



Motor activity and academic achievement

The importance of movement from kindergarten to primary schools

Attività motoria e successo scolastico

Importanza del movimento dalla Scuola dell'Infanzia alla Primaria

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ABSTRACT

Physical activity is not always performed regularly, school disciplines based on verbal language are often preferred in favour of reading, writing and counting, and students sacrifice hours dedicated to game and movement. It is considered – wrongly – that motor education has a subordinate role compared to the other subjects included in the curriculum. Actually the body has a very important influence on the general growth of the child, also on cognitive functioning. Early years of life are a window of opportunities to encourage, promote and optimize motor, intellectual and social development, on which the academic achievement will depend on, later. There is a growing interest in the relationship between movement and school performance, studies have been conducted at international level to verify the positive combination. The purpose of this article is to analyze some research to confirm the relationship between movement and academic achievement in children from 3 to 10 years. A total of 16 studies were reported, 6 referring to the Kindergarten and 10 referring to the Primary School.

L'attività motoria non sempre viene svolta in modo regolare nelle scuole, spesso si prediligono le discipline scolastiche basate sul linguaggio verbale e si opta a sacrificare ore dedicate al gioco e al movimento a vantaggio del leggere, scrivere e far di conto. Si ritiene – erroneamente – che l'educazione motoria abbia un ruolo subalterno rispetto alle altre materie previste nei piani di studio. Il corpo, in realtà, ha un'influenza molto importante sulla crescita generale del bambino, anche sul cognitivo. I primi anni di vita sono una finestra di opportunità per spronare, favorire e ottimizzare lo sviluppo motorio, intellettuale e sociale, da cui dipenderà successivamente il successo scolastico. È cresciuto l'interesse sulla relazione tra movimento e prestazioni scolastiche, sono stati condotti degli studi a livello internazionale per verificarne il positivo connubio. Lo scopo di questo articolo è analizzare alcune ricerche per confermare la relazione tra movimento e successo scolastico nei bambini di età compresa tra i 3 e 10 anni. In totale sono stati riportati 16 studi, di cui 6 riferiti alla Scuola dell'Infanzia e 10 riferiti alla Scuola Primaria.

KEYWORDS

Motor Activity, Academic Achievement, Kindergarten, Primary School, Educational And Teaching Continuity.

Attività motoria, Successo scolastico, Scuola Infanzia, Scuola Primaria, Continuità educativa e didattica.

Introduction¹

Motor development is characterized by a series of steps, purposes that the child must reach before arriving at the taxonomically more complex ones; they depend extensively on stimulus, maturation, experience and motivation. The development is dedicated, for the most part, to the acquisition and refinement of the gross motor skills that involve the large muscle groups of upper and lower limbs; fine motor skills, however, include the ability to write, to draw, to color, to take objects or to tie shoes (Krog, 2015, p. 434).

Childhood is a delicate period for the structuring of motor skills, fundamental for physical, social and cognitive development. The body plays an integral role in all development processes, the body scheme will be the identity card that we will always carry with us, from birth to old age. It is therefore necessary to consider the first years of life as ideal opportunities to learn how to develop the control of muscles and movements (Krog, 2015, p. 426).

The psychomotor development, which indicates the progressive acquisition of skills concerning both mental and motor activities, organizes different skills necessary to ensure good academic performance (Teixeira Costa et al., 2015, p. 127).

In the early years of life, particularly between 3 and 4, children acquire a series of basic motor patterns (to walk, to run, to jump) making gradually able to perceive, to know and to control the body. This period is fundamental for the acquisition of general coordination skills (motor learning and control, adaptation and transformation of movement). Because children at this age are naturally curious and generally enjoy exploring, these skills develop easily, in particular when learning opportunities are offered and a physically and cognitively stimulating environment is established (Teixeira Costa et al., 2015, p. 127). The favourable period, privileged to develop having fun and motivating them, it is certainly starting immediately, in preeschool age. In the Kindergartens (not in all, thankfully!) it is sacrifice, it is keep a little aside unity of learning with objective contents inherent to the body, the movement. Children are not always able to develop their full potential in a natural way, it would be appropriate to offer effective stimulus from this point of view (Krog, 2015, p. 438).

A healthy fitness has been largely related to the improvement of cognitive skills, in particular with general academic achievement but also, not to be underestimated, to health. Practicing moderate to vigorous physical activity stimulates the brain in a positive way, specifically seems to initiate brain chemical changes that increase attention and could improve cognitive functions (Mullender-Wijnsma et al., 2015, p. 365).

Movement at school is usually associated with physical education. However, given its potential effects on learning, it could change moments into movements, during theoretical lessons, which combines some school concepts with motor performance, optimizing the results. Pause in which students have the possibility, in classrooms, to get up, do exercises with the upper and lower limbs, joint mobility, balance, general dynamic coordination, of spatio-temporal organization, also useful to simulate attention and memorization. In this way “save” time without necessarily having to choose between theoretical disciplines and physi-

1 This study, although being the result of common elaboration and sharing of formulation and contents, can be attributed as shown below: Fiammetta Galli: first part Manuela Valentini: second part.

cal activity, considering that often teachers prefer the former and ignore the latter (Mullender-Wijnsma et al., 2015, p. 366). Then leaving space for motor activity classes, regularly, at the gym. Talent doesn't happen by chance but must necessarily be cultivated, cared for, nurtured from an early age; talent isn't enough: educated, formed the individual as a whole, in a holistic, unitary conception of Person. We aren't for superman a one-off, but individuals with ingenuity, propensities that can put at the service of the community, daily in respect of everyone and everyone by promoting a positive quality of life, including environmental. Excellences of respect, sharing that are educated "immediately" where beyond the family, the school brings its strong contribution with all its content in an interdisciplinary perspective without exclusions.

1. Material and methods

In the present review 16 studies are reported, searched and found in the databases: Sport Discus, PubMed, Web of Science, Psycarticles. The articles were searched between June and November 2017.

2. Results

The studies reported in this systematic review were consulted: three from Web of Science, nine from Sport Discus, three from PubMed and one from Psycarticles. The studies, to be included in this paper, had to concern the effect of motor activity in academic performance in children of Kindergarten and Primary School, aged between 3 and 10 years. All the studies examined are in English and published between 2010 and 2017, except for one interesting study, conducted in 1996. The research had to adopt a transversal, longitudinal, interventional method or be reviewing studies related to the topic. The examined children had to belong to Kindergarten or Primary School and participate – in the case of interventional studies – in the proposed motor activity programs.

The articles were divided into two categories, depending on whether they belong to Kindergarten or Primary School.

Source	Country	Sample	Age range/ mean	Intervention	Main results	Journal	Search Engine
Connor-Kuntz F. J., e Dummer G. M., 1996	USA	72 children	5 years	30 minutes sessions delivered three times per week for 8 consecutive weeks	Language skills and difficulties improvement	Adapted Physical Activity Quarterly	Web of Science
Krog S., 2015	South Africa			Systematic review		African Journal for Physical, Health Education, Recreation and Dance	Sport Discus

Teixeira Costa H. J. et al., 2015	Spain	324 children (I: 162, C: 162)	3-5 years	Physical education lessons twice a week, of 45 minutes long each, for 24 weeks	Motor development, physical fitness and cognitive function	Journal of Human Sport & Exercise	Web of Science
Pasichnyk V., et al., 2015	Ukraine	60 children (I: 15, C: 15)	5 years	"Smart Balls" Program	Physical fitness and cognitive function	Journal of Physical Education and Sport	Sport Discus
Rajovi R., et al., 2016	Slovenia	45 children	4-6 years	"NTC" exercise program for 6 months, 2-3 times a week for 10-15 minutes	Fine motor precision, manual dexterity and coordination	Physical Education and Sport	Sport Discus
Oberer N., Gashaj V., e Roebbers C. M., 2017	Switzerland	156 children	6.5 years	40 minutes circuit and six minutes run	Improvement of motor skills	Human Movement Science	Sport Discus

Table 1. Prospectus of the studies examined for the Kindergarten in order of year of publication. Source: own processing

Source	Country	Sample	Age range/mean	Intervention	Main results	Journal	Search Engine
Reed J. A. et al., 2010	USA	155 children	9-11 years	Physical activity 30 minutes a day, 3 days a week for 4 months	Pshysical activity, academic achievement and fluid intelligence	Journal of Physical Activity and Health	PubMed
Colquitt G. et al., 2011	USA	172 children	4-9 years		Physical fitness and academic achievement	Sport Scientific & Pratical Aspects	Sport Discus
Blom L. C. et al., 2011	USA			Systematic review		Journal of Research in Health, Physical Education, Recreation, Sport & Dance	Sport Discus
Best J. R., 2012	USA	33 children	6-10 years	Videogame fisicamente attivi/sedentari	Attività fisica e funzionamento cognitivo	Developmental Psychology	Psycharticles
Käll L. B., Nilsson M., e Lindén T., 2013	Sweden	1965 children (I:408; C: 1557)	5-year longitudinal study	"School in Motion" Program	Academic achievement and motor activity	Journal of Health	Web of Science

Haapala E. A. et al., 2014	Finland	341 children	6-8 years		Motor activity, reading, comprehension and arithmetic skills	Medicine & Science in Sports & Exercise	PubMed
Telford D. et al., 2014	Australia	620 children	8-10 years	150 minutes for week of physical education for everyone and additional 90 minutes only for intervention group	Academic achievement and physical activity	Journal of Science and Medicine in Sport	PubMed
Mullender-Wijnsma M. J. et al., 2015	Netherlands	228 children	7-8 years	Lessons "Fit en Vaardig op school"	Physical education and academic achievement	Journal of School Health	Sport Discus
Haapala E. A. et al., 2017	Finland	150 children	6-8 years		Motor activity, reading and arithmetic skills	Journal of Science and Medicine in Sport	Sport Discus
Marques A. et al., 2017	Portugal			Systematic review		Retos	Sport Discus

Table 2. Prospectus of the studies examined for the Primary School in order of year of publication. Source: own processing

Physical activity, according to the researches consulted, has positive effects on some functions, in particular in disciplines as linguistic, logical-mathematical, social, cognitive, motor and executive skills, fluid intelligence and academic performance, as reported followed in the results comparison table for the Infant School and Primary School.

Infant School	Primary School
Children aged 4 to 6 years who have participated in the motor program with language-enrichment improved their linguistic and motor skills (Connor-Kuntz, e Dummer, 1996, p. 313).	Third-grade children who have participated in the physical activity program have improved fluid intelligence and academic performance, achieving higher scores in language/English, maths and science (Reed et al., 2010, p. 348).
Children who practice physical activity benefit from a better and faster brain integration (Krog, 2015, p. 439).	Primary children with a healthier physical fitness also perform better in language, reading and math (Colquitt et al., 2011, p. 9).
Children aged 3 to 5 years who have participated in a motor activity program have significantly improved their psychomotor profile and motor skills (Teixeira Costa et al., 2015, p. 135).	There is a positive and meaningful correlation between healthier physical fitness and better results in standard tests of linguistics and mathematical disciplines, and a negative correlation between these and the absences from school, among primary children (Blom et al., 2011, p. 18).

The 5-years-old children who have participated in "Smart Ball" program have achieved improvements in some cognitive functions, such as visual memory, in dialogue, in thought and in attention (Pasichnyk et al., 2015, p. 780).	Children assessed after they have performed physically active games showed improvement of executive functions, in particular: greater speed in resolution of the interference of conflicting visual-spatial stimulus. Response time, in general, was faster among older children than younger children (Best, 2012, p. 1507).
Children aged 4 to 6 who have participated in the NTC program implementation intervention group, improved motor performance and skills and overall health (Rajovi et al., 2016, p. 316).	Children who have followed the physical activity program have achieved improvements in academic performances, in Swedish, mathematics and English compared to those who had not participated (Käll, Nilsson, e Lindén, 2014, p. 478).
The 6-years-old children participated in a series of tasks and tests to assess the level of motor coordination and executive functions, and a positive correlation was found between the two variables (Oberer et al., 2017, p. 176).	The best outcome for motor tests in children aged 6 to 8 years was related to an improvement in reading ability, reading comprehension and arithmetic skills (Haapala et al., 2014, p. 1022).
	Learning among primary children has eased and improved considerably and facilitated as a result of participation in motor activities and physical education classes held by specialists in the field (Telford et al., 2014, p. 103).
	Participate to physical active lessons made learning and the performance in math and reading easier (Mullender-Wunsma et al., 2015, p. 370).
	Males, with little physical activity and higher sedentary time, were worse in reading performance (Haapala et al., 2017, p. 588).
	Children who participate in motor activity classes have better scholar and social performance than children who spend more time sitting down (Marques et al., 2017, p. 319).

Table 3. Comparison of the results of the protocols referred to Infancy School and the results of the protocols referred to Primary School. Source: own processing

3. Discussion

The studies examined showed that there is a relationship between movement and academic achievement. In the Kindergarten, and even more in Primary School, children who were educated in physical activity achieved better results in other didactic disciplines. Furthermore using movement as break between a lesson and another seems to be beneficial. Besides the academic achievement, motor activity improves children's physical fitness and socialization, especially when group activities are proposed in playful way. To motivate, to entertain, to play on the move is the first step to introduce a regular physical education program; too often it is seen as a less important discipline compared to the others and for this reason it is underestimated and greatly reduced, if not completely eliminated, used as educational blackmail with the students to keep them quiet during the theoretical explanations of other disciplines: "We will not go to the gym, if you are not alert!".

Cognitive development is eased by the movement and this has a positive impact on performance, especially in disciplines such as language, mathematics and social sciences. Specific learning units can also be implemented, in particular in Kindergarten, providing for the implementation of games associated with small tasks in order to facilitate the learning of concepts through physical exercises. In this way children learn while having fun, more easily, since they don't live the experience as another frontal lesson.

Do exercises is important to counteract another problem that in recent years afflicts the population, even children: obesity. The sedentary lifestyle has become the norm both at home and at school, for the many hours spent in front of the TV and sitting at the desks. The school should analyze, reflect and find solutions in balancing moments of sedentariness with others of movement.

It has been found that combining physical activity with some schoolwork can improve language skills, even improve some language difficulties (Connor-Kuntz, e Dummer, 1996) and this should be the norm in Kindergarten to allow optimal development and maximum potential by improving cognitive and motor skills (Krog, 2015). In fact, increasing weekly physical education hours has produced positive effects on performance and overall behavior (Teixeira Costa et al., 2015; Pasichnyk et al., 2015).

Specific exercises, moreover, are able to improve certain motor abilities, such as fine motor skills and manual dexterity, positively conditioning also the cognitive functions (Rajovi et al., 2016; Oberer et al., 2017).

As regards the studies examined in the Primary School, more structured interventions were proposed in which physical education hours were often substituted for theoretical lessons. Increasing motor activity improves performance and physical fitness, also helps mental well-being (Käll, Nilsson, e Lindén, 2014, Colquitt et al., 2011; Haapala et al., 2014; Telford et al., 2014; Marques et al., 2017). Furthermore implementing a program of simple exercises and walk has had positive effects on mathematics, in reading (Mullender-Wunsma et al., 2015) and also on intelligence, specifically fluid intelligence, which indicates the ability to reason quickly and in an abstract way to solve problems in new and never experienced situations (Reed et al., 2010). Motor activity has also a positive effect on executive functions (Best, 2012) and on school behaviour (Blom et al., 2011), while a sedentary lifestyle negatively correlates with academic achievement (Haapala et al., 2017).

Conclusion

In a tweet of 26 April 2013 Pope Francis wrote: Dear young people, don't bury the talents, the gifts that God has given you! Don't be afraid to dream great things! To believe in one's own potential, also working on one's own limits, making oneself capable of growth for oneself and for others. Encouraging activities at school but also in motivating, active and fun free time combined with reflexivity and sharing. Adding verbal languages to not verbal ones will be useful for developing different intelligences, enhancing each person's talents. Cognitive, affective, motor, social and relational meet for a single objective: the formation of the Person. All the researches have provided evidence on the relationship between increased physical activity and academic achievement, especially in males and, in particular, in Primary Schools. Integrating more hours of exercise in the curriculum has led to a general improvement and in some works it is specifically evident in the linguistic disciplines, in mathematics and in social studies. Reducing physical activity, instead, involves physical risks: one of the main consequences is

obesity, whose likelihood of manifestation increases with the decrease of time dedicated to motor activity. In studies, therefore, an interconnection between motor abilities and academic skills emerges, in particular a positive impact of the first to the second. The improvement in academic performance in relation to physical activity is more evident among males aged between 7 and 10. The implementation of motor activity programs has made improvements on many fronts, a positive correlation has been observed between the academic performance, especially in Primary School children, and time dedicated to motor activities. A sedentary lifestyle is a serious problem affecting most people between the ages of 3 and 10 years (and not exclusively), the first precaution to be taken is to increase and stimulate motivation in dynamic activities. Contrary to common sense, the movement should not be seen in opposition to other disciplines, but as integral part of them, in a unity of knowledge that creates a balance between analogic language and verbal languages.

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