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Original Article

The role of the educator/adult in supporting children of pre-school age in learning difficult tasks: the case of the Playground "Primo Sport 0246"

TORTELLA PATRIZIA[1], FUMAGALLI GUIDO[2], COPPOLA ROBERTO[3], SCHEMBRI ROSARIA[3], PIGNATO SALVATORE[3]
[1]University of Bozen, Italy,
[1]University of Verona, Italy,
[1]University of Kore Enna, ITALY

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Abstract:
The continuous decline in physical activity and the increase in sedentariness also seen in preschoolers contributes to the increased risk of non-communicable diseases, such as cardiovascular diseases, metabolic diseases, type II diabetes, cancer in future adults. What are the possibilities for implementing children's physical activity? Can a playground contribute to the implementation of physical activity and motor and cognitive skills in kindergarten children? Research is carried out at the Parco Giochi Primo Sport 0246 in Treviso to evaluate the most effective teaching methodology to promote new motor learning in a difficult task and cognitive processes (executive functions). The combination of structured activity and free play, with the support (scaffolding) of a motor educator in a very difficult motor task, is more effective than free play activities alone.
Key words: scaffolding, motor skills, executive functions, playground, preschool children.

Introduction

1 - Theoretical and conceptual framework

In recent years there has been a worldwide decline in physical activity in children and especially adolescents. The phenomenon is worrying because children today tend to move less and less and this predisposes them to the risk of overweight (Tiziana et al., 2018), obesity and consequent metabolic and cardiovascular diseases (Pratt et al., 2014; Tester et al., 2014). What opportunities for movement have children today? Children spend up to 8-9 hours a day at kindergarten (Tortella, Fumagalli, 2019) and during this time they may exercise, but they don't, while they spend most of their time sitting and playing fine motor skills games (Tortella et al., 2011). The common thinking of parents and teachers is that preschoolers have a level of physical activity appropriate to their age, but this is not true. Only a low percentage of children (15%) comply, for example, with the guidelines (Hubbard et al., 2016). The Society of Health and Physical Educators (SHAPE, 2013), the World Health Organization (WHO, 2019) and the International Motor Development Research Consortium (Healthy and Active Children, 2019) recognize the importance for children to develop basic motor skills, such as running, jumping, rolling, throwing, pulling, etc (D'Elia, 2019). Some studies in addition show that for the effectiveness of learning it is essential that motor education programs are qualitative, well designed and organized and conducted by qualified teachers, trained in the technical field but also with methodological-didactic knowledge for children (Subramanian et al., 2015; Brian and Taunton, 2018). Until the first half of the 20th century, motor development was considered an internal and innate process driven by a biological and genetic clock that controlled the maturation of the central nervous system and the maturation of the musculoskeletal system (Gesell, 1933; Shirley, 1933). The adult/educator mainly had the role of accompanying the child along his path of knowledge and maturation. There was no precise distinction between educational strategies for the acquisition of cultural knowledge or motor skills. Cross-cultural studies have allowed to highlight the differences between different cultures and the consequent different motor development. The "ecological perspective" has taken over from the "maturationist vision" and development is now considered as the result of a system of interconnected aspects, each characterized by constraints (Bronfenbrenner, 1979, Newell, 1986).

New research that looks at children with a systemic vision, considering them in the interaction between different areas of development (Diamond et al. 2016) shows that motor and cognitive development are not innate and the result of only genetic heritage, but develop from childhood to old age (Kovács & Mehler, 2009).

Common aspects between physical activity and cognitive processes (executive functions) can be found. Both have little possibility of transfer (Adele Diamond et al., 2016, Tortella et al., 2016). If, for example, I develop balance, I do not necessarily improve prehension capacity, and if I develop memory, I do not necessarily improve cognitive flexibility. For the development of both it is necessary to do a lot of exercise, repeated over time, with a certain frequency, duration and intensity. The increase of both following an intervention is greater,

Corresponding Author: GAETANO RAIOLA, E-mail: graiola@unisa.it

when initial processes and skills are lower. The basic condition for the development of both is also that the child has fun and that the activities are varied and challenging. The adult/educator is no longer just an accompanist of the maturation process, but becomes responsible for the development of the child and the activities proposed to the children take on an intentional and planned form. In a study on modern and traditional Tae Kwo Do, Trulson points out that a different training methodology promotes a different development of cognitive processes. A group of young offenders aged 13-17 followed a training with the traditional Taek Won Do method, in which a good part of the activities was based on the careful observation of the opponent's moves and on the possibility of action only after him. The other group carried out a "modern" path of Tae Kwon Do, based on the development of technique, strength, coordination. Only the group that followed the traditional method significantly improved the executive functions, in particular self-control and inhibition, highlighting a decrease in the values of aggressiveness and anxiety and an increase in socio-relational skills.

Research has shown that the continuous increase in difficulty of a task requires a continuous adaptation of cognitive and motor processes. This cognitive and motor demand contributes to the development of executive functions and motor skills (Ericsson & Towne, 2010; Etnier, Nowell, Landers, & Sibley, 2006; Kramer & Erickson, 2007). Other aspects, such as stress, sadness, loneliness, illness, lack of sleep, reduce very quickly the level of executive functions (Diamond et al. 2016). Positive aspects such as good relations and social inclusion and support, joy promote their cognitive and motor development (Jing, Zhang, Wolff, Bilkey, & Liu, 2013; Etnier et al., 2006). Good social relations and positive emotional experiences also contribute to school success (Durlak et al., 2011; Jones et al., 2015; Kiuru et al., 2015).

Perception of competence and self-efficacy are also powerful motivating factors in motor and cognitive activities (Bandura, 1994). Confidence in one's own abilities and thinking that through exercise one can learn is extremely important, especially for a preschooler (Bandura, 1994; Murphy & Dweck, 2010. Stodden et al. (2008) highlight in the model of the relationship between physical activity, motor skills and health that a positive perception of one's own abilities facilitates involvement in activities, promoting learning.

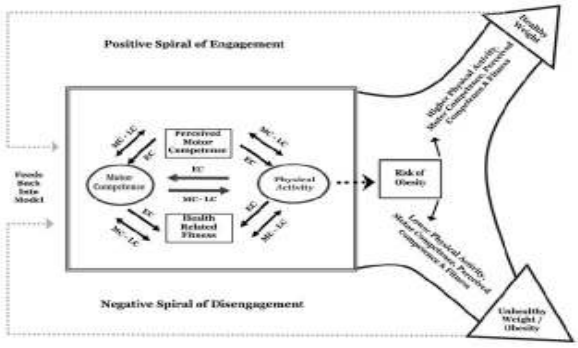


Fig. 1. Model of the relationship between motor skills, physical activity, obesity and health (Stodden et al. 2008).

The new figure of educator now assumes the important role of "modulator" of the perception of competence of the child, and consequently the customization of activities becomes important. If the proposed activities are difficult, in the area of "proximal development" and adequately supported by the adult they can promote the development of motor skills and cognitive processes (Davis et al., 2001, Diamond, Barnett, Thomas & Munro, 2007). Vigotsky defines the "proximal development zone" as the level of difficulty that a subject can overcome only with the support (scaffolding) of an adult or an experienced subject. Bodrova & Leong (2015) in the Tool of The Mind show that difficult repeated activities, supported by the adult, accompanied by joy, pride promote increased executive functions and success in primary school.

1.1 - Cognitive processes and motor skills in childhood

Time at kindergarten seems to have an important role also in the development of motor, socio-emotional, relational and cognitive (executive functions) and children's development. A longitudinal study showed that children who attended a quality kindergarten scored higher in college than their peers who did not have this opportunity (Chetty et al., 2011). Developing cognitive processes at pre-school age such as inhibition, self-control and attention regulation seems to predict future school success (Gilmore et al., 2013), success at work (Bailey, 2007), physical and mental health and success in life (Moffit et al., 2011, Jones et al., 2015). These processes seem to be even more effective in life than the level of intelligence and socio-economic status (Evans et al., 2008). Children who have good inhibitory control are able to resist temptations, to be careful and focused in what they are doing, to respect social rules and norms (Nakamichi et al., 2017). Some pre-school and primary school programs (Raiola, 2012ab) that combine inhibitory process development with school skills development

activities demonstrated to be more effective for school success than simple school skills development programs (Diamond et al., 2019).

1.2 - The playground as a place for child development

The time spent by children in kindergartens is an excellent opportunity for physical activity. In a study (Tortella and Fumagalli, 2019) 360 kindergarten teachers from 23 Italian regions stated that they have parks and gardens inside the school, while 79 teachers stated that their school does not have these spaces. 73% of teachers also said they use school parks and gardens 0-2 times a week and 72% said they do physical activity for children 0-2 times a week, in class/room/gym in kindergarten.

The playground is a space where children can develop their motor, social, relational and cognitive skills (Sallis et al., 2008). Studies have shown that the organization of spaces and materials in the park can promote the inclusion of children with special needs. (Hulteen et al. 2017 and Tortella et al. 2016) have shown that a studied choice of games and disposition in space, together with a methodology of use, as in the case of the Primo Sport Playground 0246, promote the development of motor skills and cognitive processes. The organization of the park and its games promote affordances, i.e. possibilities of action, which invite the child to use a space or tool. A horizontal staircase will invite, for example, to walk hanging "with the hands", a slide will invite to go down or up, a vertical wall with handles will invite to cling and climb. The repetition of activities that concern the same motor macro-area (manual skills, mobility and balance) helps to promote the development of motor skills**.** Tortella et al. (2016, 2019) highlighted in their studies at the playground Primo Sport 0246 that free play alone does not promote significant development of motor skills and cognitive processes, while the combination of free play and structured activity, supported by the educator is very inclusive and effective in motor and cognitive development. It is also very much appreciated by kindergarten children. Methodology and didactics used by the experienced teacher are fundamental for the effectiveness of motor programmes at the playground.

It is particularly relevant and decisive to have within the park simple and complex, difficult games, which require the active support and feedback of the teacher. Children are easily discouraged by difficult tasks, especially if their level of motor skills is low. The teacher's scaffolding and subsequent feedback are very important for the development of children's perception of competence and motivation (Tortella et al., 2016, 2019). Difficult tasks in the proximal development zone require prolonged attention, commitment, memory and can be stimulating for children if they realise that "learning requires practice". Even children without or with intellectual and physical disabilities of various degrees, who during free play avoid difficult games after moments of structured activity, personalized and supported by the educator try independently or with the help of friends.

2 - Research aims

With this study we want to see the effects of different methodologies on motor education:
- in learning a difficult balance task (in zone of proximal development)
- in executive functions (working memory, inhibition)

3 - Ethical considerations

The study was conducted at "La Ghirada" in Treviso, in the playground Primo Sport 0246, a park built to promote motor development of children aged 0 to 6 years (Tortella et al., 2016). The research was approved by the Scientific Committee of Laboratory 0246, which verified compliance with the Declaration of Helsinki. Parents, teachers and school leaders received detailed information about the study and gave informed consent.

Methodology and methods

Il Parco Primo Sport 0246

The playground is composed by areas: area of manual skills, mobility and balance, each containing specific tools / games of the area of reference. For more information about the concept of the park, see the article by Tortella et al., 2016.

Fig. 2. The playground Primo Sport 0246 in Treviso. The areas of the motor-cognitive circuit of manual skills, mobility and balance are highlighted.

The concept of the playground provides the possibility for parents to access it through 3 doors, located near the three areas of the park: manual skills, mobility, balance. The three macro-areas refer to the categories of Gallahue (1975) and act as containers for the fundamental motor skills, such as: crawling, throwing, grasping, walking in balance, etc. All the tools are organized according to an order, from the easiest to the most difficult game. The three areas are composed by the sub-areas for children from 3 to 6 years and 0 to 3 years old.

In this study, attention is paid to the balance circuit and especially in learning the difficult task of "walking without falling on the bar with springs".

Fig. 3. Bar with springs in wood, height cm. 40, length cm 300

Fig.4. The balance circuit.

The circuit of balance takes 10 minutes. The child moves from one game/tool to another, from: 1) three bars of balance on the ground, 2) wooden logs, 3) balance bar with springs, 4) elastic footboards, 5) Return to the three bars of balance, using different motor behaviour and ripetition of the circuit. If there is a partner on the game, the child waits that he/she arrives at the agreed signal, so that he/she can then leave. Children are asked to pay attention to the partner before them and to understand when it is time to leave. In the case of a departure error, the experienced motor educator stops the activities and asks all children involved in the area of balance to remember the rules of the game in question. The rules are replaced when the children have learned them with confidence.

Participants

Twenty-three (23) kindergartens in Treviso asked to participate at the project and six of them were selected on the basis of the same socio-economic status of the families.

The study involved 100 5-year-old children from 6 kindergartens in Treviso, a town in northern Italy.

49 children participated in the structured activity combined with free play: 30 minutes + 30 minutes;

51 children participated in free play: 60 minutes.

Organisation of activities

The activity at the playground consists of 60 minutes, once a week, for 10 weeks, in the mornings from March to May 2014.

The two groups of children of free play and structured activity combined with free play come to the park on different days and never meet.

Free play took place for 60 minutes in all the zones of the playground, while structured activity was concentrated for 10 minutes in each of the areas of manual skill, mobility and balance. In each area there was an experienced motor educator who supported each child as needed and provided feedback.

The structured activity allowed the children to face a path with difficult tasks and to be supported by an experienced motor educator.

The group of 15-20 children of the structured activity was divided into three subgroups of 5-7 children.

A training circuit methodology was used. Each group of children stayed 10 minuted in one area and then moved in the new one for other 10 minutes and moved again to the next area until the 3 areas were

completed (10 minutes in the manual area, 10 minutes in the mobility area, 10 minutes in the balance area, for a total of 30 minutes).

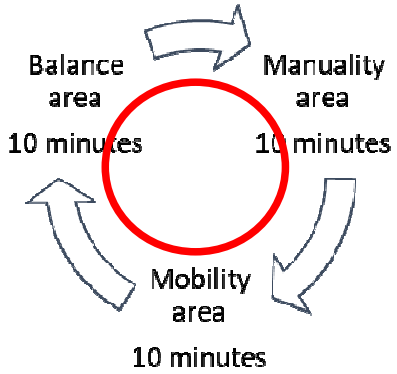


Fig. 5. Organisation of the activity in areas of manual skills, mobility and balance.

Activity

In each area (manual skills, mobility and balance) there was an experienced motor educator who explained to the children the circuit for the 10 minutes of stay. Some of the tools/games on the route were very easy, while others were very difficult, in the "zone of proximal development".

In the area of balance, the bar with springs was very difficult, outside the reach of children in kindergarten and the expert motor educator offered to support the child by proposing to cling to his arm to climb on the bar. However, the child was free to choose whether or not to use the help. Once on the board the educator invited the child to walk on it until the end of the path (length 3 m) and specified that if he/she felt like falling could decide to make a "beautiful jump".

At the beginning the children executide lot of "beautiful jumps" and the educator highlighted the skill and beauty of the action. Once the jump was made, the child was invited to climb up the bar from the take-off point. It continued until the end of the path of the bar with the springs.

Fig. 6. Activity at the bar with springs

The execution of this circuit took some time and the child could do it about a couple of times, in 10 minutes, in the balance circuit. The experience of the motor educator was very important in this situation because his task was to promote in the child perception of competence, joy of doing, fun, desire to try and learn.

Each area has specific rules that the children must remember in order to be able to complete the circuit. When the rules have been learned they are changed, so that the children must always have a cognitive commitment. For example, the child only leaves for the path of the axis with the springs when the partner in front of him has finished. In the meantime, he waits and jumps like a kangaroo, runs on the spot, etc.

The scaffolding

A "scaffolding" is the set of help strategies used by an individual to help another individual. The strategies can be of different types and here in order to learn how to execute the most difficult game, the bar with the springs we used the physical scaffolding. the motor educator offers his arm so that the child who wishes can cling, to climb on the bar. Then he moves away and the child tries to walk alone.

Methods

1) A mixed method is used, with a qualitative and a quantitative component. The qualitative component uses the camera tool and small focus groups with children. Standardised tests are used for the quantitative component.
2) 1) Motor component: the time in seconds that the children spend walking on the bar with the springs is measured, from the moment they detach the first foot from the ground to start climbing on the axis to when they touched the ground for the final jump.
3) The stopwatch was never stopped until the end of the circuit. The errors were then counted (every time a foot touched the ground).

Cognitive processes

The Day/Night test (Gerstadt et al., 1994) evaluated working memory and inhibition abilities. The child was shown 16 cards of two types, one white, representing a yellow sun and the other black, representing the moon and the white stars, according to the modalities and rules of the protocol. When the child saw the card with the sun he had to say "night", when he saw the card with the moon and the stars he had to say "day".

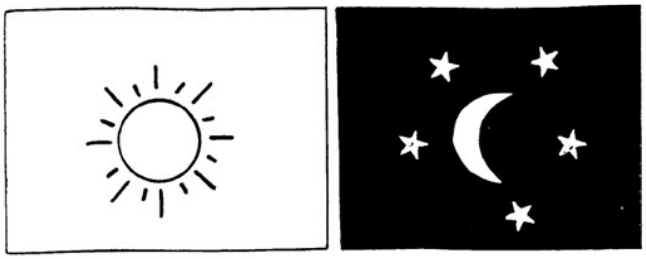
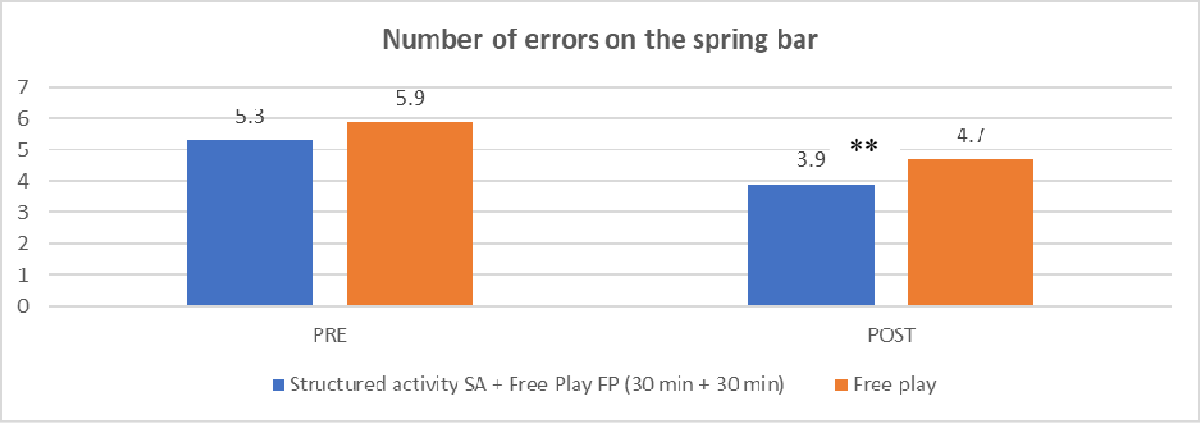
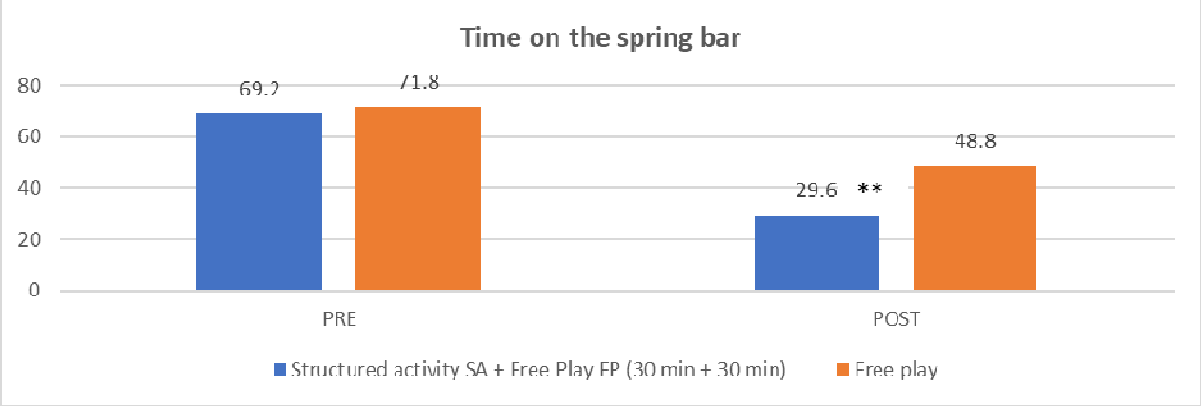


Fig.. 7. The cards used for the day/night test (Gerstadt et al., 1994)

Main finding

Table 1. Number of errors and time taken in the task of the spring bar





Number of errors

Children who participated at the structured activity combined with free play (SA + FP) did about the same number of errors at the pre-test as the group of only free play (FP), but at the post-test the group SA + FP (30 minutes SA + 30 minutes FP) significantly decreased the number of errors compared with the group of only FP (60 minutes FP).

Execution time

The children of the two groups took about the same time to complete the course in the pre-test, while in the post-test the group of SA + FP (30 minutes + 30 minutes) performed significantly faster than the group of FP (60 minutes).

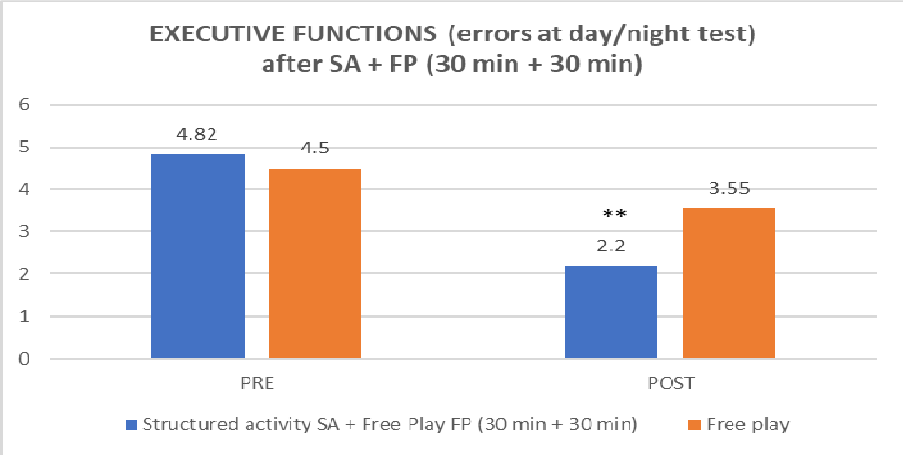


Table 2. Results of the Day/Night test

Results of the Day/Night test

The children of SA + FP (30 min + 30 min) made about the same number of errors at the pre-test but after training made significantly fewer errors.

Qualitative observations

Through the use of the video camera it emerged that the children of the SA + FP (30 min + 30 min) when they played freely chose spontaneously to return to the difficult game of the bar with the springs to try again independently. A very interesting aspect is that they often involved the friends on the common goal of support / learning the difficult task.

During the videos taken with the group that played freely all the time it was observed that the children initially tried to get on the bar with springs but after a couple of failed attempts they avoided the game. After 1-2 trials, no child approached the bar with springs. Consequently these children never practiced this game / instrument and did not learn and develop new skills. In the free play more relaxed and sedentary activities have been observed. Previous studies in which accelerometers were used to monitor physical activity and its intensity showed that in the time of FP in the playground children were more sedentary than during SA (Tortella et al . 2019). Some parents reported to motor educators that when children returned home they said they had to practice so much because by doing so they would learn. During the focus groups the children said they had fun and wanted to come to the playground several times more during the week.

Implications, practice or policy

After five years of studies and research at the Playground Primo Sport 0246, the activities continue routinely with the Treviso kindergartens throughout the year. Secretaries who take care of the organization and employees have been hired, graduates in physical education and specialized in the methodology of conducting park activities. The playground is now an active place for all the children of the city, who can access in the morning, thanks to motor education programs and in the afternoon to play freely. The park is always open and free. Teachers and parents are now more used to attend the park in winter, with cold and bed weather.

Conclusions

A public or private playground open to the public, as in this case, can become an "active" place that promotes motor and cognitive development in preschool children. The presence of intentional, structured programs with the support of expert motor educators, combined with free play, is fundamental. Free play alone

was not enaugh to motivate and promote children new motor and cognitive skills. It is possible to consider the playground an "outdoor gym". The positive effects of outdoor physical education and the possibility of using large spaces are added.

It is important to consider the role of the educator / adult as an active support (scaffolding) in learning difficult tasks. The positive effect on the increase in children's executive functions shows that motor education, under certain conditions, can be very useful both for motor development but also for children's cognitive processes.

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