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Original Paper

Biomedical Human Kinetics, 11, 136–143, 2019
DOI: 10.2478/bhk-2019-0019

# The effects of extracurricular physical education classes on gross motor development in primary school children – pilot study

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## Summary

*Study aim*: The aim of the study was to investigate the changes in gross motor skills in children participating and not participating in a project of extracurricular physical education classes in primary schools called "From fun to sport".
*Material and methods*: Thirty-one children in the first grade of primary school participated in the study (16 boys and 15 girls). A pedagogical quasi-experiment was applied. Children from the experimental group participated in an additional 45-minute lesson. To assess gross motor skills the TGMD-2 (Test of Gross Motor Development-2) was used.
*Results*: Statistically significant differences were observed in the level of gross motor skills between children attending extracurricular physical education classes and those who did not participate in such activities (GMDQ: $\Delta$ boys = 11.86, $p = 0.032$; $\Delta$ girls = 13.1, $p = 0.036$).
*Conclusion*: The experiment revealed large effects of additional activities of the project on increase of children's motor skills level. Additional time should be included in physical education for the development of gross motor skills in physical education classes at the initial stage of school education.

**Keywords: Motor skills – Gross motor skills – Children – Education – Experiment**

## Introduction

Effects of different interventions on the development of gross motor skills are still an important subject of scientific research [14, 30, 31 ]. Studies on interventions, which should be diverse, should be continued in typically developing children [5, 16, 22]. Gross motor skills are defined as motor skills that involve large muscle groups [7]. As children grow, the level of coordination and control of their bodies improves. These skills, like the ability to use writing instruments and produce handwriting, will be used throughout the life span. Bayley [2] stated that primary physical education made distinctive contributions to the development of children's fundamental movement skills and physical competences, which are necessary foundations of participation in later lifestyle as well as sporting and physical activities. There is evidence of an association between fundamental movement skills and physical activity [18, 25, 32]. A crucial period for acquiring new skills is during the preschool and primary school age [20]. Motor skills should be practised and reinforced [12, 24, 29]. Moreover, the levels of proficiency in motor skills and physical activity in adulthood, adolescence and childhood are associated [1, 11, 27]. Motor deficiencies may discourage children from participating in sport activities in the future [6]. McKenzie et al. [17] found that an increase in the level of basic skills of body control is essential for undertaking more advanced forms of activity. The opposite situation may reduce the motivation to develop a healthy lifestyle [18].

In some countries development and teaching gross motor skills are treated as a physical education priority [21].

It is the duty of Polish schools to organize appropriate conditions of teaching so that children are able to obtain the greatest benefits currently and in the future. The approach emphasizing gross motor skills provides to children an appreciation of their peers. This approach allows the building of a community and social capital in the broad sense, which encourages achievements and reveals the achievements and successes [23]. We use an educational model in which overcoming life and learning difficulties

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can be achieved by emphasizing mainly the development of personality in the broad sense, along with greater accentuation on development and learning of gross motor skills. An expression of great social importance of properly conducted education is that the schools, kindergartens and other educational institutions are obliged to create conditions of education for all students with learning difficulties, including those with special educational needs. The schools are responsible for proper preparation of teachers, organizing work and planning activities undertaken for student. Head teachers can ask PE teachers to conduct PE classes with first to third grade students. Such classes are usually conducted by integrated education teachers who also teach all the other subjects. Therefore, few students are likely to be taught by PE teachers. According to teachers, PE classes exert a considerable influence on conducting classes with older primary school students [3].

The knowledge about gross motor skills teaching outcomes in pedagogical activities of school would allow one to determine the importance of this process, and develop guidelines on creating programmes and conditions for development of modern education solutions.

This study obtained approval from the Senate Ethics Committee of the Józef Piłsudski University of Physical Education in Warsaw.

The cognitive aim of the study was to identify and analyse the impact of extracurricular physical education classes on the level of development of gross motor skills in children from the first grade of primary school.

The practical aim was to formulate guidelines on the introduction of priorities emphasizing the role of gross motor skills in physical education, especially in the first three years of primary school.

The following research questions were formulated:

What is the level of gross motor skills before introducing extracurricular classes?

What is the impact of extracurricular education classes on the level of gross motor skills?

Are standard physical education lessons sufficient for the development of gross motor skills in control group children?

## Material and methods

This paper presents a quasi-experiment evaluating the impact of extracurricular physical education classes on gross motor development. The experiment was performed within the "From fun to sport" project with an emphasis on gross motor elements. The aim of this project was to improve the physical fitness and motor skills of typically developing children of first grade students of primary school. The project focused on the youngest school group, i.e. the group that had the least chance of taking advantage of PE classes conducted by professional PE teachers. Another aim was to prepare children to participate in physical culture in the broad sense, with a particular emphasis on sport. Among specific objectives of the project were also developing self-confidence, overcoming fears and concerns, and arousing interest in performing various motor activities in children. There are no papers demonstrating that all project goals have been achieved.

One hundred and sixty primary schools from Warsaw participated in the "From fun to sport" project. Warsaw City Council, Department of Sports and Recreation and Bemowo district were the organizers of the project. A school and class were taken as an experimental group.

Children from the experimental group participated in regular 45-minute physical education classes conducted by a primary education teacher three times a week, and in an additional 45-minute lesson a week taught by a PE teacher with 6 years of professional experience. This physical activity programme was held on Wednesdays from 3.00 p.m. to 3.45 p.m. at a school gym. The intervention approach was direct instruction. Running, hopping and throwing games were played during these extracurricular PE classes. In total, 32 units (1440 min) were held. The programme was financed by the local government. Children from Primary School no. 341 in Warsaw, which was geographically the closest to the previous school, formed a control group. Children from this group attended three classes of physical education a week conducted by a primary integrated education teacher. Children from both groups had no contraindications to physical education and had no health or educational problems. All parents and guardians were informed about the gross motor skill research during the meeting at the beginning of a school year, and provided written consent for their children to participate in the study.

The model reference values to compare the rate of changes in gross motor skills were taken from the USA study. The TGMD-2 was normed on 1208 children from ten states. They were tested in 1997 and 1998 [28].

The method of pedagogical quasi-experiment and the technique of parallel groups were applied. Purposive sampling was employed in the study. The groups functioned and developed naturally in reality.

In both groups the tests were conducted at the beginning of the school year (at the end of September 2012 due to the first three weeks of children's adaptation to school conditions), and at the end of the school year (June 2013).

Initially 48 primary school age children from two selected schools were enrolled in the study: 24 in the experimental group (E) and 24 in the control group (C). The inclusion criteria comprised: no medical or pedagogical contraindications to participate in physical education classes, written consent of parents or guardians for children's participation in the study, and in the case of the

**Table 1.** Characteristics of the study groups: experimental and control

| | E | | C | |
|---|---|---|---|---|
| | Boys (n = 11) | Girls (n = 9) | Boys (n = 4) | Girls (n = 7) |
| | $\bar{x}$ ± SD | $\bar{x}$ ± SD | $\bar{x}$ ± SD | $\bar{x}$ ± SD |
| Age pretest [years] | 7.30 ± 0.25 | 7.19 ± 0.28 | 7.34 ± 0.23 | 7.24 ± 0.32 |
| Age posttest [years] | 8.01 ± 0.25 | 7.90 ± 0.28 | 7.95 ± 0.22 | 7.85 ± 0.32 |
| Body height pretest [cm] | 126.00 ± 6.66 | 126.33 ± 3.87 | 124.00 ± 4.90 | 130.14$^{A}$ ± 6.62 |
| Body height posttest [cm] | 131.50 ± 6.09 | 131.94 ± 3.96 | 130.38 ± 4.85 | 136.86 ± 8.09 |
| Body mass pretest [kg] | 25.91 ± 4.76 | 26.22 ± 5.43 | 22.50 ± 2.52 | 27.14 ± 7.69 |
| Body mass posttest [kg] | 27.75 ± 5.70 | 29.41 ± 6.08 | 25.55 ± 2.33 | 30.44$^{A}$ ± 9.39 |

Pretest (at the beginning of the school year), posttest (at the end of the school year), E – experimental group, C – control group, $^{A}$ – abnormal distribution.

experimental group voluntary attendance in extracurricular physical education classes. The criteria for exclusion from the study were lack or withdrawal of consent at any time of the research by parents or guardians. A minimum of 87.5% attendance was required (no more than 4 skipped lessons). Finally, 31 first-grade children from two classes participated in the study. Twenty children from Primary School no. 321 in Warsaw (11 boys and 9 girls) constituted the experimental group that had extracurricular activities. The control group consisted of 11 children (4 boys and 7 girls) from Primary School no. 341. Detailed characteristics of the participants are presented in Table 1.

The Test of Gross Motor Development-2 (TGMD-2) was used to assess children's gross motor skills (Ulrich 2000). Validity and reliability of the test were confirmed in an independent study (Cools et al. 2009).

The TGMD-2 battery of tests allowed evaluation of 12 skills divided into two subtests:

– Locomotion (run, gallop, hop, leap, horizontal jump, slide),
– Object control (striking a stationary ball, stationary dribble, catch, kick, overhand throw, underhand roll).

The TGMD-2 skills assessment is based on qualitative criteria. Therefore, for the use of the test the following were important: competence of the examiner, appropriate testing conditions, time required to collect data, testing procedures, and possible errors, both situational and derived from an examiner and participants' personalities. The examiner of children's skills was a person with 7 years of professional practice in conducting physical education in primary school who was trained and experienced in the use of the TGMD-2 test.

Each gross motor skill was analysed in terms of the degree of mastering its components. If the child performed correctly the skills component the observer marked 1 point, and if the child did not perform correctly the observer marked 0 on the scores form. Prior to accomplishing each task, the examiner demonstrated and verbally described the skill. The instructions were given according to the instructions included in the TGMD-2.

Then, participants performed 2 test trials under the examiner's supervision. The examiner totalled the scores of the 2 trials for each skill and each participant.

To evaluate the observation reliability all test trials were video recorded, and after about one month test recordings of six randomly selected participants were reassessed again. The correlation coefficient between the 2 observations was used as a reliability measure. The examiner correlation coefficient for all performance criteria of gross motor assessment was 0.83, and for locomotion and the object control was 0.82 each. The correlation coefficient of the subtest raw scores for locomotion and object control were 0.92, and 0.99, respectively. Taking into consideration the gross motor development quotient the correlation coefficient was 0.86.

The raw scores of both locomotion and object control subtests ranged from 0 to 48 points. In comparative analysis of relations between the test scores and children age standard scores were calculated according to the formulas established on the basis of the USA data [28]: locomotion $y = 24.77\ln(x) - 8.1432$ ($R^2 = 0.98$); object control in girls $y = 4.4725x + 2.8571$ ($R^2 = 0.99$); object control in boys $y = 26.236\ln(x) - 11.682$ ($R^2 = 0.98$).

In order to determine the gross motor development quotient (GMDQ) the sum of locomotion and object control raw scores was converted to a result on a scale from 46 to 160.

Statistical analysis was performed using the program SPSS 20. The Shapiro-Wilk test was applied to determine if the data distribution was normal. The significance of differences between groups was defined by Student's t-test (if data distribution was normal and there were no extreme values) or Mann–Whitney U test (if data were not normally distributed). The level of significance of $p < 0.05$ was used.

## Results

After one school year and completion of the project programme in the experimental group, in both girls and boys, mostly improvement of gross motor skills was observed, particularly in the object control where there were statistically significant differences.

Figure 1 shows results of the Locomotor and Object Control in girls and boys from the two study groups: experimental and control.

Table 2 similarly demonstrates data of GMDQ, locomotion and object control. In the pretest study, there were no significant differences between the experimental group and control group. In the posttest study, there were statistically significant differences in GMDQ ($\Delta$ boys = 11.86, $p = 0.032$; $\Delta$ girls = 13.1, $p = 0.036$) and object control ($\Delta$ boys = 10.27, $p = 0.045$; $\Delta$ girls = 7.02, $p = 0.042$).

Figure 2 presents the percentage of changes in locomotion and object control results in relation to the baseline values of the study groups. The greatest progress was made by girls in the experimental group (locomotion

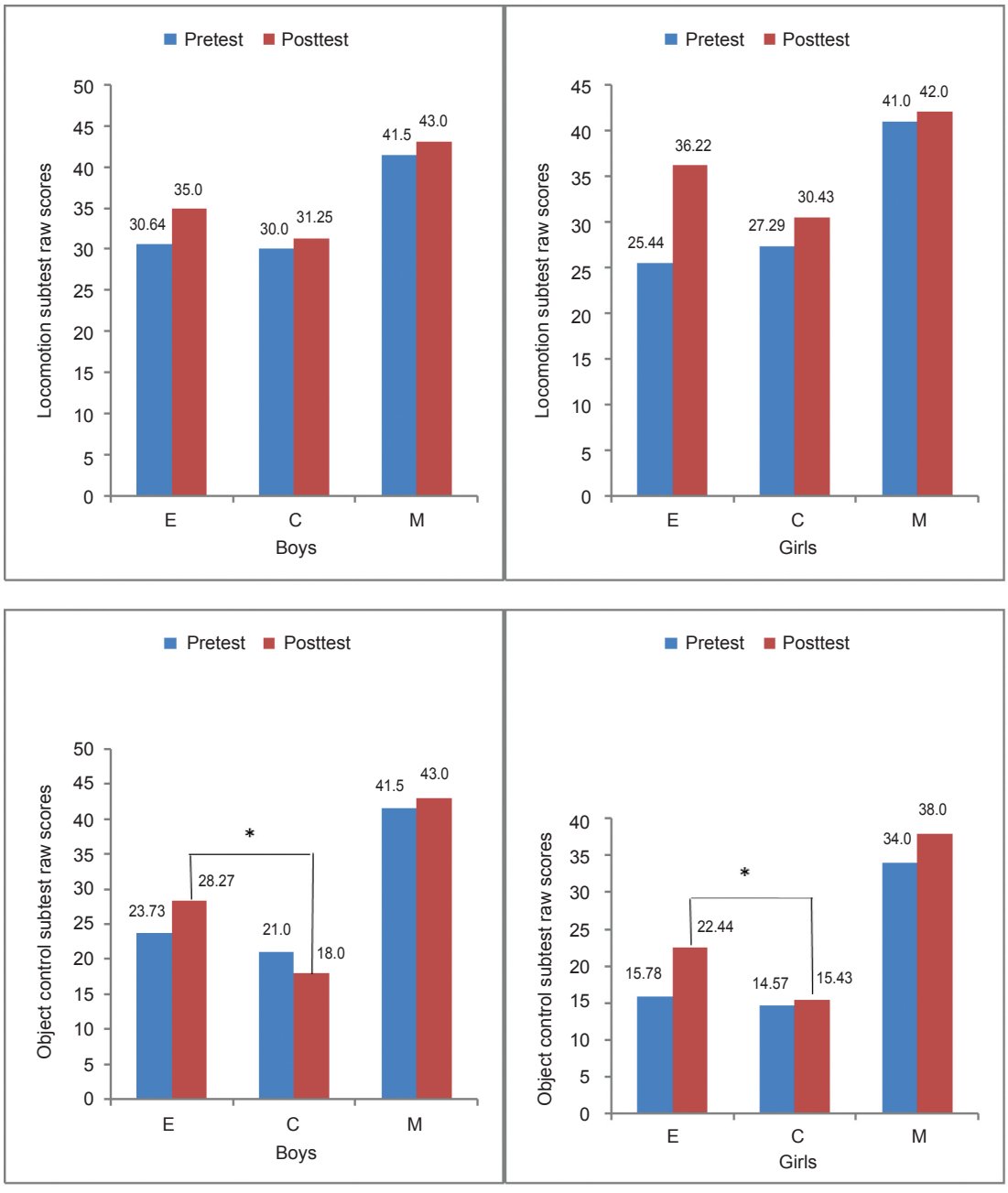



**Fig. 1.** Comparison of locomotion subtest raw scores obtained in pretest and posttest in boys and girls

* – $p < 0.05$, M – applied model of reference values (Ulrich 2000), E – experimental group, C – control group.

**Table 2.** Values of significance differences of Gross Motor Development Quotient, locomotion and object control subtests

| Test | Boys | | | | Girls | | | |
|---|---|---|---|---|---|---|---|---|
| | Pretest | | Posttest | | Pretest | | Posttest | |
| | Δ (E and C) | p | Δ (E and C) | p | Δ (E and C) | p | Δ (E and C) | p |
| GMDQ | 6.89 | 0.421 | 11.86 | 0.032* | –2.33 | 0.600 | 13.10 | 0.036* |
| Locomotion | 0.64 | 0.903 | 3.75 | 0.143 | –1.84 | 0.633 | 5.79 | 0.77 |
| Object control | 2.73 | 0.597 | 10.27 | 0.045* | 1.21 | 0.665 | 7.02 | 0.042* |

* – p< 0.05, E – experimental group, C – control group.

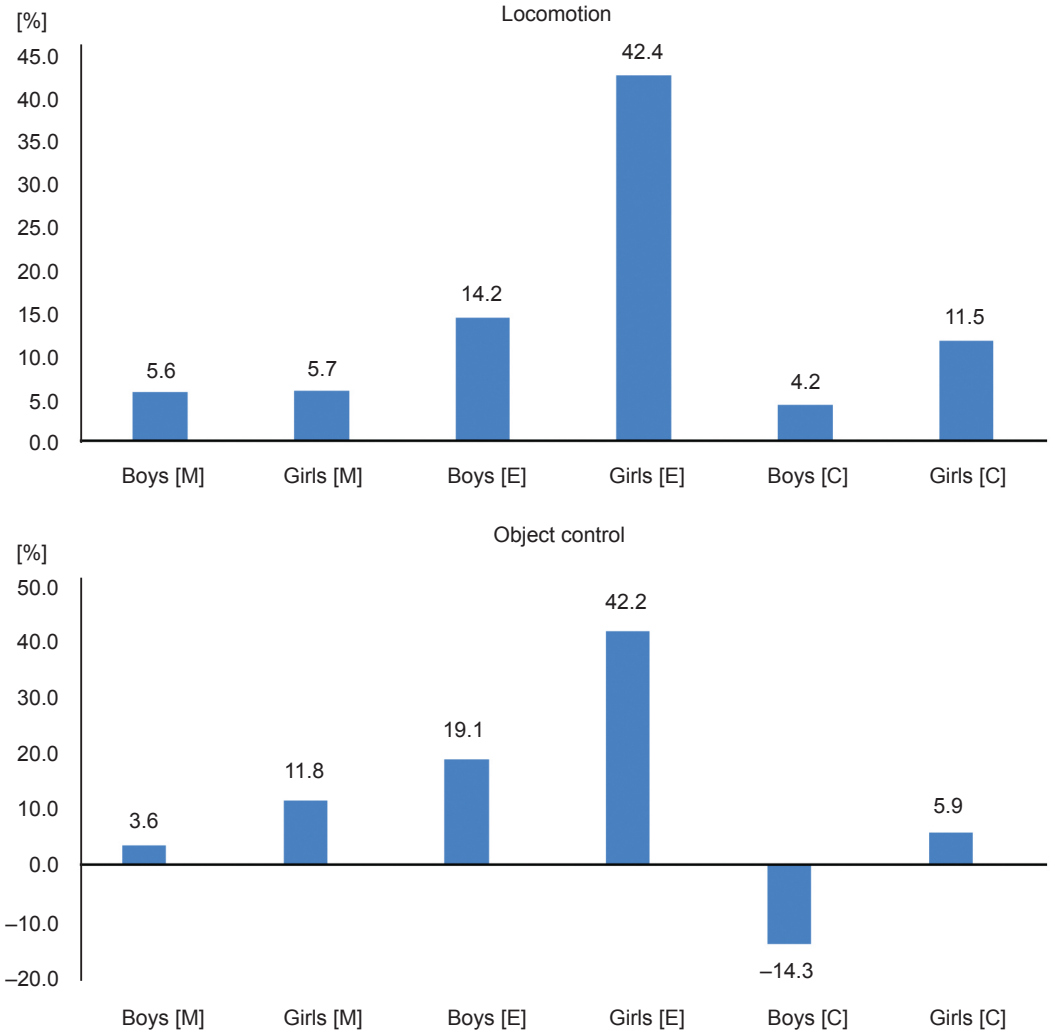



**Fig. 2.** Percentage of changes in locomotion and object control subtest results in relation to the baseline values of the study groups
M – applied model of reference values (Ulrich 2000), E – experimental group, C – control group.

– 42.4%; object control – 42.2%) and boys experimental group (locomotion – 14.2%; object control – 19.1%).

In terms of GMDQ only girls in the experimental group made progress (19.5%). The boys from the experimental group presented a very slight deterioration of the result (–0.4%). In the control group, deterioration of – 8.1% and – 5.4%, respectively, was recorded among boys and girls (Fig. 3).

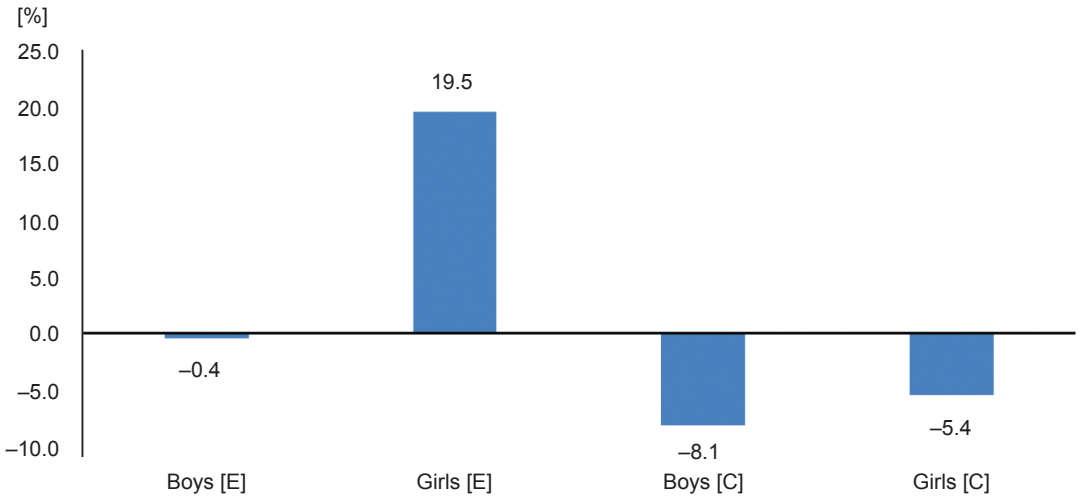



**Fig. 3.** Percentage of changes in Gross Motor Development Quotient values in relation to the baseline values of the study groups

E – experimental group, C – control group.

## Discussion

It is well documented that regular physical or extracurricular physical education classes have a positive effect on gross motor skills in children [2, 31]. However, the scale of such positive changes is not always provided. The results obtained in this study concerned the influence of an additional 45 minutes a week of physical education classes, which were oriented towards gross motor development, and evidenced an increase in gross motor skills level in children from the first grade of primary school. At the same time, this research confirmed a high percentage value of the proposed physical activity programme for children aged 7 to 10 years. The most important outcome of this study was the discovery that most of the children in the experimental group improved their scores more than it would result from age-associated changes in relation to the model of reference values [28].

There is no published research concerning the role and importance of gross motor skills in Polish children's development. Previous research conducted in Poland on a group of preschool children revealed a delay or lower level of gross motor skills in relation to the USA reference data [26]. Possible reasons for these differences, e.g. body build, sports or cultural traditions, differentiation of physical education programmes, were not analysed in that study. However, as demonstrated by the results of this study, children in Poland are able to accelerate their development of motor skills and gradually mitigate these differences, if an intervention programme is implemented.

Research on motor skills performed in other countries indicated the great importance of gross motor skills for the development of young children [8, 165].

The experience of some countries, which have adopted or defined physical education priorities in the form of supporting the development of gross motor skills in children, was very positive [4, 21]. Seven years after the Hong Kong government introduced a gross motor development programme a reduction in deficiencies in these skills was observed in subsequent studied generations of children in relation to their peers in the USA [4, 9, 10, 13].

The size of the experimental and control groups is a limitation of the present study.

It was no possible to ensure that both groups had precisely the same content of physical education, school condition or teacher characteristics (age, experience, motivation, etc.). Therefore, the research results cannot be fully generalized to other groups of children. However, the findings are in line with the results of other authors.

The present study should be continued on larger groups of participants of various age groups, and should include different forms of pedagogical interventions (for example educational intervention – preventive intervention – crisis intervention), focused on the development of gross motor skills as a primary school age priority. Other extracurricular programmes and compulsory physical education classes need to be analysed. Precise diagnosis of the level of gross motor skills in children is necessary to determine the level of possible deficiencies in this area. One way to improve the rather low levels of motor skills among Polish children could be to develop additional physical activity programmes or establish priority in physical activities designed for children to develop their gross motor skills.

## Conclusions

Conclusions based on the material analysis include:

1. Children from both experimental and control groups demonstrated significantly lower levels of motor skills than children in the USA.
2. A strong positive influence of extracurricular physical education classes on the level of gross motor skills was observed in children from the first grade of primary school, whereby they obtained a higher rate of increase in the level of motor skills in relation to their peers from the USA.
3. The development of gross motor skills in children from the first grade of primary school may be assisted by an additional hour of physical education.
4. Physical education classes proved to be insufficient for the development of gross motor skills of children from the control group, especially for boys in object control skills, and for both girls and boys in gross motor development quotient.

**Conflict of interest: Authors state no conflict of interest.**

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Received 20.03.2019
Accepted 12.09.2019

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