert network was globally more active in students from traditional schools than in students from Montessori schools. In addition, it was found that traditionally schooled children spend more time in the network 'by default'. That means that they can generate creative ideas, however, they are less prone to implement them.

These results show that pedagogy influences the brain networks necessary for creative thinking, as well as their dynamics. Further research will allow us to better understand and deepen these initial results. A longitudinal study is currently underway, as most of the participants in the study have agreed to be reviewed again in 2 to 3 years. However, it is essential to realize now that pedagogy can support or constrain the natural development of creative thinking. Given the implications for students' personal and professional futures, these findings deserve to be widely shared.