

## **Action video games improve math abilities in children with developmental dyscalculia**

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### **Abstract**

Developmental dyscalculia (DD) is a neurodevelopmental disorder of biological origin. DD is a specific learning disability that affect the development of numerical and arithmetic functioning with estimated prevalence rates between 3 and 6%. The basic number system seems to be evolutionary, but numerical and arithmetic skills are also influenced by cultural factors, especially the preschool and school experience. Children with DD have problems in mastery many mathematical abilities like counting, magnitude processing, arithmetic and spatial number representation. Several neurocognitive functions are considered at the basis of DD, such as visuo-spatial, attentional skills and executive functions. Starting from the evidence that these abilities can be improved by intensive use of specific video games, we tested the possibilities to improve mathematical skills with an action video game training. We tested numerical cognition and visuo-spatial attentional skills as well as overt visual exploration in two matched groups of children with DD before and after they played action or non-action video game for nine sessions of 80 min per day (12hrs). We found that only the group trained with action video game improved in number sense and arithmetic skills. Also visuo-spatial attentional skills improved after action video game training, without however translating into any evident modification of oculomotor exploratory activity. Our results show that a fun training of visual and attentional processing impacts on mathematical skills, unveiling the causal role of visuo-spatial attention in numerical cognition. Action video game could provide an efficient remediation of DD. Considering that visuo-spatial attention can be proficiently trained in infants using specific video games, early and inexpensive prevention programs could be developed to reduce the incidence of DD.

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