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### **Evaluation of the doctoral dissertation**

by Maryna Khorkova, titled “The Impact of the Eduball method on selected parameters of creativity and motor fitness in early-age school children”

The doctoral dissertation submitted for evaluation by Maryna Khorkova, M.A., consists of a collection of published, thematically related scholarly articles, which is in accordance with the provisions of Article 187 of the Polish Act on Higher Education and Science of July 20, 2018. The documentation received for review consists of copies of two multi-authored scientific articles, in both of which Maryna Khorkova, is the first author, as well as a concise 82-page document in the form of an author’s summary containing information about the doctoral candidate’s curriculum vitae and scientific achievements, an abstract describing the research she has conducted, broken down into the results presented in the attached scientific articles, and - as is typical for doctoral dissertations in monographic form - concise introductory information on the research, a description of the research objectives and hypotheses, research materials, methods, and tools, research results, discussion, and conclusion, as well as a bibliography. The documentation also includes information on the source of funding for the research presented, which formed the basis for the preparation of the doctoral dissertation, namely the NCN project UMO-2022/01/4/NZ7/00021 (“the National Science Centre (Poland) program for students and scientists from Ukraine without a doctoral degree, implemented under the Basic Research Program in the third edition of the Norwegian and EEA funds

for 2014–2021”). The documentation also includes relevant statements by the doctoral candidate, the supervisor, and the co-supervisor, as well as statements by the authors regarding their participation in the research, which are important in the case of co-authored works.

1. Khorkova M., Bojkowski Ł., Korcz A., Łopatka M., Adamczak D., Krzysztozek J., Bronikowski M. (2024) The relationship of creativity and motor creativity with physical activity and motor fitness in a gender perspective among 8–9-year-old children. *Children-Basel*, 11(12), 1501. <https://doi.org/10.3390/children11121501> (Impact Factor: 2.0).
2. Khorkova M., Bojkowski Ł., Korcz A., Łopatka M., Adamczak D., Krzysztozek J., Bronikowski M. (2025) Impact of the Eduball method on cognitive creativity, motor creativity, and motor fitness during physical education classes in 8- to 9-year-old children. *Frontiers in Public Health*, 13, 1660650. <https://doi.org/10.3389/fpubh.2025.1660650> (Impact Factor: 3.4).

From a formal standpoint, I assess the documentation as having been properly prepared and complete. With the exception of the Polish abstract and the statements, the documentation was prepared in English.

The doctoral dissertation presented to me for evaluation in the form of published and thematically related scientific articles, falls within the field of physical culture and physical education and addresses the important and timely issue of teaching methods for early-school-age children and methodological innovations. The work concerns the evaluation of the suitability of the Eduball integrated teaching method, which combines children’s physical activity in the form of games and play with their intellectual development (the development of knowledge, skills, and competencies in selected theoretical subjects), but it focuses in particular on the development of children’s creativity. The goal of the reported project, as indicated by the doctoral candidate, was to assess the impact of the Eduball method on selected parameters of creativity and motor skills during physical education classes in early elementary school children (second-grade elementary school students were studied).

The use of educational ball sets within the Eduball method - which differ in color and are marked with numbers, letters, or special symbols - allows the physical education teacher to conduct educational mini-games involving movement, in which children acquire a certain range of knowledge and skills in subjects other than physical education while engaging in physical activity. The simultaneous development of children's motor skills and movement abilities, due to the technical elements used in ball games, makes the Eduball method a suitable response to the needs of comprehensive development in preschool and early elementary school children, as well as integrated education. This method constitutes a unique form of intellectualizing physical exercises that enhances "physical training" while simultaneously enabling the achievement of a range of educational and developmental goals. On the one hand, it is thus the intellectualization of physical education, and on the other, the "physicalization" of teaching theoretical subjects.

In her research, the doctoral student employed an experimental design involving two measurements - one before and one after the introduction of the experimental stimulus. This design included two experimental groups and one control group. The selection of classes for the experimental and control groups was made after the initial measurements of the dependent variables and was random. The study participants were students aged 8–9, recruited from three elementary schools following the standard core curriculum. A complex research methodology and a range of appropriately selected research tools were employed. The baseline assessment included 195 students (nearly half of whom were girls) and encompassed the evaluation of anthropometric characteristics (height and body weight), motor skills, self-reported physical activity, cognitive creativity, and motor creativity. Motor skills were assessed using selected Eurofit tests. A test on the Piórkowski apparatus was also conducted, aimed at measuring eye-hand coordination, reaction time, and movement precision. The level of physical activity was determined using the Physical Activity Screening Measure. Cognitive creativity was assessed using the Test for Creative Thinking – Drawing Production (TCT-DP). Motor creativity was assessed using Torrance's "Thinking Creatively in Action and Movement" (TCAM) test.

The experimental intervention in this study was a two-month Eduball program implemented during physical education classes in both experimental groups: The first

experimental group participated in Eduball classes once a week, in addition to two traditional PE classes; the second experimental group participated twice a week, with one traditional PE class. The control group followed the standard program, receiving only three traditional PE classes without any Eduball elements. Data from participants in the experimental groups who attended less than 60% of the intervention sessions were excluded and not included in the analysis of the final assessment results. The final assessment included 173 students and comprised the same measurements.

The results of the first (baseline) assessment of dependent variables revealed significant gender differences in motor skills, while no differences were observed between scrutinized boys and girls in terms of physical activity, cognitive creativity, and motor creativity. Furthermore, no associations were found between physical activity, motor skills, and any type of creativity in either gender group. In the baseline assessment, there were no differences between the experimental and control groups in any of the measured parameters. In the final assessment, however, statistically significant differences were noted in favor of the second experimental group in TCT-DP scores, in terms of motor imagination (TCAM test), and in eye-hand coordination in the Piórkowski apparatus test. Intra-group comparisons showed a significant improvement in all motor performance parameters, as well as in fluency and imagination (TCAM test) in all groups. However, no significant change was observed in TCT-DP or originality (TCAM test) in the experimental groups, while a significant decrease in these two parameters was observed in the control group.

Maryna Khorkova noted that the study's results show that, although gender differences in motor skills were observed among the 8- to 9-year-old children in the study, no differences were found between boys and girls in terms of physical activity, cognitive creativity, or motor creativity. No correlations were observed between physical activity, motor skills, and measures of creativity, suggesting that fostering creativity in children requires purposefully designed environments and pedagogical strategies, rather than relying on natural associations with levels of fitness or activity. I appreciate the doctoral student's caution in drawing conclusions in this regard.

In the doctoral student's assessment, the results indicate that the Eduball method has positive potential as an effective pedagogical tool in the process of physical education in schools. The intervention demonstrated a positive effect on the creativity of the children

studied - particularly on the increase in cognitive creativity, motor imagination, maintenance of motor originality, and improvement in eye-hand coordination - with higher frequency of implementation. Although the experimental stimulus in the form of the Eduball method did not lead to significant increases in all components of motor creativity in the presented study, it prevented the declines observed under traditional PE conditions. These results underscore the importance of incorporating creativity-oriented approaches into PE programs to support and develop children's natural inclination toward both movement and creativity. According to the doctoral student and co-authors of the publication, the data suggest that PE enriched with innovative methods, such as Eduball, provides a valuable context for developing children's creative potential in parallel with their motor development—and with equal effectiveness for both genders.

Notwithstanding my positive assessment of the doctoral dissertation, I would also like to express my appreciation for the doctoral candidate's overall academic activity, as evidenced by the number of her academic publications beyond those included in the dissertation (six papers), her participation in numerous academic conferences, a research internship, and training programs related to the topic of the dissertation. This demonstrates her deep commitment to academic work and a genuine passion for research.

### **Summary and Conclusions**

The doctoral candidate addressed an issue of significance to the fields of physical culture, physical education theory, and pedagogy, and conducted a rigorous pedagogical experiment. She also prepared a concise extended research abstract that is solid in both content and style and published two closely related scientific articles with Polish ministerial ranking points and IF scores that constitute the evaluated doctoral dissertation. The preparation of this work in very good academic English, which is not the author's native language, deserves additional praise. Maryna Khorkova demonstrated a very good knowledge of the literature in the field and correctly carried out a complex experimental research project.

In my opinion, Maryna Khorkova's doctoral dissertation, titled "The Impact of the Eduball Method on Selected Parameters of Creativity and Motor Fitness in Early-Age School Children," constitutes an original solution to a scientific problem and demonstrates the candidate's general theoretical knowledge in physical education and her ability to conduct independent research, which means that it meets the key requirements of the Act on Higher Education and Science of July 20, 2018. I recommend that Maryna Khorkova be admitted to the subsequent stages of the doctoral procedure.

A handwritten signature in blue ink, appearing to be 'M. Lenartowicz', written in a cursive style.

Dr hab. prof. AWF Michał Lenartowicz