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Miniaturization of Eduball educational balls: Pedagogical study using cognitive neuroscience techniques

Abstract

Numerous studies show that combining physical and cognitive activities brings many benefits in both areas. However, despite this, a strict subject division still prevails in schools, even in early education. This limits teachers' opportunities to incorporate didactic content into movement and vice versa. One reason for this situation is the lack of appropriate methods to implement this idea in didactic practice. To address this problem, the Eduball educational ball was created. The method is based on games with basketball and volleyball balls on the surface of which letters, numbers, and other signs are printed and thus teacher can stimulate students' motor and cognitive abilities at the same time. Nevertheless, the method mainly stimulates gross motor skills during physical education classes in the gym. Meanwhile, recent research show that combining fine motor skills with tasks could bring even better results. Therefore we miniaturized Eduball educational balls and adapted them to the size of the hand, thus creating the mini-Eduball method, which can be used in the classroom, for example, during breaks between lessons. We hypothesized that mini-Eduball activities performed immediately before class, i.e., during a 10-minute break, affect mental processes crucial for school effectiveness, such as attention and abstract reasoning. We further hypothesized that breaks with fine-motor games incorporating cognitive tasks (such as mini-Eduball) stimulates these processes ("warm up" students' brains) more than purely cognitive or motor games or even sophisticated techniques of brain stimulation, such as binaural beats or tDCS, regardless of the level of motor skills. To test our assumptions, we conducted a laboratory experiment with 90 healthy adults (ages 18-25), dividing them into a control group and five experimental groups: 3D puzzles, binaural beat stimulation, mini-Eduball, traditional balls, and transcranial direct current stimulation. We provided various types of cognitive, motor, or cognitive-motor stimulation to each group, and cognitive and coordination tests were conducted immediately before and after the 10-minute intervention. However, our results show that the mini-Eduball

group did not perform better than the others in any of conditions. Moreover, it was significantly worse in sustaining attention than the 3D puzzle and transcranial stimulation group. We suggest that this may be because mini-Eduball games are very cognitively demanding and do not provide a break effect between challenging tests. Therefore, mini-Eduball games cannot be considered an exercise break, but rather as part of learning process. Further research is needed to verify this conjecture.