

# Impact of Physical Education Classes on Gross Motor Skills in Elementary School Children

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**Abstract** Gross motor skills allow for whole-body movement and thus require the use of the body's massive core muscles to carry out daily tasks like walking, jogging, and sitting up straight at a table. Several studies have outlined the pivotal role of gross motor skills in a child's development, encompassing physical health, cognitive progression, psycho-social well-being, and academic performance. The purpose of the current study was to examine how physical education classes affect primary school students' gross motor abilities. To provide a representative sample of this age range, 151 children from Tirana between the ages of 9 and 14 were randomly chosen for this study. Participants were subjected to a four-task evaluation prior to and after the academic year in order to gauge the effectiveness of the physical education program. The tasks included: 1. balancing backward, 2. hopping for height, 3. jumping sideways, and 4. moving sideways. The BMI scores of the participants were also measured. SPSS Statistics 26 software was employed to perform statistical analyses. The study's conclusions highlight the importance of physical education programs in a child's development of gross motor abilities, shedding light on their multifaceted influence. Findings point to the potential of interventions and tailored programs in enhancing motor skills among children, and their positive impact on children's growth and their overall well-being. This research will benefit PE teachers, health professionals, and policymakers to better address the physical and developmental needs of the younger generation.

**Keywords** Coordination, KTK Test Battery, Gross Motor Skills, Physical Education, Children

## 1. Introduction

Activities that demand the use of larger muscles of the body, such as shoulders, arms, pelvis, and thighs, as well as those that necessitate supporting weight with the upper limbs, are carried out following a time when general motor skill exercises are completed. A sufficient degree of coordination is crucial for children's development, also for their health and their academic success [1]. To function properly and have greater comprehension, motor skill perfection is required [2]. Scholars have attempted to identify potential factors that might negatively impact locomotor performance in young subjects and the implications that such deficiencies might present for them in later stages of life. The link between weight and the development of motor skills is explored by examining the association between motor coordination and body mass index (BMI) utilizing the correlation between the two [3]. Given that obesity scores impact coordination and motor skills, additional attention should be paid to these skills in obese children [4]. Obese boys and girls who are less physically fit are found to have poorer motor skills than their non-obese peers [5]. When doing tasks requiring the use of the hands and fingers, fine motor skills are used.

These skills enable the exact movement of small muscles. This integration is lifelong and crucial for the development of fine motor skills and performance over the academic year. Children begin to imitate handwriting gestures, self-dressing, and self-feeding, throughout the preschool stage. When exposed to these activities and given new practical exercises, many kids exhibit significant progress [6].

Motor competence is known to correlate positively with a variety of health-related outcomes throughout childhood and adolescence, including physical activity, physical fitness, happiness, and cognitive health. It also provides an extensive understanding of the connection between physical fitness, motor coordination, and other facets of a child's development [7]. Researchers have identified a strong link between young people's levels of perceived athletic competence and their participation in social activities. Those with coordination disorders tend to perceive themselves as less competent in a variety of categories and have less social support than control participants. Overall, they show poorer self-esteem and higher levels of anxiety than control groups [8, 9].

Motor coordination has also been studied from the perspective of its impact on academic performance. Data obtained suggest that participation in particular sports may have considerable effects on children's academic achievement. Although cardiorespiratory fitness is likely to mitigate these correlations, sports activities that involve more sophisticated motor skills, as well as individual sports participation, may be directly linked to academic success [10, 11]. In view of the considerable effect that motor skills have on children's overall well-being, a number of studies have underscored the need for a regular assessment of motor skills using standardized instruments as effective tools in aiding early development, targeted training, performance optimization, and injury prevention [12]. Körperkoordinationstest für Kinder (KTK), is reported to be a standardized and easy-to-administer assessment tool, frequently utilized by PE teachers and therapists in school and clinic settings to evaluate motor coordination skills of 5- to 14-year-old children [13, 14].

## 2. Objectives

The primary goal of the current study was to explore the effects of a physical education program on gross motor abilities among elementary school students.

## 3. Materials and Methods

Participants in the study were randomly chosen to ensure a representative sample of children within the 9-14 age group. A total of 151 children from the city of Tirana, aged 9-14 years, completed two sets of measurements, prior to and at the end of the school year respectively. During the year, the children were subjected to a different physical

education program, which included a five-to-seven-minute warm-up period involving exercises, stretching, and running. The main part was 25-30 min in duration, in which subjects sustained 60-80 HR Max, and was organized in the form of sports games like, basketball, volleyball, football and other recreational games. The session ended with a 5-8 min cool-down period of active or passive stretching, and breathing exercises. Before conducting the gross motor tests, the children underwent anthropometric measurements including assessments of body height, body weight, and BMI ( $\text{kg}/\text{m}^2$ ). These baseline measurements allowed for a more comprehensive evaluation of their physical development. KTK was used to measure gross motor coordination abilities. The battery comprises four distinct tasks: 1. balancing backward, 2. hopping for height, 3. jumping sideways, and 4. moving sideways.

The inclusion of anthropometric measurements alongside motor coordination testing allows for a comprehensive assessment of the children's physical development and their motor coordination skills, thus shedding light on the relationship between these aspects.

### 3.1. Statistical Analysis

IBM SPSS Statistics 26 was used for the statistical analyses. A combined descriptive and inferential approach was adopted to investigate pre- and post-scores associated with the dependent variables. Means of the dependent variables were compared in order to examine changes in these variables, and for the statistical evaluation of any possible training effects, t-tests were used. Summary tables with metrics for descriptive statistics, including mean, standard deviation, minimum, maximum, standard error of skew, standard error of kurtosis, and other pertinent measurements were drawn.

Also to present data distribution, visualization tools such as histograms and box plots were used. In terms of inferential statistics, normality tests were conducted to assess data distribution against a normal distribution. Additionally, research hypotheses were tested using t-tests to evaluate potential changes between pre and post-measurements for various parameters, including weight, height, body mass index, balance backward, hopping for height, jumping sideways, and moving sideways. Reliability was assessed through bivariate correlations between measurements.

## 4. Results

### 4.1. Body Mass Index

The BMI Boxplot for Pre and Post measurements is shown in Figure 1. BMI increased with an average of 0.6  $\text{kg}/\text{m}^2$  as shown in the Post measurement results. The pre-measurement findings show a 17.6 BMI value while the post-measurement data show an 18.2 BMI value. A

statistically significant difference between the two measures was found by the dependent t-test ( $t(114) = -4.31, p=0.002$ ).

#### 4.2. Balance Backwards

The scores from the first and second measurements in the balancing backwards tests were subjected to descriptive

statistical analysis. Figure 2's Box plots for both measurements show the minimum, maximum, and mean number of steps taken by the children who finished the balancing backwards test. Based on the findings of the balance backwards test ( $t(114) = -7.643, p=0.001$ ), it was concluded that there was a significant difference ( $p < 0.05$ ) between the two measurements regarding children's development of balance with nine steps.

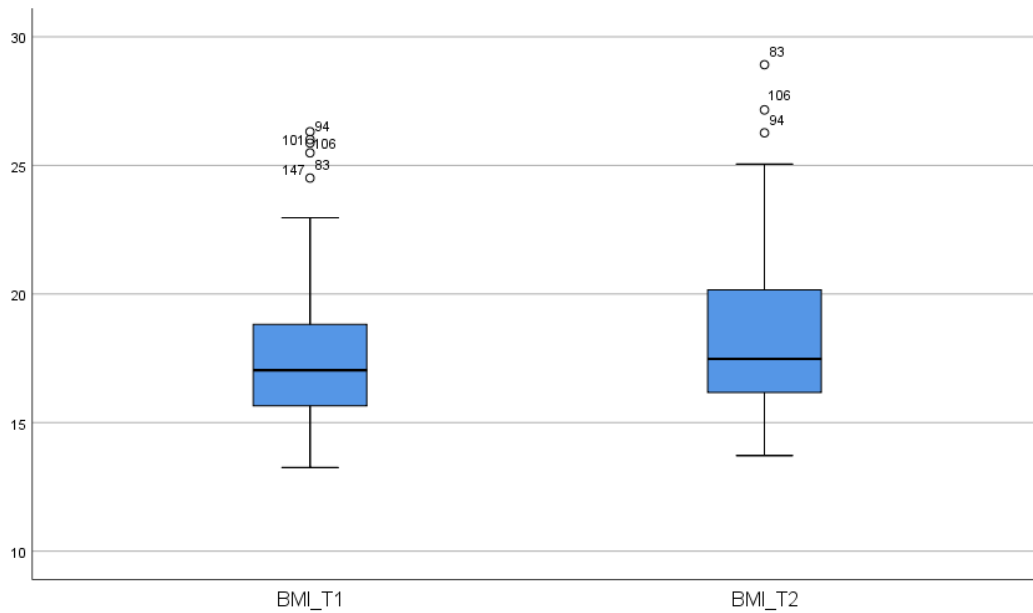


Figure 1. BMI Box-plot for pre and post scores

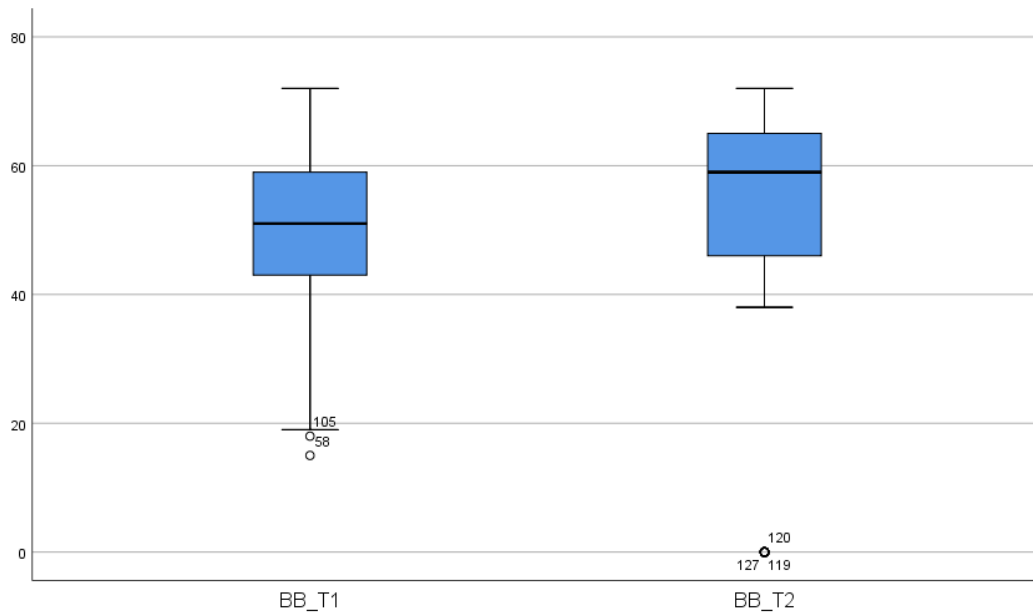


Figure 2. Balance Box-plot for pre and post scores

### 4.3. Hopping for Height

To compare the variables of the Pre and Post scores, t-tests were used, using the one-legged leap in particular. The Pre and Post values of the 'Hopping for height' test were subjected to descriptive statistical analysis, as shown in Figure 3. Notably, an increase from 3.3 cm (from  $53.99 \pm 9.96$ ) cm in the Pre-Test to  $56.69 \pm 13.24$  cm in the Post-Test was observed. To statistically evaluate the difference between these two measurements, a dependent t-test was performed. A significant difference ( $p < 0.05$ ) was seen between the two measurements, according to the dependent t-test results ( $t(131) = -3.659, p < 0.0005$ ).

### 4.4. Jumping Sideways

Figure 4 displays a box plot for both measurements of the children who participated in the test. For the "jumping sideways" test, t-tests were used to compare the "Pre" and "Post" results. The results from the descriptive statistical analyses speak for a positive increase in the 'jumping sideways' parameter from Pre to Post measurements. A notable improvement in the 'jumping sideways' test performance is shown in the 'Post' assessment. The value of the parameter shifts from  $64.78 \pm 9.77$  at Pre to  $72.81 \pm 9.04$  at 'Post.' The dependent t-test findings ( $t(123) = -10.436, p=0.001$ ) indicate that the two measures vary significantly ( $p < 0.05$ ).

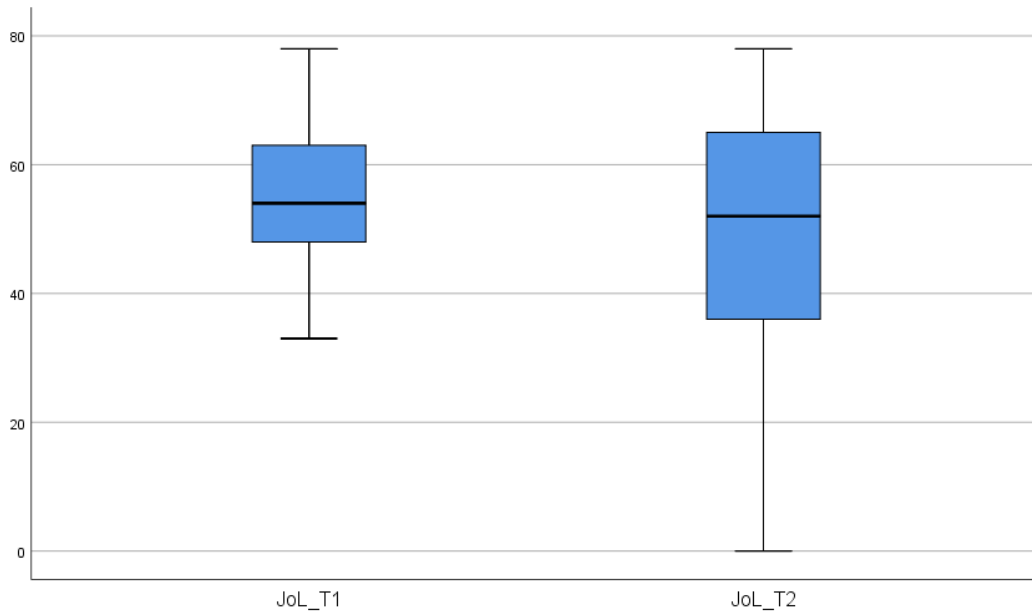


Figure 3. Hopping for height Box-plot for pre and post scores

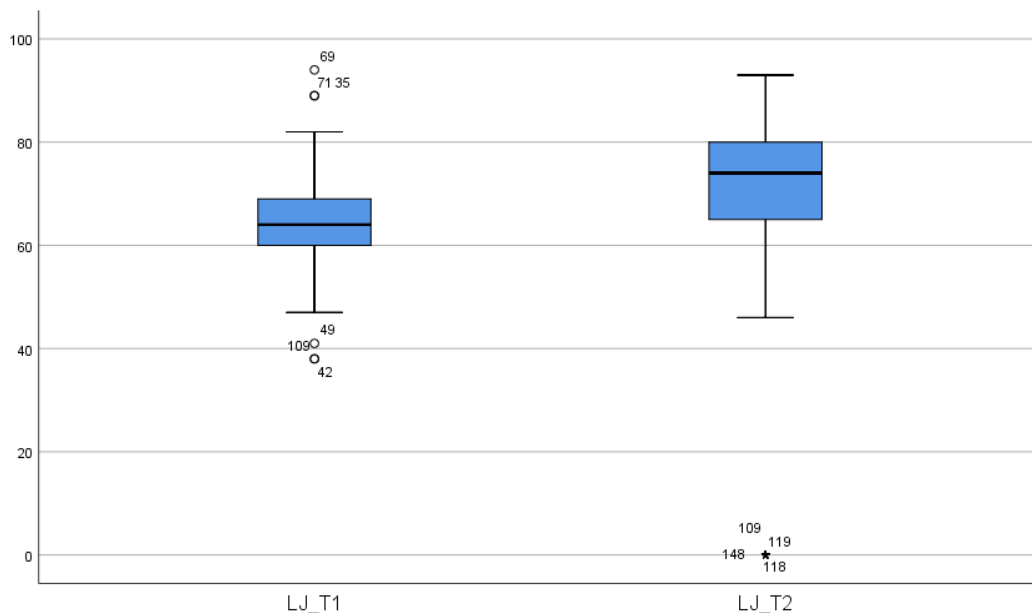
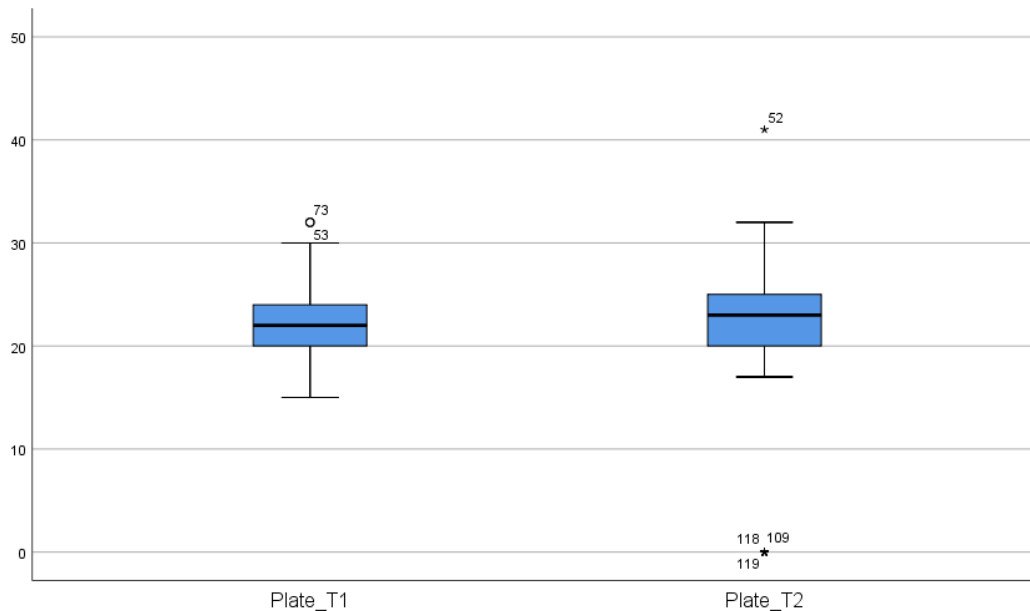


Figure 4. Jumping sideways Box-plot for pre and post scores



**Figure 5.** Moving sideways Box-plot for pre and post scores

#### 4.5. Moving Sideways

In the second measurement, subjects displayed values as low as 12 and as high as 28 displacements (see Figure 5). The variable varies from 14 movements  $\pm 2.65$  at Pre to 22 movements  $\pm 2.01$  at the Post, indicating an increase. The conclusion that children's lower limbs coordination develops significantly with 6 additional movements is based on the results of the dependent t-test ( $t(114) = -16.991, p=0.002$ ). These results indicate a significant difference between Pre and Post measurements ( $p < 0.05$ ).

### 5. Discussion

This study highlighted the importance of motor coordination in a child's development, emphasizing its role in physical health, cognitive development, psychosocial well-being, and academic performance. The findings are in line with the existing body of research that suggests that interventions and programs aimed at improving motor competence in children can have a positive impact on various aspects of their development and well-being. Early detection of reduced motor coordination or increased percentage of body fat is crucial for the development of a healthy lifestyle later in adulthood. Therefore, education and health programs aimed at improving motor competency development and physical activity participation are advised [15, 16]. The use of standardized assessment tools, such as KTK, proved instrumental in understanding and assessing motor coordination in children. The KTK's use within this study highlights the importance of employing standardized and universally accepted assessment tools in research and clinical practice. Such tools not only facilitate reliable and comparable data

collection but also enable the cross-referencing of results with established norms. This, in turn, helps practitioners and researchers gain a deeper understanding of a child's motor coordination relative to their peers. Additionally, the KTK's widespread acceptance indicates its suitability for assessing motor coordination in children, serving as a practical resource for professionals working with pediatric populations. In essence, the incorporation of the KTK battery underscores the rigorous approach taken in this study to assess and analyze motor coordination in children. It emphasizes the broader significance of using standardized tools, both in research and clinical settings, to better comprehend the nuances of child development and inform strategies for intervention and improvement in motor coordination. Regarding the "Balance backwards" test, when comparing the measures taken during the Pre and Post-test, the findings of the descriptive statistical analysis demonstrated a favorable development of the balance. There was a noticeable increase in the balance beam post-test scores. These results are supported also by a study that investigated the PA as a correlate of stability competence [17]. The "Hopping for height" test data results showed that the extra-curricular physical education (PE) classes effectively improved this parameter. These findings underscore the positive impact of the extra-curricular PE classes on the participants' performance in the "Hopping for height" test, reflecting an enhancement in their physical abilities. Also, the "Jumping Sideways" test data results demonstrate that subjects have made significant progress in their lower limb coordination, as seen by the 9.3 jump improvement. These outcomes highlight an enhancement in explosive power and support the conclusion the children's lower limb coordination has significantly improved, as seen by the rise in the number of jumps. On the other side result data of the "Moving sideways" test

shows a favorable development of this task according to the comparison of the variables Pre and Post measurements with the T-tests for this parameters test obtained from the descriptive statistical analyses. All the above-mentioned data results are also supported by several studies [18-21], indicating that PA helps young children develop their motor skills, but as kids grow older, participation in PA becomes increasingly dependent on motor ability. This study places a strong emphasis on the importance of motor coordination in child development. It underscores its role in various facets of children's lives, including physical health, cognitive growth, psychosocial well-being, and academic performance. Furthermore, this study sheds light on the critical interplay between extra-curricular PE activities and motor coordination. The findings emphasize that motor coordination is not an isolated aspect of a child's development but rather an integral component influencing their overall well-being. Notably, improvements in motor coordination may contribute to a child's wellbeing, allowing them to engage more actively in physical activities and sports. This, in turn, can foster healthier habits and combat the growing concerns of sedentary lifestyles and childhood obesity. In addition, the cognitive benefits associated with enhanced motor skills, including improved concentration, problem-solving abilities, and spatial awareness, are essential for academic success. These findings provide valuable insights for educators, health professionals, and policymakers striving to support the physical and developmental needs of children.

## 6. Conclusions

Based on the results we can conclude that there was an improvement in general gross motor skills after one year of monitoring these parameters in elementary school children, offering a clear picture of how these skills developed over the course of one academic year. The average height, weight, and body mass index values have also clearly increased. Physical education teachers—not general teachers—need to make professional efforts and intervene in the physical education classroom, according to our analysis of the data from this monitoring study. The observed increase in performance on the balance backward test is a promising indicator of the children's enhanced balance abilities. This improvement of 9 steps outlines significant progress in their motor coordination skills over the course of the study. Such advancements in motor coordination are not only important for physical health but can also have positive implications for their overall well-being and participation in physical activities. Moreover, this study's findings suggest that the interventions or activities undertaken during the academic year may have contributed to this positive development in balance. Future initiatives and tactics targeted at improving kids' motor skills and coordination may benefit greatly from an understanding of the elements that contributed to this progress. It is worth noting that the use of descriptive

statistical analyses and the dependent t-test allowed for a robust evaluation of the data, reinforcing the credibility of these findings. These results may have important implications for educators, physical therapists, and researchers interested in promoting motor skill development in children. Further research and longitudinal studies could provide a more comprehensive understanding of the long-term effects of such interventions on children's motor coordination and physical well-being. findings underscore the transformative potential of interventions and programs tailored to enhance motor competence among children, fostering a positive impact on diverse facets of their growth and overall well-being. The early identification of deficiencies such as poor motor coordination abilities or increased body mass percentages takes on paramount significance, serving as a cornerstone for instilling and nurturing healthy lifestyles in children. As such, this research offers a wellspring of insights that can guide educators, health professionals, and policymakers in their dedicated efforts to address the physical and developmental needs of the younger generation.

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