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**LETTER TO THE EDITOR: GREAT RESEARCH
IDEAS FAIL BECAUSE OF WEAK
EXPERIMENTAL DESIGN**

**PISMO UREDNIKU: DOBRA RAZISKOVALNA
IDEJA PADE S SLABIM EKSPERIMENTALNIM
NAČRTOM**

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We read with great interest the findings of Demirci and Demirci (2018) on the article "The effects of game and physical activity lessons in children with learning disabilities". This study examined the effect of participation of students with learning disabilities (LD) in Game and Physical Activities (GPA) lessons on their academic achievement and exercise self-efficacy (SE) levels. The authors conducted a semi-experiment with physical activity (PA) intervention for 30 male students with LD. In addition to regular PE, the experimental group attended GPA five times per week for 40 minutes. The GPA followed the basic movement skills curriculum program written by Turkish Ministry of Education. The study found a significant decrease in body weight and body mass index (BMI) of the students in the experimental group and a large impact of GPA on their exercise SE and academic performance.

As previous studies have shown (e.g., Fedewa & Ahn, 2011), PA is as beneficial to academic achievement for children with LD - if not more so - than for children without such disabilities. Previous studies (e.g., Gore, 2006) have already found that SE predicts academic outcomes and have explored possible interventions to change SE beliefs in adults and children. The important contribution of this study is to explore how PA might change SE beliefs in children with LD.

Despite the good research idea and the importance of the objectives, the main shortcoming of the paper is the unclear organization of thoughts. The introduction of the paper is written in a confused way; therefore, it is difficult for the reader to understand what the main objectives are. Most of the ideas and research findings on which this study is based are described in the discussion section. The reader must first read the entire article to understand the basis of the research. To the best of our knowledge, we identified their implicit thesis; adapted and individualized activities and teacher instruction for students with LD during PE increases exercise self-efficacy, which increases overall self-efficacy, which contributes to academic success. However, the experimental design does not allow us to test that.

Despite its great potential, the experimental design is the weakest link of this study. Unfortunately, the description of the study protocol is inadequate to be replicated by other researchers. The authors failed to describe in detail the characteristics of the participants and the GPA program. First, we learn nothing about the nature of the participants' learning disabilities. There is a wide range of learning disabilities: from motor to cognitive to sensory; we believe that any experimental PA program would have different effects on the different types of disabilities. Second, the paper only describes the content of the GPA program and lacks description of objectives, methods, and adapted teacher instructions and exercises. The reader

cannot determine what makes the difference in teaching PE students with LD to achieve the desired goals.

Also, it is important to know if the participants attended a regular school or a special school for students with LD. Did the participants attend different schools or the same one? Did the participants in the experimental group attend GPA in their schools from their PE teachers or together after school from the same instructor? If the participants attended a special school for students with LD, then we assume that the PE teacher(s) already followed the adapted PE curriculum to some extent; on the other hand, the degree of inclusion of students with LD in regular PE depends mainly on the teacher's knowledge, skills, and willingness to individualize instruction and practice. We recommend the authors to explain these details and control the listed factors in the experimental design.

As we read the article further, we noticed several errors in the statistical reports. First, the authors state that the participants are 9-11 years old, while the descriptive statistics in Table 2 show that the mean age is 8.27 years for the control group and 8.33 years for the experimental group. Second, the authors failed to report results on the decrease in body weight and BMI for both groups, although they discuss this in the Discussion.

Third, we question the procedure of quantifying experimental effects, i.e., the calculation and presentation of Cohen's d . On the one hand, we recommend that the authors present the effect size with a confidence interval; on the other hand, the number of participants in both groups is too small to use Cohen's d as a correct measure. Cohen (1992, p. 156) writes: "In research planning, the investigator needs to know the N necessary to attain the desired power for the specified α and hypothesized ES . N increases with an increase in the power desired, a decrease in the ES , and a decrease in α . For statistical tests involving two or more groups, N as here defined is the necessary sample size for each group." He also points out that the only specification for power is .80 (i.e., $\beta = .20$; the probability of rejecting a false H_0), which should make the number of participants in each group at specified $\alpha = .05$ at least 26, 64, and 393 if the expected effect size in the population is large, medium, or small, respectively. For smaller sample sizes (< 50), Cohen's d tends to inflate the results, and the upward bias is relatively large when sample sizes are less than 10 in each group (Nakagawa and Cuthill, 2007). There is a correction factor available that reduces the effect sizes by a few percentage points. Nevertheless, the authors did not use it.

The most important finding of the study is that participation in the GPA has a large impact on the development of exercise self-efficacy and academic performance in children with LD. However, the authors made an overly firm statement that children with high SE contribute to successful outcomes.

In summary, we agree with the authors that given the inherent academic difficulties of children with LD, PA should not be overlooked as an effective intervention to stimulate children's learning. We support the authors' initiative to raise awareness of the importance of individualizing the learning process in PE, especially for children with LD. However, it is crucial to present a more detailed experimental design and to reconsider the introduction of control variables.

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