

## Assessing the impact of a physical education project based on games approach on the actual motor competence of primary school children

FRANCESCO SGRO<sup>1</sup>, ANTONELLA QUINTO<sup>2</sup>, FABIANA PLATANIA<sup>3</sup>, MARIO LIPOMA<sup>4</sup>  
<sup>1,2,3,4</sup>Faculty of Human and Society Sciences, University of Enna “Kore” ITALY

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### Abstract.

The Italian project “Sport di Classe” is supported and implemented at national level by several organizations for promoting physical education and physical activity in the primary schools. The aim of this research was to examine the effect of the project on the development of fundamental motor skills by taking into account the level of motion in extra-time activities of the sampled participants and their gender. The research involves 100 children (57 males and 43 females; mean age: 10 years old). A proxy-report version of the CLASS questionnaires was used to estimate how children spent their extra-school time. According to these data, children were grouped into two levels of motion (i.e., High and Low) and, for each group by gender, paired-samples t-test was performed for assessing the actual motor competence developmental level pre- and post-project. The males who have been included in the low level of motion group had a significant improvement in locomotion and in gross-motor development quotient scores (most-likely and very likely positive effect, respectively). A contrary effect it was estimated for the females: only the girls included in the high-level motion group showed significant and very likely positive effect of the treatment in their locomotion scores. These results highlight the effect of the analysed physical education project, although the relative positive results on the selected participants is not sufficient to overcome the problems about the worsening in children’s FMS that the literature always underlines.

**Keywords:** Test of Gross Motor Development; CLASS questionnaire; teaching methods; extra-school activities; teaching-learning processes.

### Introduction

It is well known that the fundamental motor skills (FMS) is related with the physical activity and the sport practice. For this reason, in 1998, the Centers for Disease Control and Prevention (CDC) Division of Nutrition and Physical Activity organized a workshop where the future directives of the research in these fields were determined. Particularly, the importance of motor development and its impact on the physical activity were regarded as the focus point of the research (Logan et al., 2015; Fulton et al., 2001). In this respect, some authors hypothesized that a greater commitment in physical activity is linked with a good level of FMS (Clark & Metcalfe, 2002; Seefeldt, 1980; Stodden et al., 2008) and that a child skilled in physical activities will be more active people as well (Clark, 2005). The importance of FMS is also supported by the large amount of studies that investigate several aspects related to the teaching-learning process, such as the usefulness of several and various assessment methods (Sgrò, Nicolosi, Schembri, Pavone, & Lipoma, 2015; Sgrò, Quinto, Pignato, & Lipoma, 2016; Sgrò, Mango, Pignato, Schembri, Licari, & Lipoma, 2017; Sgrò, Pignato, & Lipoma, 2018).

However, recently data provided by the European Commission outlined as almost everywhere in Europe children fail to meet the recommended 60-min of moderate to vigorous physical activity everyday (WHO, 2018). Several reasons are indicated as the causes of this issue: time spent playing videogames, low availability of physical activity and sport fields, and low level of impact of physical and sport education process during school time. On the contrary, the school is widely recognized as an important setting for supporting the skills, knowledge and behaviours oriented to physical activity and sport across lifespan. In this respect, physical education (PE) lessons require high-quality teaching-learning methods, more lessons per week and a strong relationship with extra-school physical activity and sports clubs for providing additional opportunities.

In Italy, as well as in other European countries, physical education lessons in primary school level are not assigned to well-trained teachers, are not regularly, and the effect of such lessons on the development of adequate FMS level is significantly limited (Sgrò, et al. 2016; Sgrò, Quinto, Messina, Pignato, & Lipoma, 2017). Recently, for overcoming the aforementioned issues, a physical education project has been supported and implemented by the Italian Ministry of Education, University and Research and the Italian National Olympics Committee in the Year 4 and Year 5 of Italian primary schools. Anyway, for the best of authors’ knowledge, unit now no scientific analysis has been performed for measuring the impact of that project on the development of FMS in Italian primary school students. So, by considering that similar initiatives can be implemented in the

further years as well as in other European countries, the aim of this study was to examine the effect of aforementioned project on the actual motor competence of the students who attended the related physical education and sport lessons by taking into account the level of motion in extra-time activities of the sampled participants and their gender.

## Methods

### *Participants and procedures*

The participants of this study were sampled from a primary school of a city located in the South of Italy. The participants were 100: male: 57; female:43; mean age:10 years old; mean height: 1.40 m; mean weight: 38.05 Kg. The participants were involved in a physical education curriculum that will be described in the following sections of this manuscript. The project was administered for 5 months and the levels of actual motor competences were verified pre- and post-project' teaching activities. The assessment procedures were performed at the gym of the school, where almost four skilled operators met the participants. Overall, the assessment period was along six days. For each day, in order to guarantee valid and reliable assessment procedures, the participants were divided in smallest group (i.e., five children per group). Anthropometric measures were carried out from the same operator for all participants by means of a wall-mounted meter for the height and an electronic weighing scales for the weight; these measures were used to estimate the Body Mass Index (BMI) as  $\text{Kg/m}^2$  of each child.

### *Actual motor competence assessment*

Gross-motor developmental level was measured by means of the Test of Gross-Motor Development (TGMD) (Ulrich, 1985). TGMD is composed by 12-item test divided into locomotor (run, gallop, hop, leap, standing horizontal jump, slide) and object control (strike, stationary ball bounce, catch, kick, overhand throw) subtests. Three to four skill criteria characterized each item and the operators have to identify if a child mastery or not each item's criteria. For each item, the participants performed three trials; before the assessment began, participants were involved in a low-intensity warm-up program for ten minutes. For each trial, the raw score for locomotor subtest ranges from 0 to 26, while the raw score for object control subtest ranges from 0 to 19. The raw scores of each participant was converted to the standard score for each subtest, separately, according to the age of each child. Next, the standard scores have been used to estimate the Gross Motor Development Quotient (GMDQ). The GMDQ was used to explain the level of actual motor competence of the child according to the normative data provided within TGMD (i.e., very low, low, under the mean, mean, over the mean, high, very high). In the current research, four operators were involved in the assessment of gross-motor development by means of TGMD. The operators followed the execution of each item in the gym and they video-recorded the performance of each child. Then, the evaluation of each trial was performed by each operator, separately, by means of the software Longomatch (LongoMatch, Ver. 0.20.8, <http://longomatch.org>) that accounts for several procedures (i.e., slow-motion, move the video forward and backwards frame-per-frame) useful for providing valid and reliable evaluation of the participants' performance. The inter-raters reliability ranged from 0.87 for locomotor subtest to 0.91 for object control subtest.

### *Children's Leisure Activities Study Survey (CLASS)*

CLASS is a questionnaire used to investigate the children's extra-school daily routine in terms of physical and sport activities (i.e., 30 items like dance, tennis, soccer, to ride a bike, etc.) and recreational activities (i.e., 14 items like playing a musical instrument) (Telford, Salmon, Jolley, & Crawford, 2005). For each activity, it is necessary to report the frequency (how many times from Monday to Friday and how many times on weekend) and the total time spent by the child in these activities (minutes or total hours from Monday to Friday and from Saturday to Sunday). The version of CLASS used in this study was the proxy-report, since the parents filled the questionnaire according to the activities performed by their child during the aforementioned periods. According to cultural and geographical location of the participants engaged in this study, some physical activities were selected and grouped together into three categories with homogeneous characteristics: sport, physical activity, and leisure. This procedure agreed with the one used in previous studies (Howley, 2001; Bush, et al., 2008). Moreover, for overcoming statistical problem related to a lot of structural zeroes obtained for many activities, the next step was to commute the time spent for each of the aforementioned three categories in dichotomous variables: a) from 0 to 120 minutes; b) more than 120 minutes. Finally, two levels of motion were defined according to the obtained time: a) Low Level of Motion (LLoM): participants were included in this category if their physical activity and sport time were from 0 to 120 minutes; b) High Level of Motion (HLoM): participants were included in this category if their physical activity and sport time were more than 120 minutes;

### *The Italian project "Sport di Classe"*

"Sport di Classe" (SdC) is a physical education project that promotes physical activity and the educational values of sport as a means of growth of individual and collective expression in the Italian primary school. It requires the involvement of a specialized expert in physical education, called "school sport tutor", who is appropriate trained for the project and works alongside the teacher for one hour a week, collaborating in planning and implementing motor activities. As regard to the teaching-learning activities considered in this study, the tutor developed a teaching plan following the Italian National Guidelines for the development of the curriculum of physical education in primary school and he has carried out PE lessons based on games activities.

These lessons included team and individual games and they differ from the sport-based training approach because the rules of the games are not codified, they do not cause early selection neither specialization, and small-sided games and circuit were used as prominent teaching approach. Circuits have been developed using available tools, such as cones, mats, over, balls, obstacles, and rope, while SSG was used following the indications provided by Sgrò and colleagues (2018). The participants involved in this project were year 9 to 10 students and they followed the treatment for twenty weeks during the last school's year.

#### Data analysis

First, data related to motor competence were checked for verifying whether they were normally distributed or accounted for some univariate outliers. Then, according to the level of motion and gender, student's t tests for paired samples were conducted for verifying if exist a significant effect of the SdC project on the level of actual motor competence. If significant effect was found, the size of that effect was established by means of the non-clinical magnitude-based inference method (Hopkins, Marshall, Batterham, & Hanin, 2009). The interpretation of the effects in a negative, trivial, or positive practical sense on the dependent variables (i.e., Locomotor score, Object control score, and GMDQ) was based on the following thresholds: <0.5 % most unlikely; 0.5-5% very unlikely; 5-25% unlikely; 25-75% possibly; 75-95% likely; 95-99.5% very likely; and >99.5% most likely (Batterham & Hopkins, 2006). For each significant effect, we reported the t-value (*t*), the degrees of freedom (*df*), p-value, 90% confidence limits (CI90%), and the practical inference true effect, as suggested by Hopkins and colleagues (2009). The analyses were conducted using SPSS 20 and the alpha level was set to 0.05 in all tests.

#### Results

Data screening revealed thirteen subjects were univariate outlier, so their data were discarded from further analysis. Because no other violations were verified, parametric analyses were carried out. Table 1 described the anthropometric characteristics of the children according to their level of motion.

	Low Level of Motion [n=48]		High Level of Motion [n=39]	
	M	SD	M	SD
Age (year)	10.20	0.61	10.08	0.66
Height (m)	1.39	0.78	1.41	0.80
Weight (kg)	36.04	11.65	39.20	10.36
BMI (kg/m <sup>2</sup> )	1.82	0.43	1.94	0.41

The further results are presented by following the analysis according to the participants' level of motion and, for each level, to participants' gender.

#### Participants with low level of motion

By considering the overall sample classified in the low level of motion, no significant differences were noted between the score pre- and post-project for the three parameters considered as proxy of the actual level of motor competence. If the gender was used as factor, significant effect of the lessons on motor competence was identified only for the male. In detail, significant differences were noted for:

- ) locomotor score ( $t = 3.71$ ,  $df = 23$ ,  $p = 0.001$ , 90% confidence limits 2.0 to 5.4, most likely): the score related to these abilities was higher in the post- than in pre-lessons assessment;
  - ) GMDQ ( $t = 2.10$ ,  $df = 23$ ,  $p = 0.046$ , 90% confidence limits 0.4 to 3.8, likely): the score used for quantifying the overall level of gross-motor skills development was higher in the post- than in pre-lessons assessment;
- The images in Figure n.1 show the impact of the treatment according to the GMDQ's aforementioned levels.

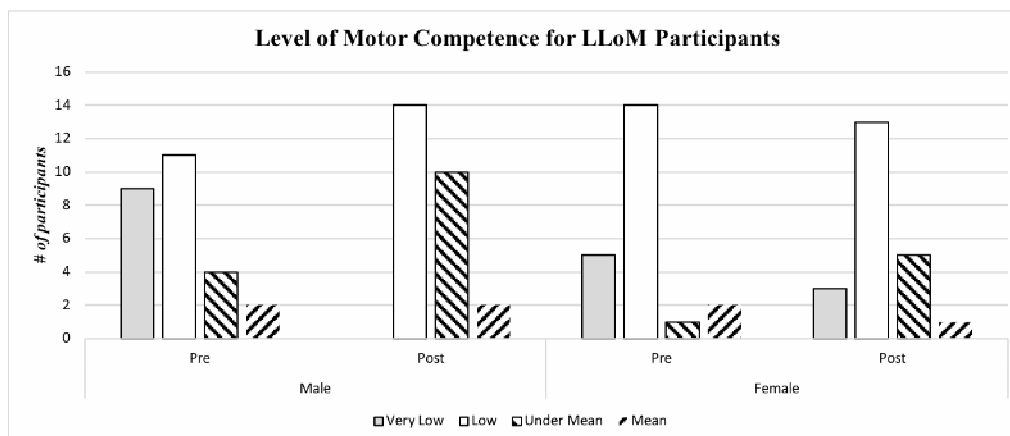


Figure 1 – GMDQ level's in low level of motion participants (LLoM) pre- and post-lessons  
Participants with high level of motion

By considering the overall sample classified in the high level of motion, significant differences were noted between the score pre- and post-lessons for the following parameters:

-) locomotor score ( $t= 3.72$ ,  $df= 25$ ,  $p=0.001$ , 90% confidence limits 2.0 to 5.4, most likely): the score related to these abilities was higher in the post- than in pre-lessons assessment;

-) GMDQ ( $t= 2.39$ ,  $df=25$ ,  $p=0.025$ , 90% confidence limits 0.7 to 4.1, very likely): the score used for quantifying the overall level of gross-motor skills development was higher in the post- than in pre-lessons assessment;

If the gender was used as factor, significant effect of the teaching-learning project on motor competence was identified only for the female. In detail, significant differences were noted for:

-) locomotor score ( $t= 3.30$ ,  $df= 11$ ,  $p=0.007$ , 90% confidence limits 1.5 to 5.1, very likely): the score related to these abilities was higher in the post- than in pre-lessons assessment;

The images in Figure n.2 show the impact of the treatment according to the GMDQ's aforementioned levels.

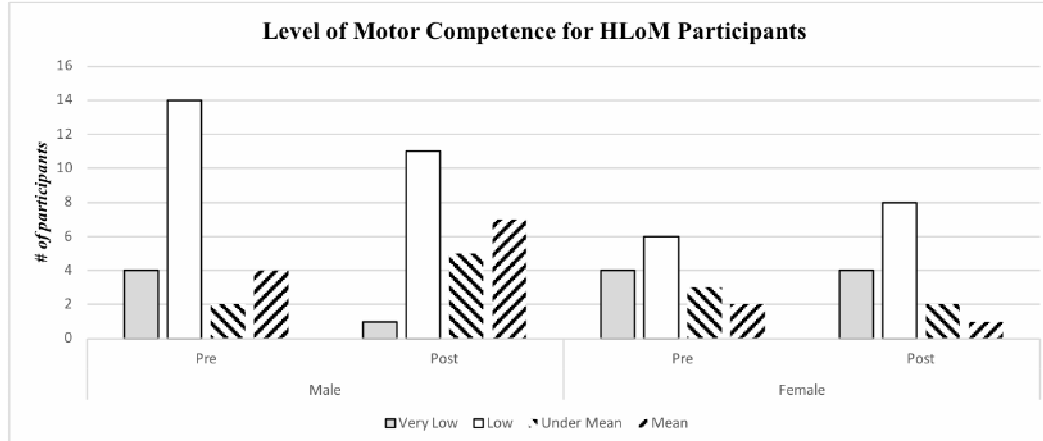


Figure 2 – GMDQ level's in high level of motion participants (HLoM) pre- and post-lessons

## Discussion and conclusion

The purpose of this study was to evaluate whether the project “Sport di Classe” had an impact on the FMS development of Italian children according to their level of motion and gender. Overall, the current results highlighted statistically significant positive differences in locomotion scores and GMDQ for the males. Girls showed a significant improvement only in locomotion scores. No significant differences were found in object control scores. These results are in partial agreement with previous similar studies which have shown that male are more skilled than females. (Barnett et al., 2011; Goodway et al., 2010; Griffiths & Billard, 2013; Valentini et al., 2016; Sgrò et al. 2017). Other studies that have addressed the effect of physical activity interventions on fundamental movement skills underlined an improvement of such skills (Brusseau, et al., 2016). Bryant and colleagues (2016) found that one day per week of physical education protocol performed by a class of Year 4 and Year 5 (experimental group) increased significantly mastery of fundamental movement skills, pedometer step and physical self-perception in comparison with a peer-age class enrolled in a game-based physical education process (control group). As regard to the evidences of the CLASS questionnaire and their relationship with the scores obtained in the TGMD, the current result show that the males, who have been included in the Low Level of Motion group (LLoM) had an improvement more significant than the ones of the High Level of Motion (HLoM) group both in locomotion and in GMDQ scores. A contrary effect it was estimated for the females: only the girls classified in the HLoM were affected by a significant and very likely positive effect of the treatment in their locomotion scores. In line with these results, the impact of the SdC project seems to be different according to gender, level of motion, and skills typologies and this evidence need to be considered for developing effective curriculum and teaching strategy.

However, the overall level of gross motor development remains under the mean provided by Ulrich's normative data both in the assessment performed before and after the PE lessons, as shown in the figures 1 and 2. The result agreed with previous studies (Hardy, et al., 2012). FMSs development should be a key strategy in childhood interventions aiming to promote long-term physical activity, especially in primary school. Indeed, an appropriate development of FMS can affect the extent to which abilities are really carried out, and this could affect the potential level of activity achieved during the educational physical activities as well (Fairclough e Stratton, 2005). For this reason, the expectation is that more skilled children are more active than children less experienced. In fact, in Hardy and colleagues' analysis, low scores in object control and in locomotor abilities were related to inactive subjects. In a review written by Logan and colleagues (2015), the studies examined found positive relationships between FMS and physical activity, except for the study developed by Erwin and Castelli (2008). However, although there is an increased number of evidences about the importance of the FMS and its link with the physical and psychosocial development of the children (Logan et al., 2012; SHAPE America, 2014), the literature always underlines a worsening in these abilities among children and adolescents (O'Brien et al., 2016). The most disturbing feature is the alert that, over the generations, the worsening trend of the overall motor performance capacity indices is change in anticipation respect the age. So, “in accordance with

the trends identified by Dordel (2000), as the decades passed, there is a lowering of the critical age where the children motor performances taking negatives features in respect with the past standard values" (Filippone, et al., 2007; Sgrò, et al., 2017). It is possible to assume that this worsening, in light of the relationship between physical activity and FMS, is due at the failure satisfy of the physical activity guidelines by the children and adolescents. In particular, these new guidelines recommend accumulating at least 60 minutes of MVPA each day for children and adolescent school aged (Tremblay et al., 2011; US Department of Health and Human Services, 2008; WHO, 2010). In this respect, some researches underlined that children spend most of their sedentary day watching tv or playing with videogames (Tremblay et al., 2011) and they spend less than 5% of the day in MVPA (Basterfield, et al., 2011; Pate et al., 2004). The current results are in line with the aforementioned analysis and they confirm as a spot-check protocol of physical activity is not sufficient to improve the FMS developmental level to an adequate score. Furthermore, it was verified as the development of FMS needs to be supported by means physical education process really based on students' motor competence and it needs to account for the students' gender and level of motion or sport history. However, the current results are affected by some limitations, such as the low sample size and the lack of any elements useful for verifying the effect of the project on cognitive and social-relationship domains of learning. These elements need to be strongly considered for planning new studies with aims strictly related to the ones addressed in this study.

Since, the key points resulted from the current study and useful for the practitioners are:

- 1) the low level of FMS development remains a critical issue that needs to be faced by all the stakeholders involved in the educational planning;
- 2) the effect of the analysed physical education lessons, although the relative positive results on the selected participants, is not sufficient to overcome the aforementioned problems and to establish a heterogeneous impact for supporting a healthy lifestyle across the lifespan;
- 3) physical education aims can be reached if they are supported, also in primary school, by effective teaching-learning curriculum based on well-known teaching strategies such as game-centred and tactical approach.

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#### **Author Contributions**

Francesco Sgrò was the lead researcher, designing, analyzing the data and writing the paper. Antonella Quinto and Fabiana Platania J. were involved with the collecting and analysis of the data and writing of the paper. Mario Lipoma was involved with the study design and writing of the paper.

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