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Physical activity in development of motor skills and cognitive processes in preschool children: consequences in school readiness

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TABLE OF CONTENTS

Acknowledgments	9
Preface	11
Prefazione	13
Glossary	17
PART I: GENERAL INTRODUCTION	21
1 Theoretical perspectives	21
1.1 <i>What is the basic nature of humans? What are the contributions of nature and nurture to development?</i>	23
1.2 <i>How knowledge and behavior arise from genetic endowment, physical maturation and experience?</i>	26
2 Motor development	33
2.1 <i>Is motor development a general, universal developmental process?</i>	33
2.2 <i>The maturational perspective</i>	34
2.3 <i>A descriptive period</i>	37
2.4 <i>A period of forgetfulness</i>	38
2.5 <i>Information processing</i>	38
3 A new idea of motor development: the ecological perspective	41
3.1 <i>Gibson's ecological theory of perceptual development</i>	43
3.2 <i>Dynamical systems approach</i>	44
3.3 <i>The constraints that influence the development</i>	45
4 The state of research	47
4.1 <i>Behavior is embedded</i>	47
4.2 <i>Movement is embodied</i>	50
4.3 <i>Motor development is encultured</i>	52
4.4 <i>Current research in motor development</i>	54
4.5 <i>The role of caregivers in development</i>	54
4.6 <i>Between motor and cognitive development: Bronfenbrenner's bio-ecological theory of developmental processes</i>	57
5 The development of cognitive abilities	61
5.1 <i>Vygotsky's perspective</i>	62

5.2	<i>Developmental neuroscience</i>	63
5.3	<i>Neural connection can be modified by experience</i>	64
5.4	<i>Frontal cortex and cognitive functions: maturation or experience?</i>	64
5.5	<i>The prefrontal cortex and the executive functions</i>	67
5.6	<i>Prefrontal cortex: maturation or experience?</i>	70
5.7	<i>Genetic and environmental influences in brain development</i>	73
6	Child’s environment and effects on cognitive functions,	77
	academic achievement and performance	
6.1	<i>Influence of better executive functions in school readiness</i>	78
6.2	<i>Influence of worst executive functions</i>	81
6.3	<i>Benefits of early activity in improving executive functions</i>	81
6.4	<i>Are there evidences that improving executive functions we</i>	83
	<i>improve academic performance?</i>	
7	Programs to enhance cognitive functions	85
7.1	<i>Conditions to develop programs on EF increasing</i>	88
8	Physical exercise and modifications of the brain	91
8.1	<i>Summary of the explanation of why physical activity may</i>	92
	<i>improve cognitive functions</i>	
8.2	<i>Physical exercise, cognitive functions and academic achievement</i>	93
8.3	<i>Classifications of the studies</i>	97
8.4	<i>Some considerations about the benefit of physical activity</i>	100
9	Physical activity and physical health	105
9.1	<i>Motor competence</i>	101
9.2	<i>Summarizing, what are the conditions influencing executive functions?</i>	115
10	Qualitative experiences of physical activities improve	117
	cognitive processes	
10.1	<i>Vygotsky’s theory and improvement of executive functions</i>	119
	<i>in “Tools of the Mind”</i>	
10.2	<i>What have these two methods in common?</i>	122
10.3	<i>Another important aspect</i>	124
10.4	<i>Summary</i>	124
10.5	<i>References</i>	129

PART II: ORIGINAL RESEARCH	157
11 The design of the research	157
11.1 Study design	157
11.2 Quadro generale della ricerca	170
11.3 References	175
PART III: THE STUDIES	177
12 Question a) “what is the role of the environment	177
in developing physical activity in preschool children?”	
12.1 Study 1A - Prospettiva ecologica: importanza di ambiente e	178
<i>contesto nello sviluppo motorio dei bambini / Ecological perspective: importance of environment in child motor development.</i>	
12.2 Study 1B - Paper - Prospettiva ecologica: importanza di ambiente	187
<i>e contesto nello sviluppo motorio dei bambini</i>	
12.3 Study 2A - Motor cognition during free play in 3 years old children	194
<i>builds up on factors involving space organization and social interaction/ L’organizzazione di spazi e ambiente contribuisce a costruire la cognizione motoria , durante il gioco libero, nei bambini di 3 anni.</i>	
12.4 Study 2B - PAPER - Motor cognition during free games in 3	203
<i>years old children builds up on factors involving space organization and social interaction.</i>	
13 Question b: “How may we develop motor skills in children”?	215
13.1 Study 3 - PAPER - New environments for the education of 0-6 years	215
<i>old children: what teachers think about the playground for formal and non formal education. Nuovi spazi per l’educazione dei bambini da 0 a 6 anni: cosa pensano gli insegnanti del parco giochi come luogo di educazione formale e non formale</i>	
13.2 Study 4A - Manuscript in preparation: Exploring the effects	229
<i>of 10 hours playground activity on motor competence and physical fitness in 5 year old children</i>	
13.3 Study 4B - Paper: Exploring the effects and specificity of	251

	<i>playground activities on motor skills in 5 years old children</i>	
13.4	<i>Other results of the research at the playground?</i>	253
14	Question c) “if and how may we develop cognitive processes by means of physical activity”?	261
14.1	<i>Study 5 A - Paper Percezione-azione: il ruolo dell’educatore nella attribuzione di significato all’ambiente e al compito, con bambini di 5 anni</i>	262
14.2	<i>Study 5 B - Paper - Difficult motor skill acquisition in 5 y old children can be modulated by educators</i>	268
14.3	<i>Studio 6 - Paper - Health, physical activity and executive functions in 3-5 years old children. The opinions of the parents. : Salute, attività fisica e funzioni esecutive nei bambini da 3 a 5 anni. Le opinioni dei genitori.</i>	274
14.4	<i>Study 7 - Paper – Mente e corpo nella relazione educativa nelle scuole dell’infanzia: lo sviluppo delle capabilities per una buona qualità della vita/Mind and body in the educational relationship in Kindergarden: the develop of capabilities for a good quality of life</i>	297
14.5	<i>Study 8 - Paper – How can teachers contribute to develop executive functions through motor activity?</i>	305
14.6	<i>Study 9 – Are there improvements of cognitive processes with the activities at the playground?</i>	316
14.7	<i>Study 10 - Focus groups with teachers of primaries schools</i>	323
15	Altre osservazioni qualitative	323
15.1	<i>Study 11 - Uno studio sull’asse orizzontale del parco giochi</i>	323
15.2	<i>Study 12 - Considerazione / studio qualitativo. Interviste e focus groups con insegnanti e genitori dei bambini al parco sul tema del pericolo/ Considerations – a qualitative study. Teacher at the playground and the fear of danger for children, a focus group with parents of children attending the playground.</i>	331
15.3	<i>Study 13 – Attività fisica e successo scolastico/ physical activity and school readiness</i>	341
	PART IV: SUMMARY OF RESULTS, DISCUSSION AND	351

CONCLUSIONS

16	Summary of results	351
17	Riassunto dei risultati	363
18	Overall discussion and conclusion, practical implications ..	375
	and directions for further research.	
18.1	<i>Study 1</i>	378
18.2	<i>Study 2.....</i>	378
18.3	<i>Study 3.....</i>	379
19	Discussione, conclusione, implicazioni pratiche,	383
	indicazioni per ricerche future	
20	Papers discussed in the thesis	393
21	Publications by the author	397
21.1	<i>International publications by the author: Articles in international</i>	397
	<i>peer-reviewed journals</i>	
21.2	<i>International publications by the author: Abstracts in international</i>	398
	<i>peer-reviewed journals</i>	
21.3	<i>Oral presentations at international congresses</i>	398
21.4	<i>Poster presentations at international congresses</i>	399
21.5	<i>Stages abroad.....</i>	399
21.6	<i>Designing the Primo Sport 0246 playgrounds for children 0-6</i>	400
	<i>years old</i>	
21.7	<i>Publications in Italian</i>	400
21.8	<i>Capitoli di libri in lingua inglese</i>	403
21.9	<i>Relazioni orali a convegni e congressi nazionali</i>	403
21.10	<i>Presentazione di poster a seminari e convegni nazionali</i>	405
	Estratto per riassunto della tesi di dottorato	407
	Abstract in lingua italiana	407
	Abstract in English	407

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Preface

A survey of the scientific literature shows that there is a large consensus in the scientific and education communities on the beneficial effects of physical activity on health; accordingly, recommendations on levels and types of activities to be performed by children and adults have been published by scientific associations and international organizations (WHO, NASPE, AAP, HAH). Good health is a fundamental right of children important for both well being and for school success; good health is also important for development of executive functions, which also contribute to well being and school readiness.

Despite this correlation, the relationship between motor and cognitive development in children has not been extensively studied, also because the methodological difficulties occurring when the focus are rapidly developing human beings of age ranging from 3 to 6 years. Note that most of the studies addressing physical and cognitive competences in this population of children are based on parent's reports and interviews and that methods for objective and reliable quantitative and qualitative data acquisition have only recently been introduced. In addition, the classical view that children "mature by themselves" and that acquisition of skills depends on chronological age rather than experience, environment and cultural context is still very popular among parents and educators as well as among some components of the scientific community.

On the other hand a new era on the science of development is approaching. Recent data from neuroscientific studies suggest a positive association between physical activity, physical fitness, executive functions and academic performance. In the international congress of Seattle (2013) on Child Development data were presented showing that the practice of physical activity can promote development of executive functions and school success in children; in line with these suggestions, new data were recently published (Verburgh, 2014) and more are now expected to appear. The ICSSPE (International Council of Sport Science and Physical Education) has organized a "by invitation only" symposium held in Berlin in September 2014 where a task of world experts of science, education, business and politics was asked to discuss on the scientific and practical aspects of promoting cognitive development with physical activity. In those two days of "brain storming", we concluded on the need of interdisciplinary approaches to promote both the growth of scientific knowledge and the identification and implementation of specific programs to develop school readiness in children. In that meeting some important

different points of view by different cultural contexts also emerged, confirming that an ecological perspective is necessary to understand and promote motor and cognitive development.

In this thesis I investigate the possible association between physical activity, physical fitness, executive functions and school achievement.

In the first section I discuss the theoretical framework of development by reviewing past and recent theories of child development.

In the second section I review the methodological aspects of my approach to the study of 3-6 years old children for acquiring both qualitative and quantitative information on their development.

In the third section I present the data and the studies that I have performed during my PhD course addressing three basic questions: a) *What is the role of the environment in developing physical activity in preschool children?* b) *How may we develop motor skills in children?* c) *If and how may we develop cognitive processes by means of physical activity?*

The last sections summarizes and draws the conclusions of my studies that highlight the role of the environment (physical and cultural) in child physical development and proposes new approaches to physical education that may contribute to cognitive development and school readiness in preschool children

Prefazione

Il mio obiettivo in questi anni di dottorato è stato di ricercare una congiunzione tra le evidenze scientifiche emergenti nel campo dello sviluppo psicofisico e l'educazione, al fine di identificare percorsi didattici utili per lo sviluppo dei bambini.

I punti chiave da chiarire sono stati: sviluppo motorio e processi cognitivi, sviluppo motorio e funzioni esecutive, funzioni esecutive e successo scolastico, attività fisica e successo scolastico. Durante il percorso di tesi ho affrontato i diversi argomenti impegnandomi in studi sperimentali ed osservazionali diretti a esplorare specifici aspetti del problema generale per cercare di giungere a formulare un quadro complessivo dell'argomento attraverso la stesura di questa tesi.

Recenti ricerche mettono in risalto una possibile relazione tra attività fisica e funzioni cognitive (esecutive functions). Si tratta di capacità esercitate prevalentemente attraverso il funzionamento della corteccia prefrontale che hanno un significato rilevante per produrre condizioni che favoriscono il successo scolastico, in particolare nelle capacità di matematica e letto-scrittura. Le prime ricerche nell'ambito risalgono al famoso test dei marshmallows, effettuato negli anni '50 in cui si è visto che i bambini che all'età di 5 anni erano dotati di maggiore capacità di attesa ottenevano in seguito i migliori risultati ai test universitari di accesso alle università americane più prestigiose.

Una caratteristica importante delle funzioni esecutive che è stata messa in evidenza negli ultimi anni è che si tratta di funzioni "allenabili". Probabilmente i dati più importanti sono quelli prodotti dal gruppo di Vancouver della Professoressa Diamond che evidenziano l'importanza dell'aspetto metodologico per la conduzione di attività "educative". In particolare negli ultimi anni si è anche messo in evidenza un possibile nesso tra capacità motorie e funzioni esecutive; sempre lo stesso gruppo canadese ha dimostrato come alcune arti marziali possano indurre un aumento di funzioni esecutive ma solo se l'apprendimento di queste è indotto da specifiche metodologie didattiche tipiche delle arti marziali "tradizionali" e mancanti nelle forme moderne che delle precedenti mantengono solo gli aspetti "tecnici" dei movimenti propri delle discipline.

Affrontare il tema dell'allenabilità delle funzioni esecutive e delle possibili relazioni tra sviluppo motorio e cognitivo in bambini nell'età prescolare è sicuramente molto importante in quanto si tratta di una fase della vita in cui il sistema nervoso è particolarmente plastico e in cui queste funzioni sono particolarmente sviluppabili. I

bambini che migliorano il loro livelli di funzioni esecutive prima dell'inizio della scuola primaria possono accedere al percorso scolastico con maggiori possibilità di apprendimento. Le evidenze che mostrano come il livello di funzioni esecutive posseduto all'età di cinque anni si mantenga anche da adulti, spingono ancor più a considerare prioritaria la necessità di provvedere a percorsi educativi didattici che permettano lo sviluppo nei bambini di tali funzioni cognitive, anche per coloro che partono svantaggiati, come nel caso di sindrome ADHD (in questo disturbo specifico di apprendimento è presente un livello molto basso di queste funzioni).

Infine i recenti studi che evidenziano una relazione tra sviluppo di funzioni esecutive e attività fisica aprono un settore di ricerca molto interessante rispetto ai bambini in età prescolare, poiché la componente motoria è parte integrante dell'attività giornaliera del bambino/a. Benché non siano ancora stati chiariti gli aspetti attraverso cui l'attività fisica possa promuovere lo sviluppo di queste funzioni, i dati presenti in letteratura sottolineano l'importanza dell'educatore/adulto e della metodologia utilizzata.

La presente tesi cerca di indagare su questi aspetti, definendo innanzitutto cosa si intenda per sviluppo motorio di un bambino/a e cosa si intenda per attività fisica, collocando l'indagine all'interno di teorie dello sviluppo ecologiche, di modelli neuro scientifici e comportamentali che possano contestualizzare lo sviluppo cognitivo in relazione allo sviluppo motorio. Vengono presentate le funzioni esecutive utili per l'apprendimento scolastico, secondo le più recenti ricerche del settore.

Un aspetto importante (ma non unico) dell'attività svolta nel corso di dottorato è stata l'esecuzione di attività di ricerca sperimentale con bambini in età prescolare presso un parco giochi progettato dalla sottoscritta e finalizzato allo sviluppo delle competenze motorie dei bambini. Attraverso l'attività svolta con le scuole dell'infanzia di Treviso (dove il parco è situato) ho potuto valutare l'influenza dell'ambiente e di diversi metodi di insegnamento dell'attività motoria sullo sviluppo di competenze motorie di base e definire percorsi ideali che possano promuovere lo sviluppo contemporaneo di competenze motorie e cognitive (funzioni esecutive) nei bambini in età prescolare (compresa fra i 4 e i 6 anni). La metodologia di indagine utilizzata nelle ricerche è stata di tipo quantitativo per quanto riguarda le misurazioni delle competenze motorie e cognitive dei bambini, effettuate attraverso test standardizzati diffusi nella comunità internazionale, e di tipo qualitativo per approfondire le conoscenze relative alle credenze di genitori, insegnanti e dei bambini stessi.

I risultati, in accordo con le teorie di sostegno al progetto, evidenziano che uno specifico approccio didattico all'attività fisica promuove lo sviluppo di competenze motorie nei bambini (in particolare legate a equilibrio e manualità) e che le competenze stesse sono molto specifiche, con scarse o nulle possibilità di trasferimento dell'apprendimento su altre competenze motorie non allenate.

L'analisi dei dati qualitativi ha evidenziato i diversi punti di vista di genitori e insegnanti rispetto allo sviluppo motorio dei bambini/e, alle pratiche utili per promuoverlo, all'importanza dell'attività fisica nello sviluppo. Emerge una considerazione dello sviluppo del bambino di tipo maturazionistico, che non tiene conto dell'importanza di ambiente fisico, umano, culturale e in particolare del ruolo dell'esperienza.

Fondamentale nel corso degli studi è stata l'osservazione di come una corretta applicazione del concetto di "sviluppo prossimale" sia fondamentale per l'apprendimento delle competenze motorie in un compito al di fuori della portata del bambino e come questo intervento comporti importanti modifiche delle affordances e della propria percezione di competenza da parte del bambino, con profonde ricadute sulle spinte motivazionali e sull'impegno profuso per l'esecuzione del compito ("se mi esercito imparo!"). Al momento stiamo sperimentando questo concetto operativo di "scaffolding" nell'ambito dell'acquisizione di funzioni esecutive attraverso il movimento; alcuni dati preliminari che mostrano principalmente come intendiamo procedere nello studio e con quali strumenti di valutazione, sono riportati nella tesi. Da queste sperimentazioni ricaviamo l'ipotesi che prima della competenza motoria venga la competenza di percezione motoria, che agisce come motivazione alla pratica che è la premessa e la *conditio sine qua non* per la promozione dello sviluppo motorio.

Questo aspetto, emerso attraverso esperienze di attività motoria, conferma l'importanza di un'educazione personalizzata in zona di sviluppo prossimale, come condizione fondamentale per lo sviluppo dei processi motivazionali e di percezione di competenza che sono alla base del successo individuale.

Riporto, in breve, l'organizzazione della tesi.

La parte prima riporta i riferimenti teorici sulla relazione tra attività fisica, processi cognitivi, capacità di apprendimento;

La parte seconda illustra l'organizzazione complessiva della ricerca

La parte terza sviluppa la ricerca attraverso un percorso guidato da tre domande, rispetto alle quali vengono presentati i relativi studi effettuati:

Qual'è il ruolo di ambiente e contesto nello sviluppo delle attività fisiche nei bambini in età prescolare?

Come si sviluppano le competenze motorie?

Se e come possiamo sviluppare processi cognitivi attraverso l'attività fisica?

La quarta parte presenta la discussione dei risultati e le conclusioni.

Glossary

Abilities – genetically linked physical and mental attributes that determine how quickly and how well particular skills can be learned.

Acculturation – a process of cultural and psychological growth.

Ageing is used regardless chronological age.

Childhood self-esteem – how much children value themselves

Culture – a system of beliefs about the way people interact within a segment of the population.

Development—Changes influenced by heredity, maturation, and experience.

Early childhood – the period from the age of 18 months to 6 years of age

Ecological models – models that emphasize how multiple factors determine people's health – promoting behavior.

Embodied learning – a theory that states that a dynamic interaction occurs among children's body movements, the sensory experiences obtained from the movements, and the context of the movements.

Exercise a subset of physical activity consisting of planned, structured, repetitive bodily movements with the purpose of improving or maintaining one or more components of physical fitness or health.

Extrinsic motivation – behavior driven by external rewards from the environment (such as prizes, money and praise).

Fundamental movement skills – patterns of movement that are the basis for learning complex motor skills. The three categories of fundamental movement patterns are locomotor actions (walking and running), non locomotor actions (bending, twisting, and balancing), and manipulative actions (knot tying, drawing).

Games – forms of competitive play characterized by established rules and set goals.

Intrinsic motivation – behavior driven by internal rewards (such as pleasure and enjoyment).

Learning - a process that results in relatively permanent and consistent change in behavior and is based on experience.

Maturation is always confused with development and means the progress toward physical maturity, the integration of individual's body systems and the ability to

reproduce. Development with physiological changes continue all the life with a slower rhythm.

Metabolic syndrome – a combination of health measures such as body fat, blood pressure and cholesterol that are combined and used to predict the onset of cardiovascular disease and type 2 diabetes.

Meta-cognition – children’s awareness of what they know and how they can use it.

Micro factors – factors that influence health behaviors on a personal level, such as family, friends and peers.

Motivation – a psychological or physiological state that energizes behavior to achieve goal.

Motor behavior - is used when both motor development and motor learning are contemplated or it is not important distinguish between motor development and motor learning.

Motor control - the control by nervous system of the muscles that allow skilled and coordinated movements.

Motor development - the development of movement abilities, related to experience and age. Researchers in motor development analyze developmental changes in movement and the factors underlying those changes, with attention also to process of change and resultant movements outcome. Development continues throughout life and does not stop at a particular age.

Motor learning - movement changes, relatively permanent related to experience or practice rather than age. When a person changes the grip on the racket we can tell of motor learning.

Outcome expectations – the results that someone anticipates will happen

Physical activity - bodily movement produced by skeletal muscle contraction that requires energy expenditure.

Physical growth - means a quantitative increase in size or magnitude of the body. For humans physical growth begins with conception and ends in late adolescence. From a developmental perspective, the term physical growth is also used to indicate changes in functional capacity(ies).

Play- activity that is freely chosen and intrinsically motivating and pleasurable. Children can play by themselves (solitary play), adjacent to others (parallel play) or by interacting with others (cooperative play).

Psychometrics – a field of study that uses standardized tests to measure and classify abilities.

Psychomotor abilities – enduring characteristic that influence the capacity to manipulate and control objects.

Scaffolding - support given by a teacher during the learning process

Sedentary behavior – behavior that results in an energy expenditure equal to that of sleeping, sitting, lying down, or watching television.

Self efficacy – the belief that one can perform adequately in a given situation

Skill – the ability to use knowledge effectively and readily in the execution of performance

Sport – forms of competitive physical activity

Stress – a pattern of behavior in response to events that disturb equilibrium and tax the ability to copy

Switching – stopping what one is doing and acting in a totally different way.

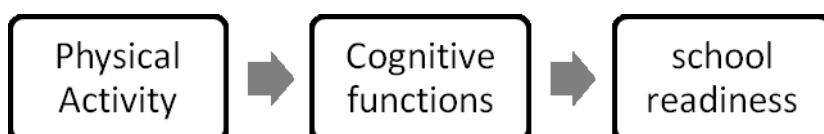
Theory of mind – a theory that explains how young children learn to take the perspectives of others.

Transfer - the degree in which learning in one setting is used in another setting.

PART 1 – GENERAL INTRODUCTION

1 THEORETICAL PERSPECTIVES

How can we contribute to develop cognitive functions related to school readiness? Studies on motor development and physical activity highlight some evidence between cognitive development and physical activity and possible links to school readiness.



The relation between physical activity, cognitive processes and school readiness has been studied in the last few years and the state of the research is still at the beginning. The complexity of the topic needs an historical path, crossing through the most relevant fields in the international research and constituting the theoretical perspective of the thesis. Tomporowski (2014) suggests to consider an interdisciplinary approach involving different disciplines such as Philosophy, Education, Psychology, Neuroscience, Exercise physiology.

Working in different fields makes it necessary to clarify the meaning of the concepts and I built a glossary of the most important terms. A special consideration needs the conception of *development*.

The *development* plays a very important role both in political and personal behavior. The meaning of the word *development* in English and French is “*to unwrap*”, in Latin is “*incrementum, progression*” (Sapere.it, 2014). In Treccani dictionary *development* is “*processo attraverso il quale una persona raggiunge la sua forma fisica e psichica definitiva: avere uno sviluppo fisico (o psichico) normale, regolare, ritardato; l’età dello sviluppo, della crescita e, in particolare, della pubertà, sviluppo dell’intelligenza, delle capacità critiche, della personalità*” (Treccani, 2014). Nagel (1957, p. 17) considered *development* as “*what happens to a system with a specific structure and initial capacities, characterized by a series of successive changes leading to relatively permanent, new structural properties*”.

In colloquial discourse *development* means that the body develops because it is growing due to food and exercise.

The following map, built up on the basis of the suggestions derived from Tomporowski's presentation at the ICSSPE meeting in Berlin (2014), shows the historical "Roots" of physical activity and the learning program. It evidences the interdisciplinary role of different fields of research.

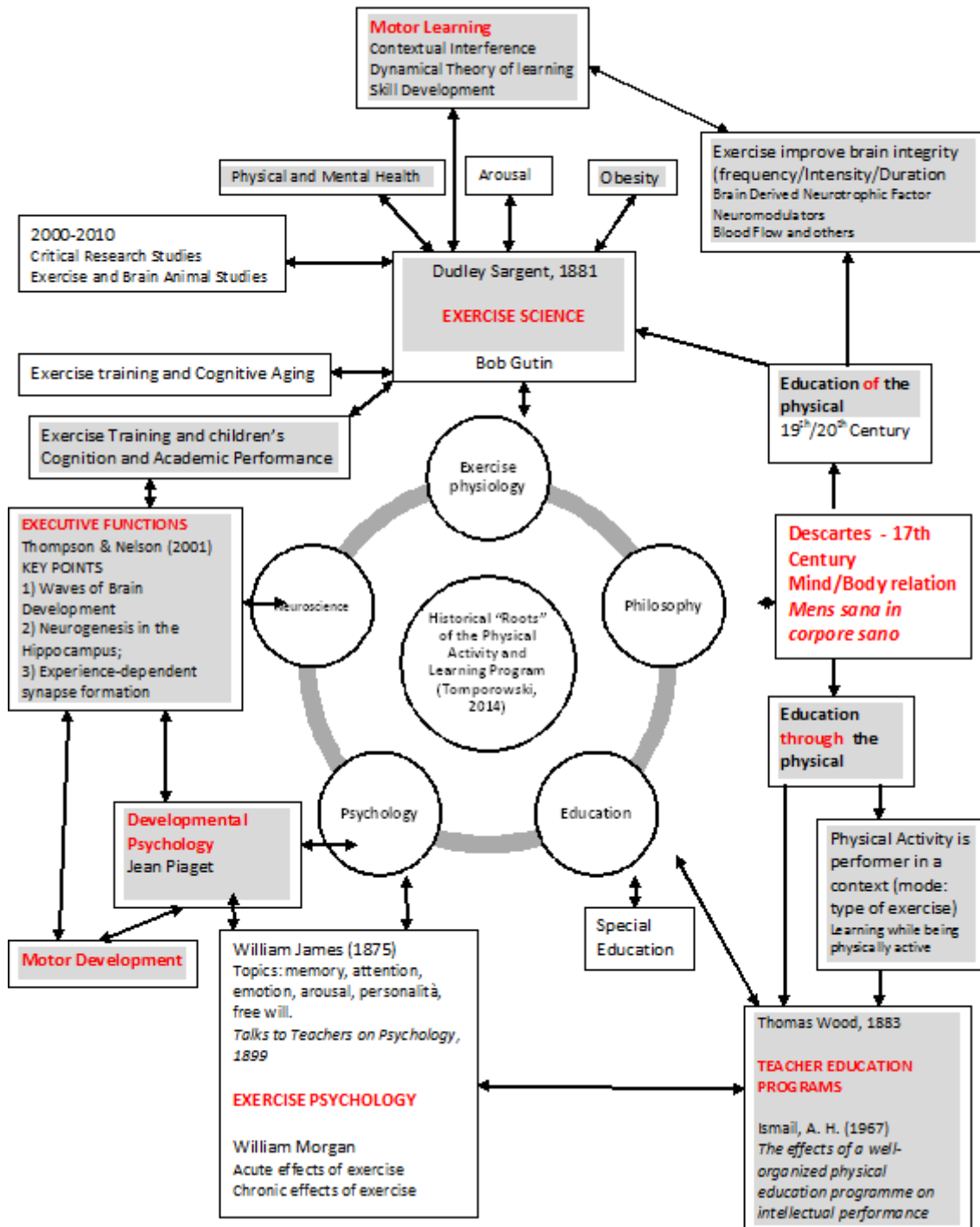


Fig. 1.1 - Roots of physical activity and the learning program (a gift from Prof Tomporowski, modified by myself)

1.1 WHAT IS THE BASIC NATURE OF HUMANS? WHAT ARE THE CONTRIBUTIONS OF NATURE AND NURTURE TO DEVELOPMENT?

Some important issues of development are related to the questions: what is the basic nature of humans? What are the contributions of nature and nurture to development?

Philosophers of Science have identified for the concept *development* the following views (Overton, 1984; Reese, 1991): the mechanistic, the organismic, the contextual.

The *mechanistic* view sees the world like a machine composed by different parts operating in time and space. Its roots are in Newtonian physics and some important empiricist philosophers are Locke (1632-1704) and Hume (1711-1776). For these authors the human is like a passive robot, motivated by the environment and the sources of the body (Miller, 2011).

The development is *caused by prior forces and events acting on a passive, machine like mind composed of interlocking parts* (Miller, 2011, p. 14). In this view children passively acquire a copy of reality. There is a universal law for behavior and development.

The *organismic* view is modeling on living systems. For Leibniz (1646-1716) the world is *composed of organized “wholes” spontaneously and inherently active and self regulated* (Miller, 2011, p. 15). Maturation and engage in the world allow new skills to emerge. The organismic view considers active, organized whole and constantly changing, with inherent properties and goals. In this view children actively construct their knowledge. There is a universal law for behavior and development. Piagetian theory is an example of universal stages and mechanisms of development.

The *contextualism* view considers that a behavior can be understood only referring to its social-historical context. The pragmatist philosophers William James (1842-1910) and George Herbert Mead (1863-1931) inspired this view. Behavior changes from context to context, has a purpose reached in the past and some goals in the future. Like the organismic view, it is a holistic perspective. The universal law of behavior and development is not valid in this view, rather children's patterns of development can be different from one culture, subculture, historical time (Miller, 2011).

There are other views based on particular economic and political ideologies (Riegel, 1972).

The *capitalistic system*, largely Anglo-American, sees the human struggling for success and very competitive. Thomas Hobbes (1588-1679) argues that humans are selfish, competitive and nasty. Children, old people, mentally retarded and women are considered inferior. A child is considered in this view an incomplete adult and must be modeled into appropriate adult roles (Miller, 2011).

The *mercantilistic ideology* was in continental Europe from the seventeenth through nineteenth centuries. There was particularly land ownership and state controlled trading. There were different social classes, little competitions and society emphasized cooperation. Rousseau (1712-1778) sees the children as good but ruined by the adults. The goal of education was self-realization. A child-oriented education was developed by Maria Montessori (1870-1952) (Miller, 2011).

Economic, philosophical and political beliefs guide the theories and often these views are implicit and people are not aware of them.

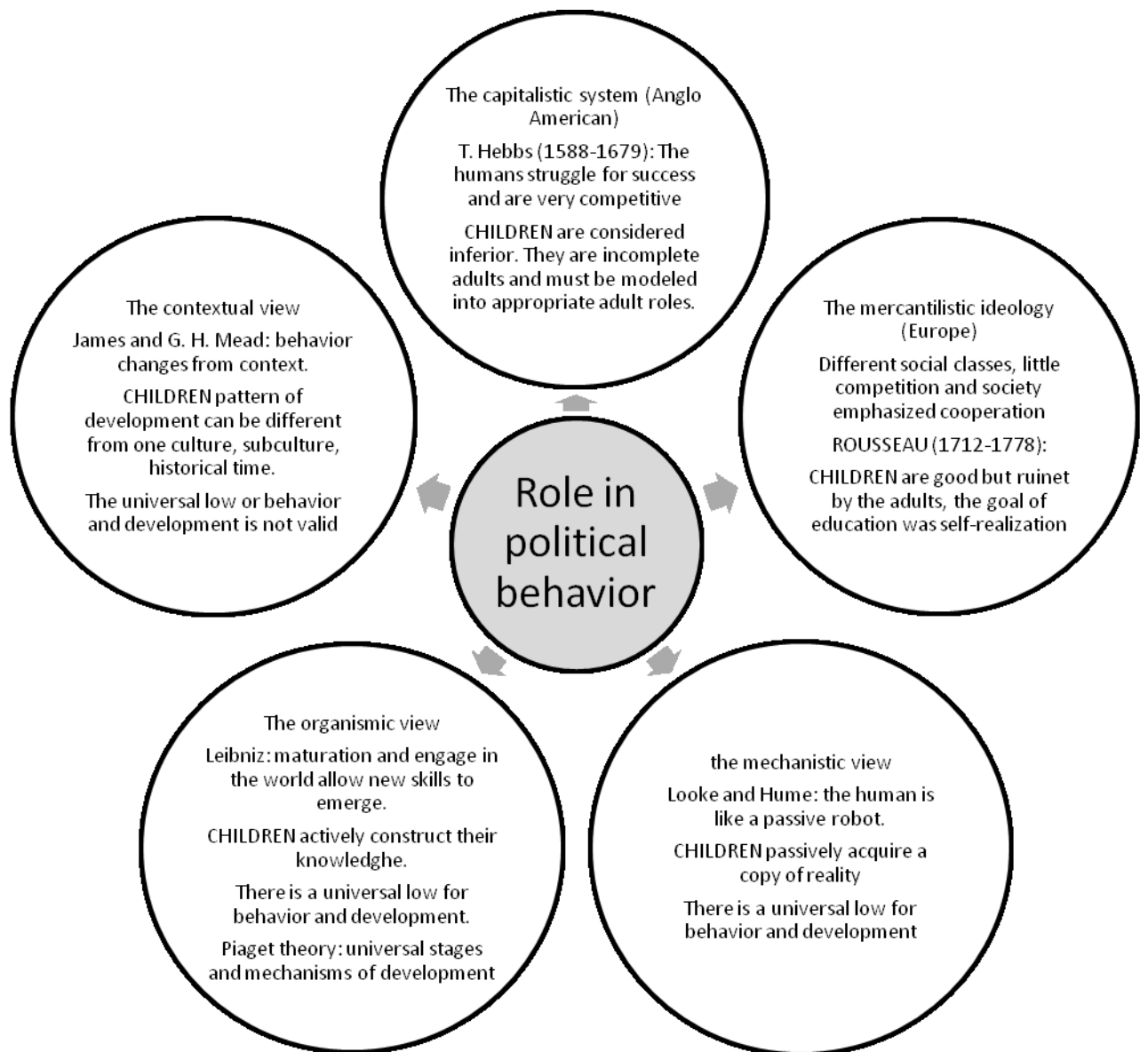


Fig. 1.2 - Role of development in political behavior

1.2 HOW KNOWLEDGE AND BEHAVIOR ARISE FROM GENETIC ENDOWMENT, PHYSICAL MATURATION AND EXPERIENCE?

About the contribution of nature and nurture to development a question is: “how do knowledge and behavior arise from the genetic endowment and physical maturation and from experience”?

The controversy began in classical Greek times and later Descartes (1596-1650) believed that certain ideas are innate while Locke (1632-1704) argued that a newborn’s mind is a blank slate (tabula rasa). Today it is clear that nature and nurture are inextricably intertwined.

The following are some perspectives from a biological point of view.

In 1859 **Charles Darwin**, the founder of evolutionary biology published *On the Origin of Species*, with a new idea of evolution, causing a lot of controversy, that continue today because of a conflict with religious views about the origin of the world and its creatures. He introduced the scientific theory about the natural selection. His theory was confirmed by discoveries in classical and molecular genetics and now is considered the primary explanation for adaptive evolution. The Darwinian evolutionary theory introduced the notion on time as inherent factor and the notion of phylogenetic change. He intends the evolution as a mechanism of accidental selection of variations by the environment. The variations are the principle of the selection. Mendel introduced later the explanation of the growth of the organism as a result of instructions contained in the genes.

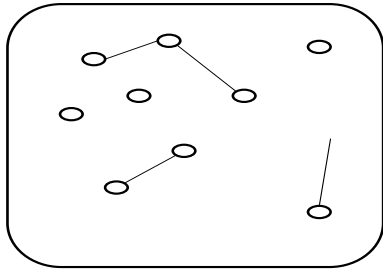
After the Darwin revolution **Gerald Edelman**, in 1987 published the book *Neural Darwinism – The Theory of Neuronal Group Selection*. He argued that the human body is capable to create complex adaptive systems. Edelman wanted a theoretical framework to connect biology and psychology with developmental and evolutionary mechanisms. His theory of neuronal group selection was a way to provide this (Edelman, 1978) and it was based on three basic points:

- Developmental selection: genetic factors control the gross anatomy of the brain but somatic selection during growth and development determine the individual synaptic level of connectivity between neurons and their organization into functional neuronal groups. This means that every person has a different synaptic structure. Thanks to the functional plasticity the neuronal groups self organize in “modules”, made up of different types of neurons.

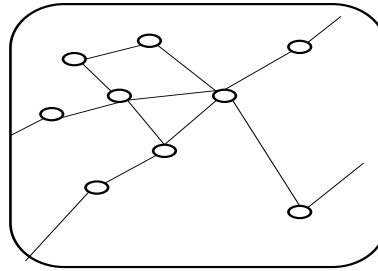
- Experiential selection: the experiences determine a process of synaptic selection within the neuronal groups. The neurons involved can be strengthened or weakened, dependently on the experience.
- Reentrant signaling: there are spontaneous groups of neurons forming re-entrant connections.

Fig 1.3 - The basis of the Theory of Neuronal Group Selection. Adapted from Edelman, 1993, p. 116, figure n. 1.

DEVELOPMENTAL SELECTION



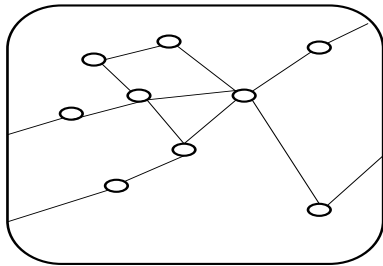
Yelding Primary repertoire



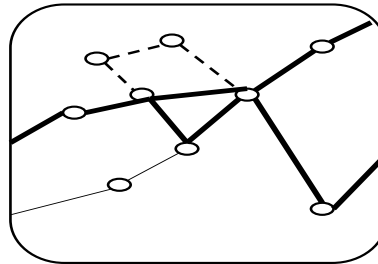
Cell division, cell Death, Process Extension and Elimination CAM Action

Formation of networks of neurons by result of activity and trophic factors released at synapses

EXPERIENTIAL SELECTION



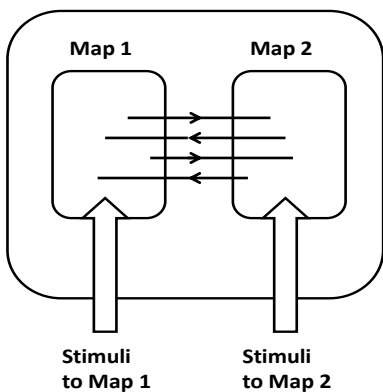
Yelding Secondary repertoire



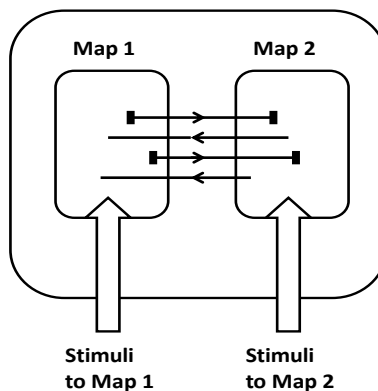
Changes in strenght of populations of synampes

Selective strengthening or weakening of synapses as a result of behavior.

REENTRANT MAPPING



TIME 1



TIME 2

Functional maps and correlation between neuronal groups.
 ■ Indicate active reciprocal connections

Edelman found that the nervous system of the individual has a wide range of structural and functional variability at molecular, cellular, anatomical, physiological and behavioral levels (Edelman, 1987). He also argued that a newborn encounters an enormous quantity of stimuli that cannot be described as preexisting and even after the partition of the stimuli in categories as a result of experience, it is not possible to explain what happens in infant development (Edelman, 1987).

Edelman's theory of *neuronal group selection* argues that an organism categorizes the world from processes of selection upon variation, instead of from instruction or information transfer as argued by the theory of *information processing of functionalist view* (Edelman, 1993). The interactive processes of selection and variation allow the world to become labeled and perceptually categorized: the selection process occurs largely in embryonic and postnatal development a period in which the neuronal groups build up by adjacent neurons, strongly interconnected in structures; the variation process is an alteration of synaptic strengths depending on the animal's activity that can select the response of more adaptive neuronal groups.

Sporns and Edelman (1993) argue that the process of skill learning is specific and this means that if you want to develop a specific task you need to train it in the way to strength the synapses involved in that task. Training facilitates the opportunity to make more probable to execute the same behavior next time. The underlying mechanism of learning is based on Hebb's law: specific groups of neural connections are more functionally persistent and amplify versus more inefficient connections (Hebb, 1949). When the organism interacts with the environment each pair of neurons utilized correlates well and these connections will be strengthened thanks to exercise and repetition. The inefficient connections will be very little correlated and their connections will become weakened and sometimes completely nonfunctional by time. (Adams, 1998). The groups of neural connections persist through selection without determination or instruction by genes or the environment. All of this is possible thanks to a mechanism of remarkable functional plasticity, in the brain. Plasticity means the flexibility or modifiability of neural connections that allows an organism to change physiology, experience and environment (Bownds, 1999). Plasticity activates in response to injury and expertise (Gazzaniga et al., 1998). Kittens reared with one eye lose the ability to use the two eyes together to perceive depth. In this case neurons and neural groups could not build the functional specificity developed after normal exposure to the environment (Goldstein, 2002). The experience is fundamental in neural connections.

In motor control a movement results from the contribution of multiple population of neurons, each involved in a particular direction of movement (Georgopoulos et al., 1986). A particular movement is the result of the activation of an appropriate combination of neuronal groups. The choice of the appropriate movement, between multiple degrees of freedom of the joints is made in a selection of appropriate movements from a repertoire of variants, resulting from the underlying neuronal group selection (Sporns and Edelman, 1993). Maennistoe et al. (2006) demonstrated that a special targeted skill training in children with motor learning difficulty improved consistently their targeted skills, compared with children trained in general skills. The specificity of the learning is also demonstrated by research of Revie et al. (1993).

Gottlieb argues on the *probabilistic epigenesis*, not just genetic (Gottlieb & Halpern, 2002) of development that *there are bidirectional influences within and between levels of analysis* (2007, p. 1). Consequently the development depends on genetic activity → structure → function.

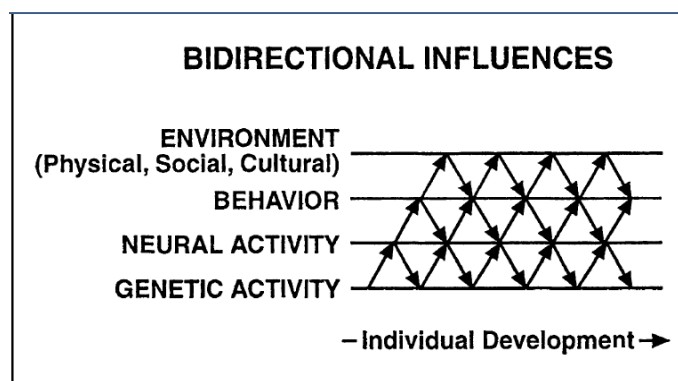


Fig. 1.4 - Metatheoretical model of probabilistic epigenesis (From Gottlieb, 2007, p. 2, figure 1).

In the figure 1 we can see that in Gottlieb's theory the neural structures begin to work before they are fully mature. Neural activity is intrinsically (spontaneous) or extrinsically stimulated and play a fundamental role in the developmental processes. Probabilistic elements, introduced in the developing system and in its outcomes combine with bi-directionality of influences within and between all four levels of analysis (genetic activity, neural activity, behavior, external environment with physical, social, cultural

influences) influence the development. A very important aspect is the ubiquity interaction of gene-environment. Gottlieb argues that the genetic activity is influenced by neural, behavioral and external environmental events. In order to link genes and nervous system also to developmental psychopathological outcomes is important to recognize the bi-directionality of influences and the involvement of behavioral and environmental factors. This explains the different neural and behavioral outcomes of individuals of the same genotype. Observing an intrusive mother of 3-month-old infant we find that probably at 1 year the child will show insecurely attached. The mother's overstimulation affects on child's behavior and child's behavior affects earlier on mother's behavior. Consequently the *phenotypic variation is not strictly limited to random genetic mutation, drift and recombination*, (Gottlieb, 2007. P. 9) but is the result of a lot of epigenetic processes that contribute to individual ontogeny.

New technologies of brain imaging, generating maps of brain activity, fMRIs, electrical activity stimulated cognitive neuroscience. With these instruments it is possible to study developmental changes in cognitive processing. A complex interaction of nature and nurture is how modern neuroscience sees the brain development. Biology and experience are related in the biologically driven overproduction of synapses in the early development. The synapses not stimulated by experience are subject to pruning. Children are living in an environment where they have more or less experiences at about the same time, that influences the pruning. The different experiences and the nature of brain activity determine which synapses survive. (Miller, 2011). The brain is present but also very flexible to deal with adverse circumstances (brain plasticity). Under the concept "neuroscience" we find cognitive neuroscience which study the neural mechanisms underlying cognition. It focuses on the neural sub states of mental processes and their manifestations.

Summarizing, the development can be seen with several aspects:

- a) as a continuous process of change in functional capacity;
- b) related to age (but not dependent): it can be faster or slower at different times; rates of development can differ at the same age of individuals and not necessary advance at the same age for individuals.
- c) involving sequential and irreversible changes, as a result of interactions within the individuals and between the individual and the environment (Haywood et al., 2009).

A variety of individual functions develop, such as: cognitive, social, physical, psychological functions.

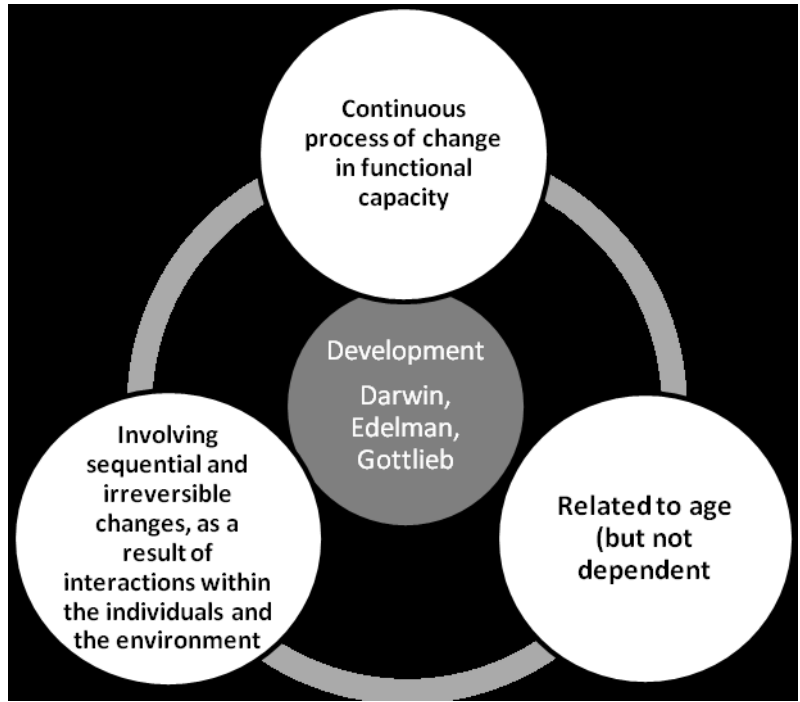
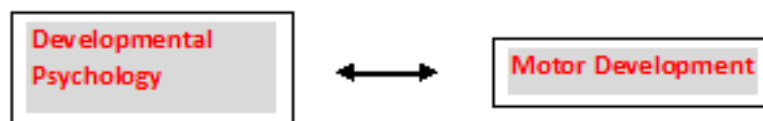


Fig. 1.5 - Development according to Darwin, Edelman and Gottlieb

2 MOTOR DEVELOPMENT

Our nature lies in movement. Complete calm is death. Blaise Pascal

In developmental psychology the analysis of motor development is fundamental to understand child development. Adolph (2014) argues that studying motor behavior can give information into the process of child development.



A wide description of motor development is necessary to better understand, in the following chapters the possible relation between physical activity and cognitive processes.

Researchers studies highlight the relation between child early age style of life and the state of health in older age (Haywood et al., 2009).

2.1 IS MOTOR DEVELOPMENT A GENERAL, UNIVERSAL DEVELOPMENTAL PROCESS?

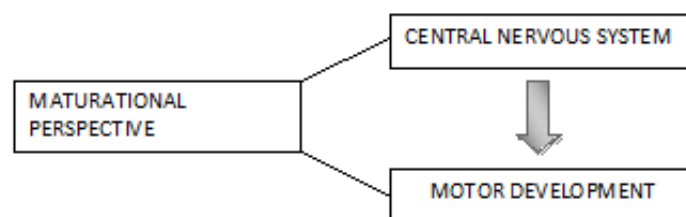
To answer at this question it is necessary to delineate the evolution of perspectives in motor development, describing those that have been and still are the most influencing theory and practices related to motor development in infancy. Furthermore this can help to understand better the consequences in education and teaching.

As Adolph highlights (2015) since 1980 there were only few studies (5,2% of 5.617 journal articles) of motor development compared with other fields of developmental research, such as cognition, social, language, perception, emotion, personality.

2.2 THE MATURATIONAL PERSPECTIVE

The research on motor development dominated the literature in the half of the 20th century, particularly with studies of Gesell (1946), McGraw and (1945), Shirley, (1931). Why the interest on motor development has gone down in the last years? Adolph (2015) supposes it might be due to the fact that the early researchers described motor development as a normative sequence of behavior and that this defined profile of development did not need to implement research.

During the 1930s the maturational perspective explained the developmental changes as consequences of maturational processes, particularly of the central nervous system, that controlled motor development McGraw (1943). Motor development was considered an internal or innate process guided by a biological and genetic clock. in maturational perspective the central nervous system is the only responsible for motor development.



The role of the environment was considered to make speed up or slow down the process of change, and not as a fundamental factor in promotion of changes in the considered biologically determined development. Gesell (1928, 1954) had the assumption that *each stage of development corresponds with a stage of evolution*. For him the biological and evolutionary history of humans determined a rigid sequence of development orderly and invariable. After the studying of twins he consolidated the concept that children developed in an orderly fashion and that developmental changes were predictable, predetermined. Consequently Gesell argued that children develop naturally, without special training and influence of environment.

Gesell was inspired by Coghill's (1929) link between developmental changes in the swimming patterns of salamander embryos and embryological development. He used infants' movements, as Coghill done with salamander embryos' movements, to highlight the existence qualitative changes in human development.

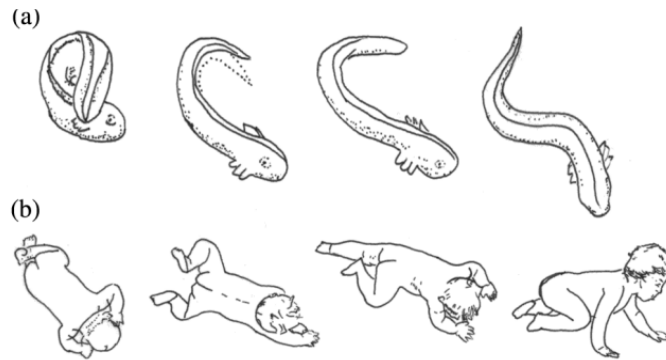


Fig. 2.1 - Coghill G. E. (1969) identified 4 positions of swimming movements in the salamanders embryo and Gesell (1934) inspired drawn 6th, 7th, 9th, 18th stages of infant crawling.

Coghill (1969) believed that the onset of particular behavioral configurations was coincident with the growth of specific neural connections. He found that first the early motor pattern and then the corresponding sensory tracts developed. Consequently his idea was that the maturation of neural connections produced swimming. Gesell was influenced by Coghill's finding in different aspects (Thelen, Adolph 1992): a) the idea that shape or morphology of the organism behavior lead to understand development; b) the extension of the principles of morphology and growth to all aspects of mental life; c) the behavior is a consequence of the growth of the nervous system; d) *"growth is a patterning process. It produces patterned changes in the nerve cells; it produces corresponding changes in patterns of behavior"*(Gesell & Ilg, 1943, p. 18); e) neural changes are product of growth and they are not influenced by function. "Patterns of behavior in all species tend to follow an orderly genetic sequence in their emergence. This genetic sequence is itself an expression of an elaborated pattern, a pattern whose basic outline is the product of evolution and is under the influence of maturational factors (Gesell, 1933, p.217). McGraw identified 7 stage in walking development. Gesell described 22 stages of crawling development and he produced the developmental norms, which represent the expected maturational stage of a child reflecting the integrity of his, her nervous system.

Gesell (1934) and Thompson (1838) designed tasks and detailed age-based changes that become the basis of the Bayley Scales of Infant Development (1969) and Frankenburg & Dodds tests (1967).

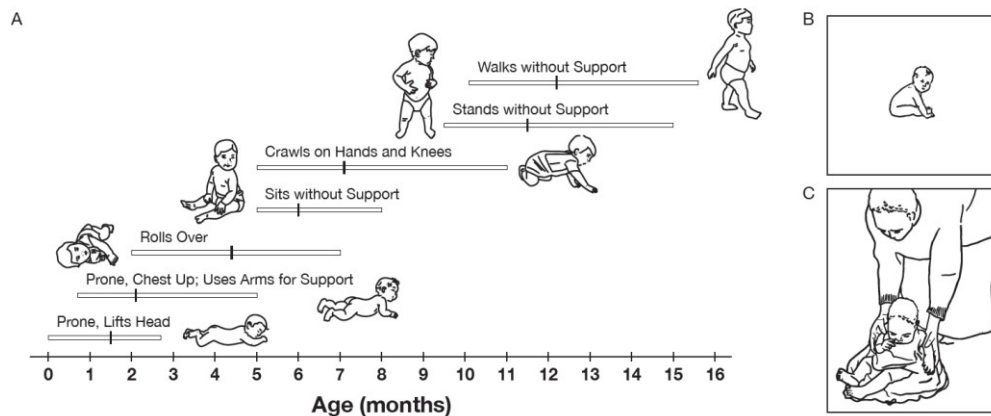


Fig. 2.2 - The figure shows a standard chart of infants' motor milestones. It illustrates that motor skills improve with age. (Adolph et al., 2015)

A) Standard motor milestone chart: postural and locomotor skills are ordered by chronological age progression and age norms for each skill. The horizontal bar shows the normal range of skill onset; vertical lines show the average age of first occurrence. Picture of (Bayley, 1969; Frankenburg et al., 1992) from Adolph et al. (in press), p. 3

B) This picture, and the figure show an isolated infant and animal in an empty space, without of context (title page of McGraw's, 1945).

C) This picture shows a more embedded and enculturated situation of sitting in a West African infant. The infant is shown supported by the ground, and a caregiver. The full environmental and contextual aspects are evident.

Although Gesell and Thompson (1934), McGrows (1935) and Shirley (1933b) also supported that perception, cognition, motivation and social interaction affected motor skill acquisition only the normative data and milestone charts were considered. Perhaps this level of certain knowledge about motor development increased interest for other fields of developmental studies that determined the cognitive revolution, such as the

studies on the mind that played the attention on the inner processes (Piaget 1952, Vygotskij 2013). Researchers in cognition often consider the development related to chronological age and the passage of time is considered the factor responsible for developmental changes (Adolph & Berger, 2006; Adolph et al. 2012; Siegler, 2006). The concept of *maturation* represents only passage of time and does not consider the neural-hand waving as an agent of change (Dominici et al., 2011). In this view researchers organize children in age groups persuaded that this is convenient for study them (Wohlwill, 1970). They don't consider that in a group of children of the same age there could be differences, due to magnitude, to height, weight, experience and other aspects. In this perspective the onset age is considered related to the number of days between birth and the appearance of a new motor behavior (Saavedra et al., 2012). The experience is also considered the days between onset of a behavior and the date of the test (Adolph, Vereijken, & Shrout, 2003). Walking age is, for instance, often considered in term of chronological time, yet and the child age confused with the experience (Adolph, in press). To learn to walk infants walk every day the length of 45 football fields and fall 100 times (Adolph et al., 2012). In addition, to attribute an onset age to the first appearance of a skill is related the assumption that skill acquisition is stage-like and that an infant after that day can walk. The development of the walking skill is not linear: one day the infant walks and then he does not walk for some days. He needs a lot of experience of walking and falling before the skill stabilizes (Adolph, Robinson, Young, & Gill – Alvarez, 2008). For example, in the development of depth perception a person needs to be exposed to a minimal amount of visual stimulation. This means that a person doesn't need a specific environment to develop changes, but without a general environment the skills will not develop (Wholwill, 1970).

2.3 A DESCRIPTIVE PERIOD

In 1950s a normative description movement, led by Espenschade (1947), Glassow and Rarick & Smoll (1967) arrived and researchers focused on the products (scores, outcomes) of development rather than on the developmental processes, responsible for the quantitative scores. Glassow (1932) and Halverson (1983) made careful biomechanical descriptions of the movement patterns of children, while performing motor skills. The

educators used these new information of age-related changes in motor development in their practices.

2.4 A PERIOD OF FORGETFULNESS

From 1950s and 1980s motor development was forgotten by researchers. Until 1970 researchers described movement identifying age group norms (Clark & Whittall, 1989) and tried to identify the natural sequence of changes.

The motor milestones are nowadays still the accepted guidelines for clinicians and guide the educational practices by several caregivers that consider that the basic motor skills will automatically develop, as they depend on neuromuscular maturation. Following this belief parents, teachers and practitioners don't find it necessary to facilitate development of basic skills also because they consider the cardiovascular, the skeletal, the endocrine, and the muscular systems not relevant in motor development, as the central nervous system is the only responsible of development (Haywood & Getchell, 2011).

2.5 INFORMATION PROCESSING

Other perspectives are Bandura's social learning (1986) and Skinner's behaviorism (1938).

During the 1970s and 1980s information processing became the dominant perspective in physical education. It considered the brain like a computer, taking in information, processing it and outputting movement. Motor learning and development was considered as the result of some external or environmental input (Schmidt & Wrisberg, 2008; Schmidt and Lee, 2005). In this perspective the formation of stimulus-response bonds, feedback and knowledge of results were emphasized. Information processing perspective appeared around 1970 and experimental, developmental psychologists, motor learning scientists expert specializing in physical education followed it in 1970s and 1980s (Schmidt & Wrisberg, 2008). Some developmentalists studied perceptual-motor-development in children within this perspective (Clark & Whittall, 1989).

The methodologies used by information processing psychologists are rigorous experimental methods. Some of them are: the method of rule-assessment approach, based on error analysis; eye movement analyses; microgenetic method, flow diagram, computer simulation model.

3 A NEW IDEA OF MOTOR DEVELOPMENT: THE ECOLOGICAL PERSPECTIVE

Instead of motor development, researchers now prefer to use terms like perceptual-motor-development, perception and action, motor skill acquisition. Adolph (2015) argues that it could be because these terms highlight the relation between adaptive control of motor actions and psychological processes such as perception, planning, decision making, memory, motivations.

The most popular perspective used by researchers in motor development, today, is the *ecological perspective*, that emphasizes the interrelationship between the individual, the environment and the task. All system becomes important in the resultant movement and the emergence of a motor skill is dependent on the interrelation of body, environment and all internal and external constraints. This perspective considers constraints existing within the body, such as cardiovascular, muscular; outside the body, like ecosystem related, social, cultural. Heywook & Gatchell (2009) consider three branches of the ecological perspective:

- a) the dynamical system, related to motor control and coordination. The approach is inspired by Nicholai Bernstein and expanded by Esther Thelen (Gibson & Pick, 2000; Thelen & Smith, 1994; Kelso, 1995).
- b) perception (perception-action) (Gibson, 1979).
- c) a new developmental robotics (Lungarella, Metta Pfeifer & Sandini, 2003; Oudeyer, Baranes & Kaplan, 2013, Vernon, von Hofsten, & Fadiga, 2011).

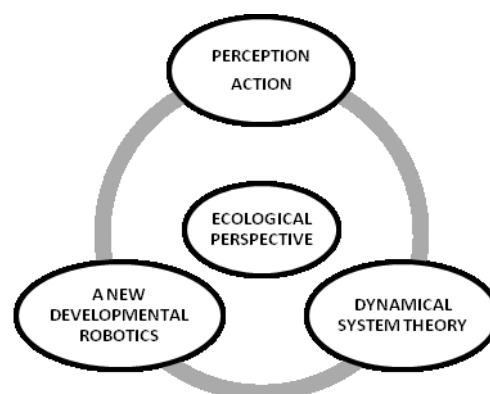


Fig. 3.1 - Components of the ecological perspective of Gibson

The new approach is interested to flexible, adaptive motor behavior. In this optic the morphology of the body determine the possible movements and consequently the developmental changes in body structure change its possible actions. Movement begins in the fetal muscles very soon, during waking and sleep and it happens incidentally (Green & Wilson, 2006; Wilson, Green & Weismer, 2012). Some actions accomplish immediate goals and others serve developmental functions. Moving can influence the developing nervous system. Fetal movements are useful to train muscles, flex joints, stretch skin. This movements are necessary to provide a normal development. When an infant is sleeping the nervous system generates twitches, which are very useful for him, to learn some important information about the working of his body, while sleeping (Blumberg & Marques, 2013).

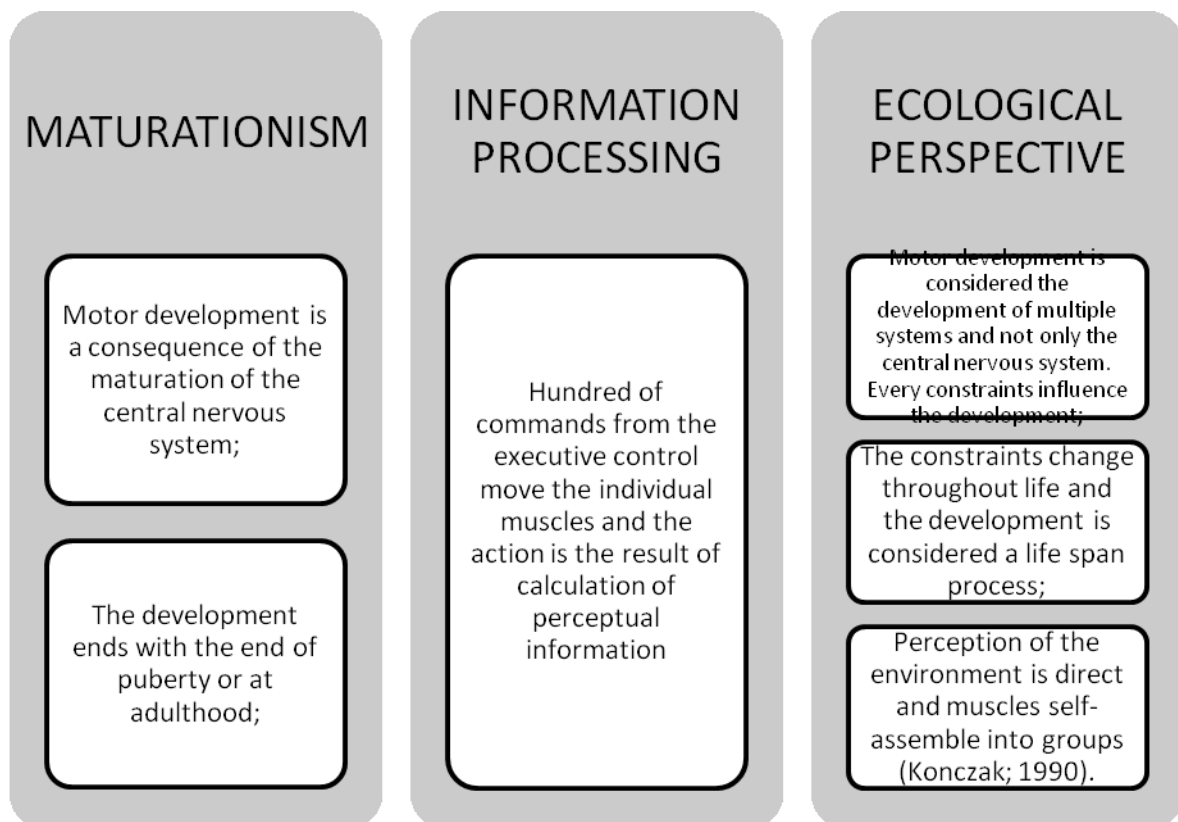


Fig. 3.2 - Theories of development

3.1 GIBSON'S ECOLOGICAL THEORY OF PERCEPTUAL DEVELOPMENT

Eleonor Gibson posed at the basis of her perspective the *affordances*, a term introduced by James Gibson (1979). The *affordance* is an opportunity for action, what the environment offer or provide for an organism. For example some surfaces *afford* walking or crawling, and the social environment offer *affordances* as smiling and angry. The relationship between the organism and the environment offers *affordances*, that can be useful to a person, related to his/her capacities. When a child exploring and playing experiences new motor skills and acquire them he discovers new *affordances*. Everybody has own ability to use potential affordances depending on the experience (Gibson & Pick, 2000). For Gibson children are motivated to perceive or learn to perceive objects, and others thanks to the evolutionary heritage. They are able to extract information and proprioceptive stimulation perceiving the objects and fro their body in movement in the way to understand how the affordances fit with their abilities. The expert person is able to distinguish a saxophone in a melody, while a person who has not music knowledge cannot. The perception improves by listening to the music and directing the attention and not by adding words, or applying schemes, or cognitively gluing together the notes, or perceiving a stimulus. (Gibson, 1988).

During the exploration of objects in different environments children learn about important properties of objects and the affordances of the properties. In stimulation the child finds the structure, that is the information available to be perceived. For Gibson the structure of the information *is in the stimulus* (object), while for Piaget the structure *will be build* by the nature of the interaction between the child and the world (Miller, 2011). In addition, for Piaget children build their knowledge by forming *schemes* based on their experience with objects, that are static images needing corrections by the operational knowledge.

The perception in children improve with experience and it is not stage-like. What information children can extract depend on their maturational level, immediate goals, and own specific individual set of learning experiences.

It is very important for children to be active by exploring the world. A preschool teacher can provide them interesting and different objects, surfaces, environments where they can play.

The great problem of our society now, the “physical inactivity”, with obesity epidemic may be harmful in children’s learning and self-regulation (Davis et al., 2011).

Gibson ecological orientation is relevant in the current state of cognitive developmental research. This theory could enrich the information processing approach considering the properties of the environment and the events as dynamical stimuli in the process. Moving the body on surfaces and around objects helps cognitive development. To explore and perceive surfaces, events and objects with their affordances is the knowledge of the world. When children practice physical activity and control their bodies with rapid decision making they also learn to control their cognitive activities, such as the metacognitive activities (monitoring and checking) (Tomporowski, in press). Gibson focuses on an idea of “self” based on what the child do, in terms of “agency”, connoting doing and action (Miller, 2011).

Contemporary research (Adolph, 2008) on perception argue that some perceptual learning is specific (e.g. dangerous activity such as going down the slope) and some is general. When a child becomes able to extract relevant information about new locomotor problems and their potential solutions we can say that the child is in a process of learning to learn.

3.2 DYNAMICAL SYSTEMS APPROACH

It is a branch of the ecological system introduced by Kugler, Kelso, Turvey (1980, 1982). They followed Bernstein and suggested that the organization of physical and chemical systems are constrains in the behavior. Differently from maturational and information processing this perspective considers the coordinated behavior as “*softly assembled*”, rather than hardwired (Haywood et al., 2009). The constrains within the body act together as a functional unit. There is not a hardwired plan, a pre-programming control and this gives greater flexibility to actions in different situations, and infinite combination of kinematical solutions (Newell, 2003). As a consequence of self organize system the movements is the results of the interaction between individual’s, environmental tasks’ constraints. Summers & Anson (2009) proposed the concept of *coordinative structures*, to identify “*intentional, soft-assembled, autonomous multi-level entities governed by dynamical principles of self-organization*” (pp. 571). If we change a constraint the emergent movement changes (Clark, 1995). Each body’s system can be considered a constraint and do not develop at the same rate. Some of them mature quickly and some

slowly (Thelen, 1998). Developmental changes, disease or injury may strike one's system during his entire life. Changes in the body activity during everyday life alter the real-time biomechanical constraints on movement (Bogin & Varela-Silva, 2010). Dynamical system theory is an organismic theory, based on the Gottlieb's probabilistic epigenesis. Thelen and Smith (1998, 2006) argue that human development is an open system and that the order emerges from different parts. Many heterogeneous parts of the system are free to combine (cells, tissue, organs, others) in an infinite number of way. In an open system the parts interrelate in a non linear manner. Fluctuation within the system, as changes of context may alter the pattern of the system. If a child is going up a hill, after a certain level of inclination he must change the style of locomotion, going for example by quadrupedal gait, climbing. This sort of soft assembly of movements is the essence of plasticity in human development.

3.3 THE CONSTRAINTS THAT INFLUENCE THE DEVELOPMENT

In his model of constraints of motor development Newell (1986) highlights the dynamical, constantly changing interactions in motor development and emphasizes the influence of the experience (task) and of the environment (Haywood et al, 2011).

Newell suggested that motor development is due to the interaction of the organism with the environment and the task. When one of these factors changes the movement changes and over time also motor development changes. He defined these aspects constraints. A constraint limits or discourages but also permits or encourages (Haywood et al, 2011).

- a) **Individual constraints** (individual body structure): biological, physical (height, limb length, strength), motivational (values, believes) mental characteristics. The constraints are both structural and functional. *Structural constraints* are related to individual body structure, such as height, weight, muscle mass, leg length and change with growth and aging; *functional constraints* are related to functional behavior, such as motivation, fear, experiences, inhibition, values, believes and others and change faster in the time. The functional constraint shapes the movement of running, walking and sitting

- b) **Environmental constraints** (outside the body): physical (temperature, humidity, light, gravity, surfaces, clothes, economical-social-cultural environment (encouraging or discouraging to be active, believes, values, cultural habits, education, economical possibilities);
- c) **Task constraints** (external to the body): the goal of a movement or activity, the rules and roles, the equipment, clothes, body height, height in which the movement occurs and the purpose or reasons of the task: (why is he moving? What is the purpose? What are the beliefs and values of the individual? A different movement ariseS from changing one of these points and a different interaction between these points changes motor development.

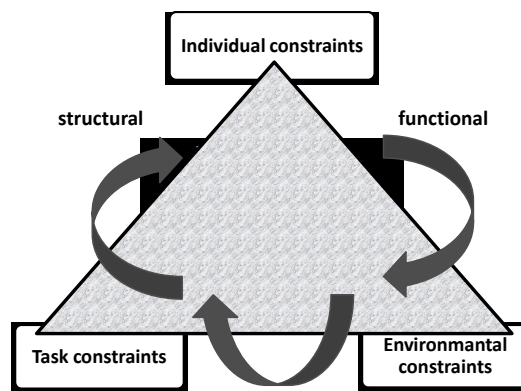


Fig. 3.3 - Newell's model of constraints. Adapted from the original picture in (Haywood et al, 2011)

4 THE STATE OF RESEARCH

The following themes are emblematic of the state of the research on motor development. Adolph et al. (2015) defines the main aspects resulting from the recent studies in motor development as following:

- a) Movements are **embodied** in children's growing physical bodies, acting in the real world;
- b) Behavior is **embedded** in the physical environment, enriched with sensory information, requiring perception for action;
- c) Motor development is **enculturated**, shaped by caregivers, social norms, cultural practices.

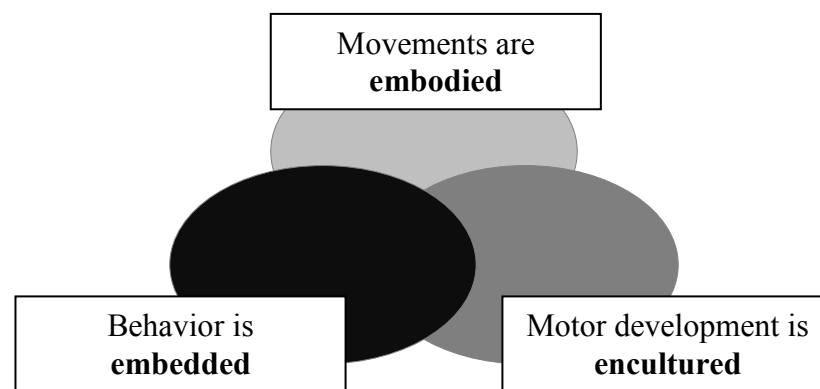


Fig. 4.1 - Emblematic theme in the study of motor development.

4.1 BEHAVIOR IS EMBEDDED

We are situated in a physical environment that suggests, constrains and shapes motor actions. The environment factors, such as gravity, temperature, space organization, tools, and others are always influencing the person. The environment is variable and it requires flexible and adaptive actions. The capability to adapt is guided, in the more sophisticated animals, by perceptual information. As the perception involves the whole animal, that is

nested in its environment, the approach is necessarily a systems approach (Adolph et al. 2015). Gibson E. J. (1984) thought that perceptual learning could only be understood in the context of development, so her theory started with a developmental approach. Hers was a functional approach to perception and perceptual development (E. J. Gibson, 1982). A functional view considers the purposes of perception in everyday activity and over the evolutionary history of the species. The question in perception researchers is: “*how animals perceive what is going on around them so as to make good use of what the world offers?*” (E. J. Gibson, 1997, p. 42).

For Gibson (E. J. Gibson & Pick, 2000) informations arrive richly imbued with structure (objects, surfaces, ..) to sensory receptors . This is not a static image but it emerges over transformation in space and time (movements of objects, observer movement, edges gradients, flow. .)

The organism must learn through experience how to generate and detect the appropriate perceptual information. The child and the surrounding environment constitute an interactive system with each constituent reciprocal to the other (E. J. Gibson, 1997).

Animals generate information about the environment and must tailor their actions to the environment. Reciprocally the environment provides the animal with opportunities and resources for action (E. J. Gibson & Pick, 2000, p. 14) and with information that specifies those opportunities and resources.

The appropriate description is an ecological one: the animal’s body, capabilities, and propensities must be described relative to the environment; reciprocally the properties and features of the environment must be described relative to the animal.

Perception takes animal environment reciprocity into account because to perceive the world is to co-perceive the self (E. J. Gibson, 1991).

For Gibson (1988a) perceiving is an active process. We don’t just hear, we listen; we don’t just see, we look. The visual system is a motor system as well as a sensory one.

Perception guide action in a changeable environment. Thus perception and action operate as a continuous cycle whereby perception obtains information for action and action has consequences that inform perception about both the organism itself and the events that it perpetrates (E. J. Gibson, 1997, p. 25). All actions must be guided by perceptual information. Reciprocally, actions turn up perceptual information about the environment, what the animal is doing, and what it might do next. Gibson (1997, p. 25) differentiated between exploratory action and performatory action (controlling environmental

consequences). But both types of action generate perceptual information and both are guided by perceptual information.

Development for Gibson (1970) included changes over evolution and in the individual's lifetime.

Development involves changes in animals bodies, perceptual sensitivity, action capabilities, and environments. The developmental course of these changes creates changes in the perception action loop and thereby constrains or facilitates perceptual learning and development (E. J. Gibson & Pick, 2000).

New action capabilities bring about new ways of generating information and also alter the relevance of the information generated (E. J. Gibson, 1988a).

Objects take on special relevance once infants acquire manipulatory skills. Accordingly infants exhibit sensitivity to the three dimensional form of objects after they can produce coordinated visual-manual exploration, which in turn, depends on the ability to sit independently (Soska, Adolph, & Johnson, 20).

The learning is more dynamic and fundamental than a static display. (Gibson and Pick, 2000); it does not occur only in the brain but it is a whole body activity. Perceptual information are generated through actions (Pfeifer, Lungarella, Sporns, & Kuniyoshi, 2007). There is a dynamical relation between goal-directed actions and exploration of the environment. Exploring the environment from a distance and through direct contact gives information to plan actions in advance and during execution of a skill and help children to learn the limits of their motor abilities in specific situations (Adolph et al., 2015).

Affordances

What animals learn to perceive are affordances for actions (E. J. Gibson, 1980,1982,1992,2000).

Affordances are possibilities for action that the environment offers (J. J. Gibson, 1979).

Possibilities for action depend on the fit between the animal's bodily capabilities and the physical properties of the environment

The animal environment relations exist objectively in the interface between self and world. Affordances thus are real regardless of whether they are perceived or used. Affordances reflect both animal environment reciprocity and perception-action

reciprocity because affordances must be perceived, perception must guide action and actions are implicit in affordances.

In Gibson (1982) “*we do not perceive stimuli or retinal images or sensations or even just things; what we perceive are things that we can eat, or sit down on, or talk to*” (p. 60).

We don’t only perceive the size or distance of objects. We perceive whether something is within arms’ reach and whether it will fit into our grasp. What we perceive are the functional relations between self and the world.

Perceptual development is a process of learning about affordances, becoming better able to detect appropriate supports and resources and discovering new affordances as action capabilities change (E. J. Gibson, 1992).

4.2 MOVEMENT IS EMBODIED

The morphology of the body determines the range of possible movements, as all our movements occur in our body. Adolph (2008) considers that an infant is not encouraged to learn particular motor solutions, because of the continues changes, while he is encourages to acquire flexibility and adaptability. The learning begins as soon as muscles are innervated, when the fetus moves in an incidental activity, while awake and asleep. Also children dedicate large amount of their time in gross motor play. Like for other mammals, spontaneous gross motor play involves large movements of the body, objects directed actions, social play. Movements are repeated, with some variations. Children engage in spinning, rolling, handholding, and simulate to play with other people, involving in sophisticated symbolic activity ad rules (Burghardt, 2005). For Pellegrini & Smith (2007) play promote development of bones and muscles, promote neural plasticity, through generation of variable neural activity and proprioceptive feedback (Van Praag, Shubert, Zhao, & Gage, 2005). Spinka, Newberry, & Bekoff, (2011) find the play a very good way to provide new skill, to practice hazardous behaviors (Fagen, 1981). Social play in young can develop skilled performance under stressful condition (Pellis & Pellis, 2009).

A child action is not necessary an antecedent of another action. Infant cruise, for example, is not an antecedent of walking. It just because before in time, as infants cruise before they walk. These two locomotor movements are very different in structure and are not consequently. When infant cruise their movements are very different with those necessary

to walk. While infants are cruising, they are in a standing position and while they are holding onto furniture for support, they are moving sideways. While they are walking they need to go in a forward direction and need to support their full weight on their feet (Adolph, Berger, & Leo, 2011).

Motor skills become increasingly precise with age and experience (Adolph & Berger, 2006; Bertenthal & Clifton, 1998) and some children achieve a milestone earlier or later than average and by very different pathway (Siegler & Jenkins, 1989).

As control increases variability decreases (Adolph & Berger, 2006). For example, to be capable to seat need to control the segmented bendable, spinal column to provide the head and trunk to stay securely inside the base of support, provided by the baby's bottom and legs (Saavedra, van Donkelaar, & Woollacott, 2012).

In motor development variability provides new possibilities for actions that make movements more adaptive (Hadders-Algra, 2000; Sporns & Edelman, 1993). Spontaneous and exploration activity help infants to provide different movements, and help them to gradually converge on a solution in line with magnitude, dimension of the body and characteristic of the task (Goldfield, Kay & Warren, 1993).

Selection and stage theories suggest that less functional strategies and less advanced behaviors are eliminated from the motor repertoire. Some alternatives are that older, less advanced strategies coexist with newer and they change in frequency, depending on the task (Siegler, 2006). The capability to choose from a wide range of possible actions might be the demonstration of a more adaptive behavior (Gibson & Pick, 2000; Piaget, 1952).

Children usually use a variety of strategies to solve a problem and they tend not to use a new one, also when it is certainly better (Schmuckler, 2013; Siegler, 2005). Infants persist in less efficient movements also when they coexist with more efficient ones (Adolph, Verijken & Denny, 1998; Atun-Einy, Berger, & Scher, 2012). Movement strategies may emerge as waves and sometimes performance gets better and sometimes worse.

The body changes during life and alters the biomechanical constraints on movement. Acquire new motor skills helps body to move in different situations. There are some atypical body situation, like for example Olympic female gymnasts basket athletes and others, that need special adjustment in movement. Also overweight and obesity, implicate an atypical body that implies arrangements of motor control (Ogden, Carrol, Kit, & Flegal, 2012).

Children obese and overweight are less coordinated and infant in the same conditions have delayed development Graf et al., 2004; Slining, Adair, Goldman, Borja & Bentley,

2010). Obesity in childhood utilized more energy and the costs of locomotion are greater (Nantel, Brochu & Prince, 2006). Thanks to developmental plasticity children with atypical body can adapt motor behavior (Adolph et al., 2015).

4.3 MOTOR DEVELOPMENT IS ENCULTURED

Cross cultural studies help to understand the role of experience in development.

Some empirical evidences indicate cross-cultural differences regarding gross motor development (De Onis, 2006; Aina & Morakinyo, 2005). Particularly sub-Saharan African infants showed to be more motorically developed, compared to other groups, specially respect Caucasian infants, who were at the lowest rank (Werner, 1972. Lohaus et al. (2014) showed that Cameroonian infants, increased gross motor skills (sitting, standing, walking) much earlier than German infants, when measured at the age of 3, 6, months. The difference in gross motor skills disappeared at the age of 9 months. German infants, on the other hand, were increasing fine motor skills from the age of 3 to 9 months.

Studies of Geber & Dean, 1957; Griffiths, 1969; Konner, 1977; Nelson, 1959) suggested that the earliest precocity of African newborns cannot be innate but due to the influence of experience. Also Thelen et al. (1993) suggested that motor achievements during the first year of life depends on practice.

Hopkins (1976) noticed that in the different cultures there are prescribed behavioral techniques applied to children, in form of specific teaching exercises to develop the milestones of movement (sitting, standing, walking). He also demonstrated that infants of Afro-Caraibben mothers that practiced a cultural routine of handling were more precocious in sitting and walking than British infants (Hopkins and Westra, 1988, 1989,1990; Hopkins, 1991). Other studies document the different cultural approach to motor development, that produce different motor development (Ainsworth, 1967; Kilbride & Kilbride , 1975; Apoko, 1967; Le Vine & Le Vine; 1963, Bril & Sabatier, 1986). Lohaus et al. (2014, according to Werner (1972) consider differences in development as the result of *cross-cultural differences in child-rearing practices*.

Keller & Kaertner, (2013) argue that cultural differences in test performance may be related also to test biases: particularly competencies that are emphasized in non western contexts may be underrepresented in the tasks. They assert that in Bayley tests balance

skills, relevant in many sub-Saharan environment, are grossly underrepresented (Keller & Kaertner, 2013). There are not specific items in the test, able to capture the specificity of the experience, typical for some cultural groups. On the other hand some items, such as ascending or descending stairs or cutting with scissors and manipulate a pen are not familiar for African children, respect western children and the balance skill of walking hanging a jar on the head is not measured in the tasks. Consequently the results might be caused by familiarity with the objects instead of development.

Kolling et al. (2014 p. 1) argue that *developmental processes are culture-specific manifestations of universal behavioral predispositions and developmental pathways constitute culture-specific solutions to universal developmental tasks*. It is therefore necessary to associate the studies on motor development with the specific eco-cultural context, that manifests orientations toward autonomy and relatedness (Keller (2007; Keller & Kaertner, 2013).

Adolph, Karasik, & Tamis-LeMonda (2010) also consider the developmental advances of one cultural group compared with another limited to *specifically (formally or informally) trained motor skills*. Consequently they criticize the assumption of a universal development sequence.

Vierhaus et al., (2011) reported that cultural differences between German and Cameroonian Nso children disappeared at the age of 9 months. Other longitudinal studies showed several perinatal and demographic variables associated with infants' mental and motor development within 24 months (Brazelton, 1972; Santos et al., 2001; Solomons, 1978; Wu et al., 2008).

Sigmundsson and Hopkins (2010) found that Icelandic infants from 2 - 3 to 7 months after five months of swimming training improved in balance and grasping skills, respect infants that don't participate to the study. At the age of five years old both baby swimmers and the control group were tested on the same skills and baby swimmers resulted the best in balance and grasping, four years later. This study show how physical exercise may have positive effects on motor skill development also after four years.

4.4 CURRENT RESEARCH IN MOTOR DEVELOPMENT

Adolph (2008) argues that some perceptual learning is specific and some is general. When a child acquires a new motor skill he/she acquires also new possibilities for actions, new affordances and it is a process of “learning to learn“. Motor development is now considered important in research also because of its important on cognitive development (Rakison & Woodward, 2008). Campbell, Eaton & McKeen, 2002) support that 4 y old children who are highly active are better than less active children to inhibit the behavior, when it is necessary. Brain neuroimaging studies evidence connections between motor behavior and cognitive activity (Diamond, 2000) and highlight that specific differences in brain networks in autism, ADHD and Williams syndrome depend on biological basis. Early experiences may also have permanent effects on gene expression from the molecular to the behavioral level (Diamond, 2009).

4.5 THE ROLE OF CAREGIVERS IN DEVELOPMENT

Infants, toddlers and children live in an environment and in a social context. Fundamentally they depend on the caregivers rearing. Different caregivers behaviors might influence different motor and cognitive development, as suggested by cross-cultural studies (Yen-Tzu, et al., 2008; Kolling, 2014; Keller, 2007). Yang (2003) observed that Taiwanese mothers use more encouragement and emphasize independence respect the first-born children, with measurable consequences on infants motor and mental development. Yen-Tzu et al. (2008) noticed that there are different priority in rearing practices among cultures, that lead to different developmental performance. A range of studies support that prone sleepers acquire motor milestones earlier than supine sleepers (Jantz, Blosser, & Fruechting, 1997; Davis, Moon, Sachs & Ottolini, 1998; Majnemer & Barr, 2005) and Yen-Tzu et al. (2008) suppose that the practice of the Taiwanese parents to place their infants in a supine position with little play activity in the early months might contribute to lower results in Bayley tests.

Fundamentally, people in the various cultural groups share ideas of adequate parenting practices. The consequent child rearing activity produces developmental consequences within cultural groups, that constitute the local culture (Bornstein & Lamb, 1999).

Parental belief system informs behavioral practices on infant and children (Bornstein et al., 1996; Super & Harkness, 1996. Hopkins & Westra (1988) argue that cross-cultural studies show that infants subjected to physical exercise are facilitated to develop fundamental motor abilities or motor milestones. Some studies support this effect (McGraw, 1935; Lagerspets et al. 1971; Zelazo et al. 1972).

Keller (2007) identifies *a model of parenting*, which consists in parenting practices, common but specific to every cultures, and shaped by the interactional mechanisms between care-giver and infant. Parenting system can help infants to adapt to a wide variety of potential environments (Keller, 2000; Keller, Lohaus et al., 2004; Rothbaum et al., 2000a) and can be also seen as a key to understand the different acquisition of motor milestones in different cultures.

PARENTING SYSTEMS	FUNCTION
<ul style="list-style-type: none"> • Primary care • Body contact • Body stimulation • Object stimulation • Face to face • Narrative envelope 	<ul style="list-style-type: none"> • Nurturance and survival • Survival, belonging • Motor development and body perception • Socio-cognitive development and exploration • Sensitivity for own and others' mental states • Directing child's attention and understanding

Fig. 4.2 - Heidi Keller - Model of Parenting. Function of the different parenting system (Gelfand et al., 2013)

The different components of the model vary in different context, influencing infant and children development.

Body stimulation is an important way for parents to communicate with their children but also to provide the infant motor challenges through the actions of touching and moving (Keller, Schoelmerich, & Eibl-Eibesfeldt, 1988) and it can be also functionally related to motor development. In the case of Cameroonian infants Lohaus et al. (2014) noticed that the parents stimulated the body, particularly with rhythmic activities, stimulating the vestibular system and consequently incremented balance skills.

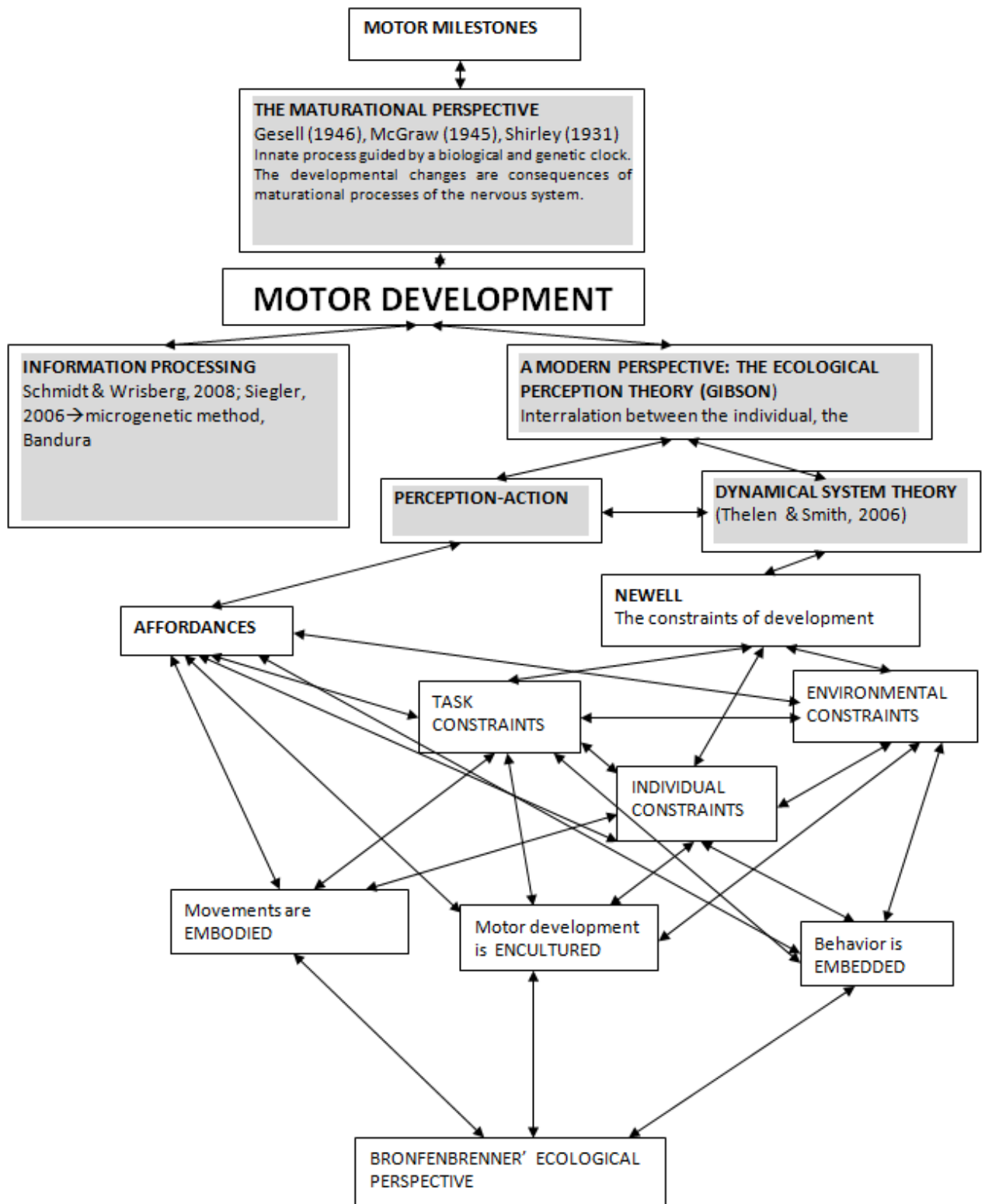


Fig. 4.3 - A summary of motor development

4.6 BETWEEN MOTOR AND COGNITIVE DEVELOPMENT: BRONFENBRENNER'S BIO-ECOLOGICAL THEORY OF DEVELOPMENTAL PROCESSES

In accordance with the previous perspectives, that emphasized the fundamental role of the environment in child development, the Bronfenbrenner's bioecological theory, a contextual approach, associated with Vygotsky socio cultural approach, highlights different levels of interaction that we need to consider. The author considers the context as a set of nested structures, influencing the person at every level and each others.

Bronfenbrenner (1979) images the developing child embedded in a multileveled social, material and cultural context and argues that developmental researchers should focus simultaneously on child, context and on developmental processes. The characteristics of context and environment can promote or inhibit development and are organized in levels:

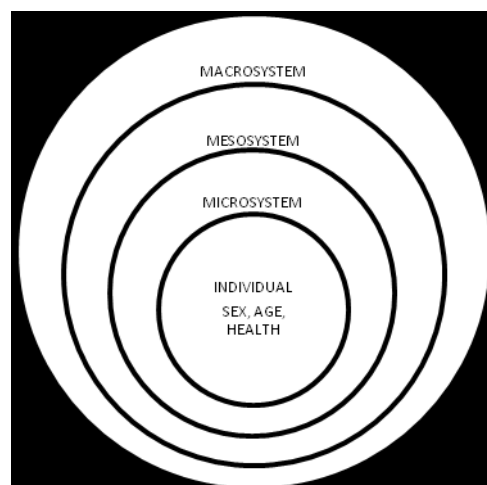


Fig. 4.4 - .Ecological Theory
Bronfenbrenner, 1979

1. microsystem: family, school, peer, church and others (immediate face to face interaction).
2. mesosystem: it includes more Microsystems inside that should be considered in the synergetic effect and not focusing on one component at a time. For example we may ask if the school system is supporting family's values.

3. exosystem: it is related to systems of which the child is not necessarily a part. It could be something that happens to the parents or others. For example watching television may have effects on family interaction.
4. macrosystem: this is the prevalent cultural, social, economic model affecting the child. It could be the beliefs, the social characteristic of the kindergarten, the teacher's methodology and others. These aspects may influence goals, risks, and actions.

These four level are changing over time in relation with changing in beliefs, interacting to each-other. If the parents are convinced that the practice of physical activity for a child may produce stress, they don't find opportunity for improving physical activity in the child (Rahayu, 2014). If they change their idea, after participating to a congress, telling to friends or after other experiences they may change and look at new opportunities for moving. The context change fundamentally as a result of socio-historical changes and may depend on the children's ages. Changing age children change their goals and kind of relations with others.

Bronfenbrenner & Morris (2007) introduced the bio-cological model developing the transition from the focus on environment to a focus on proximal processes, considered the engines of the development. In this new model the development is intended as "*the phenomenon of continuity and change in the bio-psychological characteristics of human beings, both as individuals and as groups*" (p. 793). The bioecological model points out the core of the model, that is the process. Bronfenbrenner & Morris (2007) consider the proximal processes (interaction between organism and environment) at the primary mechanism to produce human development. The power of the process is based "*on the characteristics of the developing person of the immediate and more remote environmental Contexts and the time periods in which the proximal processes take place*"(p. 795). Gottlieb considered the proximal processes as environment (physical, social, cultural).

Bronfenbrenner & Morris (2007) highlights three main biopsychological characteristics of the developing person: a) dispositions, such as processes that sustain the operations; b) biological resources of ability, experience, knowledge, skills; c) demand characteristics that can encourage or discourage a reaction from the social environment. This three aspects build the person structure and shape his or her future development. The other important contribution of this model is the dimension of time. A prominent place have here the dimension: 1) micro-time: continuity versus discontinuity in proximal processes; 2) meso-time: periodicity of the episodes, such as days and weeks; 3) macro-time:

changing expectations and events in the society. Another decisive element of the model is the experience.



Fig. 4.5 - Bioecological models

Not only the properties of an environment are important but also how the person utilizes this properties in the environment. All the elements are fundamental in development. Experience means changes in how the environment is perceived, in cognitive development. Experience is related to the feelings, anticipations, forebodings, hopes, doubts, personal beliefs. Other two fundamental aspects are: 1) proximal processes as bidirectional. It is necessary to observe a fact in both directions: observing the relation between an infant and the mother it is necessary to observe mother's behavior and characteristic and child's behavior and characteristic and not just the mother's behavior that may promote a certain activation of the child. As for Brauenbrenner for Gibson the acquisition of new affordances allow new perception of the environment, but is a different type of perception. For Gibson it is strictly in the movement, in the direct relation with the environment, as a new opportunity for action. In the bio ecological perspective it is more related to an internal processes.

5 THE DEVELOPMENT OF COGNITIVE ABILITIES

To better understand the possible effect of physical activity on cognitive development it is important to have a brief view of the development of cognitive processes from the perspectives of two theorists that are very influent in the history of motor and cognitive development.

Author	Theory	Evaluation	Fundamental Criticisms
Cognitive Developmental Psychology J. Piaget (1896-1980)	Intelligence is a form of biological adaptation to the environment. Development of knowledge and abilities are the result of individual interacting with the environment. Specific heredity: reflexes are significant in the first few days of life. The experience modify them. Physical maturation: genetic determined growth of physical structures. Physical maturation is frequently correlated with psychological activities. With maturation of physical structures new activity emerge. General heredity: organization and adaptation: schemes as results of adaptation to the environment. Scheme changes as a child mature. Assimilation-accomodation. Stages: sensorymotor period, preoperational period, concrete-operations period, formal operations period. Are fixed order and are irreversible.	1) Criticism of the inflexibility of stages. 2) Object permanence: using reaching tests children may failure due to the immature motor system (Baillargeon, 1993, Diamond, 1990, Mandler, 1988). 3) 3,5 months old children have object permanence in tasks without reaching (Baillaregon 1987, Baillargeon & Devos, 1991, Spelke, Breinlinger, Macomber & Jacobson, 1992). 4) Evidence of precocity in other stages.	Universal development 1) Changes in children's cognition depend on maturational processes. 2) Internal maturational processes rather than environmental processes or events determine cognitive development. 3) children performance in Piagetian tasks are influenced by limitations in motor coordination and others. 4) often children don't perform well on tasks beyond their developmental stage.

The dynamic-system approach (Thelen and Smith, 1994) otherwise of Piaget (rigid stages) accepts the discontinuities in development as natural interaction of nonlinear dynamic system. It considers a complex system, like children and their environment. The authors argue that instability is necessary for the development of new abilities. The dynamical system highlights that “children do progress through stages, but not strictly via maturation” (Bornstein & Lamb, 2011). Bidell & Fischer, 1992 consider that optimal environmental related experiences help to develop the full extent of cognitive abilities.

Some authors, as Feuerstein (1979), Vygotsky (1962) assume the mediation by a teacher to be crucial to cognitive development.

5.1 VYGOTSKY'S PERSPECTIVE

Author	Theory	Evaluation	Fundamental Criticisms
<p>Vygotsky L. S. (1896-1934) Socio-cultural psychology</p>	<p>The child is in the context and participate in the activities, in the culture. Culture incorporate physical and historical influences. Zone of proximal development: the distance between a child's independent level and the potential development under adult guide or collaboration with expert peers (Vygotsky, 2013). Scaffolding: supporting a child emerging skill. Internal developmental processes operating only when the child is interacting with people in the environment and is cooperating with peers. The process is more important than the product. External interaction become internal interaction. Attention to process.</p>	<p>Stenghts Socio-cultural related development. Attention on the social-cultural context in definition of children and their activities. Language and other tools are useful to trust the others, to begin a strong relationship. The zone of proximal development is representing a fluid boundary between self and others, adults, child and environment (Miller, 2011). Focus on processes between child and setting. Development occurs in the child-society relation. Learning promotes development. As a child learns in a proximal zone of development he achieves a higher level of development, that promote readiness for a new goal. Consideration of individual differences into a culture and between cultures. Different culture circumstances may encourage different development.</p>	<p>Weaknesses Vagueness of the notion of the Zone of Proximal Development (Miller, 2011). Assessing only children's proximal zone may provide an incomplete developmental idea of the child: it is not possible to know motivation, and others. It is not clear how to access the proximal zone (Paris & Cross, 1988). The psychological processes involved in internalization (mental representation) remains unclear (Rogoff, 2003). Little knowledge about the stability and generality of an individual child's zone. Little knowledge about developmental implications of the zone? Is adult guided relation necessary or only helpful for children development? Are the results generalizing to other similar situations?</p>

Relation between Vygotsky's zone of proximal development and Gibson's affordances

As a child learns in a proximal zone of development he/she achieves a higher level of development, that promote readiness for a new goal. It may be possible to argue, following Gibson, that when a child acquire a new affordance he discover new other affordances, starting a process of learning to learn. Both Vygotsky and Gibson have an embodied vision of child development.

There are, probably due to the short life of Vygotsky several open questions about the theory and the practical consequences. Miller (2011) points out the unclear role of the adults and peers in scaffolding the child. Is it necessary to promote child development the adult/peer expert guide or it is possible to consider it only a help? What is the role of motivation, affect in proximal zone of development? The future research may answer to the open questions. Bronfenbrenner (2005) focalizes on the importance of studying child development in the context, observing the entire context and not just what the child is performing. Different cultural environments have different expectations of children at different age and therefore offer different age-related opportunity for action. The level of child's cognitive and physical development influences the context in which the child enters, the nature of social-cognitive processes, child's effects of events (Miller, 2011).

5.2 DEVELOPMENTAL NEUROSCIENCE

Before illustrating the evidence on the links between motor and cognitive functions it is important at this point to introduce information about cognitive development in the current research. I summarized something already seen in the previous chapters. Charles Darwin and Jean Piaget were the pioneer of the developmental science. Segalowitz (1994) evidences that Piaget's biological approach to human cognitive development didn't consider the brain development and he argues that it could be due to a lack of information about brain development and function. McGraw and Gesell focusing on motor development extended their conclusions to mental and social development (Gesell, 1929; McGraw, 1943). Describing stages in development of motor abilities McGraw connected the transition between the stages to the maturation of motor cortex and to the

inhibition of sub-cortical pathways. However both the two researchers didn't relate brain development to behavioral changes. In the 1970s and 1980s the approaches to human behavioral development was based on the consideration of the brain as a software. Only recently researchers (Gottlieb, 2007; Thelen & Smith, 1994) thanks also to the knowledge on genetics and on brain development begin to consider the role of the environment (social and physical) in the development of the whole organism. New molecular, genetic, cellular and functional neuro-imaging methods have led to emergence of developmental cognitive neuroscience (Johnson, 2011).

Developmental Cognitive Neuroscience is an interdisciplinary field of research that want to understand: a) how children's minds change as they grow up; b) how is the brain changing; c) environmental and biological influences on brain development.

5.3 NEURAL CONNECTION CAN BE MODIFIED BY EXPERIENCE

Specially during early development experiences and learning contribute to modify functionally and anatomically chemical synapses. The functional plasticity of neurons defines our individuality and consists of changes in the effectiveness of existing synaptic connections, in the short-time (functional alterations) and of the growth of new synaptic connections between neurons in the long term (anatomical alterations) (Kandel, Barres & Hudspeth, 2013). At the birth most of the cells are in the adult locations (Tanapat, Hasting, & Gould, 2001) and fundamental changes take place in the human brain during the postnatal development. In the frontal cortex, important for many cognitive abilities the peak of synaptic density is at around 24 months of age.

5.4 FRONTAL CORTEX AND COGNITIVE FUNCTIONS: MATURATION OR EXPERIENCE?

The prefrontal cortex PFC is a region of the frontal lobe located anterior to the primary motor and pre-motor cortex (Brodmann, 1909). The researchers consider this area critical for many cognitive abilities (Fuster, 1989; Goldman-Rakic, 1987) also because the PFC

has the most prolonged period of postnatal development of the human brain (Kostovic, Judas & Petanjek, 2008).

The first question for researchers was if there could be a relation between the structural and functional organization of the brain and cognitive abilities. Diamond (1991) suggests that the frontal lobes are composed of different regions with different functions that mature in different time corresponding to the changes in certain cognitive abilities. Another approach supports the view that the frontal cortex is involved in new skills and knowledge acquisition in early life and in organizing other parts of the cortex. Thatcher (1992) argues that the functions of left and right hemisphere are organized early in human development through complementary sequences that recapitulate differences in adult function.

To the first thesis Diamond (1985) observed that children in AB test (Piaget, 1954) improved performance with age and also demonstrated that two important cognitive abilities, such as recall memory and inhibition were involved in the task and that their performance was related to age.

In 1989 Diamond & Goldman-Rakic in the same AB test, observing human infants and operated adult rhesus monkeys with bilateral prefrontal and parietal lesions, evidenced links between dorso-lateral prefrontal cortex and the cognitive skills in spanning a temporal separation and inhibiting the prepotent response.

Bell & Fox (1992), through electrophysiological and behavioral data confirmed the role of the maturation of frontal brain electrical activity in the first year of life.

Some experiment suggested other hypothesis for brain history.

Gilmore & Johnson (1995) found that infants were successful to the task of temporal special integration over a delay (AB) at a much younger age of what expected, disconfirmed the hypothesis of age related maturation of the brain. Baillargeon (1993) found that infants at 3-5 months seemed to have an internal representation of the occluded objects, because they observed longer impossible events of occluded objects respect possible events. Baillargeon (1993) and Diamond (1991) argued that children in AB tasks failed because they were unable to coordinate the sequence of movements to retrieve a hidden object in the right/different place.

Munakata, McClelland, Johnson and Siegler (1997) demonstrated subsequently that 7 months old infants were able to retrieve objects, when a transparent screen was interposed between the toy and them but not if the screen made the object invisible. As the same

planning was required the failure of AB task cannot be due to lack of coordination of motor behavior.

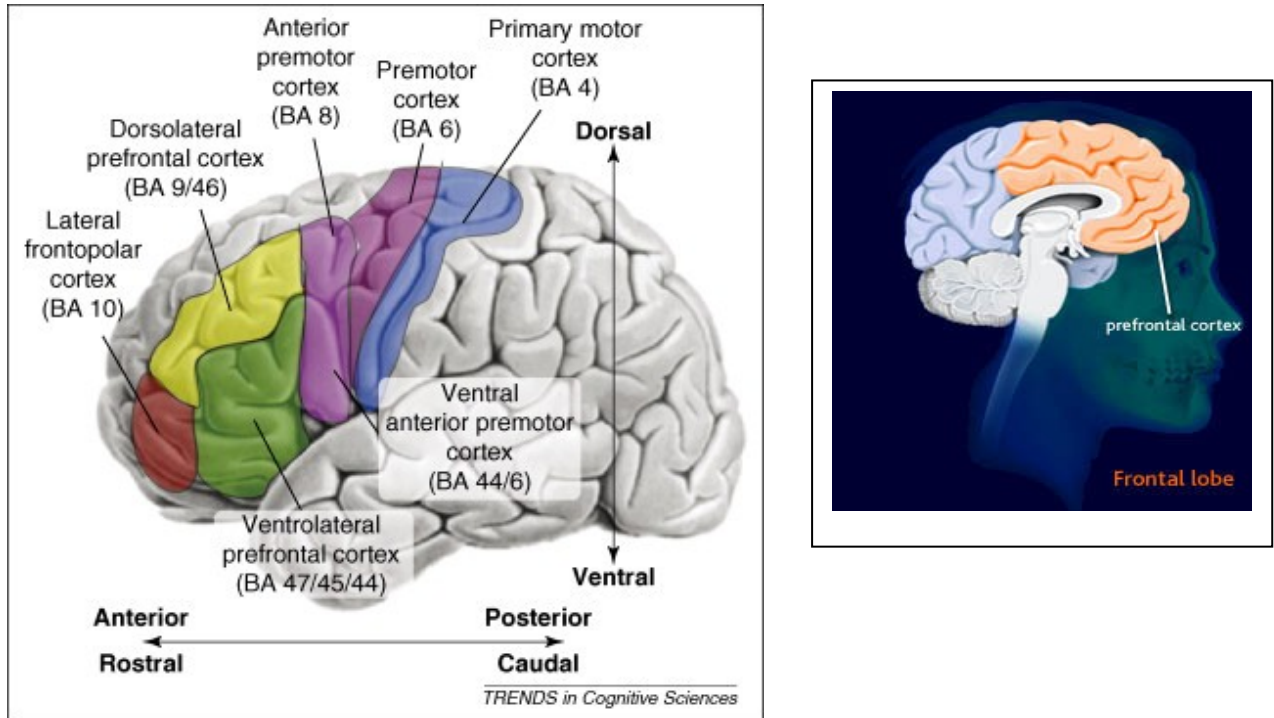


Fig. 5.1 - Brain areas with pre-frontal cortex

Several authors suggest that another hypothesis to understand the role of PFC in cognitive development may be that the region plays a critical role in the acquisition of new information (Bornstein & Lamb, 2011). A consequence of this thinking is that the cortical regions involved in a particular task will change with the stage of acquisition.

Functions linked to frontal cortical and as inhibition of prepotent responses and other particular functions develop gradually and slower than other functions and may be sensitive to experience from prenatal to postnatal life (Finlay & Darlington, 1995).

In prenatal development the sensory system appears to be active with spontaneous activity that plays an important role in the differentiation of cortical regions. In early postnatal life infants orient and attend to certain types of stimuli. The subsequent social experience and interaction with caregivers may contribute to specialize the remaining parts of the cortex, and some researchers (de Haan, Luciana, Malone, Matheny and Richards, 1994) argue that this may influence the synaptic structure of PFC, just like

sensory cortices. Later postnatal brain development is much more an active process than previous periods, and it depends on children activity and caregivers affect.

5.5 THE PREFRONTAL CORTEX AND THE EXECUTIVE FUNCTIONS

In 1928 the American neurologist Tilney suggested that the period of human evolution may be considered as “the age of the frontal lobe” and Luria (1966, 1973) was one of the most important scientists in giving understanding of the importance and functions of the frontal lobes, as he studied the “higher cortical functions”. At the origins researchers were interested in adult brain, but over the year there was interest in development of frontal lobes. In evolutionary origin the pre-frontal cortex, that is one of the latest structures of the brain to evolve, has the capacity to pre-adapt the human to the environment, connecting with all other structures in the brain (Fuster, 2013). It is the vanguard of neurobiological evolution and of homeostasis. The prefrontal cortex, the associative cortex of the frontal lobes, has a critical role in the integration of actions, as expression of the adaptation of the organism to the environment. Pre-adaptation consists of anticipating, planning, decision making, organizing goal-directed actions. It is responsible of orchestrating temporally integrated functions in goal directed actions and operates within perception-action cycle. There is not in the brain the exclusivity of particular areas in particular tasks (Fuster, 2013). During the PA cycle process of adaptation (foundation of any cognitive functions) different input from the emotional world from mid cortical and limbic regions of the brain are coming. Many interactions between the cognitive and emotional systems take place in the prefrontal cortex a funnel between the limbic system (amygdale and hypothalamus) and the neo-cortex. The primordial function of the prefrontal cortex is the temporal organization of goal directed action (Fuster, 2013). The executive functions that are in the prefrontal cortex emerge from the self organization of action sequences, represented in the cortex. They mediate the temporal organization of behavior, language and reasoning. The prefrontal cortex executes complex actions that are based on previously acquired patterns of action and then realized (plans). This is way the prefrontal cortex is considered an organ of creativity. All the executive functions in the prefrontal cortex have a future dimension: working memory, preparatory set, planning, decision making, executive attention, and inhibitory control. The major

executive functions have a future purpose of organizing directly or indirectly actions toward their goal. The feedbacks of goal-directed actions are: monitoring, output assessment, reward. None of these functions can be assigned to a particular area, but certain areas are more involved in certain functions (Fuster, 2013).

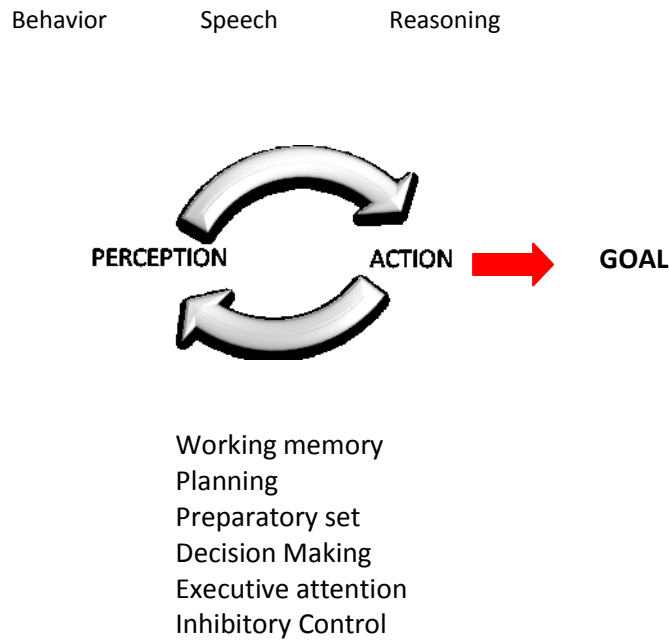


Fig. 5.2 - Temporal organization of the action (Fuster, 2013).

One of the functions of the pre frontal cortex is working memory that is defined as a temporary retention of perceptual information, for the execution of an act in the short term (Baddley, 1983). It emerges in the preschool period (Anderson et al., 2001, 2008) and develops rapidly in middle childhood and trough adolescence and early adulthood (Anderson, 2001).

Inhibition of irrelevant stimuli is a suppression of a prepotent but inappropriate response in situations with several response options. It is necessary for attentional control (Barbas, Bunce & Medalla, 2013). Selection or suppression of signals for a task is related to the emotional significance capturing the attention. The dorsal and medial prefrontal cortex varies in their connections with the amygdala, the structure processing emotional stimuli. The significant emotional signals capture attention and are remembered, thanks to the projection from the hippocampal formation, the amygdale and medial temporal memory-related cortices. Inhibition is often referred to behavioral inhibition and sometimes

cognitive control and there are different behavioral paradigms, with different mechanisms involved. Some paradigms are: Stroop, the Wisconsin Card Sort Test, reversal learning, Go/NoGo responding, behavioral extinction.

Attentional control: it refers to self regulation, self monitoring, the capacity to filter irrelevant detail and to focus attention for long period. The attentional control skill develops rapidly in children, from age 4 and became stable around 6, 7 years (Diamond & Taylor, 1996; Smidt et al., 2004). The capacity to inhibit responses emerges around 7-12 months (Anderson et al., 2001, 2008; Diamond, 2002; Manly et al., 2001; Reuda, Posner, & Rothbart, 2005). The capacity to inhibit indistinctive behavior emerge at 3 years old (Diamond, 2002; Espy, 1997), it improves until around 9 years old, with another spurt at around 15 years old (Anderson et al., 2001).

It is influenced by pain that has psychic and social aspects.

Cognitive flexibility, another executive function of the prefrontal cortex can be observed in task-set- switching, where responding continuously switches between two sets of contingencies (Barbas, Bunce & Medalla, 2013). Cognitive flexibility begins to emerge around 3 years old (Espy, 1997; Jacques & Zelazo, 2001; Smidt et al., 2004).

The maturation of working memory in dorso-lateral prefrontal cortex needs a protracted period of development. The performance in working memory is age related.

The prefrontal cortex is active in childhood and its integrity is fundamental for normal development. Recently several empirical studies have documented increments in the development of executive skills through infancy, childhood and adolescence. This increments were coincident with growth spurts in frontal lobe development (V. Anderson et al., 2001 Blakemore & Choudry, 2006; Smidt, Jacobs, & Anderson, 2004). Diamond et al. (Diamond, 2002; Diamond & Goldman-Rakic, 1985; Diamond & Taylor, 1996; Goldman –Rakic, 1987) described in 12 months infants frontally mediated, goal-directed behavior. Other researchers (Welsh, Pennington, & Groisser, 1991) describe a stage-like progression of executive skills. The mastery is not achieved at 12 years in several areas.

Problem solving: some evidence report that this skill matures from middle childhood through late adolescence (Anderson, 2002, 2008; De Luca & Leventer, 2008).

Processing speed: it appears and rapid develop until 6 and 12 years old (Kelly, 2000; Levin et al., 1991).

The presence of problems in executive functions early in life has strong implications on cognitive, social and emotional development (Anderson, Spencer-Smith, 2013). Problems in maintaining attention, planning, reasoning, abstracting, thinking in a flexible way, regulating behavior may have consequences on child learning, interacting with others positively (Anderson, Spencer-Smith, 2013).

5.6 PREFRONTAL CORTEX: MATURATION OR EXPERIENCE?

The prefrontal cortex needs over two decades to reach the fully maturity, while, for example the sensory cortex needs only few years (Casey, Giedd & Thomas, 2000). This fact means that it is very sensible to environmental influences, during infancy, childhood and adolescence (Andersen & Teicher, 2008; Crews, He, & Hodge, 2007) and that there is variability in cognitive functions, included working memory and cognitive control, among children and adults (Braver, Cole, & Yarkoni, 2010; Kane & Engle, 2002; Vogel & Machizawa, 2004; Vogel, McCollough, & Machizawa, 2005).

Some authors (Davidson, Amso, Anderson, & Diamond, 2006; Lehto, Juujarvi, Kooistra, & Pulkkinen, 2003; Miyake et al., 2000) consider core EF: working memory, inhibition, cognitive flexibility. Collins & Koechlin, 2012; Lunt et al. 2012, consider reasoning, planning, problem solving as higher lever executive functions derived from the core executive functions.

The evidence demonstrates **negative effects** of prefrontal cortex development, due to chronic stress, physical and psychosocial deprivation. Recent studies highlight that special intervention programs may mitigate the negative effects and also provide positively brain development (Mackey et. al. 2013). It has been discovered that brain areas are dynamic and malleable also after the critical period. Training is very useful to improve the following cognitive functions:

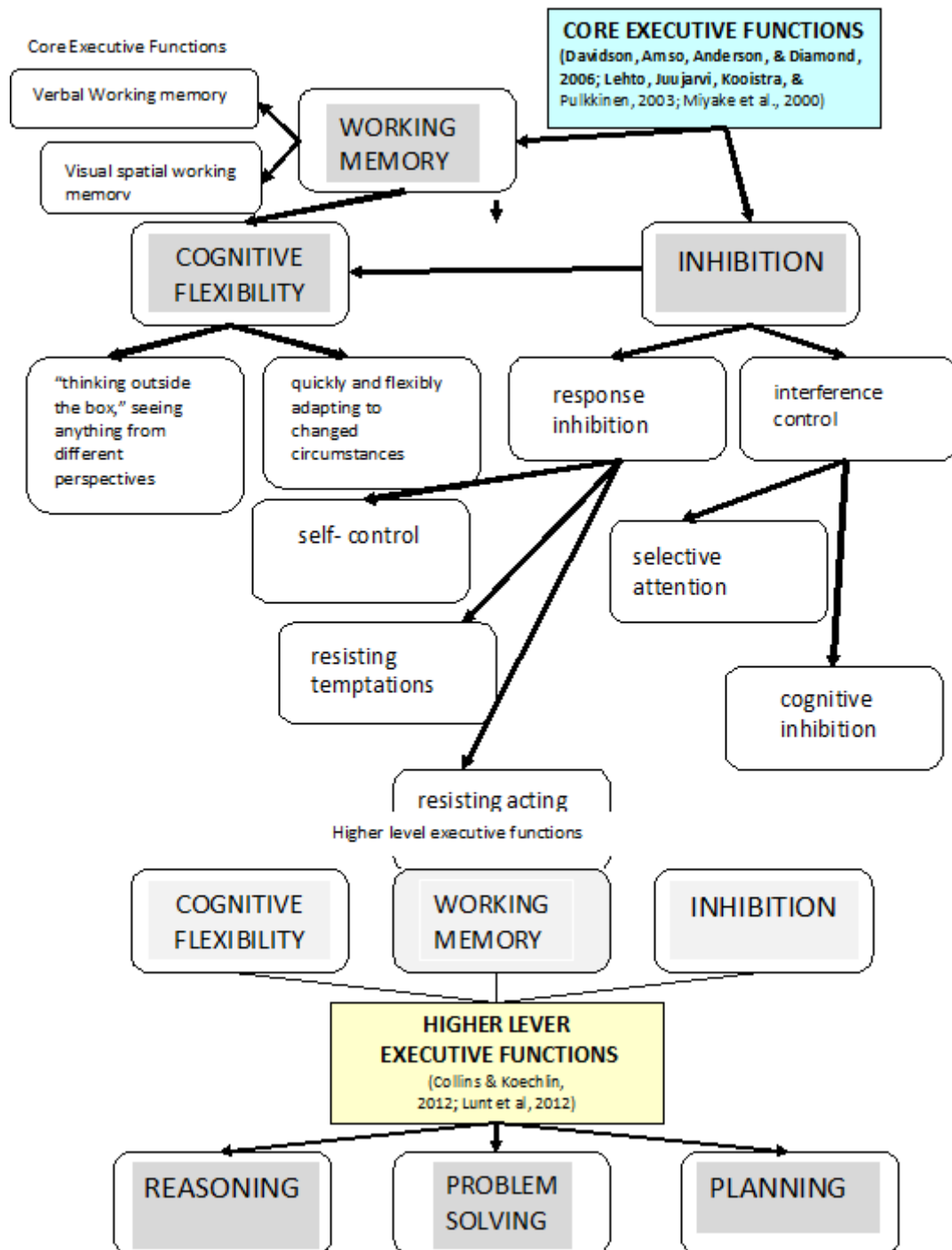


Fig. 5.3 - Core executive functions

Effect of training on development of cognitive functions (Mackey et al. 2013)	
From low level perceptual learning to visual-motor skill acquisition	From low level perceptual learning to visual-motor skill acquisition
Attention	Attention
Processing speed	Processing speed
Working memory and cognitive control	Working memory and cognitive control
Long-term memory	Long-term memory
Reasoning	Reasoning

The sensitive period

The period of maximal influence of the environmental stimuli on the neural system is the sensitive period. This period of maximal opportunity differs in the neural systems (Rice & Barone, 2000) and it is associated to exposure to normal, expectable environmental input. After this period plasticity persists longer.

The sensitive period in brain development (Mackey et. al. 2013).		
Sensory system	First year of life. If there are not visual inputs in the first year vision will not develop normally.	Maurer, Mondloch, & Lewis, 2007; White & Fitzpatrick, 2007
Language	Maximally plastic during the first 2 years of life. There is impairment if child's experiences are poor during this period.	Werker & Tees, 2005
Vision, hearing,	The first few years are determinant for these functions.	Nelson & Sheridan, in press

language, attachment		
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Recent studies highlight that also after the sensitive period the plasticity persists longer. After restored vision in children born blind there was a considerable amount of visual function also at 13 years old (Ostrovsky, Meyers, Ganesh, Mathur, & Sinha, 2009). There is also evidence of plasticity up to 8 years of age in language system (Pallier et al., 2003). The plasticity of the brain has sensible periods, but the boundaries at any age are unknown. Evidences highlight that intense training can “remove the brakes” in adults (Bavelier, Levi, Li, Dan, & Hensch, 2010).

5.7 GENETIC AND ENVIRONMENTAL INFLUENCES IN BRAIN DEVELOPMENT

The interest of researchers in exploring brain development derived, at the beginning from the necessity to study brain damages and to identify the best conditions to prevent and cure a disease. The first question was: “how are the structure and the functioning of the brain influenced by genetic and environmental influences?”. The phenomenon of *plasticity*, emerges from typical development, representing neural change of the species and also from learning, representing neural changes associated with experience, specific to the individual (Galvan, 2010).

Typical development means that the child has influences species-typical, during the sensitive period. For example the experience-dependent mechanisms as the visual system needs contrast borders and the language system speech sounds. The unique experiences during development, of the individuals may produce individual differences. Learning, though experience-expectant, as learning opportunities, are unique experiences and differ across children (Mackey et al. 2013).

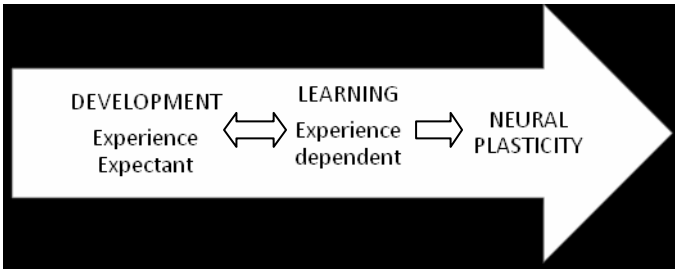


Fig. 5.4 - Neural plasticity

The genes supply the basis for brain development and experience adjust the genetic brain plan, shaping the architecture of the neural circuits, related to the needs and distinctive environment of the individual (Nelson & Sheridan, in press). The environmental stimuli actively turn genes on and off and this is fundamental to synaptic plasticity (Cohen & Greenberg, 2008). A Gene-environmental interaction is a phenomenon that means that the environment can allow the genetic predisposition. For example, in the case of genes responsible of stress-induced anxiety the genetic vulnerability is expressed only if the child lives in a stressful environment (Caspi et al., 2002).

When the ability (genes) and the environment (learning) of an individual are matched, the ability can increase regardless of whether its source is genetic or environmental (Mackey et al. 2013).

Negative environmental influences on prefrontal cortex

When children live in an insufficient environment they are subject to encounter obstacles to reaching their full potential. **Children of low SES (socioeconomic status) are at greater risk.** (Mackey et al. 2013).

Prenatal environment: negative physical factors interfering with brain development (Mackey et al. 2013).	
To be exposed to alcohol and other drugs in uterus (Dopamine, presents in several psychoactive substances)	Langlois & Mayes, 2008
Tobacco exposure	Cornelius & Day, 2009
Marijuana exposure	Campolongo, Trezza, Palmery, Trabace, & Cuomo, 2009
Cocaine exposure	Accornero et al., 2007; Sheinkopf et al., 2009; Derauf et al., 2009

Child's environment: negative physical factors interfering with brain development (Mackey et al. 2013).	
Malnutrition (iron deficiency,	Beard, 2003; Owen, Downes, Sahakian, Polkey, & Robbins, 1990;
Lead exposure (food, chemical waste, synthetic materials interfere with biochemical processes involved in brain development)	Canfield, Gendle, & Cory-Slechta, 2004; Cecil et al., 2008;
Chronic stress (physical restraints, maternal separation)	De Koet, Joels, & Holsboer, 2005; Krugers, Hoogenraad, & Groc, 2010; Brown, Varghese, & McEwen, 2004; Weaver et al., 2004;
Psychosocial deprivation: institutional settings often provide low caregiver-to-child ratio, unresponsive caregiving, impoverished sensory, cognitive and linguistic stimulation	Nelson et al., 2007; Gunnar, Bruce, & Grotevant, 2000; Gunnar & van Dulmen, 2007; Mueller et al., 2010;
Low SES (socioeconomic status). SES can be related to parental income, occupation, education.	Hackman & Farah, 2009; Hackman, Farah & Meaney, 2010; Raizada & Kishiyama, 2010;

6 CHILD’S ENVIRONMENT AND EFFECTS ON COGNITIVE FUNCTIONS, ACADEMIC ACHIEVEMENT AND PERFORMANCE

The studies highlight that children with low socio-economic status (SES) background have higher risk of school difficulties compared to middle-class peers (Bradley & Corwyn, 2002). The possible causes are:

Causes of low level of academic achievement and performance related to SES	
Lower level of parental education	Bradley & Corwyn, 2002
Exposure to environmental toxics, like lead	Miranda, Edward, Swamy, Paul, & Neelon, 2010
Higher level of chronic stress	De Koet, Joels, & Holsboer, 2005; Krugers, Hoogenraad, & Groc, 2010; Brown, Varghese, & McEwen, 2004; Weaver et al., 2004;

The most critical results in low cognitive tasks related to low ses children	
Some authors evidence a relationship between SES and cognition tests	Bradley & Corwyn, 2002; Duncan, Brooks-Gunn, & Klebanov, 1994;
Language and cognitive control is more strongly influenced by child environment	Noble, McCandliss, & Farah, 2007;
Attention and working memory	Mezzacappa, 2004;

There is evidence that demonstrates that a prolonged disadvantage condition in children can have long lasting consequences for cognitive functioning (Evans & Schamberg, 2009).

Some researchers are now investigating on the long time effects of the deprivation in children. Important improvements have been observed when, for example, children are removed from orphanages within 2 years of age (Ghera et al., 2009) and placed in a cognitive stimulating environment (Nelson et al., 2007). Children are able, in this good condition, to recover the best from the adverse experience. Nelson et al. (2007) argues that it may be possible to extend the sensitive period, given the right circumstances and this may improve the prognosis for children from early deprivation.

6.1 INFLUENCE OF BETTER EXECUTIVE FUNCTIONS IN SCHOOL READINESS

It is important to know that some conditions may promote or limit school achievement too. Some researchers identified the following aspects.

- *Self control* and *focused attention* are subcomponents of the core executed functions that are fundamental for school readiness (Carlson & Moses, 2001; Hughes & Ensor, 2008; Kochanska, Murray, & Coy, 1997; Morrison, Ponitz, & McClelland, 2010).
- *Working memory* and *inhibitory control* predict math and reading competence from kindergarten to University (Borella, Carretti, & Pelgrina, 2010; Duncan et al., 2007; Fiebach, Ricker, Friederici, & Jacobs, 2007; McClelland et al., 2007; Nicholson, 2007; Savage, Cornish, Manley, & Hollis, 2006).

A good level of inhibitory control early in life predicts adult outcomes. Children with a good level of inhibitory control (they were able to wait their turn, less easily to be distracted, more persistent, less impulsive) at the age from 3 to 11 years old were followed in a study by Moffitt et al. (2011) for 32 years. They demonstrated that after 30 years these children grew up with better physical and mental health. They were less likely to be overweight, to use drugs, to commit a crime and they earned more and were happy compared with a control group of children.

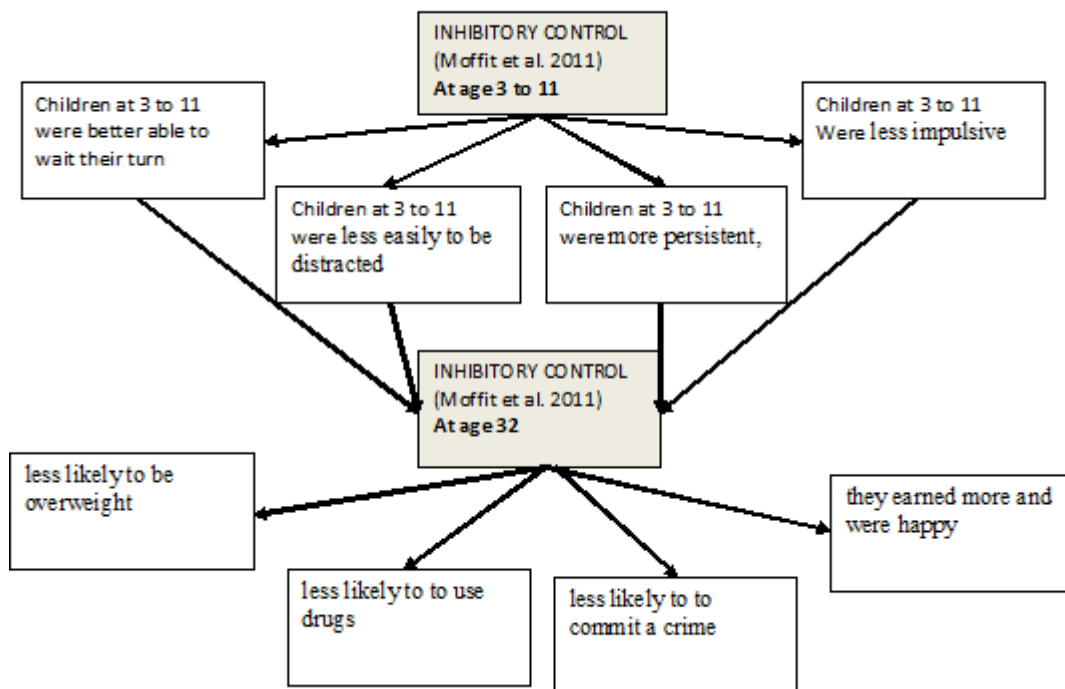


Fig. 6.1 - Inhibitory control

Poor EFs predict negative teacher-student relations that influence a lot school success. Children with poor EFs are not able to stay sitting, to listen to the teacher, to participate in organized activity with other children and these aspects create problems (Raver & Knitzer, 2002).

Some authors evidence that EFs are more associated with school readiness than IQ or entry level of math and reading (Blair & Razza, 2007; Blair, 2002) and this is also visible even in college (Duckworth & Seligman, 2005).

Executive functions related with school readiness	
Inhibitory control (resisting habits, temptations, distractions)	Diamond, 2006, pp. 70–95
Working memory (mentally holding and using information)	Diamond, 2006, pp. 70–95
Cognitive flexibility (adjusting to change)	Diamond, 2006, pp. 70–95

Working memory and inhibition predict math and reading scores from preschool to high school (Blair, Razza, 2007; Bull, 2001; Gathercole et al., 2005).

Low executive functions are present in the following conditions:

Effect of low executive functions related with school readiness	
ADHD	Barkley, (1997; Diamond, 2005; Martinussen, Hayden, Hogg-Johnson, Tannock, 2005
Teachers burnout causing from children burnout	Hastings, (2003).
Poor self-control, Drug, Crime, Incarceration	Atkinson, Healey, Mourato, (2005)
Obsessive, compulsive disorders	Penadés et al., 2007, Chamberlain et al., 2007; Andrés et al., 2007; Chang, McCracken, Piacentini, 2007
Depression	Kyte, Goodyer, Sahakian, 2005; Paelecke-Habermann, Pohl, Leplow, 2005; Rose, Ebmeier, 2006; Christopher, MacDonald, 2005; Taylor-Tavares et al., 2007
Schizophrenia	Franke, Reutrer, Schulz, Kathmann, 2007; Barch, 2005; Reichenberg, Harvey, 2007; Winograd-Gurvich, Fitzgerald, Georgiou-Karistianis, Millist, White, 2007; Enticott, Ogloff, Bradshaw, 2007;

Diamond et al. (2007) highlight that low income children have disproportionately poor EFs (Noble, 2007; Noble, 2005) and they fall progressively in school years (O'Shaughnessy et al.; 2003). Diamond et al. (2007) evidence that in USA children with syndrome ADHD that are medicated for poor inhibitory and attentional skills were 65% in 1999 and five years after 400% (Robison, Sclar, Skaer, Galin, 1999).

6.2 INFLUENCE OF WORST EXECUTIVE FUNCTIONS

(In Diamond, 2014)

Low levels of executive functions are critical for:

- *Job success*: it is more difficult to find and keep a job (Bailey, 2007);
- *Marital harmony*: more likely to act on impulse (Eakin et al., 2004).
- *Social problems*: crime, violence, reckless behavior, emotional outbursts (Moffitt et al, 2011).
- *Poor physical health*: obesity, overeating, substance use, poorer treatment adherence (Crescioni, 2011).
- *Mental health disorders*: addictions (Baler & Volkow, 2006); attention deficit hyperactivity ADHD (Diamond, 2005; Lui & Tannock, 2007); obsessive compulsive disorder (Penadès et al., 2007); schizophrenia (Barch, 2005).

These disorders are becoming very common and abundant and influence the quality of life, in general (Moffitt et al., 2010).

6.3 BENEFITS OF EARLY ACTIVITY IN IMPROVING EXECUTIVE FUNCTIONS

Diamond (2007) hypothesizes that improving EF skills early, especially in at-risk children may be very important to reduce the achievement gap and decrease societal inequalities. Children with poor EF may have problems in paying attention in class, completing assignments and inhibiting impulsive behaviors. The consequent frustration may lead to difficulties in concentrating or remembering instructions and this may convince the child that the school is a place not right for him/her, with consequences also in self-perception of him/herself and subsequently much probably drop out (Vitaro, Brendgen, Larose, Tremblay, 2005). Diamond (2007) also noticed that children with better EFs are more praised by teachers for their behavior, find school easier, enjoy themselves more, want to stay more time at school. The positive effect of self-reinforcing feedback strengthens the children (Davidson, Eden, 2000; Harris, Rosenthal, 1985; Kierein, Gold, 2000; Kolb, Jussim, Roeper 1994; Rosenthal, 2002; Trouilloud, Sarrazin, Bressoux, Bois, 2006).

The long-term effect may be more beneficial than short-term effects and Diamond predicts that improving early EF skills may improve long term academic skills, school success and retention, job success, reduce incidence of crime and drug and social disparity. She also predicts that improving EF skills may help children diagnosed as ADHD to exercise self-control and emotion-regulation. She (2007) also assumes that the recent increase in ADHD diagnoses may be due, in some cases, to the fact that some children didn't learn to exercise inhibitory control and self-discipline.

Evidence that executive functions can be improved

Adele Diamond (2013)

Strong evidence	
Adele Diamond (2013) argues that the mentioned studies are very strong because of the methodology of the research utilized: all the studies used random assignment, including active and control group (active); pre and post intervention measures; in all these studies children were assessed with more than one objective measure of executive functions, in which the children were not trained and this means that there is transfer of learning.	
CogMed computerized training	Holmes et al., 2010; Holmes, Gathercole, & Dunning, 2009; Klingberg et al., 2005; Thorell, Lindqvist, Bergman Nutley, Bohlin, & Klingberg, 2009.
A combination of a computerized and interactive games	Mackey, Hill, Stone, & Bunge, 2011.
Task-switching computerized training	Karbach & Kray, 2009.
TAE-KWON-DO	Trulson, 1986; Lakes & Hoyt, 2004
PATHS (school curricula Promoting Alternative Thinking Strategies)	Riggs, Greenberg, Kuschè, & Pentz, 2006
CSRP – Chicago School Readiness Project;	Raver et al., 2008, 2011.

Weaker evidence	
But rather strong to pass peer review	
AEROBICS	Davis et al., 2011; Kamijo et al., 2011; Tuckman & Hinkle, 1986
YOGA	Manjunath & Telles, 2001
Mindfulness	Flook et al., 2010
Tool of the Mind - school curricula	Diamond, Barnett, Thomas, & Munro, 2007
Montessori	Lillard & Else-Quest, 2006

6.4 ARE THERE EVIDENCES THAT IMPROVING EXECUTIVE FUNCTIONS WE IMPROVE ACADEMIC PERFORMANCE?

The Chicago School Readiness Project CSRP.	Significantly improvement of inhibitory control of attention and action (Raver et al., 2011).	Significantly improvement in math and reading, also 3 years later (Li-Grining, Raver, & Pess, 2011).
Blair & Razza, 2007; Blair, 2002; Duckworth & Seligman, 2005.		Significant increasing in level of math and reading also at the University
Montessori program		Improvement of academic performance on standardized tests of reading and math (Lillard, 2006).

7 PROGRAMS TO ENHANCE COGNITIVE FUNCTIONS

Often children begin the school with lacks in EF skills (Rimm-Kaufman, Pianta, Cox, 2000 and researchers investigated on various activities that could be able to improve executive functions in children.

Mackey et al. (2011) studied fluid reasoning, FR which is the capacity to think logically and solve problems in new situations (Cattell, 1987; Horn & Cattell, 1967). FR is a strong predictor in school and university achievement and in cognitively demanding occupation (Floyd, Evans & McGrew, 2003; Fuchs, Fuchs, Compton, Powell, Seethaler, Capizzi, Schatschneider & Fletcher, 2006; Gottfredson, 1997) and it is influenced by environmental factors (Flynn, 2007; Nisbett, 2009). Mackey et al. (2011) conducted a cognitive intervention in students of age 7-10 at a school to study the effects of neuroscience-based cognitive training. They individuate children with low test scores and a high percentage of economically disadvantage and trained them with a variety of computerized and non computerized reasoning games in a classroom setting. The researchers compared a group of children trained using commercially games requiring to consider several pieces of information to achieve a goal (FR training) (Mackey et al., 2011) to a group of children trained in processing speed with a special program (PS; Kail & Salthouse, 1994). The first group improved a lot in a standard measure of FR. But it didn't improve significantly in measure of processing speed (PS). The second group, trained in cognitive speed improved significantly on the PS measure but did not improve in FR measure. Both groups improved in tasks not included in the training program, exhibited transfer of learning to new task. Although the results are very encouraging it is necessary to individuate: how much training is necessary, the frequency of the exercise and the association with scholastic performance. From the neuro-imaging research (at a gross level) it would be important to uncover the changes in brain structure, the functions underling improvement and to predict long term benefits from training programs. At a cellular level cognitive training may lead to synaptogenesis and myelination (Mackey, Raizada & Bunge, 2013). Hu et al., (2011) found plastic changes in myelinated white matter tracts after a specific training.

Diamond, 2006; Diamond, Barnett, Thomas & Munro, 2007) tested a special program that taxed executive functions throughout the school curriculum to improve executive functions also in children coming from underprivileged backgrounds. Diamond (2007)

and other researchers (Barnett et al., 2007; Cerqueira, Mailliet, Almeida, Jay, Sousa, 2007; Gray, Chabris & Braver, 2003; Raizada & Kishiyama, 2010) evidences that children from low SES backgrounds are most likely to benefit from enrichment environment.

EFs are strongly associated with school readiness than intelligent quotient (IQ) and entry level in math and reading skills (Blair, Razza 2007; McClelland, Morrison, Homes, 2000). The researchers compared the “Tools of the Mind”(Bodrova & Leong, 2007) to another curriculum, the one developed by the school district, in 21 classrooms of a low income, urban school district. The “Tools of the Mind” curriculum was based on Vygotsky’s insights into EF and its development. The core of the tool was on 40 EF-promoting activities, including:

Tools of mind: external mediators that contributed to develop executive functions Bodrova & Leong, 2001		
Activity	Reference	Behavior of teachers
Private speech:	Vygotsky (1978): private speech is considered a precursor of verbal thinking .	
	Luria, 1979; Berk & Winsler, 1995; Galperin, 1992: private speech helps children regulate overt and mental behaviors. Siegler, 1989.	
Shared activities	Vygotsky (1978): in shared activities partners share the mental processes and categories involved.	
Self-regulatory functions	Vygotsky (1978): regulating other children’s behavior children practice other and self-regulatory functions and contribute to the development of meta-cognitive abilities (Bodrova & Leong, 1996).	
Play as a leading activity: imaginary situations, roles and rules	Symbolic or dramatic play is fundamental for Vygotsky (Berk & Winsler, 1995; Bodrova & Leon, 1996; for Vygotsky play is necessary for:	

	imaginary situations, roles and rules. The play is considered a good way to acquire self-regulated skills.	
Dramatic play	It is the most important activity (Bodrova & Leong, 1998a; 1999). Teachers help children to expand the roles in a theme (Jensen, 1981)	The teachers suggest how to change roles and help children to plan the play.
Play planning	The child is asked to describe what he/she expects to do during the play period. Mentally planning is very important (Shamiso, Krystine) Bodrova & Leong, (2001) argue that planning on paper is much more effective than planning orally. The external mediator is a mediator for memory (Vygotsky, 1978).	If children want to change planes they are encourage doing it, reasoning together, because it is the action of mentally planning which is important (Bodrova & Leong, 2001). This is a special moment for teachers to connect with each child helping to practice self-regulation.
Aids to facilitate memory and attention	Duncan, Burgess, Emilie, 1995	
Same Academic content of the curriculum of school district	Diamond, Barnett, Thomas & Munro, 2007	
Scaffolded writing		It is a way to utilize external mediation, private speech and shared activity (Bodrova & Leon, 1996; 1998b). The teacher helps the child to plan his/her own message by drawing a line to stand for each word the child says.
ELA Assessments		There are instruments to assess the skills and most critical concept for early literacy development, developing meta-cognitive and meta-linguistic skills. Children are assessed in an independent performance and in one performance with teacher's assistance (Bodrova & Leong, 2001).

<p>Curriculum developed by the school district</p> <p>Diamond, Barnett, Thomas & Munro, 2007</p> <p>Activities related to the District School Curriculum</p>
Balance literacy
Thematic units
Same Academic content of the curriculum “Tools of the mind”

One hundred forty-seven (62 DSC + 85 Tools) preschoolers, coming from low income families, participated to the study (average age; 5.1 years). One group received “Tools of the Mind” and the other group the curriculum of school district DSC for one year. Diamond et al. (2007), demonstrated utilizing Flanker tasks and Dots Task (Davidson et al., 2006; Rueda et al., 2004) that executive functions in 4-5 years old children can be improved through regular public classes and regular teachers. The researchers also highlighted that the more EF-demanding the task, the more highly is correlated with academic measures. Other studies of enhancing EF by “Tools of the mind” were conducted in other schools, promoting the same positive results (Barnett, et al., 2006; Saifer, 2007).

In the results specially inhibition (self discipline) predicted a unique variance in academic outcome (Blair, Razza, 2007; Duckworth, Seligman, 2005). Diamond et al. (2007) suggest that improving EF early in life may have benefits over time and reduce costs for special education, also caused by unregulated antisocial behavior and may reduce the several, increasing diagnoses of EF disorders.

7.1 CONDITIONS TO DEVELOP PROGRAMS ON EF INCREASING

Diamond, (2013) considers some relevant conditions to increase executive functions:

- a) Children with lower level of executive functions benefit the most from any EF program or intervention (Flook et al., 2010; Karbach & Kray, 2009; Lakes / Hoyt, 2004).
- b) The best results in increasing of EFs emerged when children were pushed at the higher level of EF skills (Davis, et al., 2011; Diamond et al., 2007; Manjunath & Telles, 2001).

- c) The task must be continually increasing, to avoid the activity become boring. In addition when children are asked to do better they are more motivated to improve.
- d) Ericsson, Nandagopal, & Roring, (2009) found that working in Vygotsky (1978) “zone of proximal development” is the best condition to do something at the right level of competence, to increase.
- e) Klingberg et al., (2005) evidences that repeated practice is the key to improve.
- f) Diamond et al. (2007), Lillard & Else-Quest, 2006; Riggs et al., 2006 argue that to improve EF it is fundamental that the proposed activities are embedded in all activities and are not only a module, as in the case of school curricula.

8 PHYSICAL EXERCISE AND MODIFICATIONS OF THE BRAIN

Studies on animals help to understand the neurobiological mechanisms associated with the exercise-brain (Cotman, Berchtold, & Christie, 2007). The influence of environment on behavior, brain structure and function are well explained in the work of T. Hebb and other researchers (Markham & Greenough, 2004), that demonstrate how an “*enrichment environment*” could affect brain structure in rats, causing differences in cortical thickness. In the study a group of rats were exposed to an enriched environment and developed slightly but significantly thicker cerebral cortices than other rats staying in simple, usual conditions (Diamond, Krech, & Rosenzweig, 1964); Diamond, Lindner, & Raymond, 1967). In the rats of the enrichment environment an important element was the presence of a running wheel, that there was not in the other conditions, which contribute to the development of:

- a) additional capillaries (Black, Isaacs, Anderson, Alcantara, & Greenough, 1990);
- b) spatial learning (van Praag, Christie, Sejnowski, & Gage, 1999).

The environmental influences affect the structure of prefrontal cortex and other cortical regions.

Researches on humans highlight that intensive training of attention, working memory and other cognitive functions of prefrontal cortex may produce structural changes in the prefrontal cortex (Mackey, Raizada & Bunge, 2013).

Recent researches demonstrate strong evidence that physical exercise confers positive effects on pre frontal cortex-dependent cognitive function in both adults and children. The prefrontal cortex PFC is very sensitive to its neurochemical environment.

Hillman, Erickson, & Kramer, (2008) evidence that physical activity can have beneficial effects throughout the life span, also for individual with neurodegenerative diseases (Heyn, 2004). Chaddock, Pontifex, Hillman, & Kramer, (2011) evidence in a review the deleterious effects of physical inactivity and poor aerobic fitness on brain structures and functions. This negative aspect would provide lower scholastic performance.

Colcombe (2004, 2006) found that higher level of fitness and aerobic fitness improvement were related to greater volume of prefrontal and temporal grey matter as well as anterior white matter. The increase in brain volume seems to be predictive of performance in older adult (Erickson, 2007). Brown (2003), in line with other researches,

demonstrated that exercise induces hippocampus cell proliferation and cell survival from newborn to old age (Van Praag, 2005). The researcher found that pups from mothers that had practiced aerobic exercise during the gestational period had a great number of surviving cells in the hippocampus respect to pups of sedentary mothers. It seems to be an association between the hippocampal neurogenesis, due to exercise and facilitation in learning and memory (Brown, 2003). Brown (2003) evidences that physical activity and aerobic fitness as very important for maximizing brain health and cognitive functions in development. The practice of physical activity early in life may promote the creation and maintenance of physical activity during the school years and for the lifespan. The review evidences the association between physical health, brain and cognitive abilities, related to school performance and suggest creating more opportunities of physical activity for children to increase the quality of life.

8.1 SUMMARY OF THE EXPLANATION OF WHY PHYSICAL ACTIVITY MAY IMPROVE COGNITIVE FUNCTIONS

Contemporary research is studying the mechanisms underlying the influence of exercise on cognition, thanks to the recent technical advancements. With Humans the researches has mostly focused on the effects of exercise (primarily aerobic exercise) on cognitive processes, assessed with tests (paper, pencil and computer). Neuro-imaging techniques (ERP- event related brain potential and structural and functional MRI allow to exam the link between exercise and cognition. Studies on animals investigate on the molecular and cellular changes occurring in the brain following exercise.

There are mainly three explanations for the improving of mental functions through physical activity

Biological

- the exercise improves the cardiovascular system;
- with exercise capillary growth increases and the distribution of the blood and oxygen in the brain improves (Jorgensen, Nowak, & Secher, 2000).

- increased levels of norepinephrine and endorphin, (Fleshner, 2000; Winter et al., 2007) with consequently reduction of stress and improvement of mood (Yeung, 1996)
- exercise produces an increase of brain-derived neurotrophic factor, that protects the brain from injury, and of other growth factors that help creating new cells and support synaptic plasticity (van Praag et al., 1999; Schinder et al., 2000).
- the exercise promotes the generation of new neurons in the hippocampus (Chaddock et al., 2010).

Cognitive

Diamond & Lee, (2011) argues about mental skill hypothesis, intending them as a group of mental skills that are acquired gradually and enhanced by the practice. This point of view confirms the importance of the educator in child development.

Social affective

The ability to interact cooperatively with other people seems to be very important for a child to relate in a good way with teachers and peer, by inhibiting antisocial behavior.

Diamond and Lee (2011) argue that to enhance executive functions is important to address the attention of the educator on cognitive, emotional and social development jointly.

8.2 PHYSICAL EXERCISE, COGNITIVE FUNCTIONS AND ACADEMIC ACHIEVEMENT

Sometimes school teachers, administrators and parents view physical activity a time lost for core academic subjects, in early age and in the high school (Shepard, 1997). It is easy to ear teachers or parents telling the children: “*today your behavior was bad and you don’t go to play*”. The moment of physical activity is sometimes considered like an optional time. It is very easy to find that in organizing activities, dedicated to play and physical activity only the physical education teachers are involved. Twenty years old the

researchers demonstrated that the practice of physical education at school was not time lost for other school disciplines. Now, the new strong evidences of beneficial effects of physical activity on physical health open new field of interest related to the eventually association between physical activity and academic achievement.

Diamond, 2000; Hillman, Erickson, & Kramer, 2008 argues that physical activity may influence cognitive and neural development during childhood. The construction of perceptual-action representations may represent the link between motor behavior and cognitive development in children (Rakison & Woodward, 2008; Sommerville & Decety, 2006).

Sallis et al. (1999) suggest that the association between physical education at school and better academic achievement (measured with standardized achievement score) may be due to some methodological aspects of the relation teacher-students, more than to the association between physical activity and academic performance.

Castelli et al. (2007) found that aerobic physical fitness was related to academic achievement in children of 8-13 years old, demonstrating that children more physically fit were more likely to perform better in reading and mathematics. The school performance was related also to BMI. Aerobic fitness was positive associated and BMI negative associated to positive results. Muscle strength and flexibility fitness resulted unrelated to achievement test performance.

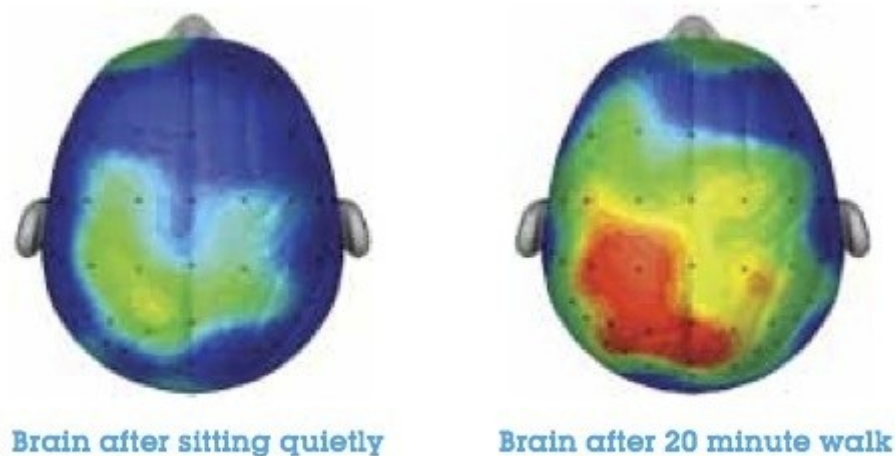
Hillman et al., (2009) and Pontifex et al., (2011) demonstrated in cross sectional studies that aerobic fitness was positive related to attention, decision making ability and other brain function in preadolescent children, compared with less fit peers.

Hillman, (2014) evidences that the detrimentally effects on brain, health and executive functions are still understudied in children, and he supposes it is due to the fact that childhood is a period of changes in brain structure, function and connectivity. Hillman et al., (2014) assessed two hundred and twenty-one 8-9 years old children, pre and post protocol activity. Children were randomly selected and assigned in the intervention group (FIT kids after school PA program) or in the wait list, control group. Children were assessed in aerobic fitness (Vo₂ peak) on a motor driven treadmill and in cognitive tasks, inhibition and cognitive flexibility task. The children of the intervention group trained 2 hours every school day, participating in intermittently at least 70 minutes of moderate to vigorous PA. The intervention included 30-40 minutes of PA in stations. After this the children had 45-55 minutes on low organizational games, centered on a skill theme. At the post test the intervention group demonstrated a greater significant improvement in

aerobic fitness compared to the waitlist control group. Only the intervention group demonstrated at the post test greater improvement in attentional inhibition and cognitive flexibility. Larger changes in neural indices of attention, processing speed and improved performance during the executive control tasks were observed only in the intervention group.

Cognitive Effects of Exercise in Preadolescent Children

Average composite of 20 students' brains taking the same test after sitting quietly or taking 20 minute walk



Source: Derived from research by Dr. C.H. Hillman, University of Illinois at Urbana, Champaign, Urbana, IL (2009).

Fig. 8.1 - Cognitive effects of exercise in children

Davis et al. (2011) studied 171 children of 7-11 years old assessing them in cognitive tasks, after three months of aerobic exercise. The intervention group improved in math achievement and executive functions. fMRI evidences increased prefrontal cortex activity and reduced posterior parietal cortex activity after the exercise program.

Hillman et al., (2005) highlighted that aerobic fitness has been positively associated with changes in neurocognitive function. The higher fit children obtained best results respect the lower fit children in behavioral measures of reaction time, response accuracy, working memory.

Dishman (2006) in studies on animals showed that aerobic exercise increases growth factors, such as the neurotrophic factor. This factor is involved in increasing capillary

blood to the cortex and in growing of new neurons and synapses, determining better results in learning and performance.

More in general, studies assessing executive functions after exercise in children evidences benefits of exercise (Davis et al., 2007; Tuckman & Hinkle, 1986):

- Vigorous physical activity results to be associated in children with better grades (Coe, Pivarnik, Womack, Reeves, & Malina, 2006; Taras, 2005);
- Physical fitness has been associated with academic achievement (Castelli, Hillman, Buck & Erwin, 2007; Dwyer, Sallis, Blizzard, Lazarus, & Dean, 2001; Wittberg, Norhrup, Cottrell, & Davis, 2010);
- Overweight has been associated to poorer achievement (Castelli et al., 2007; Datar, Sturm, & Magnabosco, 2004; Dwyer et al., 2001; Shore et al., 2008; Taras & Potts-Datema, 2005);
- Physical activity does not impaired academic achievement, even taking away classroom time (Dwyer, Coonan, Leitch, Hetzel, & Baghurst, 1983; Sallis et al., 1999);
- Sedentary and overweight children benefit better from exercise than lean children (Must & Tybor, 2005).

8.3 Classifications of the studies

Here is a table reporting a classification of the studies related to the association between physical activity, executive functions and academic achievement.

Cross sectional studies on physical activity and academic achievement
<p>Positive association between physical activity and academic achievement</p> <p>California Department of Education, 2001 Prakash, Voss & Kramer, 2013 Maynard, Coonan, Worsley, Dwyer, & Baghurst, 1987 Shebard et al., 1984 Shepard, Lavallee, Voile, Labarre, & Beaucage, 1994</p>
<p>Negative association between physical activity and academic achievement</p> <p>Prakash, Voss & Kramer, 2013 Tremblay, inman & williams, 2000</p>

Studies examining the association of the components of physical activity and reading, math, total achievement		
Castelli, Hillman, Buck, and Erwin, 2007	Association of component of PA with reading, math, total achievement.	Total fitness (aerobic fitness, muscle fitness and body composition predict school achievement
Buck Surico, Wnek, Castelli & Hillman, (2007); Hillman et al, 2009; Colcombe & Kramer, 2003.	Stroop Task, Flanker Task	Selective benefits of fitness on task of executive control.
Chaddock et al., 2010	Prefrontal mediated task (item memory, relational memory) hippocampal task (item relational memory)	Aerobic fitness is associated with better relational memory in lower fit children. No effects on no relational memory. Aerobic fitness differentially impact preadolescents on tasks by prefrontal and hippocampal function.
Hillman et al., 2005; Hillman et al. 2009; Pontifex et al., 2010; Hillman et al. 2014	Neuroelectric indices of attention	Higher fitness levels in school age children are positive associated with attention allocation processes (observed increasing in P300 amplitude in higher fit children in task of cognitive control.
Chaddock, Erickson, Prakash, Ki, et al, 2010; Chaddock, Erickson, Prakash, Vanpatter et al., 2010	Flanker tasks	Positive association between aerobic fitness and integrity of the subcortical structures. Positive association between aerobic fitness and hippocampus, episodic memory and inhibitory control.
Singh, 2012		Review founded only 2 high quality studies positively relating academic performance and physical

		fitness in children.
<p>Cross sectional works in neuro-electric evidence suggest that increased fitness through aerobic exercise intervention in preadolescent children is associated with increased functional capacity of prefrontal cortex to engage executive functions. (Prakash, Voss & Kramer, 2013)</p> <p>OPEN QUESTIONS Does aerobic training alters the development of the maturing human brain? (Prakash, Voss & Kramer, 2013)</p>		

<p align="center">Randomized studies on physical activity and academic achievement (Prakash, Voss & Kramer, 2013)</p>		
Sibley & Etnier (2003)	Perceptual skills, intelligence quotient, achievement, verbal tests, mathematic test, memory, developmental level, academic readiness and others.	Significant positive relationship between physical activity and cognition in school age (4-18).
<p>NO STUDIES have examined the effects of a randomized controlled trial on the brain structure and function of school-age children. No studies using fMRI in children to study the association between aerobic exercise and brain function (Prakash, Voss & Kramer, 2013).</p>		
<p>NO STUDIES have examined the role of physical activity in development of brain networks and cognition in children (Prakash, Voss & Kramer, 2013).</p>		

Most of the cross-sectional studies were conducted using traditional standardized psychometric and neuropsychological tests, focusing on cognitive control, working memory and inhibitory control. In many cases it has been used only one task to assess one cognitive function.

Cross sectional works demonstrate increased amplitude and decrease latency of the P300 component, suggesting a positive association between physical fitness and cognitive control.

Neuroelectric evidences suggest that increased fitness through aerobic exercise intervention in preadolescent children is associated with increased functional capacity of prefrontal cortex to engage executive functions. (Prakash, Voss & Kramer, 2013)

NO studies have examined the effects of a randomized controlled trial on the brain structure and function of school-age children. No studies have examined the use of fMRI in children to study the association between aerobic exercise and brain function (Prakash, Voss & Kramer, 2013).

NO studies have examined the role of physical activity in development of brain networks and cognition in children (Prakash, Voss & Kramer, 2013).

8.4 SOME CONSIDERATIONS ABOUT THE BENEFIT OF PHYSICAL ACTIVITY

Physical activity is in a central point, as its influences goes toward physical health and mental health. It is usually promoted to children, for its positive effects and in children regularly participating to the activities it is associated with a decreased cardiovascular risk in youth and adulthood (Penedo et al., 2005). Several researches highlight that physical activity has beneficial effects on mental health (health related quality of life and better mood states) (2005) and on brain function and cognition (Hillman, et al., 2008). Some studies evidence the association between physical activity and academic performance.

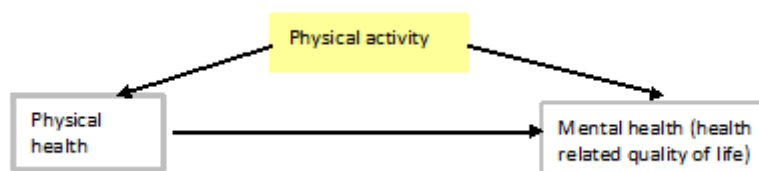


Fig. 8.2 - Relationships between physical activity and health

Researchers looking at the functional neuroanatomy of reading comprehension found an activation of the prefrontal cortex (PFC) and the parietal posterior cingulated cortex

(PPC) (Maguire, et al. (1999) and in mathematical calculations and numerical magnitude processing researchers found a link to bilateral regions of the intraparietal sulcus in children and adults and to right dorso lateral prefrontal cortex (Ansari, et al., (2006). As both mathematic and reading elicit activation in the front parietal network and fitness (Colcombe et al., 2004, 2006) is also related to front parietal network it would derive that children might benefit in school performance from increased participation in physical activity (Hillman et al., 2008).

A recent review (Singh, 2012) analyzing the literature from 1990 to 2010, regards the relation between physical activity, cognitive processes and school achievement, evidences that it is difficult to identify the specific type of physical activity, because there are several expressions of it and different intensity, duration, frequency, that often in the studies remain unclear. For example Leek et al. (2011) asserts that the fact the children participate to physical activity is not sufficient to state that they meet physical activity recommendations. Most of the studies examined were based on reliable and valid self reported measures of physical activity but none utilized objective measures (Singh, 2012).

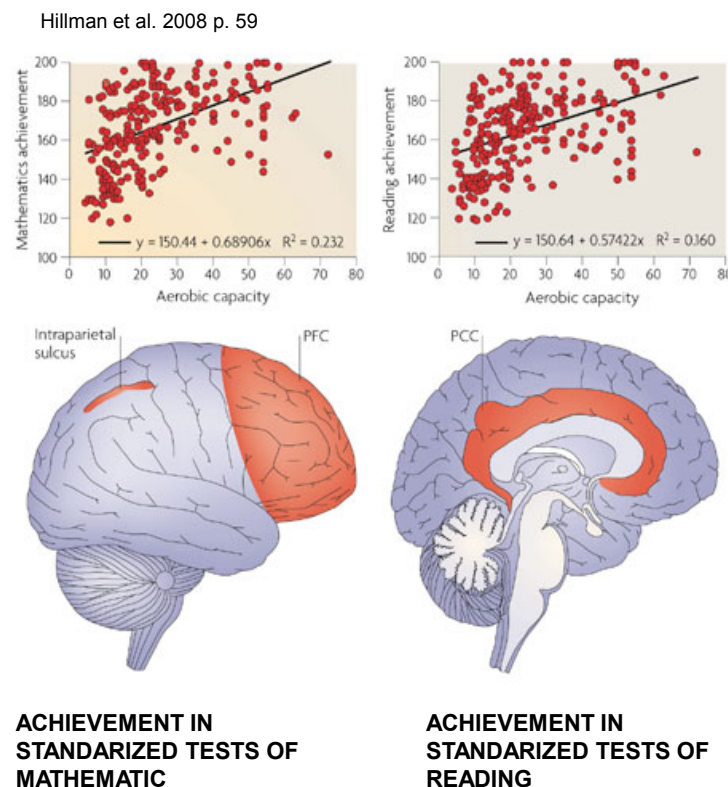


Fig. 8.3 - Relationship between aerobic capacity and achievements in math and reading tests

Some studies included a wide range of physical activity while others included perceptual and sensory motor skills. Singh et al. (2012) found relatively few studies of high methodological quality exploring the relation between physical activity and academic performance in children and however they found evidence of a positive association between physical activity and academic performance in children. They argue that more high quality studies are needed. Some studies highlight an association between physical activity, cognitive processes and school readiness, while others evidenced only relation between physical activity and cognitive processes or directly with school achievement (Singh, 2014).

Models of association between physical activity, cognitive processes and school achievement are shown in Fig. 8.4 (Singh, 2014). Also interesting is the increase in the number of reviews published in the recent years on this topic (Fig. 8.6).

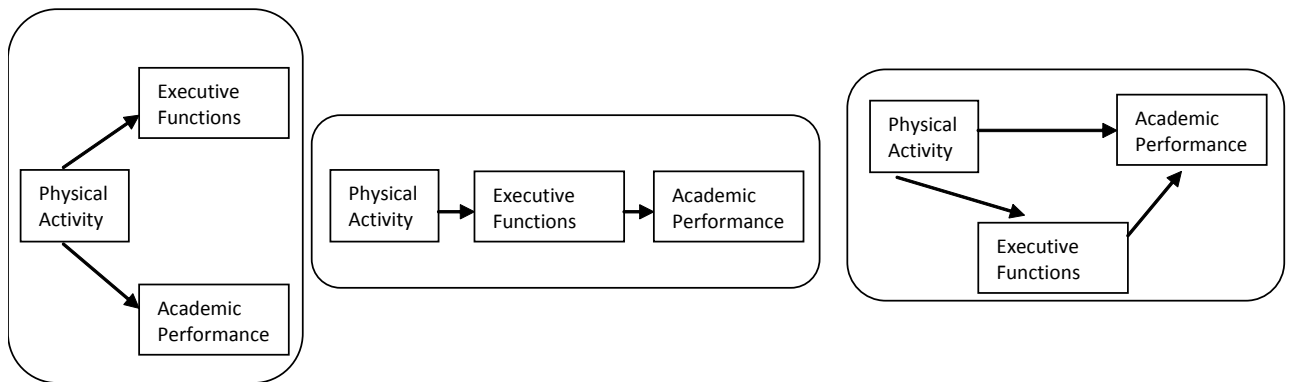


Fig. 8.4 - Proposed modalities of association between physical activity, cognitive processes and school achievement (Singh, 2014)

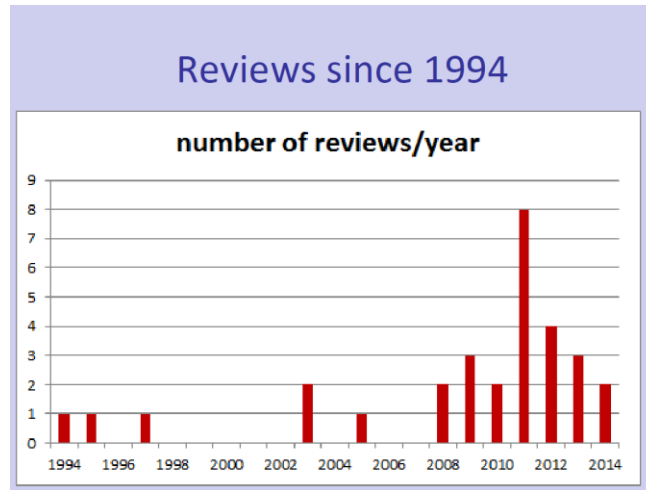


Fig. 8.5 - Number of published reviews on the relationship between physical activity, cognitive processes and school achievement

9 PHYSICAL ACTIVITY AND PHYSICAL HEALTH

The effects of physical activity on cognitive and physical health during development has received little attention and only in the last few year it is observable an increased interest. Recent findings (Sibley et al., 2003) suggest that although physical activity may be beneficial at all stage of life to intervene early in life might be important for improving and maintaining physical and cognitive health throughout the lifespan. Several studies confirm that time dedicated to health based physical activity during school hours (such as physical education) is not accompanied by a decline in academic performance (Ahamed, et al., 2007; Kim, et al. 2003) rather to an increasing of academic achievements, that is positive related to aerobic fitness and negative related to body mass index (BMI) (Castelli et al., 2007). Vigorous physical activity has been associated with better grades (Coe, 2006) and physical fitness with academic achievement (Castelli et al., 2007).

Social, Economic and technological aspects have produced changes in dietary and physical activity and consequently childhood overweight and obesity has been rapidly increasing (Wang & Lobstein, 2006) and physical fitness and performance are often hampered in overweight and obese children, particularly during endurance and weight-bearing tasks (Deforche et al., 2003).

Casperson et al., (1985) defines physical fitness as a set of inherent of achieved attributes relating to an individual's ability to perform daily activities with vigor and alertness, without fatigue and with ample energy to enjoy leisure-time pursuits. Physical Fitness is composed by:

- 1) health related components (important to public health): a) cardiorespiratory endurance, b) muscular endurance, c) muscular strength, d) body composition, e) flexibility.
- 2) skills related components (pertaining more to athletic ability): agility, balance, coordination, speed, power, reaction time.

The level of the fitness related components can be maintained or improved and depends on individuals and exercise training (Pate, 1988). The overall physical fitness can be assessed with a compendium of tests, as no single measure can provide a full representation. Several standardize test batteries have been developed, to assess physical fitness, such as Testing Children's Physical Fitness – Developing a New Test for 4-12 Years Old Children, (Fjørtoft, et al., 2003, the one used in the following studies of the thesis).

Practicing physical activity contribute to control obesity, to provide physical and mental health, to enhance school achievement.

As physical activity is a critical condition, necessary both to physical and mental health it is important to better analyze it.

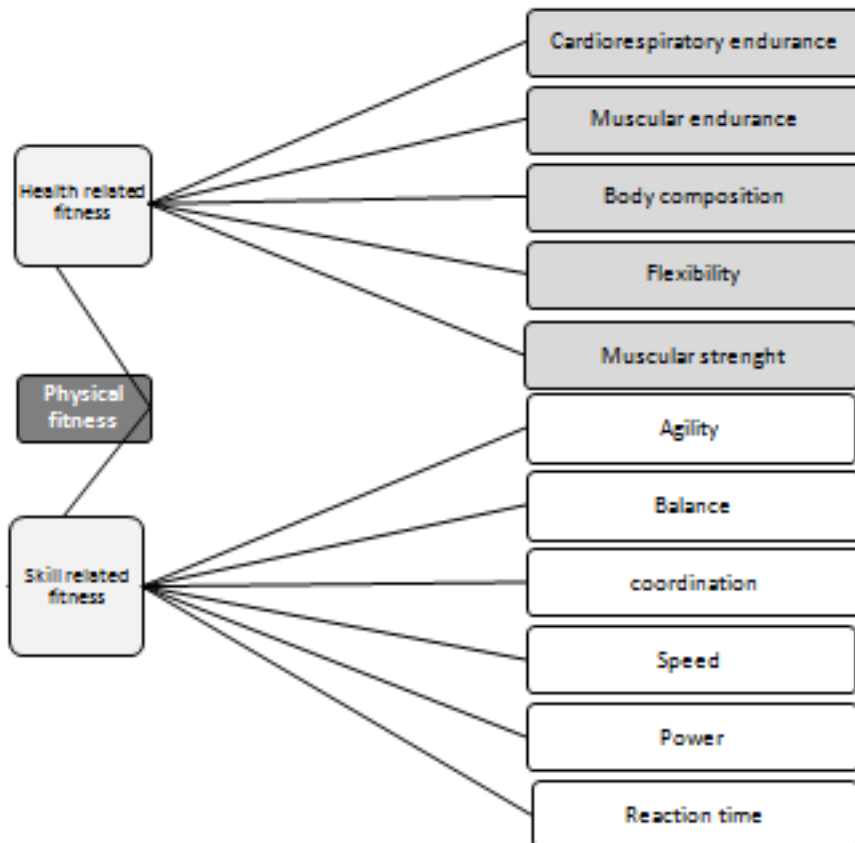


Fig. 9.1 - Components of physical fitness (Caspersen, 1985).

The general meaning of physical activity is “any bodily movement produced by skeletal muscles that requires energy expenditure” to act (Who, World Health Organization, 2014). The term movement means working, playing, carrying heavy tools, travelling, and other activities in recreational pursuits and not only physical exercise. Physical exercise is a subcategory of physical activity that required being planned, structured, repetitive, with the goal to maintain one or more components of physical fitness. Physical activity of moderate and vigorous intensity brings health benefits. Physical activity is positively related with physical fitness.

Simple physical activity, such as walking, cycling, doing sports practiced regularly has great benefits for health. It contributes to improve muscular and cardio-respiratory fitness; to improve bone and functional health; to reduce the risk of hypertension, coronary heart disease, stroke, diabetes, breast and colon cancer and depression and contribute to control the energy balance and the weight (WHO, 2014).

Physical inactivity is on the rise in many countries and is considered the fourth leading risk factor for global mortality. It has been estimated that 3.2 million people die each year because they are not active enough. People practicing at least 30 minutes of moderate intensity physical activity on most days of the week have 30% less risk of death, compared to people who don't move.

Consequences of physical inactivity (WHO, 2014)
21-25% breast and colon cancers
27% diabetes
30% ischemic heart disease

The Member States of WHO agreed to reduce physical inactivity by 10% in the framework of the “Global action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020. In 80% of WHO Member States policies and plans have been developed address physical inactivity. National and local authorities are also adopting policies to promote physical activity. In 2010 WHO published the “Global Recommendations on Physical Activity for Health”, focusing primarily on prevention of NCDs (noncommunicable diseases such as cardiovascular diseases, cancer and diabetes) through physical activity. WHO recommends at least 10 minutes of duration of physical activity, to become beneficial for cardio-respiratory health. For children, it recommends 60 minutes of moderate to vigorous intensity activity per day.

WHO (2014) proposed the following policy options with the aim to reach the recommended level of globally physical activity: to develop and implement the national

guidelines for health increasing physical activity; to integrate physical activity in other policy sectors to ensure that policies and action plans are coherent and complementary; to use mass media to diffuse the benefits of being physically active; to monitor the actions to promote physical activity. Together with UNESCO, WHO is developing a Quality Physical Education (QPE) policy package (WHO, 2014).

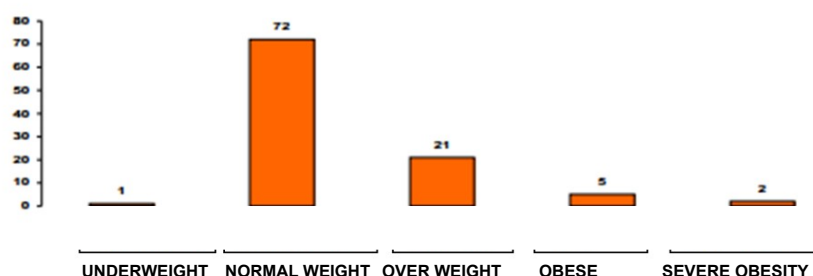
One important American association, NASPE (National Association for Sport and Physical Education, 2009) planned recommendations for children from 0 years old, recommending that all children from birth to 5 age should engage in daily physical activity that promotes health-related-fitness and movement skills.

Physical Activity Guidelines for Children Birth to Five Years NASPE (National Association for Sport and Physical Education, 2009)		
INFANTS (Birth to 12 months)	TODDLERS (12 to 36 months)	PRESCHOOLERS (3 to 5 years)
Interact with caregivers in daily activities of exploration of the environment	Toddler should accumulate at least 30 minutes daily of structured physically activity	Preschoolers should accumulate at least 60 minutes daily of structured physically activity
Should be placed in safe settings facilitating physical activity and do not restrict movement for prolonged periods of time	Toddler should engage in at least 60 minutes and up to several hours each day of unstructured physical activity and should not be sedentary for more than 60 minutes at a time except when sleeping.	Preschoolers should engage in at least 60 minutes and up to several hours each day of unstructured physical activity and should not be sedentary for more than 60 minutes at a time except when sleeping
Promote development of movement skills	T. should develop motor skills that are building blocks for more complex movement tasks.	P. should develop competence in motor skills that are building blocks for more complex movement tasks.
Safe environment for large muscle activities	T. should have safety indoor and outdoor areas for performing large muscle activities	P. should have safety indoor and outdoor areas for performing large muscle activities
Caregivers should be aware of their responsible for well-being of infants and of the importance of physical activity. They should facilitate the child’s motor skills.	Caregivers should be aware of their responsible for well-being of infants and of the importance of physical activity. They should facilitate the child’s motor skills.	Caregivers should be aware of their responsible for well-being of infants and of the importance of physical activity. They should facilitate the child’s motor skills.

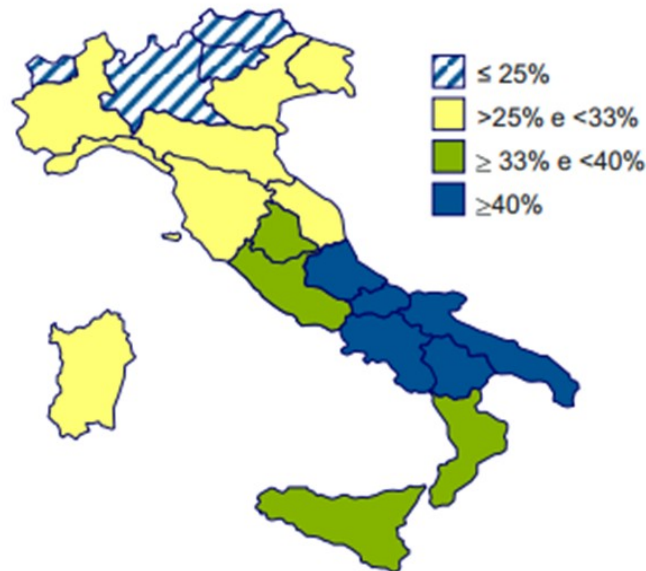
Key guidelines for children and adolescents U.S. Department of Health and Human Services
Children and adolescents should engage in 60 minutes or more PA daily
Aerobic: most of 60 minutes a day should be moderate, vigorous aerobic PA; at least 3 times in the week vigorous intensity PA
Muscle-strengthening: include a part of muscle strengthening in the 60 minutes daily at least 3 times a week.
Bone-strengthening: include bone-strengthening in the 60 minutes daily at least 3 times a week.
Encourage children to participate in PA
150 minutes per week of instructional physical education for elementary school children

A recent study of obesity and overweight in children (Okkio, 2012) highlights that in Veneto, a region of northern Italy, that will be involved in the research of the present thesis, 1.73% of children is in a condition of severe obesity, 4.9% is obese, 20.5% is overweight, 71.7% is normal weight, 1.15% is under weight. Overall 6.63% of children are obese and 27.2% is in a condition between overweight and obese. In middle and southern Italy overweight + obese are higher than in northern Italy

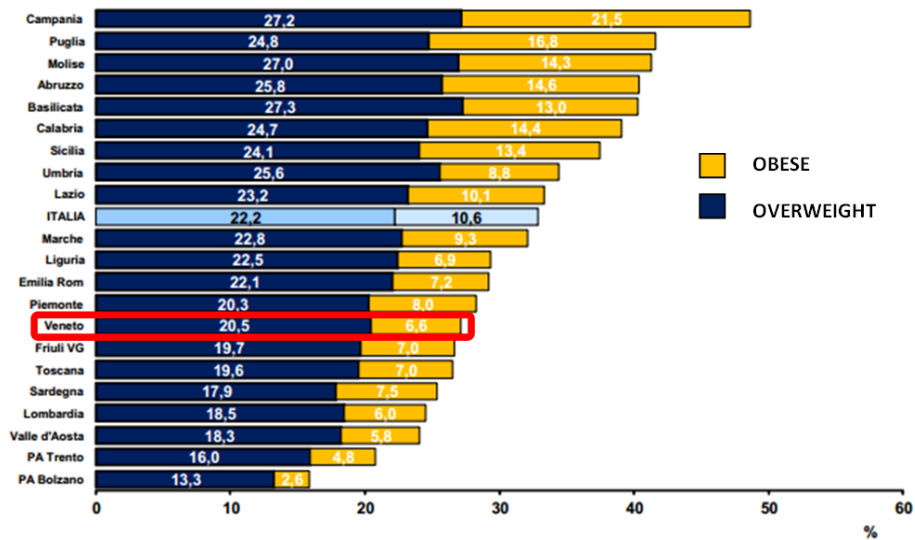
State weight of 8-9 years old children (%)



OVERWEIGHT AND OBESITY IN ITALIAN REGIONS – 8-9 YEARS OLD CHILDREN (Okkio alla SALUTE, 2012)



OVERWEIGHT + OBESITY IN ITALIAN REGIONS, 8-9 YEARS OLD CHILDREN.
Okkio alla SALUTE, 2012



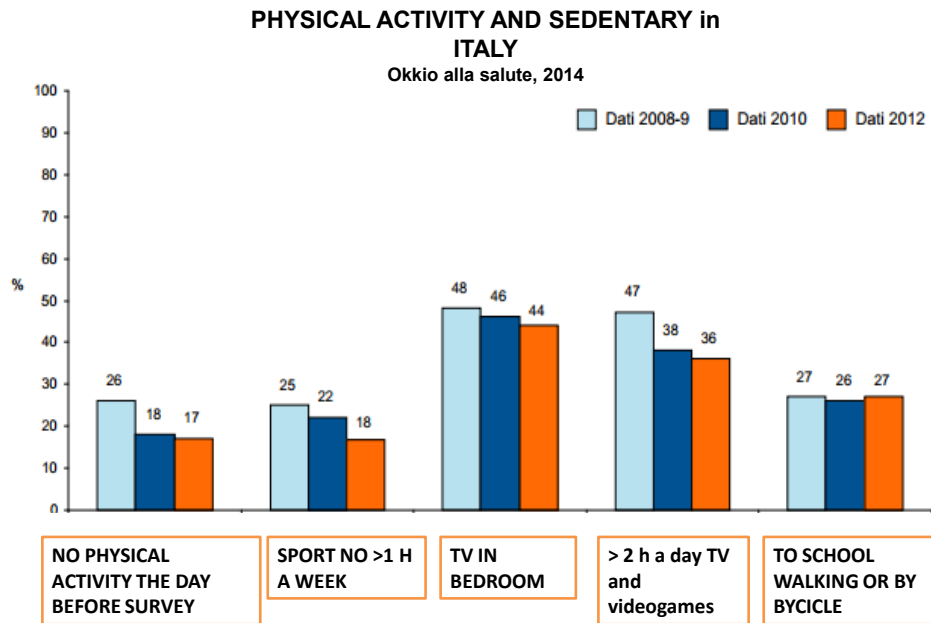


Fig. 9.2 - Obesity and overweight in Italy

A total of 6.63% of 6-11 years old children results to be obese and 27.2% results to be overweight: 18,373 children within 75,376 is overweight and obese in the Veneto region (Northern Italy- red line).

Levels of inactivity are little increasing in years, but they remain still high and sedentary represents a lifestyle related to an earlier onset of chronic diseases (diabetes, obesity and others), which usually do not emerge before adulthood (Secretary of Health and Human (2014).

As physical activity is a risk factor for well being it is necessary to promote it, as recommended by the Health International Associations.

9.1 MOTOR COMPETENCE

Motor competence is an important determinant of children general development and a fundamental aspect for their engagement in physical activity (Hill, 2010; Stodden et al., 2008; Wrotniak et al., 2006). Stodden et al., consider the development of motor skill competence as a primary underlying mechanism to promote engagement in physical

activity. Motor competence can be considered a person’s ability to execute various motor acts, including the coordination of gross and fine motor skills (Haga, 2008). Motor skills are the prerequisite for action and are fundamental to engage in physical activity. Motor competence is implicated in physical, cognitive and social development of children (Hill, 2010).

At the base of the movements there are the motor skills. Children begin early to learn the fundamental motor skills, (FMS) that are composed by locomotor skills and object control skills. Locomotor skills include moving the body (running, galloping, skipping, hopping, sliding, leaping) (Haywood & Getchell, 2009) and object control skills include manipulating, projecting objects, throwing, catching, bouncing, kicking, striking, rolling (Haywood & Getchell, 2009). Clark and Metcalfe (2002) argue that *“the overall goal of this period is to build a sufficiently diverse motor repertoire that will allow for later learning of adaptive, skilled actions that can be flexibly, tailored to different and specific movement context (p. 176).* Children that are not able to proficiently to run, jump, catch, throw and others have limited opportunities for engagement in physical activity when young and adults, because they will not have the prerequisite skills to be active (Stodden et al., 2008).

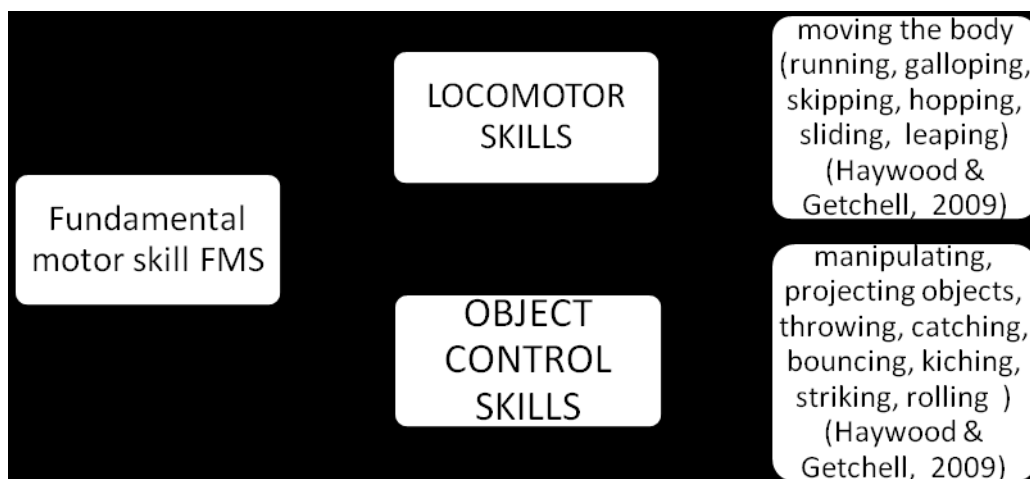


Fig 9.3 - Motor skills

Movement can be organized in

- *gross motor skills* (GMS): postural stability and balance, locomotion, other gross motor skills;
 - o *Postural stability* is considered the state in which the body's centre of mass is controlled in relation to the base of support in order to achieve and maintain it (Horak & Macpherson, 1996).
 - o *Balance* is considered the process in which postural stability is maintained. Static balance maintains a certain posture and dynamic balance maintains postural stability during movement.
 - o *Locomotion* is supporting the body against gravity and moves the body as efficiently as possible towards a goal, maintaining dynamic balance (Patla et al., 1991).

- *fine motor skills* (FMS).
 - o Fine motor skills require complex manual dexterity, for example manipulating an object, visual motor coordination and precision (drawing).

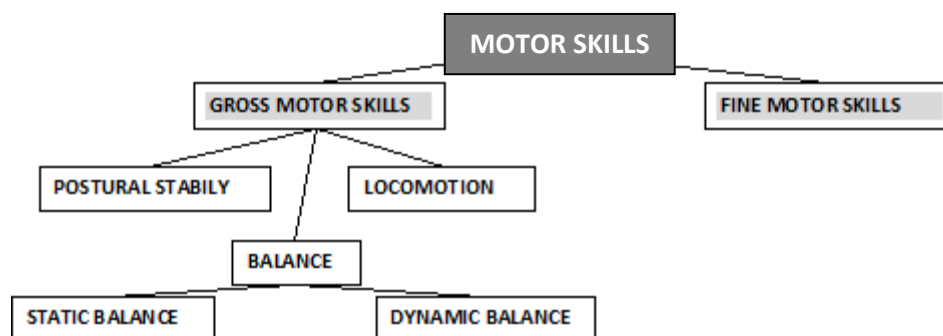


Fig 9.4 - Motor skills

Children with overweight and obesity are more likely to be impaired in gross motor skills, but not in fine motor skills (D'Ondt, 2011). A lower motor competence level may let them meet physiological, biomechanical and neuromuscular barriers, while practicing physical activity (Stodden et al., 2008). They consequently perceive themselves less competent and are less likely to participate in physical activity (Stodden et al., 2008).

There is often a common misconception, that children “naturally” learn FMS. There are several studies showing that there are children that do not obtain proficiency in fundamental motor skills development (Goodway & Branta, 2003; Goodway, Suminski & Ruiz, 2003; Hamilton, Goodway & Haubenstricker, 1999) to be motor competent as adults (Goodway & Branta, 2003, Goodbye et al., 2003). Some evidences suggest that children with a greater level of motor skills competence during childhood will remain active into adulthood (Malina, 1996). Some researchers (Tammelin, Nayha, Hills, and Jarvelin 2003) highlight that children and adolescent participating in sport-related activities, maintain their level of physical activity. This fact suggest that it is important to provide the children a wide range of possibilities of development motor skills, in early age, in the way to practice physical activity (Stodden, 2008, Welk, 1999). Welk (1999) suggests that individuals have a “perception of competence” that overshadows the importance of the “actual” competence. If a child increases a great number of motor skills he will have much more chance of finding activities he can do and I likes.

Clark and Metcalfe (2002) suggest that children follow different trajectories in motor developing, depending on individual constraints and environmental opportunities. Children’s level of motor competence depends on different experiences. The experiences depend on: environment, presence of structured physical education, socioeconomic status, parental influences, climate and others (Goodway & Smith, 2005; DiLorenzo, Studky-Ropp, Vander Wal & Gotham, 1998; Sallis, Prochaska, & Taylor, 2000). Stodden (2008) suggests that motor skill competence drives physical activity level, so it can expects that moderately to highly skilled children will select higher level of physical activity respect to lower skilled children will engage in lower levels of physical activity. As children grow up the relationship among levels of physical activity and measures of motor skills competence would become strengthen (Stodden, 2008). There is not acknowledgment in the literature respect this fact and Stodden suggests the importance of other factors, such as perceived motor skill competence, health-related physical fitness and obesity that may interact to promote or demote physical activity.

9.2 SUMMARIZING, WHAT ARE THE CONDITIONS INFLUENCING EXECUTIVE FUNCTIONS?

Researchers individuate the most relevant aspects that seem to be associated to increasing of executive functions.

- Social, emotional and physical health are fundamental for the well functioning of executive functions. The prefrontal cortex is very sensible to depression, sadness, loneliness, not to be physically fit (Baumeister, Twenge, & Nuss, 2002; Cacioppo & Patrick, 2008; Campbell et al., 2006). The selective attention is worst in situation of depression and sadness (Desseilles, et al., 2009) and when we are happy the selective attention is better (von Hecker & Meiser, 2005). To be happy seems to lead to greater creativity (Ashby, Isen, & Turken, 1999; Hirt, Devers, & McCrea, 2008).
- The negative effects of poor physical health or fitness can be seen on a physiological and neuro-anatomical level in prefrontal cortex and at the behavioral level: poorer reasoning and problem solving, forgetting things, impaired ability to exercise discipline and self-control (Diamond, 2013).
- The increased stress determines an increase of dopamine (Arnsten, 2000) and a less synchronized (Liston, McEwen, & Casey, 2009) activity of prefrontal cortex.

The Diamond's paradigm (2013) to increase executive functions considers physical activity one of the many components leading to academic achievement and graduation rates, mental and physical health.

Diamond (2013) argues that the improvement in academic achievement and in reduction of incidence of disorders (ADHD) may be obtain focalizing to all aspects of the child, such as emotional, social needs, body and not only on academic achievement. Physical activity is fundamental to provide physical fitness and meanwhile to aggregate all other fundamental aspects, such as passionate behavior, repeated experiences, long hours of disciplined practices, fun, feeling of social belonging, self efficacy, pride.

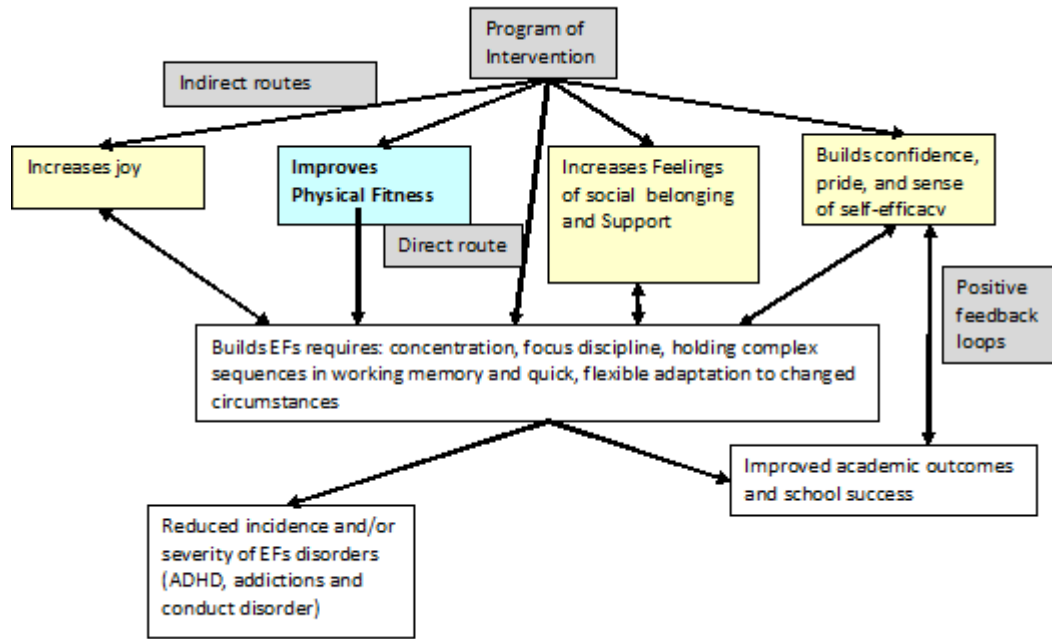


Fig. 9.5 - Diamond's model to optimize executive functions and academic outcomes
(Diamond, 2013, p. 2015)

Diamond (2013) argues that every activity involving focus attention, concentration, working memory, joy, exercises for the body, building community, should be able to improve cognitive skills and success in school and in life.

10 QUALITATIVE EXPERIENCES OF PHYSICAL ACTIVITIES IMPROVE COGNITIVE PROCESSES

To improve skills Diamond (2014) suggests to consider all aspects of the child, such as emotional, social needs, body and not only to focalize on academic achievement. She also highlights that physical activity is fundamental to provide physical fitness and meanwhile to aggregate all other aspects, such as passionate behavior, repeated experiences, long hours of disciplined practices, fun, feeling of social belonging, self efficacy, pride. Diamond asserts that every activity involving focus attention, concentration, working memory, joy, exercises for the body, building community, should be able to improve cognitive skills and success in school and in life. The following studies on Tae Kwond Do seem to propose interesting arguments of discussion.

Trulson (1986) observed that juvenile after receiving a training in the traditional Korean Martial Art of Tae Kwon Do, showed decreased aggressiveness, lowered anxiety, increased self-esteem, increased social adroitness, and an increase in value orthodoxy, as resulting from the comparison of scores before and after training. This first group of juvenile delinquents was compared with one group of delinquents trained in a modern version of the martial art, not emphasizing the psychological/philosophical aspects of the sport and with a group of students, as control group. Only the group of juvenile delinquents trained in the traditional Tae Kwon Do manifested increasing in skills related to inhibition, maybe the most important executive functions.

Lakes et al. (2004) trained a randomly group of children (from kindergarten to preadolescent children) in Tae Kwon Do, while another group of children was trained in traditional physical education group. After three months of training the martial arts group demonstrated greater improvement than the comparison group in self-regulation, affective self-regulation, pro-social behavior, classroom conduct and performance on mental math test. Boys showed greater improvement than girls.

Some authors suggest that improvement in executive functions and academic achievement associated to physical activity may not be due to the effects of the activity but to other aspects. Etnier et al. (1997) in a meta-analysis of the relation between physical activity and cognition identified that academic achievement could be due to: a) physiological mechanisms independent of aerobic fitness; b) physiological mechanisms

dependent of aerobic fitness; c) psychological mechanisms independent of aerobic fitness. In the case of Tae Kwon Do the physical activity was not aerobic.

Shephard (1997) suggested alternative explanations to the positive relation between physical activity and academic achievement: teacher attitudes, student attitudes, public policy.

Castelli (2007) suggest that also motivation may be determinant in the relation.

In this case it seems to be interesting to examine the details of one of these activities, considered by Diamond (2012) a strong evidence of the relation between physical activity and cognitive development.

In the study of Lake (2004) Tae Kwon Do (a martial art) was trained by a martial art instructor. He held black belt for more than 10 years and had 10 years of experiences with adults and children. The techniques utilized in the training included traditional Moo Gong Ryu techniques, such as blocks, kicks and punches, applied in an artistic arrangement of movement. Children learned also board-breaking techniques, complete body-stretching techniques and deep-breathing relaxation techniques. In the environment there was respect, discipline and self-control. The children could use the techniques only to protect themselves and never to hurt another person except when absolutely necessary for self-defense. All children had to wear the martial art uniform when they entered the gymnasium and all classes began at the same rank or belt level (white level, the beginner level). All students began the same way, standing in line in a particular formation and paying attention. Then they had to face the instructor and bow to demonstrate respect. At the beginning of each lesson students spent few minutes meditating. They were instructed *“to clear their mind of thoughts and worries and to focus solely on their breathing. Deep-breathing techniques were taught and reinforced during meditation”* (Lakes, et. al., 2004, p. 288). After meditation the children participated in groups focusing on teaching of several techniques. The students had to ask themselves three questions, just designed to promote self-monitoring: *“1) where I am? 2) What am I doing? 3) What should I be doing”?* (2004, p. 289). After this the students had to correct their stances, thoughts, behavior, in accordance with their expectations. The teacher remarked always to the students that they were responsible of their own behavior in every aspect of the life and not only during the activity.

Diamond (2011) emphasizes that modern and traditional versions of martial arts are different. The modern martial art emphasizes “punching and Kicking” and competition

and makes worse a still unproductive behaviors, while the traditional martial arts emphasizes self-control, self-defense, patience, waiting the other person makes an error, concentration, respect and humility (Lake, 2004). All these aspects are functional to increase the executive functions, as Muraven (2010) showed, summarizing many studies that self-control can be improved practicing regularly small acts of self control. This study is also considered (Diamond, 2011) a very strong evidence, for the methodological attention followed (random assignment, pre and post testing, intervention during regular school hours, active control group). The most important evidence is that children in this study were socioeconomically advantaged, while usually the best results have been found in studies with socioeconomically disadvantaged children.

10.1 VYGOTSKY'S THEORY AND IMPROVEMENT OF EXECUTIVE FUNCTIONS IN "TOOLS OF THE MIND"

(Bodrova, Leong, 2007; Bodrova, Leong, 2001; Bodrova, 2006)

The theoretical framework at the base of the "Tool of mind" is the theory of Vygotsky (1896-1934). One fundamental aspect of the theory is the consideration that some developmental outcomes and processes were thought to develop naturally and spontaneously, influenced by children's own learning or constructed learning (Bodrova & Leong, 2001), and are strictly depending on the socio-cultural context. Vygotsky (1978) argued that children acquire specific cultural tools through more expert members of their cultural group. The acquired cultural tools promote the acquisition of higher mental functions. After the acquisition of very cultural tools children are capable to use higher mental functions independently. Luria (1979) and Vygotsky (1978) consider that the mental functions have an internal and an external face. The external face is explained in using the tool to solve external problems while the internal face is explained in using the tool in the child's construction of his/her own mind, that will influence the develop of new categories and processes. These new categories and processes may promote new higher mental functions, such as focused attention, memory and logical thought.

Educators following this theory develop the goal to arming children with tools that contribute to develop higher mental functions (Bodrova & Leong, 1996) instead of transferring specific knowledge. Vygotsky noticed that in some cases the mechanism of

learning in children was absent and consequently they didn't progress in development. This led him to generate the idea of scaffolding, related to the work in the proximal zone of development. Bruner (Wood, Bruner & Ross, 1976) introduced the term "scaffolding" to describe the process from assistance and independent actions. In the "Tools of Mind" Bodrova & Leong, (2001, pp. 13) included the concept of the "*orienting bases of an action, external mediators, private speech and shared activity and the idea of play as a leading activity*" (Elkonin, 1977; Galperin, 1969; Leont'ev, 1978; Luria, 1979; Venger, 1988).

Galperin (1969; 1992) argues that when a child is learning a new task his action must be driven by the critical attributes of the task. To be successful the learner may deal between several elements orienting him/her within the task, in a more or less appropriate way. The role of scaffolding by the teacher is at the beginning to help the child to develop the appropriate measures and subsequently to teach children how to monitor their actions. An essential component of scaffolding is to use objects to support an adequate mental representation of the action.

In the external mediator Vygotsky recognized that children need more primitive, non verbal tool, also if he primarily focused on language – based tools.

Why was "Tool of the Mind" successful to improve executive functions?

There are many reasons that make the "Tool of the Mind" a successful way of teaching:

a) teachers were trained to utilize the methodology. Diamond (2007) argues that "Tool of the mind" is a sort of very different teaching from the traditional ones and therefore teachers need to be trained to use it. In the study they need two years to learn the methodology and to obtain successful results.

After one year of training teachers seemed to be more relaxed respect to the beginning and rarely need to intervene to help children on tasks or to redirect inappropriate behavior. In this way teachers could dedicate more time to instructions instead of controlling children.

b) Working with better executive functions and providing training in social norms improved also personal interactions between children and peers, between children and teachers, between teachers and children.

c) Children, during the program, were involved in several activities interacting with each other. Diamond (2007) argues that the social benefits may have amplified the positive effects of the program, as the researcher asserts that stress and anxiety impair executive functions and academic performance (Arnsten, 1998; Cerqueira, Mailliet, Almeida, Jay, Sousa, 2007).

d) Teachers were very careful in provide interactions and good communications between all children, avoiding loners and outcasts. Diamond argues that socio-emotional development is very beneficial to promote academic development and positive classroom climate (Duckworth, Seligman, 2005).

e) Children expressed more self-confidence during testing. When at the beginning failed with the trials they told: *"I can do this. I'm sure I can do this"* (Diamond, 2007, p. 15 Supplemental Online Material). They expressed confidence in the requests.

f) Diamond suggests that the success in the program may be amplified because of the initial low level of executive functions in children coming from low-income situations. Other studies are needed.

g) There was support by teachers and administrators (Bodrova, Leong, Norford, Paynter, 2003).

The qualitative aspects of these two experience remind to consider the important of aspects common to physical activity and other experiences (Tool of the Mind), demonstrating to be efficacious in development of executive functions.

10.2 WHAT HAVE THESE TWO METHODS IN COMMON?

Both give importance to:

- discipline
- to tell the self (private speech /self monitoring)
- the teacher has an important role in scaffolding, remarking the children their autonomy/responsibilities/rules, behavior
- the teacher were trained/trainers were specialized
- the activities were made in groups, respecting the others spaces, tools and rules,
- promote self-monitoring-control/activities were interactive.

The contribution of Vygotsky's theory in development of executive functions is very important. Working in the proximal zone of development, with scaffolding of teacher, is the right condition to avoid bore and to motivate children to do the better. As argued by (Davis, et al., 2011; Diamond et al., 2007; Manjunath & Telles, 2001) the best results in increasing of EFs emerged when children are pushed at the higher level of EF skills.

Tae kwon do (Lakes, 2004)	Results	Tool of the mind	Results	Tae kwon do (Trulson, 1986)	Results
<p>Methodological approach Emphasize on the psychological/philosophical aspects of the sport</p> <p>Trainers were trained, expert</p> <p>-artistic arrangement of movement</p> <p>-Children learned also board-breaking techniques, complete body-stretching techniques and deep-breathing relaxation techniques.</p> <p>-In the environment there was respect, discipline and self-control</p> <p>-protect themselves and never to hurt another person except when absolutely necessary for self-defense</p> <p>-All children had to wear the martial arts uniform</p> <p>-All students began the same way, standing in line in a particular formation and paying attention</p> <p>-had to face the instructor and bow to demonstrate respect</p> <p>-At the beginning of each lesson students spent few minutes meditating</p> <p>-After meditation the children participating in their group focusing on teaching of several technique</p> <p>-promote self-monitoring</p> <p>-After this the students had to correct their stances, thoughts, behavior, in accordance with their expectations</p> <p>-The teacher remarked always to the students that they were responsible of their own behavior in every aspect of the life and not only during the activity</p>	<p>Greater improvement in</p> <p>-self-regulation, -affective self-regulation,</p> <p>-pro-social behavior, classroom conduct and performance on mental math test.</p> <p>Boys showed greater improvement than girls.</p>	<p>Methodological approach</p> <p>-Consider that children acquire specific cultural tools through more expert members of the cultural group and this promotes the acquisition of mental functions.</p> <p>-In external face children solve external problems, in internal face it is explained how to use the tools, the construction of own mind, and this influence the development of categories and processes.</p> <p>-External mediators, private speech, shared activity, play.</p> <p>-Scaffolding by the teacher as a way to orient the child in a more appropriate way, to support adequate mental representation of the action.</p> <p>-Teachers were trained, expert</p> <p>-training in social norms</p> <p>several activities interacting with others.</p> <p>-Teachers were very careful in provide interactions and good communications</p> <p>-Proximal zone of development</p>	<p>More self-confidence</p>	<p>Methodological approach Emphasize on the psychological/philosophical aspects of the sport</p>	<p>Decreased aggressiveness, lowered anxiety, increased self-esteem, increased social adroitness, and an increase in value orthodoxy</p>

10.3 ANOTHER IMPORTANT ASPECT

Some activities, such as to tell the self/private speech/self-monitoring are very likely to be considered meta-cognitive activities.

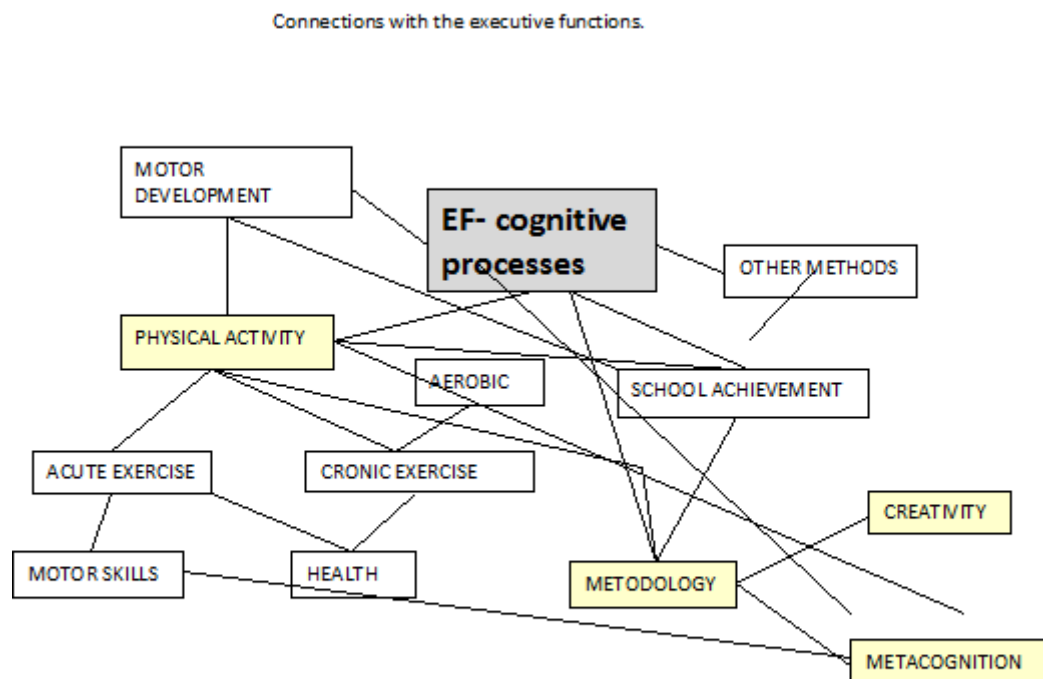


Fig. 10.1 - Factors that may affect EF- cognitive processes

10.4 SUMMARY

From the findings of research it is possible to argue that human development is in part due to maturation and in great part to experience. The experience promotes the development of the nervous system. During infancy, specially, experiences and learning contribute to modify functionally and anatomically chemical synapses, thanks to the functional plasticity. Motor development is embedded, embodied and encultured. The child is influenced by personal, social, cultural, environmental constraints, influencing at

different levels (microsystem, mesosystem, macrosystem). The study on the brain confirm the influence of environment (physical, social, cultural), behavior, neural activity and genetic activity on individual development, producing a continuous process of change in functional capacity, involving sequential and irreversible changes, related to age, but not dependent. Motor development is therefore not a universal developmental process, but it is cultural-related in individual variability. The ecological perceptual perspective on motor development considers the development a dynamical system, related to motor control, coordination and perception-action. Some perceptual learning is specific and some is general and when a child acquires a new motor skill he/she acquires new possibilities for action, new affordances. Caregivers, as part of the environment, influence the child development, giving opportunities or limiting the actions. The possibility of exploration of a certain environment is very important in development and parents may unconsciously scaffold or constrain the child.

About cognitive development the emergent studies highlight the importance of the prefrontal cortex, and of executive functions: working memory, cognitive flexibility, inhibition and attention control, problem solving, processing speed. The prefrontal cortex matures very slow, respect to the other parts of the brain. It needs about twenty years, instead of few years. For this reason it seems to be much influenced by the environmental stimuli and also very sensible to stress, physical, psychosocial deprivation on one hand and influenced by positive experiences on the other hand. For some functions there is a sensitive period of maximal plasticity of the brain and maximal influence of the environmental stimuli on the neural system. The environment can or can't allow expressing the genetic predisposition. When the ability (genes) and the environment (learning) of an individual are matched the ability can increase. Some negative prenatal environmental factors, such as exposition to alcohol, drugs, dopamine, tobacco, marijuana, cocaine, and child's environmental factors, such as malnutrition, lead exposure, chronic stress, psychosocial deprivation, low SES, may promote a negative development of prefrontal cortex. The environmental stimuli affect also cognitive functions and academic achievement. Children with low SES background have higher risk of school difficulties. The main risky situations for the child may be: lower level of parental education, exposure to environmental toxins, like lead, higher level of chronic stress. The consequences may be seen in tasks of language, cognitive control, attention, working memory. The severity of the damage depends on the time of exposure, to the negative experiences. If a child has a high level of self control, focused attention, working

memory and inhibitory control has good school readiness and performance. Working memory and inhibitory control predict math and reading competence from kindergarten to University. High level of executive functions, in general prepares job success, marital harmony, avoidance of social problems, physical and mental health. Children with better executive functions play attention in class, complete assignments, inhibit impulsive behavior, are more praised by teachers for their good behavior, find school easier and enjoy themselves more. Long term executive function skills may improve long term academic skills, school success and retention, job success. EF skills may help children diagnosed ADHD to exercise self control and emotion regulation. Diamond supposes that some case of children diagnosed as ADHD may be due to the fact that some children didn't learn to exercise inhibitory control and self discipline.

Low levels of executive functions predispose to difficulty in finding and keeping a job, in marital harmony, to social problems, poorer physical and mental health, including ADHD, thus influencing the quality of life. For this reason it is necessary to propose activities directed to improve executive functions skills, early, especially in "at risk" children. A finalized intervention may contribute to reduce the achievement gap and lead to decreasing societal inequalities. In the short time the negative effects of low level of executive functions, such as to be more punished by teachers and isolated by the peers may contribute in the long time, to reduce self esteem, to increase the effect "Pygmalion effect", to be more likely to drop out from school. Researchers investigate on the possible activities enhancing the executive functions and found some strong evidence in the following programs: CogMed computerize training, a combination of computerized and interactive games, task-switching computerized training, Tae-kwon-do, PATHS (School Curricula Promoting Alternative Thinking Strategies), CSR (Chicago School Readiness Project). Researchers found weaker evidence in the following activities: aerobics, Yoga, Mindfulness, Tool of the Mind (school curricula), Montessori).

Even though there is a stronger evidence of the relation between executive functions and cognitive tasks there are also few, weak evidences highlighting that while a child is improving executive functions may improving significantly in school performance, especially in math and reading. This competences acquired in early ages seem to remain for a long term, also in the University. An interesting program, called the "Tool of the Mind" highlights the Vygotsky's methodology as fundamental for the success: the scaffolding by the teacher to the children seems to be very important in improvement of self perception and self efficacy in children that may lead them to improvement in

executive functions. Other aspects may be relevant in realizing a program to develop executive functions: a) children with lower EF benefit the most; b) best increases emerge when children are pushed at the higher level of EF; c) the task must be continually increased; d) repeated practice is the key to improve; e) the proposed activities must be embedded in all the activities.

The strong evidences of beneficial effect of activity in the development of the executive functions have led the researchers to investigate on the possible association between physical activity, executive functions and academic achievement. Aerobic fitness, only in the experimental groups, seems to be positive associated with better results in mathematics and reading, attention, decision making ability, attentional inhibition and cognitive flexibility, reaction time, response accuracy, working memory, while BMI seems to be negative associated. fMRI evidenced increased prefrontal cortex activity and reduced posterior parietal cortex activity, after the exercise program. In studies on animals emerged that aerobic exercise increases growth factors, such as the neurotrophic factor. This factor is involved in increasing capillary blood to the cortex and in growing of new neurons and synapses, determining better results in learning and performance. Vigorous physical activity results to be associated in children, to better grades; physical activity with academic achievement; overweight with poorer achievement. In any case physical activity does not impaired academic achievement. Evidences highlight that sedentary and overweight children benefit better from exercise than lean children.

Some authors suggest that improvement in executive functions and academic achievement after physical activity could not be due to the effects of the activity but to other aspects, such as: a) physiological mechanisms independent of aerobic fitness; b) physiological mechanisms dependent of aerobic fitness; c) psychological mechanisms independent of aerobic fitness; d) teacher attitudes, student attitudes, learning disabilities, public policy, children motivation.

The researchers are studying on animals the possible effects of physical activity on the brain, regarding structural or functional modifications that may affect cognitive functions. Physical activity of rats in an enriched environment contributed to develop slightly but significantly thicker cerebral cortices. Other studies highlighted that physical activity produced modification in brain neurochemical environment; produced increasing of volume of prefrontal and temporal grey matter, as well as anterior white matter (this seems to be predictive of performance in older adults); induced hippocampus cell proliferation and cell survival (this seems to facilitate learning and memory).

The main explanations for the improving of mental functions through physical activity are: biological (functional or structural modification in the brain), cognitive (skills are acquired gradually by the practice), social-affective (interact cooperatively).

About the methodologies of research several studies have been conducted using traditional standardized psychometric and neuropsychological tests, focusing on cognitive control, working memory and inhibitory control. In many cases it has been used only one task to assess one cognitive function.

Cross sectional works on physical activity and academic achievement in neuro-electric suggest that increased fitness through aerobic exercise intervention in preadolescent children is associated with increased functional capacity of prefrontal cortex to engage executive functions.

There are not randomized studies on physical activity and academic achievement examining the effects of a randomized controlled trial on the brain structure and function of school-age children. There are not randomized studies using fMRI in children to investigate the association between aerobic exercise and brain functions and not randomized studies examining the role of physical activity in development of brain networks and cognition in children.

The most relevant conditions influencing the executive functions are highlighted by the researches: social, emotional, physical health. Diamond argues that to improve academic achievement is better to focalize to all aspects of the child, such as emotional, social needs, body and not only on academic achievement. Physical activity is fundamental to provide physical fitness and meanwhile to aggregate all other fundamental aspects, such as passionate behavior, repeated experiences, long hours of disciplined practices, fun, feeling of social belonging, self efficacy, pride. Diamond suggests that every activity involving focus attention, concentration, working memory, joy, exercises for the body, building community, should be able to improve cognitive skills and success in school and in life.

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PART II - ORIGINAL RESEARCH

11 THE DESIGN OF THE RESEARCH

11.1 STUDY DESIGN

The research was organized as an **action-research**, involving children, parents, teachers and all persons related. In agreement with Bronfenbrenner's Ecological Theory it was necessary, to consider children in their specific context, and in relation with micro, meso, exo, and macro systems.

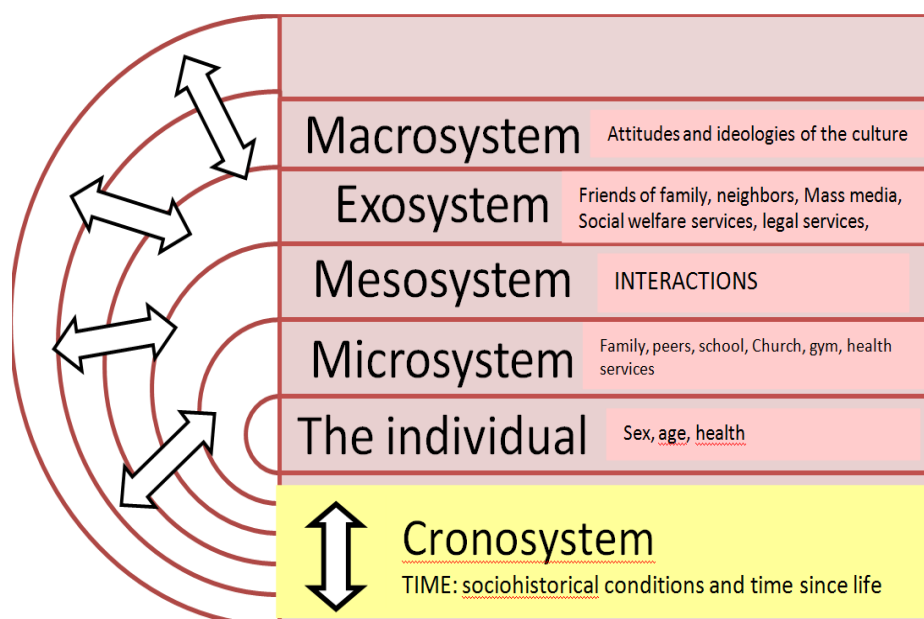


Fig. 11.1 - Bronfenbrenner's Ecological Theory

Paying attention at different aspects of child behavior, from different points of view is necessary to give values (Tessaro, 2011) to the processes of the whole child development.

While looking at the processes it is necessary to consider qualitative approach as well as quantitative approach, giving themselves rules, such as a) transparency in procedures and in assessment communication; b) sharing preventive policies; c) triangulation of perspectives, methods and evaluation techniques (Tessaro, 2011).

Cognitive, affective and motor competence interact in an inextricably dynamic way that they should not be separate (Henderson & Sugden, 1992), in accordance with Newell's model of constraints.

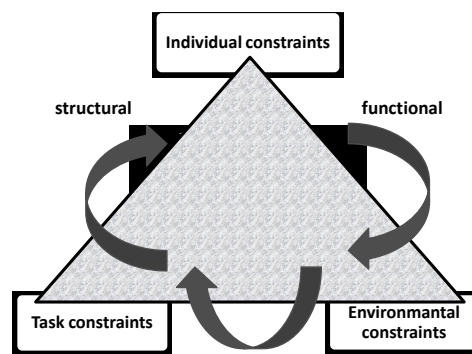


Fig. 11.2 - Newell's model of constraints

Research questions

Motor competence is built upon motor skills and it is the fundamental ingredient of physical activity (Stodden, 2008). Physical activity is the fundamental condition to provide motor development, cognitive processes and physical and mental health.

The first question of this thesis was:

1) "What is the role of the environment in developing physical activity in preschool children?"

Environment consists, as suggested by Newell, in physical and human constraints around the child, such as teachers, parents and others.

After investigating on the environmental constraints of child development the second question was:

2) *“How may we develop motor skills in children”?*

As suggested by the literature there would be several reasons and way for a child to practice physical activity and different kinds of physical activity may develop different motor skills. This is another important point, because the motor skills are at the base of physical activity and to improve them means improve physical competence and physical activity. A large body of evidences indicates a strong relationship between physical activity, physical fitness and global physical health, (Janz et al. 2001; Moore et al. 2003; Fischer et al. 2005; Jago et al. 2005) and between physical activity and social relations, (Blatchford, 1998) and self-perception, (Haga, 2008). Recently few researches highlight the possible association between physical activity, physical fitness, (Physical Health) cognitive processes and school achievement (Mental Health) (Diamond, 2014; Hillman, 2008).

Therefore, the new question arising was:

3) *“If and how may we develop cognitive processes by physical activity”?*

Diamond (2013) evidences a strong relation between traditional Tae-Kwon-Do and executive functions that do not find in modern Tae-Kwon-do, suggesting that the success in developing the cognitive processes may be due to the non motor components of the physical activity. In addition she proposes some methodological aspects: promoting discipline, facilitating activity through scaffolding, activity in zone of proximal development; self private speech/self monitoring.

Type of research

Quantitative, qualitative research, mixed method.

Field of research

Recent neuroscientific researches suggest a positive association between physical activity, physical fitness, executive functions and academic performance

Overall aim

Is physical activity associated with cognitive processes and school achievement?

Research strategy

A consistent part of the research has been realized with the children and their teachers from kindergarten in Treviso (Northern Italy), coming to the playground PRIMO SPORT 0246, in the same city. A design becomes unexpectedly a reality! The Benetton Group, through Verde Sport and Laboratorio 0246 together to the University of Verona (Center of Research on development in infancy) (Italy), CONI (Italian National Olympic Committee) of Treviso, University of Cà Foscari of Venice, (Italy) provided the financial and multi factorial supports, such as to pay the buses for the children and physical education teachers, helping me training and testing the children and other aspects that together provided the realization of the study. Prof. Hermundur Sigmundsson from NTNU Norges Teknisk-Naturvitenskapelige Universitet, Trondheim, Norway and Prof. Monika Haga from Sør-Trøndelag University College suggested to me the most indicated motor assessments and provided precious recommendations during the research.

The methodology of the research was a mixed method, in which a research action, took into account the dynamic inter-relation between researcher, children, teachers, physical educators. The most used tools were interviews, questionnaires, diary, focus groups, videorecording. Other objective methods as assessment of motor competence and cognitive skills were utilized. The playground became a sort of “open laboratory” where children could be observed and studied in the real, everyday activities and meanwhile provided to them the opportunity to develop.

Following is the list of all assessment's tools utilized in the study at the playground. The children were pre tested and after 10 lessons of motor activity training (3 months) post tested, with the same tests.

Assessment of motor skills

- 1) Test of Motor Competence: Sigmundsson, H., Pederson, A., V. (2005); Leversen et al. (2012);
- 2) Test of motor competence: Henderson, S., E., Sugden, D., A., & Barnett, A., L. (2007).
- 3) Test of gross motor competence in the playground. Tortella, Fumagalli, (2014).
- 4) Test of Physical Fitness: Fjørtoft, I., Pedersen. A., V., Sigmundsson, H., & Vereijken.(2011).

Assessment of cognitive functions

Day-night test: Gerstadt, C., L., Hong, Y., J., & Diamond, A. (1994).

Diary

Interviews

Questionnaires

Focus group

Videocamera

The motor, fitness and cognitive tasks were administered individually in a relation one to one with the researcher, in the way to realize good relation with the child, to motivate him, to minimize distractions and to favor the optimum performance. Some of the following tasks were administered in a quiet room in the kindergarten and others in the gym or in the playground. The parents were required to dress the children with suitable physical education clothing or comfortable clothes (t-shirt, gym shoes or trainers). Every type of trousers was acceptable provided movement was not restricted. The tests of gross motor competence and physical fitness were administered only in the morning, from 9.30 to 11.30, while the test of fine motor skills and day-night were administered in the afternoon. Every time it has been used a form, with the list of all the children, to report the results. In playground and gym some people trained and directed from the researcher, helped to administrate the tasks. All the tests provide quantitative objective data on motor competence and also qualitative information on how the child approaches and performs the tasks. After formal testing the observer considered non motor factors, that may have globally affected the child's performance, such as nervousness, lack of concentration, others. In some cases the test was repeated another day Sometimes, during the assessment

in the playground it started raining and we had to repeat the assessment another day. Sometimes children were ill and there were two days in which they could be assessed. If in both days they were not present it was not possible to collect data. This is the reason why the children involved in the research were a big number and the data are instead reduced at the end of the study. It happened that children were very nervous because the day after the test they had a party at school, and also on this occasion we had to repeat the tests. It happened that an examiner took wrong measurements and the test had to be repeated. All activities in the playground, included the assessment, were videotaped. Before starting with the research parents were asked an informed consent, to proceed to assess the children and utilize camera and video camera. Before each task, to every child was demonstrated what he had to do and every child, just before beginning the formal trial had a practice trial. After every practice trial the examiner has to correct eventually errors, to demonstrate again, if it was necessary, give another change to repeat to the child, in the way to be sure that the child had understood the trial. It was very important to encourage the child, by telling them "You are doing well! ok, good try!", because sometimes children are not convinced to do the right thing and are waiting for a consent. Looking carefully the children it is easy to notice how they like to be watched, followed, and appreciated by adults. The days of the tests are conducted in a way that children cannot way the arrival of this fantastic opportunity "to play" and be considered by adults. For children, parents and teacher the day of the assessment is considered something special, a special day, and they called him "the day of the party"!

The first year of test administered the parents were worried and some of them did not allow children to participate to the research. After three years there is now a waiting list of schools, teachers and parents that are asking to be part of the research. The day of the assessment is perceived by children, teacher and parents as a very important, appreciated moment, opportunity, fully dedicated to children. Following there is a list of the tests used.

1) TEST OF MOTOR COMPETENCE: Sigmundsson, H., Pederson, A., V. (2005); Leversen et al. 2012).

TMC tests general motor competence. It is standardized test battery that provides a quantitative evaluation of motor competence for tasks of daily across a wide range of

motor skills. It consists of five different tasks: two are based on manual dexterity, one of hand-eye coordination and two on dynamic balance. The measure is time to completion.

In the thesis the tasks utilized are the following

MANUAL DEXTERITY 1 - fine motor skills

Placing Bricks (PB). 18 square-shaped duplo™ bricks are to be placed on a duplo board (3x6 bricks) as fast as possible. The participant is seated at a table and is given a practice run before the actual testing (only in research of 2014). Executed in a quiet room.

MANUAL DEXTERITY 1 - fine motor skills

Building Bricks (BB). 12 square-shaped duplo bricks are used to build a tower as fast as possible. The participant holds one brick in one hand and one brick in another. At a signal the participant assembles the bricks together one after one until all 12 have been put together. None of the arms are allowed to rest on the table. The bricks should be held in air all the time. (in research of 2012, 2013 and 2014). Executed in a quiet room.

BALANCE (Dynamic) – gross motor skills

Heel to toe walking

This task is often called the tandem walking test and is considered a measure of dynamic balance capabilities. The children were required to walk down a straight line (4, 5 m) as fast as they could, placing their heel against the toes of the foot in each step (tandem). Performance was time to complete the line. Executed in the gym.

Walking/Running in Slopes (W/R).

This task is also known as ‘The figure of eight test’. The participant starts at the starting point. When a signal is given the participant walks/runs as fast as possible in a figure of 8 around two marked lines (1 meter in width). Line 1 is 1 meter from the starting point and line 2 is 5.5 meter from the starting point. If the participant starts to go on the right side of line 1 – the subject will go to the left side of line 2, turn around, and go back on the right side of line 2 and left side line 1 – and over the starting point. The time is stopped when the participant arrives the starting point. The subject can choose which direction they go. The participants were wearing suitable shoes.

2) TEST OF MOTOR COMPETENCE: Henderson, S., E., Sugden, D., A., & Barnett, A., L. (2007).

This is a standardized research tool. It is also used in clinical studies and in longitudinal observations of children with difficulties. It is a simple motor test that asks children to perform a series of motor tasks in a strictly specifies way. This test is available to be utilized at the beginning of training and after, to observe the changes. It is important to consider motor competence, because movement difficulties are often under considered, especially in children with other kinds of difficulties.

Tasks of ABC Movement utilized of the age band 3-6 years old:

MANUAL DEXTERITY 1 - fine motor skills

Posting Coins

The child holds a box with the hand and with the other hand, after a signal, he picks up the coins (12) one at a time, and drop them into the box, thorough a slot, as fast as possible. The child repeats the test changing the hand. Time of execution is measured. Executed in a quiet room.

MANUAL DEXTERITY 2 - fine motor skills

Threading Beads

The child at a signal lifts the lace and a bead and starts threading, as quickly as possible (12 beads). Time of execution is measured. Executed in a quiet room.

MANUAL DEXTERITY 3 - fine motor skills

Drawing trail 1

The child is sitting at a table and has to draw a single continuous line, following the trail without crossing its boundaries. Only the preferred hand is tested. Number of errors is registered. Executed in a quiet room.

AIMING & CATCHING 1 – gross motor skills

Catching Beanbag

The examiner throws the beanbag to the child that has to reach it with extended bands. He can catch the beanbag with one or two hand. There are 10 attempts, after 5 practice

attempts. Number of correctly executed catches out of 10 attempts is registered. The child and the examiner are standing into mats at 1.80 m distance. Executed in the gym.

AIMING & CATCHING 2 – gross motor skills

Throwing a Beanbag onto Mat

The child is standing on a solid mat and throws the beanbag, attempting to land it on any part of the blue target mat located at 1.8 m of distance. The child is encouraged to throw with one arm, but it is accepted also with two hands. Number of successful hits out of 10 attempts is registered. Executed in the gym.

BALANCE 1 (Static) – gross motor skills

One –leg Balance

The child stands on one leg, on the mat, with the arms held freely at the sides, for 30 seconds. Both the right and the left leg are tested. Number of seconds, up to 30, the child maintains balance is registered. Executed in the gym.

BALANCE 2 (Dynamic) – gross motor skills

Walking Heels Raised

Starting with the toe of the leading foot at the start of the line, the child walks along the line with heels raised without stepping off the line. The distance is 4.5 m. Number of correct consecutive steps taken from the beginning of the line without stepping off the line or letting the heels touch the floor is registered. Executed in the gym.

BALANCE 3 (Dynamic) – gross motor skills

Jumping on Mats

The child starts jumping from a stationary position with feet together. The child has to jump consecutively, continuously into 5 mats, without going out the boundaries of the mat. Number of correct consecutive jumps from the start is registered. Executed in the gym.

3) TEST OF PHYSICAL FITNESS: Fjørtoft, I., Pedersen. A., V., Sigmundsson, H., & Vereijken.(2011).

It is a battery of tests to measure physical fitness that aims to provide a reliable, objective quantification of children's physical fitness levels (Fjortoft et al., 2003; Haga, 2008). The tasks are activities included in the everyday children activities. The battery is composed by nine test items and most of them are included in other measures, such as the EUROFIT (Adam et al. 1998).

STRENGTH – gross motor skills

Standing broad jump.

The child starts with his or her two feet in parallel behind a starting line, one shoulder width apart.

Upon a signal, the child swings their arms backwards and forwards, and jumps with both feet simultaneously as far forward as possible. Test item score (best of two attempts) is the distance between starting line and landing position (in centimeters). Executed in the playground.

STRENGTH – gross motor skills

Pushing a medicine ball (1kg).

The child began with the feet parallel and a shoulder width apart, and held the medicine ball (diameter 20 cm, weight 1 kg; Giordicart, Italy, Cod. 5401, type Trial,) against the chest. The test item score (the better of 2 attempts) is the distance thrown with both hands simultaneously (in centimeters). Executed in the playground.

SPEEDS – gross motor skills

Running 20 m as fast as possible.

The child starts in a standing position. With a procedural error, performance is interrupted and the test item repeated. Test item score is time needed to run the distance (in second). Executed in the playground.

ENDURANCE – gross motor skills

Reduced Cooper test.

The child runs/walks around a marked out rectangle measuring 9 x 18 m (the size of a volleyball field) for 6 min. Both running and walking are allowed. Test item score is distance covered in 6 min (in meters). Executed in the playground.

4) TEST OF GROSS MOTOR COMPETENCE IN THE PLAYGROUND. Tortella, Fumagalli, (2014).

BALANCE (DYNAMIC) – gross motor skills

Balance on beam

The child begins with the feet parallel 10 cm from the beam (height at beginning: 26 cm, height at end: 13 cm, width: 13 cm, length: 300 cm; (Legnolandia, Italy, cod 011065, fig. 7). At a start signal the participant goes up and walks as fast as possible on the beam. The time is stopped when the participants arrives at the end of the beam. Time of execution and number of errors (every time the child goes down of the beam) are recorded. Executed in the playground.

BALANCE (DYNAMIC) – gross motor skills

Balance on elastic beam

The child begins with the feet parallel 10 cm from the beam (height 40 cm, width: 20 cm, length: 300 cm; (Legnolandia, Italy, cod 011065, fig. 7). At a start signal the participant goes up and walks as fast as possible on the beam. The time is stopped when the participants arrives at the end of the beam. Time of execution and number of errors (every time the child goes down of the beam) are recorded. Executed in the playground.

BALANCE (DYNAMIC) – gross motor skills

Balance on platforms

Each platform has diameter of 54 cm and height of 43 cm and is supported on a spring that allows lateral shifts of the platform (Legnolandia, Italy, Jumpy, cod. 011107); the circuit consists of 6 platforms separated by gaps of 60 cm (fig. 8). The child begins with the feet parallel near the first platform; at the start signal the child walks on the first platform and then jumps from platform to platform to the end of the circuit. The time is stopped when the participants jumps down from the last platform. Time of execution and number of errors (the child goes down from the platforms) were recorded. Executed in the playground.

STRENGHT – gross motor skills

Monkey Bars

The child is hanging with both hands to the bar and has to “walk with the hand” as long as he/she can. If the child arrives at the end of the bar he/she can make it reverse until he/she can. Number of pegs made is counted. The trial is finished if the child goes down with the feet. Executed in the playground.

STRENGTH – gross motor skills

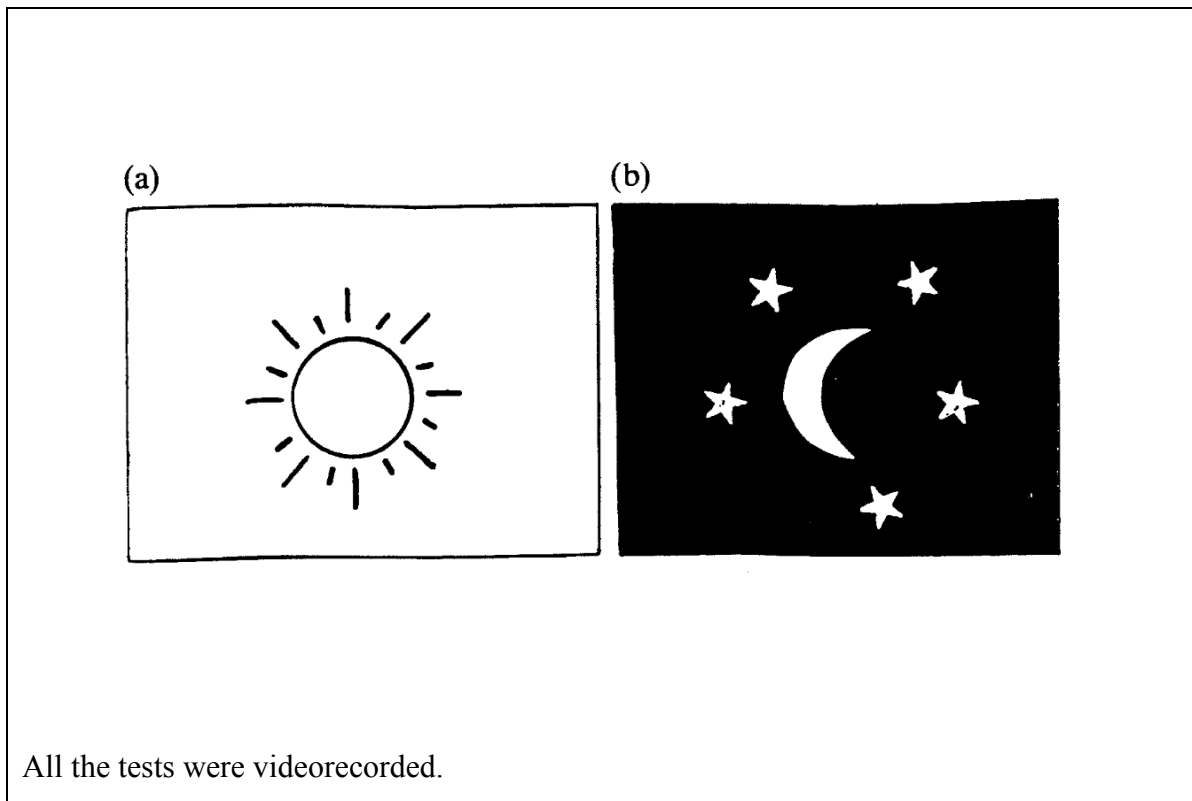
Hanging on a bar

The child stand hanging with both hands on a bar as long as he/she can. The trial is finished if the child goes down with the feet. Duration time of hanging is registered. Executed in the playground.

To assess cognitive functions we used the Day and Night test (Gerstadt, C., L., Hong, Y., J., & Diamond, A. (1994).

THE DAY & NIGHT TEST

The experimenter shows the child a black moon card and instructs the child to say DAY (a). The experimenter says (“*When you see this card, I want you to say DAY*”) (1994, p. 134) than the experimenter removes the card and the child a white sun card and instructs the child to say NIGHT (*When you see this card, I want you to say “NIGHT”* (b)). The experimenter asks the child to repeat the word day and after the word night. Than the experimenter shows a white card without saying anything and if the child hesitates to answer he/she says: “What do you say for this one?” and never says the word DAY or NIGHT. If the child answers correctly the experimenters continues and begins to cont the right answers from here. If the child does not answer correct the experimenter repeats the procedure. A subject needs to have answered each rule correctly at least once over the course of practice plus trials. (16 trials are showed in a fixed order). We measured the number of correct responses over a session. We videotaped the sessions.



Participants

The research involved about 900 children and relative parents , 24 kindergartens, 118 teachers, 20 municipalities from 2010/11 to 2014/15 from northern Italy, Veneto (Verona, Treviso), Trentino Alto Adige (Val di Non). The study was carried out in Treviso where in 2009 I designed the Playground PRIMO SPORT 0246 (Bertinato et al., 2009; Tortella et al., 2011; Buzzavo et al., 2011).

Hypothesis

Physical activity in children may promote cognitive processes and school achievement

Theoretical perspectives

The ecological theory of Bronfenbrenner, theory of Perception-Action (Gibson), the dynamical system theory, Neuropsychology, executive functions, Vygotsky, Newell, Gottlieb, Edelman,

Authors of reference

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11.2 QUADRO GENERALE DELLA RICERCA

Domande di ricerca

L'attività fisica praticata dai bambini/e durante le attività scolastiche della scuola dell'infanzia in un parco giochi può essere promotrice di sviluppo di competenze motorie e di processi cognitivi legati alle funzioni esecutive, in particolare all'inibizione?

Quali sono le implicazioni nell'insegnamento?

Tipologia di ricerca

Ricerca qualitativo-quantitativo-empirica - ricerca applicata – ricerca semi-sperimentale.

Campo della ricerca

L'interesse per lo sviluppo motorio e cognitivo (Piaget) ha assunto oggi, nella ricerca di base, una nuova fisionomia, attraverso lo studio delle interrelazioni nello sviluppo dei substrati organici del controllo motorio e delle funzioni esecutive (Diamond).

Le funzioni esecutive sono un insieme di funzioni cognitive superiori che supervisionano i processi mentali e le azioni. Sono alla base del comportamento, dell'attività cognitiva e dell'apprendimento (Banich).

Le ricerche riguardanti adulti e anziani hanno rilevato che l'attività motoria di tipo aerobico promuove un incremento nei processi cognitivi legati all'inibizione (funzione esecutiva).

L'inibizione viene considerata la capacità di bloccare comportamenti inappropriati ad un compito, e di sollecitare una nuova risposta più funzionale.

Recenti studi hanno evidenziato che anche nei bambini l'attività motoria può promuovere lo sviluppo dei processi cognitivi (Diamond, Buddle, Tomporowski, Best).

Obiettivo generale

Se e quale attività motoria può produrre sviluppo nei processi cognitivi, legati alle funzioni esecutive e in particolare all'inibizione, in età prescolare.

Obiettivi operativi: strategia di ricerca

Sono stati realizzati diversi studi, che vengono riportati nella 3 parte della tesi e spiegati in modo analitico. In questa parte si riportano solo aspetti generali.

Attività generale

(nei singoli studi, presentati di seguito, le attività sono illustrate in modo più analitico.

In linea di massima i soggetti studiati erano suddivisi in almeno due gruppi:

- *Gruppo sperimentale*: scuole dell'infanzia di Treviso, scelte con modalità random, tra quelle disponibili – bambini di 5 anni. Le scuole portano i bambini al parco giochi 1 volta alla settimana per 10 settimane e i bambini effettuano 30 minuti di gioco libero (controllati dalle insegnanti della scuola dell'infanzia) e 30 minuti di gioco semi-strutturato, guidati da esperti nel movimento formati secondo un protocollo di attività motoria. Gli esperti che coordinano il percorso delle classi agiscono secondo i precisi protocolli di lavoro riportati negli studi successivi.
- *Gruppo di controllo*: scuole dell'infanzia di Treviso che non frequentano il parco.

Test:

Vengono somministrati dei pre-test e dei post-test ai bambini delle scuole

PRE-TEST=POST-TEST eseguiti in palestra

MANUALITA'

Lancio di palla medica da 1kg a due mani, dal petto (misurazione distanza) (Test SIGMUNDSSON)

EQUILIBRIO

One leg Balance (misurazione del tempo di permanenza in equilibrio sul piede destro e sul piede sinistro).

Camminare su una linea dritta (larga 5cm) per 4,5 metri il più velocemente possibile, toccando con la punta del piede il tallone del piede che sta davanti. Si misura il tempo impiegato e gli errori di esecuzione (quante volte poggia il piede fuori dalla linea)

MISURE ANTROPOMETRICHE

Misurazione di peso, statura, circonferenza vita.

PRE-TEST=POST-TEST al parco giochi PRIMO SPORT 0246

MANUALITA'

Appeso alla barra. Quanti secondi il bimbo/a rimane appesa ad una barra

Brachiazioni. Per quanti pioli riesce a “camminare” con le mani e tempo impiegato

MOBILITA'

20 M corsa veloce. Misurazione secondi

Salto in lungo a piedi uniti partendo da fermi → distanza dalla linea in cm

EQUILIBRIO

Asse di equilibrio: viene percorsa tutta. Misurazione di tempo (sec) e errori (piede a terra).

Asse di equilibrio con molle: viene percorsa tutta. Misurazione di tempo (sec) e errori (piede a terra).

Piattaforme: tempo (sec) e errori (piede a terra)

PRE-TEST=POST-TEST a scuola.

MOTRICITA' FINE

Test bicycle trails

Building Bricks (BB) Costruire il più velocemente possibile una torre con 12 mattoncini quadrati Duplo™, senza appoggiare le mani o le braccia sul tavolo. Si misura il tempo di esecuzione

TEST DI FUNZIONI ESECUTIVE

Day-night test per bambini

- 1) Test of Motor Competence: Sigmundsson, H., Pederson, A., V. (2005); Leversen et al. (2012);
- 2) Test of motor competence: Henderson, S., E., Sugden, D., A., & Barnett, A., L. (2007).
- 3) Test of gross motor competence in the playground. Tortella, Fumagalli, (2014).

4) Test of Physical Fitness: Fjørtoft, I., Pedersen. A., V., Sigmundsson, H., & Vereijken.(2011).

assessment of cognitive functions

DAY-NIGHT TEST: Gerstadt, C., L., Hong, Y., J., & Diamond, A. (1994).

Indagini parallele

- *Somministrazione di questionari ai genitori* (informazioni sui bambini e sulle attività motorie praticate a casa)
- *Somministrazione di questionari alle insegnanti* (informazioni sui bambini e sulle attività praticate a scuola). Raccolta di POF, curriculum e progetti realizzati nelle scuole.
- *Focus group, interviste a genitori, insegnanti, bambini* (sulle attività al parco e sul significato attribuito all'attività motoria con i bambini)

Ipotesi della ricerca

I processi cognitivi relativi al controllo dell'inibizione, (funzione esecutiva), in bambini/e in età prescolare, possono essere migliorati attraverso la pratica di attività fisica e/o l'incremento delle capacità motorie.

Contesto di teorie

Neuropsicologia, psicologia cognitiva: funzioni esecutive. Gillbert, Diamond, Garon, Miyake, Banich, Davis, Lambourne

Prospettiva ecologica (J. J. Gibson):

Approccio dei sistemi dinamici (P. Kugler, S. Kelso, M. Turvey, Clark, Thelen E.,

Approccio percezione-azione (J.J. Gibson)

Costruzionismo: Vygotsky L.S.

Autori di riferimento essenziali

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PART III - THE STUDIES

12 QUESTION A) "WHAT IS THE ROLE OF THE ENVIRONMENT IN DEVELOPING PHYSICAL ACTIVITY IN PRESCHOOL CHILDREN?"

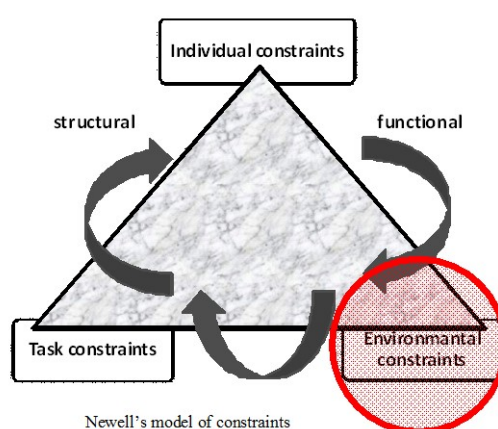


Fig. 12.1 -Poster presented 29 settembre 2011, P.Tortella, Luana Callegari, Fiorino Tessaro, Guido Fumagalli. 3° Convegno Nazionale SISMES, *Survey on motor activity in nurseries in Trentino*

In the link motor skills → physical activity → physical and mental health is important to observe how the constraints of environment and task may promote the various motor skills. In nurseries and kindergarten the teachers organize space and materials and promote structured and unstructured activities, but do they promote motor development in children? Is the organization of the environment facilitating the development of all motor skills in children? In this study we focus on the role of the teachers in promoting the child the best opportunity to develop harmoniously.

12.1 STUDY 1A - PROSPETTIVA ECOLOGICA: IMPORTANZA DI AMBIENTE E CONTESTO NELLO SVILUPPO MOTORIO DEI BAMBINI / ECOLOGICAL PERSPECTIVE: IMPORTANCE OF ENVIRONMENT IN CHILD MOTOR DEVELOPMENT.

(FROM THE ITALIAN PAPER) Tortella P., Tessaro F., Fumagalli G., *Prospettiva ecologica: importanza di ambiente e contesto nello sviluppo motorio dei bambini*, in Cruciani M., Cecconi F., (a cura di) *Atti del Nono Convegno Annuale dell'Associazione Italiana di Scienze Cognitive (AISC)*, Università di Trento, Trento 2012, pp. 213-218. ISBN: 978-88-8443-452-4, <http://www.aisc-net.org/home/2012/11/24/atti-aisc12/>

Premises

Infancy is a period of total dependence from adults. In order to provide the capabilities correlated to welfare it is necessary to raise attention on the environment, on space organization, and on social cultural context, all of them key factors in the developmental processes, according to the ecological perspective. The period 0-6 years is considered the imprinting, because of its consequences on development on physical and mental health. Also cross cultural studies highlight how motor skills are depending on experience and how different types of care provide different development. It is important to promote opportunities of movement and physical activities in nurseries and kindergarten, as also suggested by the international organization (WHO, NASPE, AHA). How teachers and educator organize the environment and plan the activity reflect their beliefs. In order to provide the widest range of efficacious activities for children, to provide their development it is important to consider what teachers tell about their activities and what they really do. This is an important environmental constraint that may lead children development in a way or in another.

Aims

In this study it was compared the statement of nursery's teachers about goals and relative activity with children, and the objective observation of what they really do.

Method

Observation of 156 children 18 months to 3 years old, coming from 46 municipalities, in six nurseries of Trentino Alto Adige (Northern Italy) , during their daily life, using video, charts and diary; administration of questionnaires to teachers.

Activities

Activities were categorized into 23 items based on a survey that we performed on the web about the physical activities performed in nurseries in Italy. Manipulation-based play, painting, musical activities and symbolic play are the most common forms of “motor activities” performed in Italian nurseries. In the two valleys, outdoor activities were the most common, whereas musical activities and foreign language were absent. Most of the activities were in the form of semi-structural play. Fifty % of the nurseries had space specifically dedicated to motor activity.

Fig. 12.1 - Education levels in nurseries in Trentino Alto Adige Italy
Interviews of 20 educators of 6 nurseries

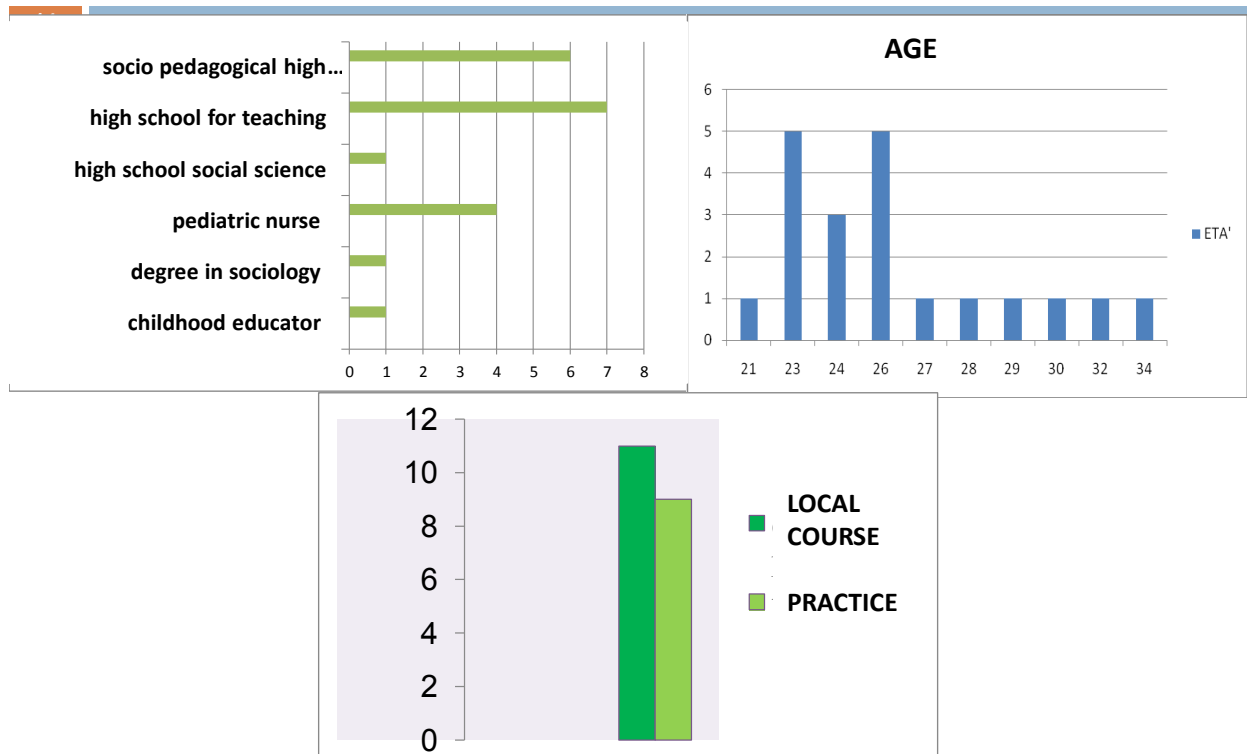


Fig 12.2 - Activities at kindergartens

OBIETTIVI, ATTIVITA' E ASPETTI NELL'ATTIVITA' MOTORIA RITENUTI IMPORTANTI NEI NIDI DEL TRENTINO					
OBIETTIVI DICHIARATI PERSEGUITI NELL'ATTIVITA' MOTORIA PRATICATA NEI NIDI			ATTIVITA' DICHIARATA IMPORTANTE NELLO SVILUPPO DELLE COMPETENZE MOTORIE AL NIDO		
Macrocategorie	Categorie	N. risposte delle insegnanti	Macrocategorie	Categorie	N. risposte delle insegnanti
Dinamiche di gruppo	Benessere del gruppo	5	Mobilità	Utilizzo di mobile primi passi	4
	Socializzazione tra bambini	13		Giochi con ostacoli	3
Imitazione	2	correre		4	
Equilibrio	Equilibrio	12		strisciare	1
Manualità	Manualità	7		arrampicarsi	2
Att. sensoriali	Att. Sensoriali	6		Salire e scendere	8
Linguaggio	Linguaggio	5		saltare	9
Autonomia	Autonomia	4		Andare carponi	6
Individualità	Individualità	1		camminare	4
Creatività	Creatività	3		Equilibrio	Rotolarsi
ASPETTI DICHIARATI IMPORTANTI NELL'ATTIVITA' MOTORIA NEI NIDI				Scivolare	3
Mobilità	Capacità motorie di base	3	Gioco simbolico	Equilibrio	2
	Muoversi in modo sicuro	3		Esplorazione	1
	Sperimentare movimenti	2		Imitare	3
	Autonomia motoria	1		Nascondersi	1
	Motricità generale	4	Attività di svago	3	
Sviluppo motorio	Sviluppo motorio	9	Manualità/tattilità	Tirare palle	3
	Forza	1		Palestra con palline	2
Corporeità	Conoscenza del corpo	3	Percorsi tattili	1	
	Percezione dello spazio	1			
	Schema corporeo	1			
15 Manualità	Motricità fine	4			
Equilibrio	Equilibrio	3			
Autostima	Autostima	1			

This is a list of activities declared by teachers in the questionnaires, organized in motor categories considered in physical activity, such as mobility, balance, manual dexterity and others, such as symbolic play, self-esteem, creativity, autonomy, language, social relations.

It emerged a difference between what teacher declared to do with children and what they considered important to do. They considered activities include in mobility's and motor development's category as the most important and at the last point they consider social relationship. When they declare what they really do with children it emerged at the higher level social relationship, followed by balance activity (to keep the body in a certain position or to recover the position after being pushed) and manual dexterity (grabbing, throwing, pulling, pushing, holding, gripping, climbing). They did not mention mobility in the practical activities that they really do in nurseries. Activities related to mobility (slithering, crawling, walking, running, rolling and others).

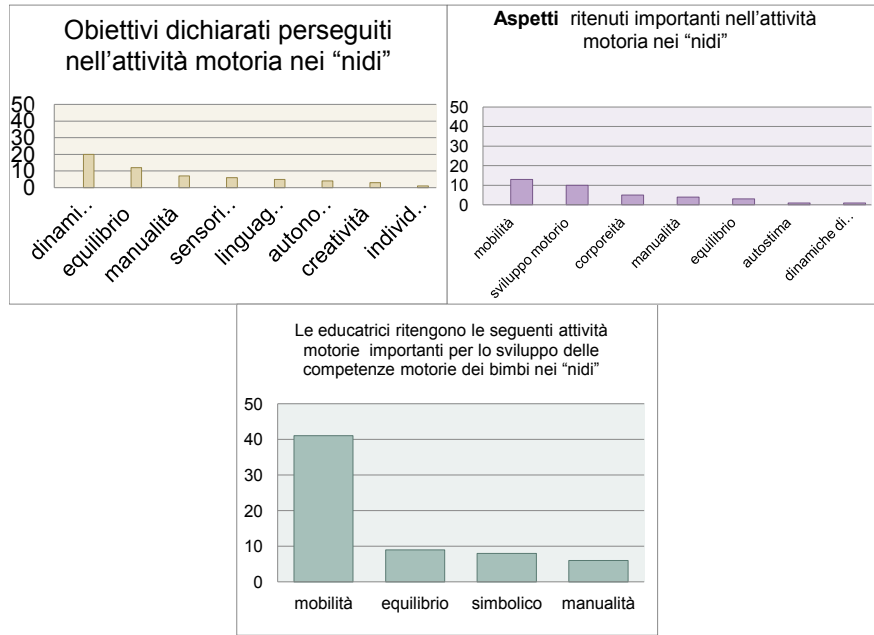


Fig. 12.3 - Types of activities

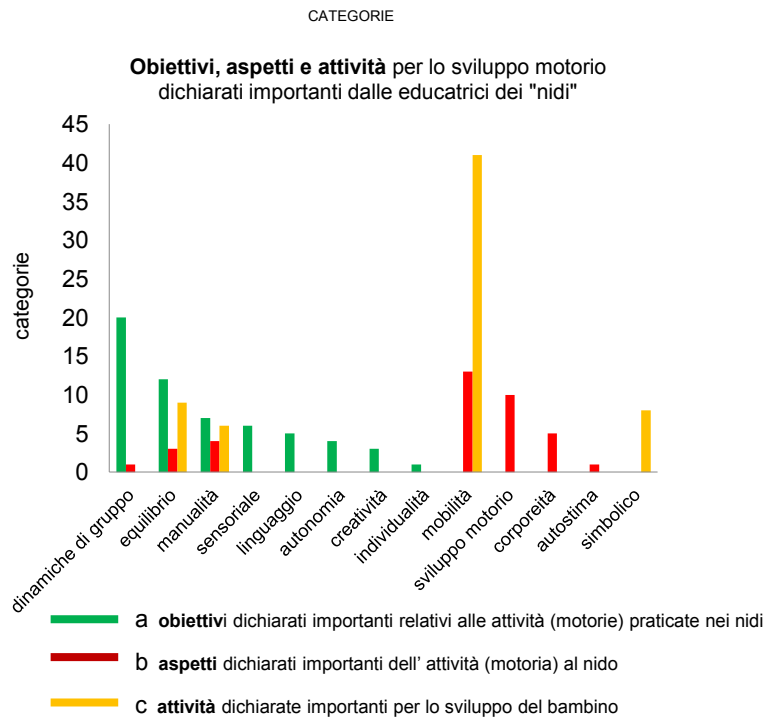


Fig. 12.4 - Activities considered relevant for child development

ITEM	
ASPETTI dichiarati importanti nell'attività motoria ma non dichiarati né tra gli OBIETTIVI né tra le ATTIVITA' motorie	
Sviluppo motorio	10
Corporeità	5
Autostima	1

ITEM	
Dichiarato ATTIVITA' MOTORIA importante ma non dichiarato né tra gli OBIETTIVI né tra gli ASPETTI importanti	
Gioco simbolico	9

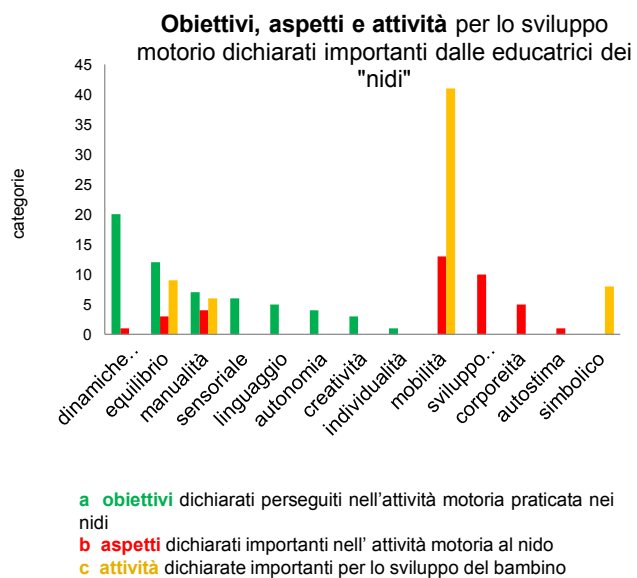


Fig. 14.5 - Activity practiced in the nurseries, observed with videocameras

ATTIVITA' (motorie) PRATICATE NEL TRENTINO n. volte/mese			CATEGORIE	
			Attività (motoria) praticata in 27 nidi (siti italiani)	
manualità	bottiglie sonore	2	manualità	bottiglie sonore
	collage	5		collage
	costruzioni	7		costruzioni
	cestino tesori	10		cestino dei tesori
	gioco euristico	11		gioco euristico
	manip. Generale	19		manipolazione generale
	pasta sale	4		pasta sale
	grafico pittoriche	23		grafico pittoriche
mobilità	travasi	13	mobilità	travasi
	giochi di movimento	23		giochi di movimento
	giochi di esplorazione	3		gioco libero
simbolico	gioco libero	2	simbolico	favole
	alla scoperta delle stagioni	3		gioco simbolico
	attività espressive	3		gioco simbolico
	gioco simbolico	17		giochi con l'acqua
varie non motorie	favole	11	acqua	giochi con l'acqua
	attività musicale	18		
	lingua straniera	4		
	regole	1		
acqua	coccole e relax	1		
	giochi d'acqua	7		
	acquaticità	2		

Fig. 12.5

ATTIVITA' PRATICATE nei nidi del Trentino (osservazione)

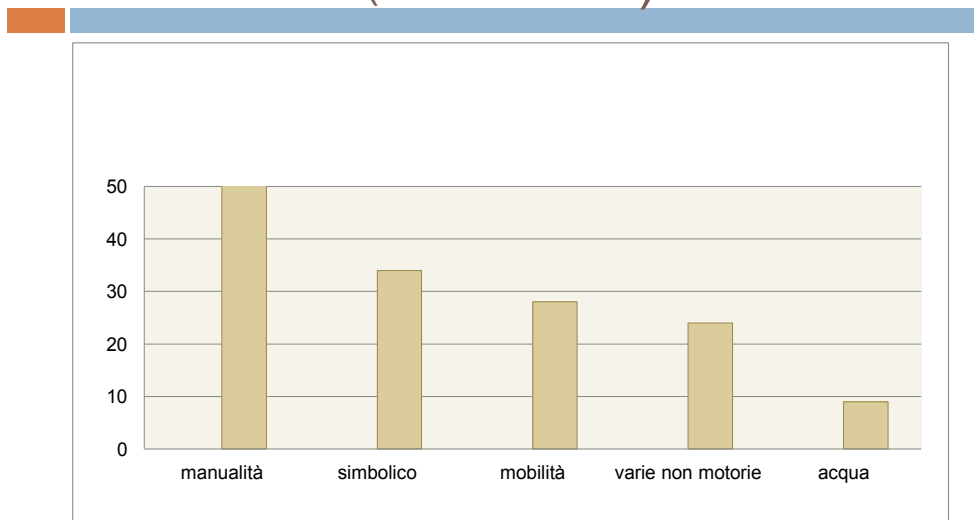


Fig. 12.6

Most of the observations (video recording during all the whole nursery day, in all the rooms frequented by children, for three days in each nursery) revealed that activities related to manual dexterity were the most practiced, followed by symbolic game, mobility, other sedentary activity, activity with water.

Dalla teoria alla pratica dell'attività motoria (Trentino)

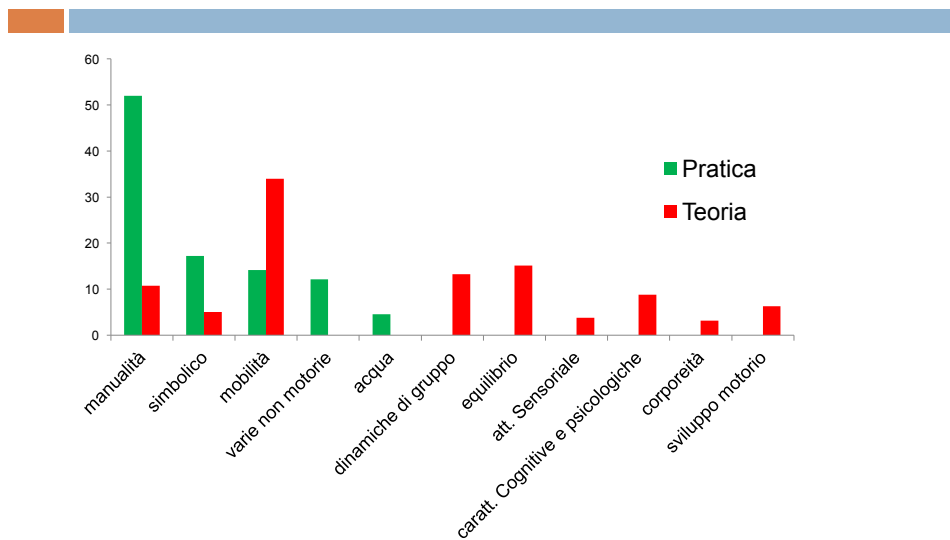


Fig. 12.7 - Differences between theory and practice in nurseries of northern Italy

It emerges a difference from what was declared by teachers and what was observed. It is confirmed that the most practiced activity is manual dexterity, followed by symbolic play, mobility and other not motor activities.

Dalla teoria alla pratica dell'attività motoria (Trentino)

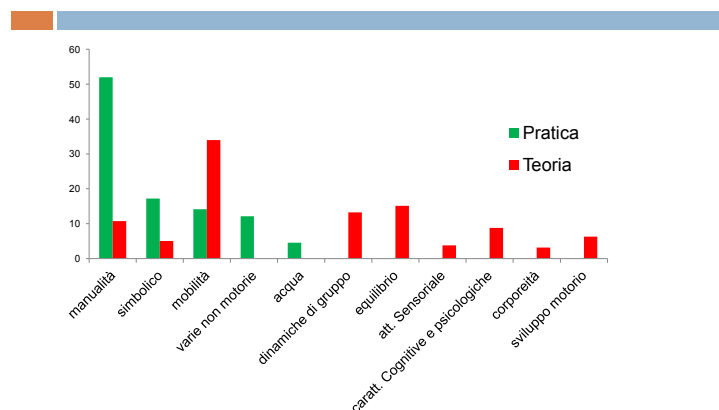


Fig. 12.8

45% of children from 0 to 3 years old stay in nurseries for 9 hours a day (7.30-16.30); 32% for 5.30 hours a day (7.30-13.00); 17% for 10, 30 hours (7.30-18.00) and 6% for 5 hours (13-18).

Conclusion

Goal of teachers, what they tell to do and their practice are very different, also respect the frequency, duration and intensity of the experiences. The observation of the activities evidenced that they were improvised; there were no planned activities; there were not consideration and attention to space, tools and organization of the environment; teachers did not value the children.

In the observed nurseries children were well cared but there was not attention to the needs related their motor development. It seems to dominate a maturation perspective in teacher that does not consider the importance of experience, social relations and environment in child development. Finally, it emerges that children spend the most part of their day in the nurseries and it is important to offer them the capabilities to well develop.

12 QUESTION A) “WHAT IS THE ROLE OF THE ENVIRONMENT IN DEVELOPING PHYSICAL ACTIVITY IN PRESCHOOL CHILDREN?”

12.2 STUDY 1B - PAPER - PROSPETTIVA ECOLOGICA: IMPORTANZA DI AMBIENTE E CONTESTO NELLO SVILUPPO MOTORIO DEI BAMBINI

(FROM THE ITALIAN PAPER): Tortella P., Tessaro F., Fumagalli G., *Prospettiva ecologica: importanza di ambiente e contesto nello sviluppo motorio dei bambini*, in Cruciani M., Cecconi F., (a cura di) *Atti del Nono Convegno Annuale dell'Associazione Italiana di Scienze Cognitive (AISC)*, Università di Trento, Trento 2012, pp. 213-218. ISBN: 978-88-8443-452-4, <http://www.aisc-net.org/home/2012/11/24/atti-aisc12/>

Introduzione

La teoria ecologica considera lo sviluppo motorio come la risultante dell'interazione tra sistema genetico, ambiente ed esperienza (Gibson 1979). Queste dimensioni concorrono allo sviluppo del bambino e il periodo neonatale può essere considerato il momento di “imprinting” dotato di importanti conseguenze sullo sviluppo (Storfer 1999).

Il bambino è totalmente dipendente dall'adulto che lo cura, in genere la madre, e con lei instaura la *relazione intersoggettiva primaria*, che insieme con altre interazioni sociali sviluppa in lui la capacità di attribuire significati agli eventi del mondo (Bruner 1996). La reciprocità dei gesti, degli sguardi, delle diverse forme di contatto percettivo tra lattante e adulto diventa fondamentale per lo sviluppo della relazione. Legerstee (2005) definisce l'imitazione neonatale un *comportamento sociale* che favorisce le primissime forme di relazione e di apprendimento tra le persone. Una buona relazione può favorire lo sviluppo del bambino, in particolare se l'adulto riesce a mediare con le difficoltà dei nuovi compiti che il bimbo incontra, attraverso l'aiuto ad agire in zona di sviluppo prossimale (Vygotskij 2006). Striano (2004) ha individuato una forte relazione tra interazione sociale, sviluppo motorio e cognitivo nella prima infanzia.

Anche lo sviluppo motorio influisce nella relazione: postura e motricità producono significativi cambiamenti nel livello di comunicazione con l'adulto. Attorno ai due mesi il bambino diviene più attivo, inizia a controllare il movimento degli arti, è in grado di controllare la testa, di mantenere a lungo l'attenzione al volto della madre (Lavelli 2007) e questo stimola la madre a interagire maggiormente con lui.

Atteggiamenti e comportamenti dell'adulto, da cui il bambino dipende ancora totalmente rispecchiano i modelli culturali di riferimento, indirizzando anche lo sviluppo motorio verso l'acquisizione di competenze diverse (Keller 2007).

Il concetto di autonomia, ad esempio, che sta alla base di sviluppo cognitivo, motorio, sociale, affettivo è declinato in modi differenti, al variare del modello culturale di appartenenza.

Il modello di *autonomia di azione*, tipico delle comunità rurali, privilegia lo sviluppo di capacità motorie. La relazione si realizza attraverso contatto fisico e stimolazione corporea. Le conseguenze nello sviluppo motorio sono che in Camerun, ad esempio, i bambini stanno seduti autonomamente a tre mesi e camminano a otto. All'età di 1 anno manipolano abilmente un machete, per pulire il sentiero (Keller 2007).

Il modello di *autonomia psicologica*, tipico delle comunità urbane, privilegia il rapporto faccia-faccia. È caratterizzato da quasi assente relazione corporea e molta comunicazione verbale e attenzione agli oggetti. I bambini iniziano a camminare mediamente attorno ai 12-14 mesi.

In alcune comunità dell'India in cui le madri tengono i bambini a tracolla per molti mesi, i bimbi imparano a camminare mediamente a 24 mesi.

Lo sviluppo motorio influisce nello sviluppo cognitivo, sociale e affettivo. Adolph e Berger (2006) hanno evidenziato che l'acquisizione di competenze motorie, come stare seduti, andare carponi, manipolare oggetti favorisce apprendimenti di tipo cognitivo. In particolare la capacità di stare seduti e di manipolare oggetti che permettono al bambino di orientarli e girarli in tutte le direzioni, contribuisce alla capacità di visione tridimensionale. L'acquisizione di competenze motorie specifiche aiuta il bambino, inoltre, a prevedere i pericoli e a evitarli (Adolph 2012).

Diversi modi di accudire dei piccoli, quindi, promuovono diversi tipi di esperienze che contribuiscono a diversi tempi di sviluppo del bambino (Hill e Hurtado 1996).

Esperienze differenti del bambino promuovono anche un diverso stile di vita e una diversa condizione di salute nel futuro adulto. Studi recenti (O.M.S. 2004) evidenziano che dieta sbagliata e mancanza di attività motoria predispongono il bambino a: altissimo

rischio di malattie cardiovascolari, diabete, cancro che si svilupperanno in età adulta. Secondo l'O.M.S. (2004) l'incidenza di obesità infantile è una delle prime cause di modificazione della salute del nostro secolo. Nel 2010 il numero di bambini al di sotto dei cinque anni di età in condizioni di obesità e sovrappeso è stato stimato in 42 milioni. Bambini obesi e in sovrappeso tendono a rimanere obesi e in sovrappeso anche da adulti. Ricerche di Tortella, Durigon, Cappellari, Fumagalli (2011) hanno evidenziato che i bambini obesi tendono a evitare attività di movimento con grande rischio di isolamento, di diminuzione di autostima e di autoefficacia.

Domanda

Dai riferimenti riportati emerge che lo sviluppo del bambino non avviene per “*maturazione*”, ma in stretta dipendenza da esperienza, ambiente e contesto sociale. Ci si chiede allora quale sia la direzione di sviluppo prevista per i bambini di oggi, tenuto conto che molte donne lavorano e i piccoli dai 4 mesi trascorrono sempre più tempo negli asili nido seguiti da persone diverse dai genitori. Quali sono i principi educativi, le pratiche su cui si basano i luoghi di accoglienza dei piccoli? Boscolo (1997) ritiene che gli atteggiamenti e i comportamenti siano strettamente dipendenti da credenze, abitudini e teorie implicite ed esplicite delle educatrici.

Ipotesi

Le teorie implicite ed esplicite delle educatrici degli asili nido guidano le loro azioni educative.

Obiettivo

Individuare le teorie che guidano le pratiche educative delle educatrici degli asili nido del Trentino Alto Adige.

Metodologia

È stata fatta un'indagine web per prendere visione di come, dove e con chi trascorrono le loro giornate i bambini da 0 a 3 anni in Europa e in Italia, nel Trentino Alto Adige. Successivamente, dopo aver individuato tutte le attività praticate dai bambini nei nidi italiani sono state costruite delle categorie includenti le diverse tipologie di attività praticate.

In parallelo è stata realizzata una ricerca sul campo in sei asili nido del Trentino Alto Adige, per osservare attraverso l'osservazione partecipata (1 mese, tutti i giorni) le attività praticate da 156 bambini da 1 a 3 anni, provenienti da 46 Comuni. E' stato in seguito costruito un elenco delle attività praticate e anche in questo caso sono state costruite le categorie delle diverse tipologie di attività.

Sono stati somministrati dei questionari alle educatrici per conoscere età, anni di esperienza lavorativa, titolo di studio, obiettivi, attività e credenze rispetto all'attività coi bambini .

Gli strumenti utilizzati sono: diario, telecamera, questionari, web.

Risultati

L'indagine realizzata in alcuni paesi europei ha evidenziato In Francia l'otto per cento dei bambini frequenta l'asilo nido, in Gran Bretagna il 22%, nella Repubblica Federale Tedesca il 13%, nella Repubblica Democratica il 43%. In Italia, nel Trentino Alto Adige il 78% dei bambini trascorre le giornate seguito dai genitori, e il 13% frequenta gli asili nido. Le attività praticate dai bambini in 27 asili nido distribuiti nel nord, centro e sud Italia, desunte dai siti web e raggruppate per categorie sono simili a quelle praticate nei nidi del Trentino Alto Adige, in particolare: giochi con l'acqua, giochi simbolici, giochi di movimento, ascolto di favole, gioco libero, bottiglie sonore e barattoli, giochi con la carta, giochi ad incastro, cestino dei tesori, gioco euristico, manipolazione, attività grafo pittoriche, travasi (Callegari 2009). Dal raggruppamento funzionale delle attività praticate sono state costruite le categorie: manualità, gioco simbolico, attività non motorie, giochi con l'acqua, mobilità.

Le educatrici dei nidi del Trentino Alto Adige hanno riportato i seguenti obiettivi per le attività realizzate con i bambini, autonomia, socialità, relazione, senso motorio, sviluppo del linguaggio.

Dalle osservazioni emerge che le attività praticate nei nidi sono improvvisate e casuali e possono essere distinte in: manualità, mobilità, equilibrio, gioco simbolico. Il 50 % dei nidi (italiani) dispone di spazi specificamente dedicati all'attività motoria ma non si osserva, (né risulta dalle risposte nei questionari) attenzione alla strutturazione di spazi e all'organizzazione di materiali. Non viene osservata né dichiarata l'importanza di ambiente e contesto socio-relazionale nello sviluppo del bambino.

Conclusioni

Ambiente fisico e contesto socio-relazionale non vengono dichiarati né considerati importanti ai fini dello sviluppo del bambino, nonostante le evidenze scientifiche ne rivelino la rilevanza. Le attività dichiarate e realizzate dalle educatrici sembrano rispondere a criteri di “accoglienza-accudimento” piuttosto che di promozione dello sviluppo di ciascun bambino. Il senso formativo delle educatrici è molto labile, nonostante si occupino di bambini da 0 a 3 anni, periodo fondamentale per lo sviluppo. Prevale una teoria di tipo *maturazionale*, che non considera l'intreccio evolutivo a spirale di esperienza personale, relazioni sociali e ambiente fisico.

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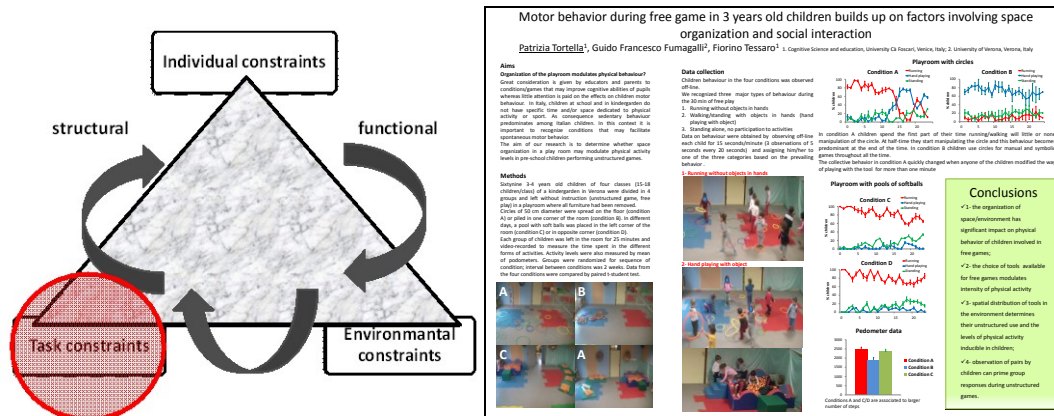
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12 QUESTION A) “WHAT IS THE ROLE OF THE ENVIRONMENT IN DEVELOPING PHYSICAL ACTIVITY IN PRESCHOOL CHILDREN?”



Newell’s model of constraints

Poster 07-09/06/2012, Tortella P., Fumagalli G., Tessaro F., *Motor behavior during free game in 3 years old children builds up on factors involving space organization and social interaction.* “International Conference of Infant Studies”. Minneapolis. Minnesota. USA.

Fig. 12.9 - Newell’s model of constraints and poster as indicated

Newell, (1986) suggests that the environment is a constraint that encourages or discourages movement. It consists of both physical and socio-cultural effects. The interest of the following study was to investigate on the role of environment, as a constraint of movement to see how it may influence the task. The task is considered another constraint, linked to child motivation. In other words this study focuses on the final movements of the children, in order to think at possible links whit the educational plan, that may consider physical and social aspect in providing opportunities for children to develop different motor skills.

12.3 STUDY 2A - MOTOR COGNITION DURING FREE PLAY IN 3 YEARS OLD CHILDREN BUILDS UP ON FACTORS INVOLVING SPACE ORGANIZATION AND SOCIAL INTERACTION/ L'ORGANIZZAZIONE DI SPAZI E AMBIENTE CONTRIBUISCE A COSTRUIRE LA COGNIZIONE MOTORIA , DURANTE IL GIOCO LIBERO, NEI BAMBINI DI 3 ANNI.

(FROM THE ITALIAN PAPER) Tortella P., Tessaro F., Fumagalli G., *Motor cognition during free games in 3 years old children builds up on factors involving space organization and social interaction*, in *Le scienze cognitive in Italia 2011, Aisc 2011, Atti dell'ottavo convegno Nazionale Associazione Italiana di Scienze Cognitive, Tecnologia, scienze umane e scienze della salute*, (a cura di Angelo Rubinacci, Angelo Rega Nicola Lettieri), Napoli: Università degli Studi Federico II, 2011, ISBN 978-88-904539-4-6, <http://www.aisc-net.org/home/category/e-book-corner/>, pp. 189-193.

Abstract

The aim of the research is to determine the role of environment on physical activity levels in 3 years old children performing unstructured activity in a kindergarten.

Sixty-two 3 years old children of a kindergarten in Verona were divided in 4 groups and left without instruction (unstructured game, free play) in a playroom where all furniture were removed. Circles of 50 cm diameter were spread on the floor (condition A) or piled in one corner of the room (condition B). In different days, a pool with soft balls was placed in the center of the room (condition C) or in one corner (condition D). Each group of children was left in the room for 30 minutes and video-recorded to measure time spent in the different forms of activities. Activity level was also measured by mean of pedometers. Groups were randomized for sequence of condition; the interval between the conditions was 2 weeks. Data from the four conditions were compared by paired t-student test.

In condition A, children spent most of the time running on and around or jumping in the circles. In condition B, the same children used circles for individual and/or symbolic games and the running/jumping behavior was limited and random. No differences in physical activity levels were measured between condition C and D. Interestingly the collective behavior quickly changed when one of the children modified the way of playing with the tool.

The data indicates 1- that the organization of space/environment has significant impact on physical behavior of children involved in free games; 2- that spatial distribution of tools in the environment determines their unstructured use and the levels of physical activity inducible in children; 3- observation of action by other children can prime similar responses during unstructured games. We speculate that motor cognition during free play builds up on factors involving space organization and social interaction.

Keywords:

unstructured games, environment, physical activity, motor cognition, social interaction.

Introduction

Great consideration is given by educators and parents to conditions/play that may improve cognitive abilities of pupils but little attention is given to physical activity and the environment. Physical activity builds up on motor skills and it is important to give the children a wide range of different opportunities of movement. All children should have equal opportunities and capabilities (Sen 1999) and governments, parents, educators and teachers have a fundamental role in building context and environment adequate for children in order to promote their development and well being. Often in kindergarten children have a prevalence of manual dexterity activities and most of the time they are sedentary (Tortella et al. 2012). Inactivity hampers the development of fundamental motor skills (Haywood & Getchell, 2009) and coordination of both fine and gross motor skills required for adult activities (Vedul-Kjesas, Sigmundsson, Stensdotter, Haga, 2011). With plays and games children may learn also the fundamental skills for social competence, (Doll, 2009 as cited in Couper, 2011). The educators have a great responsibility in promoting movement-based experiences in order to improve health behaviors and attitudes about physical fitness (Bandura, 2004; Pate, Pfeiffer, Trost, Ziegler & Dowda, 2004). Indeed interaction of individual, task and environment changes the movement and these may have consequences, later in time of changes in motor development (Haywood & Getchell, 2009).

The play seems to be a common element in nature, between different species of animals for psycho-biological development (Burghardt, 2005). Humans and animals have in common that both are involved in repetitive actions to consolidate the skills and mostly these actions seem to be not finalized to a specific goal or task. Both children and animals do not play if they are stressed or are undernourished. Pellegrini (2007) believes that free play is important because it has not fixed rules and provides more creativity. In addition while children are free playing they develop perseverance and social skill, such as the communication skills and improve their language, being forced to be understood the peers without the mediation of an adult. The free play helps to improve the emotional well-being by providing the skills to learn how to manage stress and anxiety. The play seems also to promote learning, creative thinking and problem solving in children. Through play the child crosses some critical steps in the interaction between the self and the external environment. The international organizations recognize the importance of free play in child development and recommend at least 60 minutes of daily unstructured physical activity or 30-60 minutes daily structured physical activity of mild to moderate intensity (WHO, 2014; NASPE, 2009). The presence of different environments and tools provide different opportunities of actions and the repetitiveness that often characterizes the motor activity makes it possible the practice of the principles of frequency, intensity and duration of the motor acts that are the basis of the development skills. The child playing freely may experiment different motor skills, concerning mobility, dexterity and balance, at the base of movement (Tortella et al., 2011). Environment, materials, teachers and peers become key ingredients for learning. Representations, perception and action are involved in motor skills acquisition and in memory processes and language (Glenberg & Kaschak, 2002; Pecher, Zeelenberg & Barsalou, 2003; Solomon & Barsalou, 2001; Spivey, Tyler, Richardson & Young, 2000; Stanfield & Zwanna, 2001; Zwaan). Some researchers have noticed that during free play children stay more sedentary than during structured activities and that usually in kindergarten they move lower the recommended level (Oliver, Schofield & Kolt, 2007). Imitation of peers and influences of the environment are a fundamental way to act and to learn (Mareschal & Johnson, 2003). The aim of this study is to determine the role of environment on physical activity quality and level in 3 years old children, performing unstructured play in a kindergarten, during curricular time.

Method

In a kindergarten in Verona (Bortolameazzi, 2009) usually children have 1 h a week dedicated to free play. Sixty-two 3 years old children were divided in 4 groups and left without instruction (unstructured game, free play) in a playroom where all furniture were removed. Circles of 50 cm diameter were spread on the floor (condition A) or piled in one corner of the room (condition B). In different days, a pool with soft balls was placed in the center of the room (condition C) or in one corner (condition D). Each group of children was left in the room for 30 minutes and video-recorded to measure time spent in the different forms of activities. Activity level was also measured by mean of pedometers. Groups were randomized for sequence of condition; interval between conditions was 2 weeks. Data from the four conditions were compared by paired t-student test.

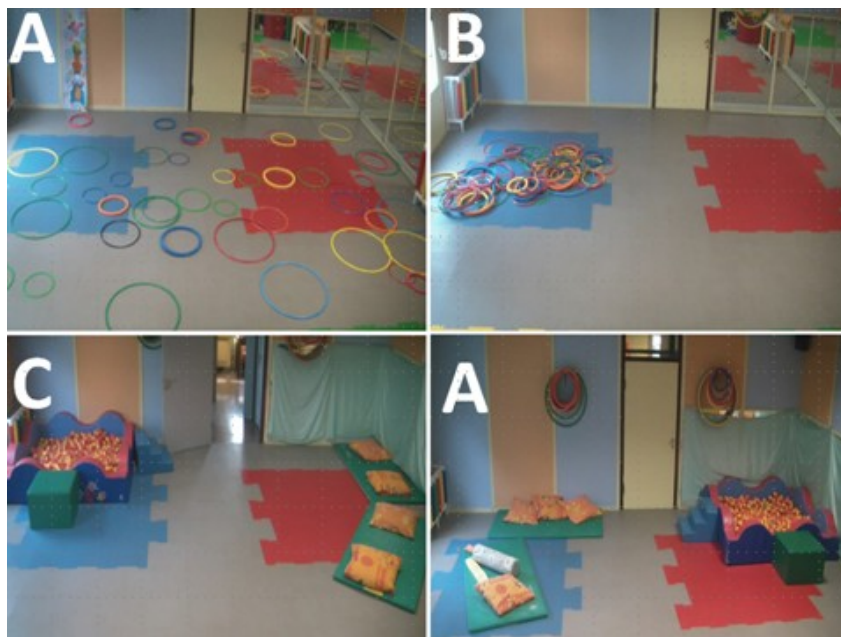


Fig. 12.10

Data collection

Activity level was also measured by mean of pedometers. Groups were randomized for sequence of condition; interval between conditions was 2 weeks. Data from the four conditions were compared by paired t-student test.

Children behaviour in the four conditions was observed off-line. We recognized three major types of behaviour during the 30 min of free play

1. Running without objects in hands
2. Walking/standing with objects in hands (hand playing with object)
3. Standing alone, no participation to activities

Data on behaviour were obtained by observing off-line each child for 15 seconds/minute (3 observations of 5 seconds every 20 seconds) and assigning him/her to one of the three categories based on the prevailing behaviour

Results

In condition A children spend the first part of their time running/walking with little or none manipulation of the circle. At half-time they start manipulating the circle and this behavior becomes predominant at the end of the time. In condition B children use circles for manual and symbolic games throughout all the time.

The collective behavior in condition A quickly changed when anyone of the children modified the way of playing with the tool for more than one minute

Children play often in pairs in condition B, using the rings to grasp together with a friend or to do symbolic play. Children never play together with a friend during the other conditions.

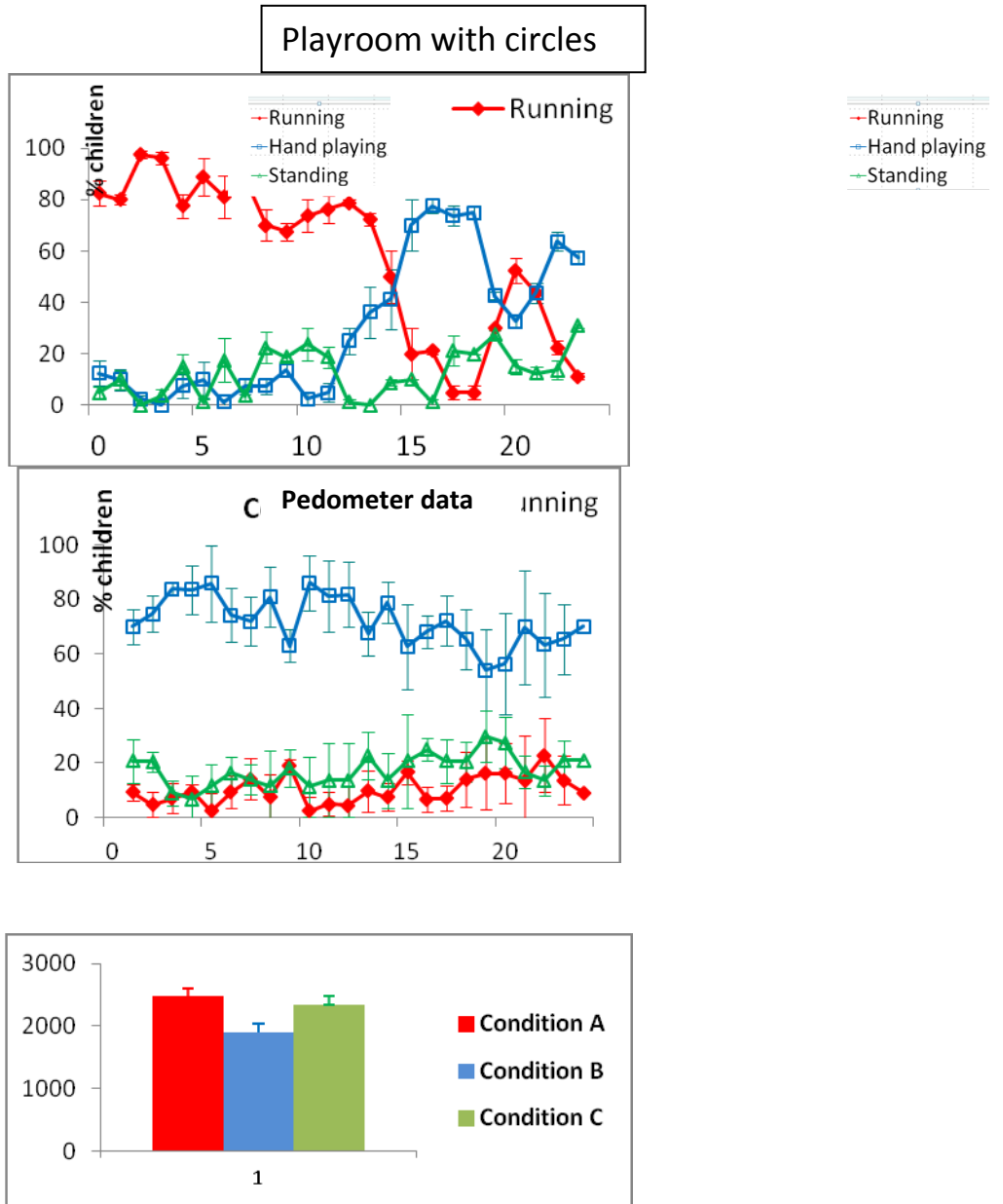


Fig. 12.11

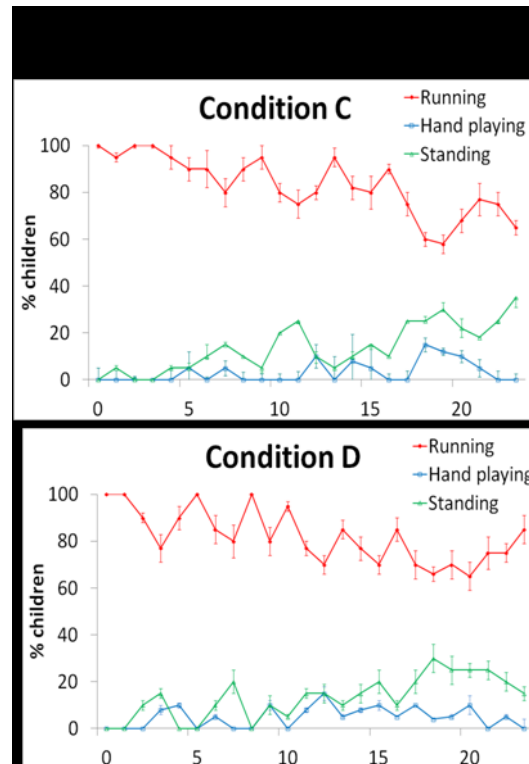


Fig. 12.12

Conclusions

- 1- the organization of space/environment has significant impact on physical behavior of children involved in free games;
- 2- the choice of tools available for free games modulates intensity of physical activity
- 3- spatial distribution of tools in the environment determines their unstructured use and the levels of physical activity inducible in children;
- 4- observation of pairs by children can prime group responses during unstructured games.

The results suggest that the kind of objects and their disposition in the space may encourage children in the way to use them, involving different motor skills and different relations with peer. When the children find the circles grouped in a corner (condition A) they used them in manipulating plays, involving the other children to play together. When the circles are distributed in all the room, children play alone, jumping and running for

the most part of the time. The consequences of this result are that an educator must be careful in the dynamic relation with the environment, in order to plan activities and organize spaces and materials for children that may promote different movements, to develop a wide range of social and motor skills. If a teacher does not value children's behavior in that specific environment's organization the risk is to provide only some few motor activities, such as manual dexterity, as highlighted in a previous study (Tortella et al., 2011). The different disposition of the tools in the environment seems to encourage or discourage the play in pairs or solitary. This study highlights some important aspects involved in teaching and it would be fundamental to consider them during planning educational programs (Tessaro, 2011).

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12 Question a) “WHAT IS THE ROLE OF THE ENVIRONMENT IN DEVELOPING PHYSICAL ACTIVITY IN PRESCHOOL CHILDREN?”

12.4 STUDY 2B - PAPER - MOTOR COGNITION DURING FREE GAMES IN 3 YEARS OLD CHILDREN BUILDS UP ON FACTORS INVOLVING SPACE ORGANIZATION AND SOCIAL INTERACTION.

(FROM THE ITALIAN PAPER) Tortella P., Tessaro F., Fumagalli G., *Motor cognition during free games in 3 years old children built up on factors involving space organization and social interaction*, in *Le scienze cognitive in Italia 2011, Aisc 2011, Atti dell’ottavo convegno Nazionale Associazione Italiana di Scienze Cognitive, Tecnologia, scienze umane e scienze della salute*, (a cura di Angelo Rubinacci, Angelo Rega Nicola Lettieri), Napoli: Università degli Studi Federico II, 2011, ISBN 978-88-904539-4-6, <http://www.aisc-net.org/home/category/e-book-corner/>, pp. 189-193.

Abstract

Great consideration is given by educators and parents to conditions/games that may improve cognitive abilities of pupils but little attention is paid to the effects on physical behavior. The aim of the research is to determine the role of environment on physical activity levels in 3 years old children performing unstructured games in a kindergarten. Sixty-two 3 years old children of a kindergarten in Verona were divided in 4 groups and left without instruction (unstructured game, free play) in a playroom where all furniture were removed. Circles of 50 cm diameter were spread on the floor (condition A) or piled in one corner of the room (condition B). In different days, a pool with soft balls was placed in the center of the room (condition C) or in one corner (condition D). Each group of children was left in the room for 30 minutes and video-recorded to measure time spent in the different forms of activities. Activity level was also measured by mean of pedometers. Groups were randomized for sequence of condition; interval between conditions was 2 weeks. Data from the four conditions were compared by paired t-student test.

In condition A, children spent most of the time running on and around or jumping in the circles. In condition B, the same children used circles for individual and/or symbolic games and the running/jumping behavior was limited and random. No differences in physical activity levels were measured between condition C and D. Interestingly the collective behavior quickly changed when one of the children modified the way of playing with the tool.

The data indicate 1- that the organization of space/environment has significant impact on physical behavior of children involved in free games; 2- that spatial distribution of tools in the environment determines their unstructured use and the levels of physical activity inducible in children; 3- observation of action by other children can prime similar responses during unstructured games. We speculate that motor cognition during free games builds up on factors involving space organization and social interaction.

Keywords:

unstructured games, environment, physical activity, motor cognition, social interaction.

Introduzione

Nell'educazione di bambini in età prescolare è necessario prestare molta attenzione ai diversi aspetti della didattica e della metodologia utilizzata e saper valutare, ossia attribuire *valore* a tutti gli elementi di qualità e di personalizzazione attivati dai soggetti (Tessaro, 2011). Le azioni didattiche realizzate con i bambini della fascia di età 3-6 possono influire in maniera determinante sulla loro crescita.

Aspetti importanti in questo contesto sono riservati al gioco, allo sviluppo di competenze motorie e all'ambiente. Il gioco sembra essere elemento comune tra le diverse specie animali e assume quindi un significato di elemento fondamentale nello sviluppo psico-biologico in natura (Burghardt G.M., 2005). Tra le analogie che esistono tra gioco umano e gioco animale è importante sottolineare che entrambi prevedono azioni ripetitive che consentono un consolidamento delle stesse, che l'attività svolta è per lo più non

finalizzata a compiti o obiettivi specifici e che sia animali che bambini non giocano se si trovano in stato di stress o sono denutriti.

A. D. Pellegrini (2007) ritiene che il gioco libero sia importante perché non ha regole prefissate e consente risposte di tipo più creativo. Tuttavia è importante sottolineare come durante il gioco libero i bambini imparino a costruire le competenze sociali, attraverso il rispetto del proprio turno e di quello dei compagni, sviluppino la perseveranza e la capacità di comunicazione, ed inoltre raffinino il loro linguaggio, essendo costretti a farsi comprendere dai compagni senza la mediazione di un adulto che di solito interpreta o aiuta il piccolo ad esprimersi. Giocare aiuta anche a migliorare il benessere emotivo, fornendo le competenze per imparare a gestire situazioni di stress e ansia.

Il gioco sembra anche stimolare le capacità di apprendimento, il pensiero creativo e la capacità di problem solving dei bambini. Attraverso il gioco il bambino percorre alcune tappe critiche nell'interazione tra il sé e l'ambiente esterno.

Il gioco rappresenta inoltre un'occasione per acquisire, mettere alla prova e migliorare le capacità motorie. La ripetitività che spesso caratterizza il gioco motorio consente infatti di mettere in pratica i principi di frequenza, intensità, durata dell'atto motorio che sono alla base per lo sviluppo delle competenze. Il bambino che gioca liberamente può infatti sperimentare diverse abilità motorie riconducibili alle classiche abilità motorie di base (mobilità, manualità e equilibrio) attraverso cui l'essere umano/animale fabbrica il suo essere motorio (Tortella et al., 2011). Ambienti, materiali, insegnanti, compagni diventano ingredienti fondamentali per l'apprendimento.

La stretta relazione che esiste tra cognizione e corporeità/motricità è dimostrata da diversi studi di psicobiologia e di psicologia sperimentale. Infatti, recenti ricerche hanno messo in evidenza che le rappresentazioni, percettiva e motoria, sono molto coinvolte nei processi di memorizzazione e di acquisizione del linguaggio (Glenberg & Kaschak, 2002; Pecher, Zeelenberg & Barsalou, 2003, Solomon & Barsalou, 2001, Spivey, Tyler, Richardson & Young, 2000; Stanfield & Zwanna, 2001; Zwaan, Stanfield & Yaxley, 2002). Secondo questi autori il modo con cui le persone comprendono e rappresentano il mondo esterno è fortemente legato a percezione e azione, e i quadri senso-motori sono attivi quando è possibile accedere ai concetti. L'obiettivo che ci si pone nell'utilizzare un oggetto diventa fondamentale per definire l'uso che ne faremo. Per afferrare certi oggetti si prepara già la presa della mano adeguata alle dimensioni dell'oggetto. (Klatzky, McClosky, Doherty, Pellegrino, 1987). Jeannerod (1994,1997) ritiene che vi sia una rappresentazione pragmatica e una semantica dell'oggetto. Nel caso della

rappresentazione pragmatica l'azione è strettamente legata alle caratteristiche dell'oggetto, nel caso di rappresentazione semantica vi è un'integrazione tra caratteristiche del soggetto, del suo significato per il soggetto, la ripresa delle azioni memorizzate con l'oggetto. Nei bambini l'imitazione è fondamentale per l'apprendimento (Mareschal & Johnson, 2003).

Molti autori ritengono che la rappresentazione visiva di un oggetto includa informazioni motorie. Recenti ricerche hanno infatti messo in evidenza che il sistema motorio non è coinvolto solamente nella produzione di movimenti ma anche nell'immaginazione di azioni, apprendimento attraverso l'osservazione, comprensione del comportamento di altre persone e riconoscimento di oggetti (Decety, 1996; Jeannerod & Frak, 1999). Nelle scimmie i neuroni dell'area 5 si attivano anche quando non vengono richieste azioni reali (Fadiga, Fogassi, Gallese, Rizzolatti, 2000). In altri termini, la visione di un oggetto sembra attivare il pattern motorio di azione svolta con quell'oggetto, anche senza che l'azione venga realmente compiuta. Nell'ultimo decennio si è consolidata l'ipotesi che la rappresentazione di un'azione (*motor imagery*) presenti una struttura neurale molto simile a quella che si genera durante l'esecuzione di una azione effettiva. Inoltre la rappresentazione può sorgere come autorappresentazione oppure dall'osservazione di azioni eseguite da altri soggetti (Jeannerod, 2008). Si viene così a costituire un processo circolare di rappresentazione dell'azione osservata.

Il sistema motorio può allora essere considerato non solo un esecutore di azioni ma una modalità di esplorazione del mondo esterno per interagire con altre persone e accrescere le proprie conoscenze. L'azione è allora il fattore principale nell'identificazione di sé e dipende dai numerosi segnali che provengono dal mondo esterno. Sorge allora il problema di distinguere il segnale proveniente da sé da quelli provenienti da altri.

In questo contesto appare molto importante riuscire a distinguere quanto sia principale l'influenza individuale e quanto quella dell'ambiente nello svolgimento di un'azione e nelle modalità motorie attuate per svolgerla. Infatti la conoscenza delle motivazioni individuali (intese come complesso di basi biologiche che sottendono il comportamento psicomotorio) e delle influenze ambientali nello svolgimento del compito possono essere rilevanti quando l'acquisizione di una definita competenza rientra in un piano educativo.

Ipotesi

Con questo studio abbiamo voluto affrontare il problema della relazione tra ambiente e comportamento motorio durante il gioco libero in bambini della fascia d'età prescolare. I dati dimostrano che l'organizzazione dello spazio ancor più della natura degli oggetti a disposizione per giocare siano rilevanti nella scelta motoria di gioco del bambino. I dati suggeriscono che anche in un contesto di gioco libero gli educatori possono avere un ruolo rilevante nello sviluppo di specifiche competenze prestando attenzione alla strutturazione dell'ambiente in cui il processo cognitivo-motorio si svolge.

Materiali e Metodi

In una scuola dell'infanzia del Comune di Verona viene dedicato uno spazio di gioco libero di un'ora alla settimana, nel quale i bambini possono sperimentare liberamente e in gruppo le diverse possibilità motorio-corporee, con la presenza di oggetti diversi.

È stata predisposta una stanza completamente vuota, entro la quale sono stati messi degli oggetti, già conosciuti e utilizzati normalmente dai bambini nelle attività scolastiche:

CONDIZIONE A: cerchi di plastica e gomma di diametro vario sparsi sul pavimento;

CONDIZIONE B: cerchi di plastica e gomma di diametro vario ammassati in un angolo della stanza;

CONDIZIONE C: piscinetta di gomma contenente palline di plastica posta al centro della stanza e materassini e cuscini vicini alle pareti;

CONDIZIONE D: piscinetta di gomma contenente palline di plastica posta in un angolo della stanza e materassini e cuscini vicini alle pareti.

Sono stati coinvolti 62 bambini dell'età di 3-4 anni. Per tutti i bambini coinvolti sono state ottenute dai genitori le autorizzazioni a effettuare riprese con la telecamera e misurazioni con contapassi. I bambini sono stati suddivisi in 4 sottogruppi con modalità random (per estrazione). Ogni gruppo praticava una volta alla settimana l'attività di gioco libero, per la durata di 30 minuti. Per ciascun gruppo, la sequenza da A a D era randomizzata per estrazione.

I bambini, al loro ingresso nella "sala giochi", passavano attraverso una "cerimonia" di ingresso in cui, seduti in cerchio intorno all'educatore per 3 minuti, erano informati del

fatto di poter giocare come meglio credevano e liberamente fino al suono di una campanella (dopo 30 minuti). Al “via”, l’educatore si sedeva in un angolo della stanza e non si muoveva né parlava per il rimanente tempo; sullo sfondo vi erano le stesse musiche per tutte le fasi di attività e decorazioni, apertura delle tapparelle e illuminazione sono state tenute costanti durante tutto il periodo dello studio.

Misurazione dei livelli di attività motoria

I bambini venivano filmati da una videocamera situata in un angolo alto della stanza (fuori della loro portata e in situazione non distraente) e l’attività motoria condotta nei 30 minuti valutata off-line.

I podometri sono stati applicati a livello della cintura dei bambini e senza rappresentare elemento di disturbo per lo svolgimento delle attività.

Per lo studio dei livelli di attività motoria, in ogni gruppo, il comportamento di ciascuno dei 10-13 bambini presenti nella stanza veniva classificato ad intervalli di trenta secondi in tre livelli:

- 1- Il bambino corre/cammina velocemente senza tenere oggetti in mano
- 2- Il bambino tiene in mano l’oggetto usandolo per giocare
- 3- Il bambino sta fermo senza tenere oggetti in mano

I dati sono espressi in termini di percentuale di bambini che, nei trenta secondi di osservazione, si è trovato per la maggior parte del tempo in una delle tre condizioni. I dati da ciascun podometro venivano trascritti a fine sessione. Le differenze tra gruppi e tra condizioni sono state analizzate con test paired *t-Student*.

Risultati

I dati ottenuti nelle diverse condizioni (A-D) erano altamente omogenei nei diversi gruppi di bambini. Il grafico di figura1 riporta i dati ottenuti da tre gruppi diversi nella condizione B per quanto riguarda la percentuale di bambini che svolgevano attività di manipolazione degli oggetti senza correre.

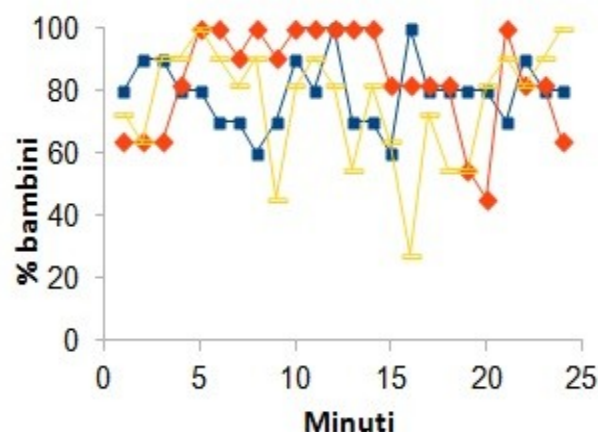


Fig. 12.13 - Percentuali di bambini da tre gruppi diversi (identificati dai colori) che svolgono attività di tipo 2 nella condizione B

Nelle diverse condizioni di gioco, i dati ottenuti sono come segue:

CONDIZIONE A (con cerchi di plastica e gomma di diametro vario sparsi sul pavimento):

I bambini continuano a correre, in modo circolare buona parte del tempo (15 su 25 minuti), saltando a due piedi, a un piede dentro e fuori dai cerchi e correndo. Il comportamento motorio si mantiene nei primi quindici minuti poi declina in quasi tutti i bambini. I dati ottenuti dalla lettura dei podometri evidenziano un elevato numero di passi da parte dei bambini.

CONDIZIONE B (con cerchi di plastica e gomma di diametro vario ammassati in un angolo della stanza):

I bambini afferrano i cerchi e li utilizzano per realizzare gioco “simbolico”, entrano nei cerchi con il corpo, anche in gruppo, si muovono nello spazio sempre con i cerchi in mano, attorno al busto, al capo, trasportandoli come se fossero borse, entrandovi come se fossero automobili. L’utilizzo predominante dei cerchi è quello manuale e i bambini corrono e camminano molto poco, preferendo situazioni statiche e utilizzando la manualità in modo prevalente. Il

pedometro evidenzia una importante e statisticamente significativa riduzione del numero di passi eseguiti rispetto alla condizione A.

CONDIZIONE C e CONDIZIONE D (con piscinetta di gomma, contenente palline di plastica, posta C al centro o D all'angolo della stanza): I bambini entrano nella piscinetta, a volte si tuffano da una specie di piccolo trampolino, e giocano manualmente con le palline. Utilizzano raramente lo spazio esterno alla piscina e si alternano spontaneamente nell'entrarvi e uscirvi. Nelle due condizioni non si notano differenze. L'attività motoria consiste in movimenti di entrata e uscita dalla piscina e di spostamenti su quattro arti all'interno della piscina; di conseguenza i dati ottenuti dai podometri evidenziano un numero ridotto di passi

In tutti e quattro i casi il comportamento dei bambini è abbastanza omogeneo . Si osserva qualche raro caso di bambino che prova a modificare la situazione di gioco del gruppo e che viene seguito da qualche altro compagno ma alla fine ritorna alle azioni del grande gruppo, che sembra avere la funzione di guida sui bambini.

I dati relativi al comportamento motorio ottenuti nelle diverse condizioni sono rappresentati in forma grafica nella figura 12.14.

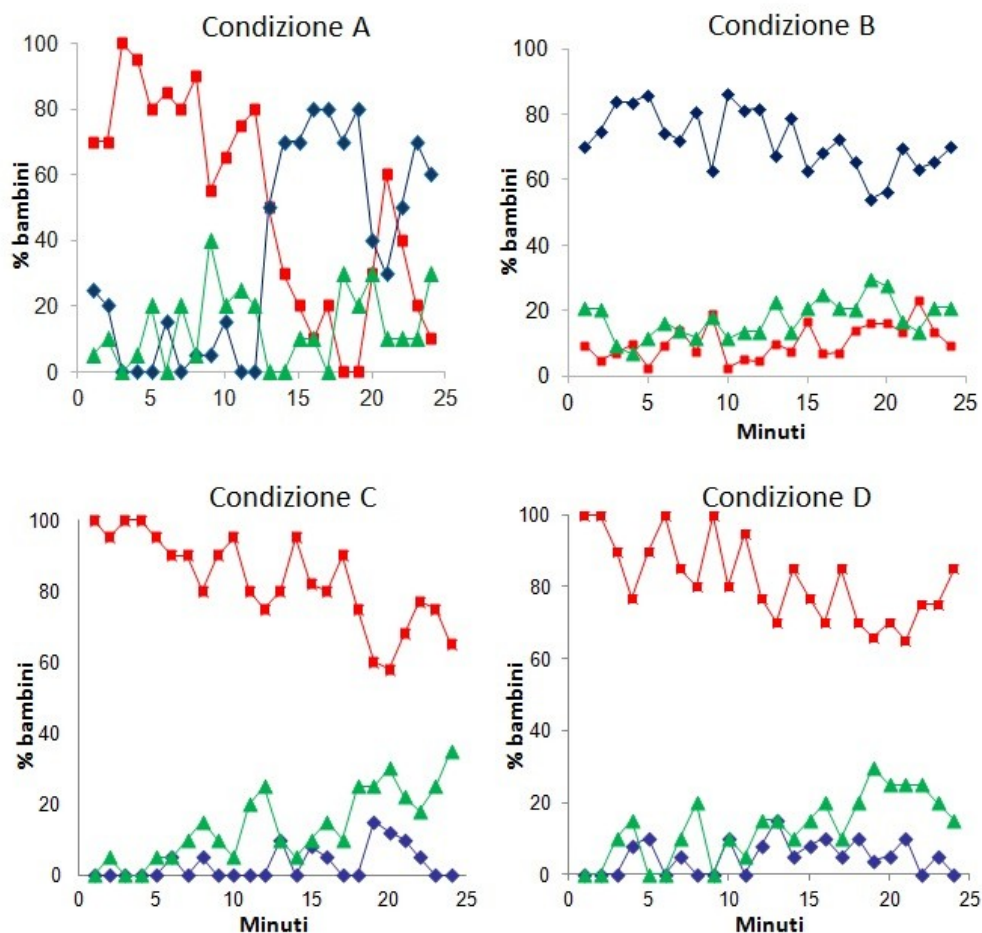


Fig.12.14 - Percentuale di bambini impegnati nei tre diversi comportamenti motori nelle 4 condizioni sperimentali. I dati in rosso (simboli quadrati) indicano bambini che corrono/camminano velocemente senza tenere oggetti in mano; i dati in blu (simbolo prisma) indicano bambini che tengono in mano l'oggetto usandolo per giocare; i dati in verde (simbolo triangoli) indicano bambini che stanno fermi senza tenere oggetti in mano

Conclusioni

I dati indicano che: a) la scelta del tipo di oggetti messi a disposizione dei bambini nello svolgimento di attività di gioco libero è molto importante nella scelta delle attività libera da parte dei bambini; b) la distribuzione nello spazio degli oggetti e l'organizzazione degli spazi condiziona fortemente l'utilizzo specifico degli stessi e influisce sulla scelta del tipo di attività motoria utilizzato dai bambini; c) i bambini sembrano imitarsi tra di loro, nella scelta delle attività praticate, anche se prevale una forte componente condizionante le attività da parte del gruppo, rispetto alle iniziative autonome dei singoli che vengono velocemente abbandonate.

Si fa presente che sia la piscinetta con le palline che i cerchi sono normalmente utilizzati dai bambini; pertanto essi dispongono già di informazioni esperienziali e concettuali per entrambi i tipi di oggetto utilizzati.

I risultati suggeriscono quindi che il tipo di attività scelto dai bambini sia determinato dalla diversa ubicazione e distribuzione nello spazio degli oggetti forse perchè questi (cerchi) risultano meno definiti in termini di utilizzo e meno strutturati nella loro disposizione/organizzazione. Altri elementi che entrano in gioco nella determinazione del tipo di gioco da effettuare, quali la struttura dell'area di gioco, la conoscenza degli oggetti e l'imitazione dei compagni, sembrano avere un'influenza inferiore.

È interessante notare che, indipendentemente dall'attività svolta, le diverse tipologie di gioco comportano comunque attivazione di schemi e abilità motorie; nel caso della condizione A viene esercitata la mobilità, nel caso della condizione B la manualità. Nelle condizioni C e D i bambini esercitano soprattutto la manualità, e la mancanza di differenziazione tra le attività nelle condizioni C e D probabilmente riflette l'alta

strutturazione dei giochi comunque presente nelle due condizioni, fatto che potrebbe limitare la creatività motoria del bambino.

Una considerazione interessante è che dalle osservazioni si evidenzia che l'attività del grande gruppo dei bambini condiziona in modo molto deciso l'attività di tipo diverso proposta dal singolo bambino, che non viene imitata dai compagni e si esaurisce in breve tempo. Ciò sembra confermare quanto proposto da Jeannerod (2008) su come, in un gruppo, si inneschi un processo circolare di rappresentazione dell'azione osservata che diventa anche un processo di tipo sociale.

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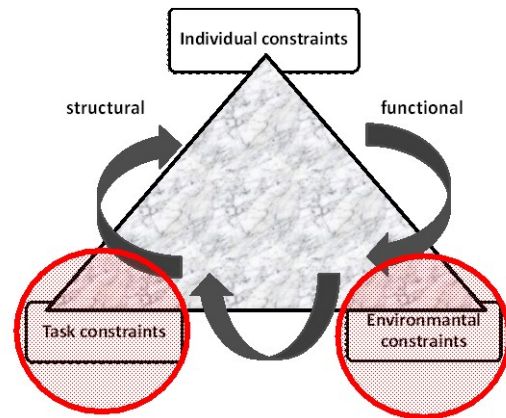
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13 QUESTION B: “HOW MAY WE DEVELOP MOTOR SKILLS IN CHILDREN”?



Playground PRIMO SPORT 0246 – Treviso
Italy



Newell's model of constraints

Fig. 13.1

The three types of constraints act always simultaneously and influence each other. In the following article the focus of attention is on the environment and on the task constraints. Newell, (1986) suggests that the environment is a constraint that encourages or discourages movement and that the task constraint is external to the body and includes the goals of movement or activities. The child is completely dependent on the caregiver and the beliefs and habits of adults influence the opportunity of movement.

13.1 STUDY 3 - PAPER - New environments for the education of 0-6 years old children: what teachers think about the playground for formal and non formal education. Nuovi spazi per l'educazione dei bambini da 0 a 6 anni: cosa pensano gli insegnanti del parco giochi come luogo di educazione formale e non formale

(FROM THE FOLLOWING PAPER) Tortella P., New environments for the education of 0-6 years old children: what teachers think about the playground for formal and non formal education. Nuovi spazi per

l'educazione dei bambini da zero a 6 anni: cosa pensano gli insegnanti del parco giochi come luogo di educazione formale e non formale, in *Formazione & Insegnamento – European Journal of Research on Education and Teaching*. Opportunities of learning. Apparatuses, Dynamics, Transformative processes. (a cura di R. Minello), Lecce, Pensa MultiMedia, settembre 2013, pp. 161-170.

Key-word

Education, physical activity, cognitive development, playground, preschool children

Abstract

Physical activity in children 0-6 years old can prevent health disease and educate to healthy lifestyles. In spite of international recommendation children move only a total of 60 minutes in the week. Teachers involved in a project in the playground “Primo sport 0246” of Treviso (Italy) suggest that the playground might be an educational opportunity for children to increase movement and other important aspects of child development during school activity, working in connection to school programs. The teachers consider the playground a formal and non-formal environment also providing opportunities for facilitating inclusion of all children, particularly those missing movement or sport facilities out of school.

L'attività fisica nei bambini da 0 a 6 anni può prevenire problemi di salute e educare ad un sano stile di vita. Nonostante le raccomandazioni internazionali i bambini si muovono mediamente solo 60 minuti alla settimana. Gli insegnanti coinvolti nel progetto al parco giochi “Primo Sport 0246” di Treviso (Italia) suggeriscono che il parco giochi possa essere un'opportunità educativa per incrementare il movimento nei bambini e altri importanti aspetti dello sviluppo, in connessione con i programmi scolastici. Gli insegnanti considerano il parco giochi un luogo di educazione formale e non formale anche per favorire l'inclusione di tutti i bambini, soprattutto di coloro che non hanno possibilità fuori da scuola.

Introduction

Obesity and overweight are significant health problems also affecting small children (Ogden, Carrol, Curtin, McDowell, Tabak & Flegal, 2006). Early overweight predicts adult obesity and associated health problems (Baker, Olsen & Sorensen, 2007) and interferes with young child interest for physical activity. Inactivity also hampers the development of fundamental motor skills (Haywood & Getchell, 2009) and coordination of both fine and gross motor skills required for adult activities (Vedul-Kjesas, Sigmundsson, Stensdotter, Haga, 2011). In a vicious circle, lack of motor competence has negative effects on amount and intensity of physical activity performed by children and their level of physical fitness (Stodden, Langendorfer & Robertson, 2009; Wrotniak, Epstein, Dorn, Jones & Kondilis, 2006) whereas children who perceive to be motor competent are more motivated to practice physical activity (Hands, Rose, Parker & Larkin, 2010; Tortella, Tessaro, Fumagalli, 2012). The global perception of the self is also related to motor competence (Cantell, Smyth & Ahonen, 2003) and studies by Haga (2008) confirm a strong relationship between physical fitness, motor competence and self-perception in children.

To be motor competent also offers opportunities to find new friends, a very important feature of childhood (Blatchford, 1998). With physical plays and games children may learn the fundamental skills for social competence, (Doll, 2009 as cited in Couper, 2011). Furthermore, recent studies demonstrate a strong relationship between early gross motor competences and later cognitive development, especially in working memory (Piek, Dawson, Smith & Gasson, 2008; Campos, Anderson, Barbu-Roth, Hubbard, Hertenstein & Witherington, 2000). Tuckman & Hinkle, (1986) found that aerobic running improved cognitive flexibility and creativity in 8-12 years old children.

Executive functions also develop during the early years of life. Executive functions such as cognitive flexibility, inhibition (self-control, self regulation), working memory, problem solving, reasoning, planning are critical for success throughout life, in career, marriage, for mental and physical health (Prince & Lancet, 2007; Eakin et al., 2004; Kusche, Cook & Geenberg, 1993 cited in Diamond & Lee, 2011). In children cognitive skills are important for school readiness, and predict math and reading competence throughout all school age (Gathercole, S., E., Pickering, S., J., Knight, C. & Stegmann, Z., 2004). Early executive functions training is necessary to avert the widening of the

achievement gaps at later age and it is very useful especially to those children that display poor executive functions (Diamond & Lee, 2011). Diamond et al., (2011) highlight that physical development associated with the practice of aerobic martial arts and yoga improves executive functions, thus highlighting the requirement for adequate physical activities and experiences during the daily activities of small children.

Physical activity

In most of the western countries small children spend most of their daily time in kindergarten (Brown, Pfeiffer, McIver, Dowda, Addy & Pate, 2009) thus charging the School and the educators of the great responsibility of promoting movement-based experiences in order to improve health behaviors and attitudes about physical fitness (Bandura, 2004; Pate, Pfeiffer, Trost, Ziegler & Dowda, 2004).

Structured (organized by educators) and unstructured (free) play covers most of the time spent at school by small children. According to Burdette and Whitaker, (2005), the active free play is important for cognitive, social, emotional development but little is known on the effects on motor development and acquisition of motor skills. Activities may be performed in- or out-door and some studies suggest that children who spend time outdoor are more active (Potwarka, Kaczynski & Flack, 2008). The positive effects of having opportunities for outdoor activities is also indicated by data showing that children living close (within one kilometer) to a playground with equipments have 5 times larger chances to have normal BMI (Potwarka et al., 2008) and children with ADHD living in or exposed to natural surroundings feel less psychological distress and improve attention, (Mole, Marshall, Pietrowsky & Lutzenberger, 1995).

Several studies have tried to determine the best conditions to increase physical activity levels and acquisition of motor skills at schools. In general, playing outdoor is associated to higher levels and duration of physical activities than inside context (Brown et al., 2009); interestingly, when children are engaged in free play while staying outdoor, they are less active than expected, spending most of the time in sedentary activities and a minimal part only of their time is devoted to moderate to vigorous physical activity (MVPA) (Sallis, Patterson, McKenzie and Nader, 1988; Brown, et al., 2009). The role of structured playing as an efficient strategy for increasing levels of motor skills has been

highlighted by recent studies (Cardon Van Cauwenberghe, Labarque, Haerens & De Bourdeaudhuij, 2008; Parish, Rudisill, & St. Onge, 2007). Recently we have shown that outdoor structured activities led by trained staff also induced an increase in motor skills (Tortella, Tessaro & Fumagalli, 2012).

Motivation

The National Association for Sport and Physical Education (NASPE, 2013), the American Heart Association Recommendations for Physical Activity in Adults (AHA, 2010) and the American Association of Pediatrics (AAP) have issued line guides for preschoolers (3-5 years) children recommending at least 30-60 minutes/day of mild to moderate intensity structured physical activity and at least 60 minutes/day of unstructured physical activity (Hodges, Smith, Tidwell & Berry, 2013). Despite national campaigns to increase levels of physical activities at all ages, data indicate that in child cares and kindergarten physical activity levels are lower than recommended (Oliver, Schofield, & Kolt, 2007).

With this study we investigated the beliefs of educators toward physical activities of 6 kindergarten of the city of Treviso in northern Italy. The schools were involved in a new educational program based on the use of “Primo Sport 0246”, an outdoor playground specifically dedicated to support motor development in 0-6 years old children. With this study we intended to analyze the beliefs and attitudes of educators toward physical activity, the significance attributed by teachers on playground and on structured physical activities in the context of their educational goals.

Methods

One hundred sixty one 5 y old children of six kindergarten of Treviso (Italy), participated in 2012 to a three months program of physical activity in the playground “Primo Sport 0246”, a special park built designed to favor motor development for 0-6 years old children (Tortella et al., 2011). The activities (one hour, once a week) were conducted by professional sport instructors. Each session consisted of 30 min of structured activities

and 30 min of free play. Forty-five educators/preschool teachers accompanied the children during the visits; they were asked not to call or help the children during the activities, their function was limited to cases of need.

Participants

The 45 teachers of the 6 kindergarten were assessed using questionnaires, informal interviews and focus groups. The aim was to know their beliefs about children physical activity and about the playground. Teachers were of different age, experience (years) of teaching and qualification.

Table 13.1
Age of teachers

Age	Frequency	Percentage
20-30	3	7
31-36	6	14
37-43	12	27,9
43-60	22	51,2

Years of teaching	Frequency	Percentage
0	2	4,7
1-5	9	20,9
6-10	5	11,6
11-16	4	9,3
17-23	12	27,9
24-30	8	18,6
31-40	3	7

Table 13.2
Years of teaching

School qualification	Frequency	Percentage
High school	29	67,4
Bachelor	1	2,3
Undergraduated school	11	25,6
Specialization in handicap	2	4,7

Table 13.3 School qualification

Results

Most of the teachers refer that children practice physical activity for one hour a week, in the classroom, in the gym or outside in the garden (when the weather is good). Children activities mentioned by the teachers were subsequently divided in four categories: manual dexterity, mobility, balance, and symbolic game.

Table 13.4

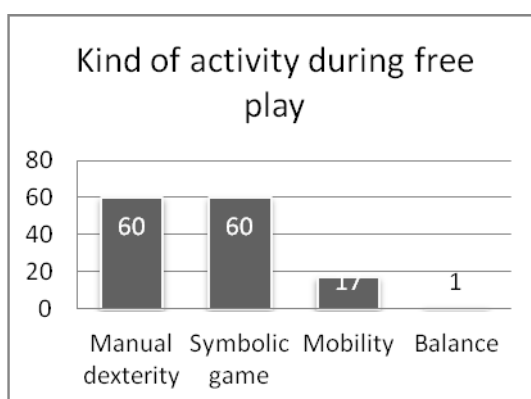
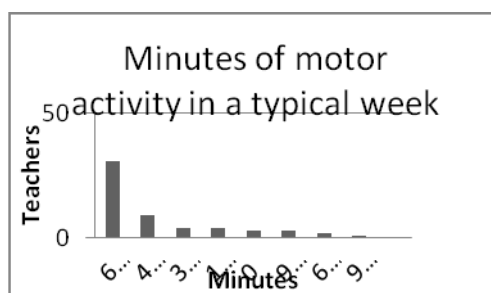


Table 13.5

The teachers consider the playground a good environment to increase important aspects of child development, such as: social skills, psychological health, motor development, self esteem, autonomy, new experiences, new relations, movement, motor skills, manual dexterity, to move many parts of the body, to become more conscious, as shown in the table below.

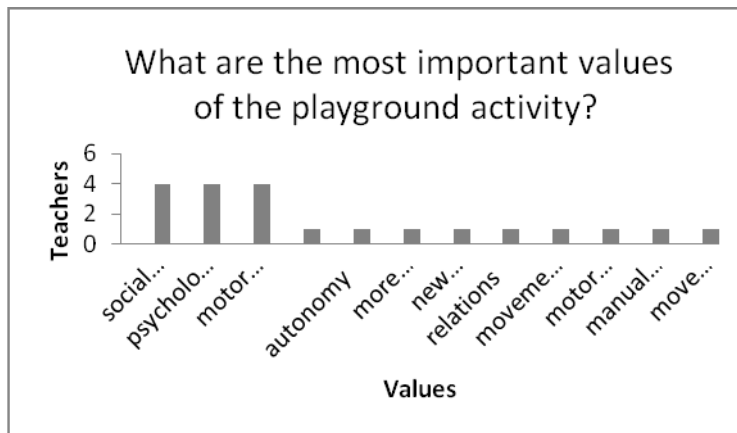


Table 13.6

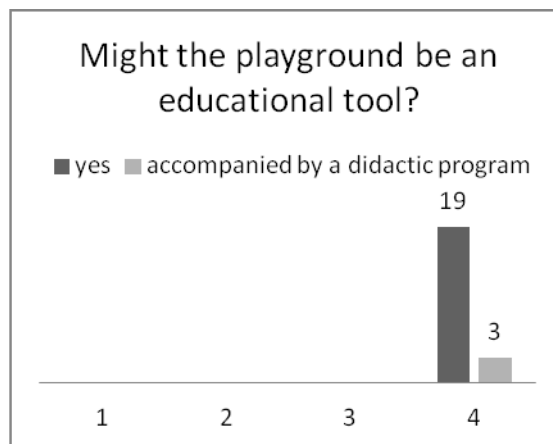


Table 13.7

For teachers the playground can be an educational tool and they suggest to propose to children both structured activity and free play and to connect the activities to school programs. Teachers recommend also taking time at the end of the experiences to listen children considerations about the activity. They highlight that the playground is a very good opportunity to provide inclusion of all children, also those with special needs. This is due to the environmental organization but also to the activities organization, that provide opportunities of motor development for every child involved.

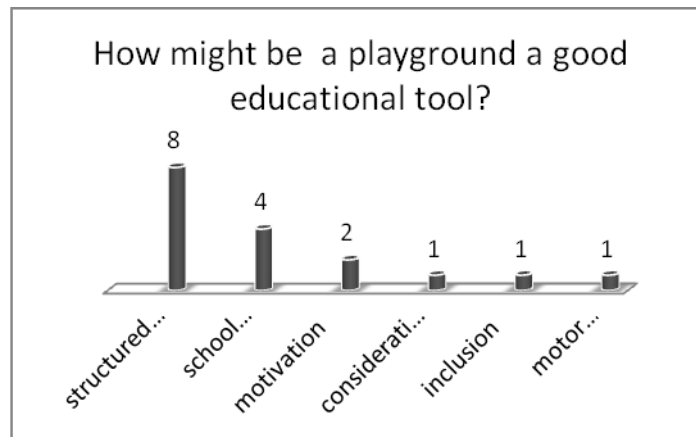


Table 13.8

Discussion

Scott-Little & Kagan, (2006), cited in Brown et al., (2009) noticed that the educators consider motor development and physical fitness to be less important for children than school readiness. It has been seen a positive association between increased education and experience of teachers and children's physical activity (Dowda, Brown, Melver, Pfeiffer, O'Neill, Addy & al., 2009). Some authors (Owen, Glanz, Sallis, & Kelder, 2006) recommend to policy makers and practitioners to integrate appropriate health-related evidence-based physical activities throughout the preschool day. Brown et al., (2009) noticed in a study that rarely teachers encouraged children to be physically active and arranged activities to increase physical activity. They also observed that when the adults were not present or involved with the group of preschoolers, children were more involved in non-sedentary physical activity and when teachers (very rarely) were involved by organizing, modeling, encouraging and acknowledging children's physical activity with a goal, children were more active. Children were also more active when teachers were better informed about preschoolers' general health, physical well-being and children's physical activity. Other studies (Cardon Van Cauwenberghe, et al., 2008) highlighted that children, particularly girls were less active when more teachers were supervising them during play in the playground. The authors supposed that it could be due by the fact that the teachers were passive, supervising sitting down or standing still. Diamond at al., (2011) suggest also that the most effective way to improve EF and academic achievement in children is probably to address children's emotional and social development, as it

might be possible through physical activity curricula. Children might be involved in passionate activities, bringing them joy and pride; can practice vigorously exercise; have a sense of belonging and social acceptance, have opportunities to repeatedly practice at progressively more-advanced levels.

Our results are in line with the premises about teacher having little knowledge on the importance of physical activity for children (Dowda et. al., 2009). Teachers say that children practice physical activity only one hour a week, while international recommendations recommend at least one hour of free play and one hour of structured physical activity every day. The most part of the activities during free play is dedicated to manual dexterity and symbolic game, with very little mobility and balance activity. This aspect demonstrates the low level of moderate or vigorous physical activity, and a lack of attention to the various motor skills and physical fitness fundamental for motor development. Teachers consider the playground Primo Sport 0246 a good educational tool with the opportunity to develop motor, social and psychological skills. To improve the educational opportunities offered by the playground teachers suggest integrating physical activity with school programs. Attention to motor development, structured activity, children motivation and inclusion and discussion after play is fundamental. Although teachers declare the importance of motor activity, children dedication to movement during school time is low.

Conclusion

Obesity and overweight are very important problem for the future of children and to avoid them children need to move more. Although teachers declare the importance of physical activity, children don't have enough opportunities of movement at school. The playground could be a good opportunity to improve children physical activity combining free play and structured activity, as teachers suggest. They consider the playground a possible educational tool, a place of formal and informal education for children. As the recent evidences demonstrate that physical activity is important for child development, for health, self-perception, social skills, school readiness and academic success, it is necessary to encourage preschool teachers in organizing appropriate physical education training programs.

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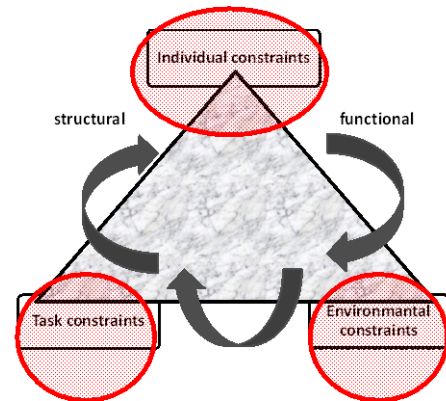
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13 QUESTION B: “HOW MAY WE DEVELOP MOTOR SKILLS IN CHILDREN”?



Playground PRIMO SPORT 0246 – Treviso
Italy



Newell's model of constraints

Fig 13.2

13.2 STUDY 4A - MANUSCRIPT IN PREPARATION: EXPLORING THE EFFECTS OF 10 HOURS PLAYGROUND ACTIVITY ON MOTOR COMPETENCE AND PHYSICAL FITNESS IN 5 YEAR OLD CHILDREN

Tortella P., Tessaro, Fumagalli G., Lorås H., Haga M., Sigmundsson H

This is the study we conducted in 2012 in the playground Primo Sport. It highlights the role of environment, of the physical educators and of the task. With this study we wanted to find a controlled activity that might promote motor development with children enjoyment.

Introduction

Prevention of sedentary behavior and promotion of a physically active lifestyle are now consolidated issues of health campaigns in most of the western countries. E.g., the World Health Organization (WHO) recently stressed the significance of physical activity (PA) for a healthy life for all European citizens in their Vienna declaration [3]. For children, international organizations recommend at least 60 minutes of daily unstructured physical activity or 30-60 minutes daily structured physical activity of mild to moderate intensity [42].

Both indoor and outdoor activities with participation of parents and teachers are advocated [12, 48]. Given that physical activity habits acquired in childhood typically track into adolescence and adulthood [24], these recommendations are especially important for health outcomes across the lifespan [26].

In western countries children spend several hours a day in kindergarten [84] and educators have a great responsibility in promoting movement-based experiences, to improve physical fitness and health behaviors. [85, 86].

In preschool children, a common finding is that physical activity levels are lower than recommended [51]. Driven by the health and psychological concerns related to this lack of physical activity, several studies have investigated the behavior of preschool children in various environmental contexts. E.g., observations of children in child care showed that most of the activities were sedentary and that $\leq 3\%$ of physical activity could be classified as being at moderate or vigorous intensity [56]. Furthermore, both the indoor and the outdoor environments (e.g., equipment, organization, urban/rural areas) impacts upon the physical activity levels of preschool children [12, 25, 38, 43, 44, 45, 49, 54]. In general, the presence of opportunities for physical activity is an important predictor of variables related to levels of physical activity [32]. Physical education programs for preschool children have shown that physical fitness and health related variables can be improved in both obese and lean children [9, 10]. In terms of levels of physical activity, free play appears to be less efficient than structured activities in producing high physical engagement during play, both indoor and outdoor [31, 35, 36, 37, 40].

Physical activity facilitates the development of (and dependent upon) motor competence [33, 47, 58, 57]. Physical activities conducted by children might involve loco-motor skills (e.g., running, hopping, sliding), object control skills (e.g., throwing, catching, kicking)

[12, 41, 47] and stability skills (e. g. balancing, turning and twisting) (82, 83) The ability to perform these many types of motor skills has been associated with school performance, levels of social interaction with peers and the global perception of the self [60]. Furthermore, motor competence influences the amount, intensity and level of physical activity: children with low motor competence are less motivated to engage in physical activities, has higher risk for sedentary behavior later in life, and as a consequence, has higher risk for becoming obese [63,64,19,14,65, 73]. Motor competence and physical activity are therefore considered as interconnected concepts in child development.

A major limitation of previous studies on physical activity levels in preschool children is the lack of a consistent methodological approach that allow for comparison between different contexts in the same study [50]. Indeed, measurements of physical activity levels are typically based on observational-based checklists and inventories or retrospective interviews/questionnaires [42]. Within the present study we investigated the effects of outdoor activities on measures of motor competence in 108 five year old children. To this aim, a set of objective measurement procedures were applied before and after the children conducted 30 minutes free play combined with 30 minutes structured activities once a week for a period of 10 weeks in a playground.

Methods

Participants

Four out of 23 kindergartens in Treviso, Veneto, northern Italy, were randomly selected for participation in the study.

Of these, two participated as comparison groups (assessment but no activities at the playground), $n = 39$, 22 boys/17 girls, mean age 5.705 (SD 0.049) and two as experimental groups (structured and free playground activity and assessments), $n = 71$, 41 boys/30 girls, mean age 5.651 (SD 0.036).

The study was approved by the University of Verona IRB and a written informed consent form was obtained from the parents (or guardian) before the children attended the study. The study was conducted in accordance with the Declaration of Helsinki.

Procedures

Assessments of motor skills were performed individually in a quiet room in the kindergarten or at the playground. Each test item was explained and demonstrated and each child could familiarize with the tests with a trial, before measurements were taken. Participants were given verbal encouragement and support throughout the testing procedure.

Playground PRIMO Sport 0246

The playground Primo Sport 0246 (see fig. 1) is located in Treviso and was designed to provide children up to the age of six controlled opportunities for practicing basic motor skills [70]. The 2500 m² area is divided into five: (I) Manual dexterity area, (II) Mobility area, III) Balance area, (IV) Symbolic game area, and (V) mixed area. It contains a total of 35 fixed instruments, each included in one of the specific area depending on its functional properties. Every tool has a number, in order of increasing difficulties. See picture

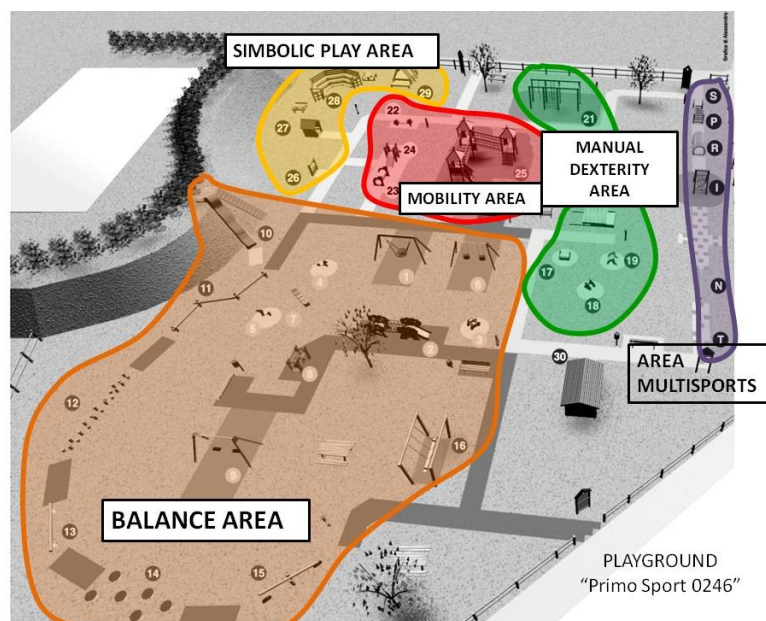


Fig. 13.3 - Playground PRIMO SPORT 0246 – Treviso Italy]

Organization of activities at Playground

The playground activity consisted of ten 1-hour sessions completed from March to May 2012. All sessions took place between 9 AM and 12 AM, with temperatures ranging between 10 and 28 degrees Celsius. It never rained in any of the sessions. Each session began with a 10-15 min walk in which the teachers walked with the children from the bus stop to the playground. Each of the two experimental groups came at the playground at the same day of the week. The classes never met each other at the playground.

The children of each kindergarten class (maximum 40 children) were randomly divided in two groups, one starting with the free-play time and the other with structured activities. After 30 minutes, the two groups switched activities (see fig. 2). Free-play was allowed everywhere within the playground, except for the portions of the areas where the other group was performing the structured activities. School teachers (at least one every 10 children) were present in the free play zone for assistance in case of emergency, but were not involved in the children's activities.

For the structured activities, the children were further divided in three groups of 6-7 children, each group spending 10 minutes in portions of areas I, II and III (see fig. 3). The sequence of the activities was: Manual area: in 10 minutes each child follows 2-3 times this sequence of tools: 1. Rope ladder; 2. Rope; 3. Hanging bar; 4. Gymnastic rings; 5. Net; 6. Monkey bars. Only one child at a time is allowed to stay in a space (see figure 4). Balance area: in 10 minutes each child follows 2-3 times this sequence of tools: 1. Balance beam; 2. Balance logs; 3. Balance elastic beam; 4. Balance platforms (see figure 5). Mobility area: in 10 minutes each child goes up and down from the various climbs points and slopes (see figure 6). Two instructors were in the manual dexterity area, one in the mobility area and one in the balance area. The instructors were trained personnel (specialized in working with motor activities for children) who provided scaffolding if requested, gave instructions about possible pathways and provided general encouragement for exploring the various aspects and challenges of the different playground activities. Another instructor controlled the time spent in each of the activities and coordinated the switch of the groups from one micro-area to the other.

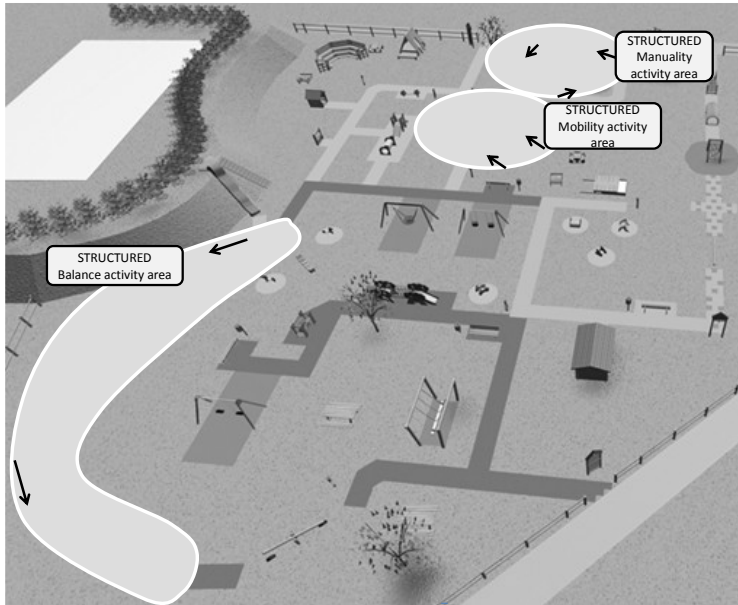


Fig. 13.4 - Schematic illustration of the playground activities

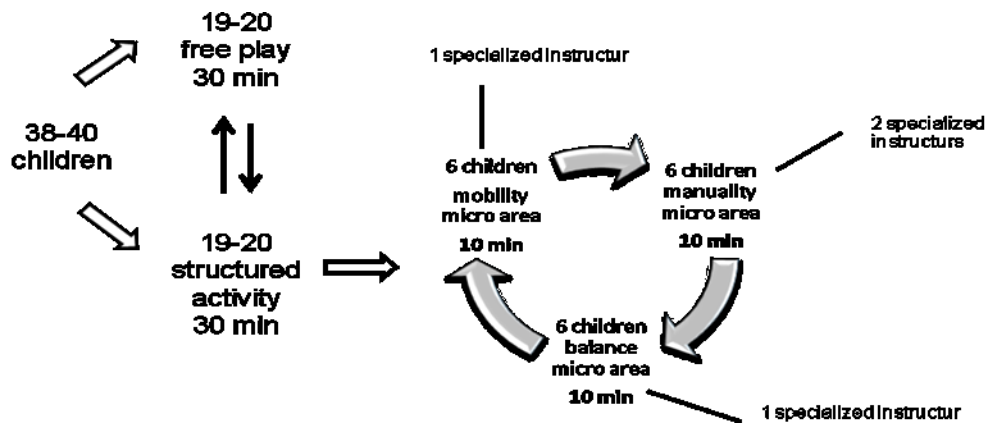
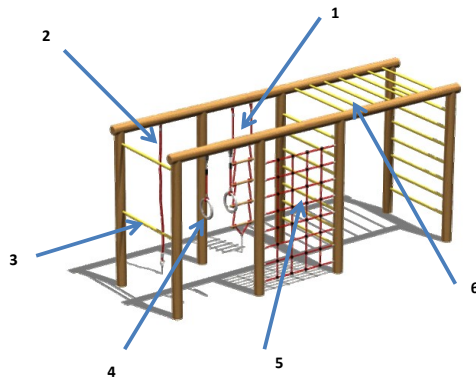
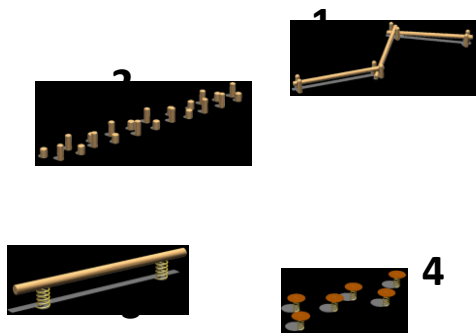


Fig. 13.5 - Illustration of the three micro-areas used in the playground activity routine



Manual Area

Balance Area



Mobility Area

Fig 13.6 - Instruments for playground

Assessment of motor skills

Three tasks were selected from the Test of Motor Competence: Building Bricks, heel-to-toe walking and walking/running in slopes (Sigmundsson et al., 2014; Leversen et al.

2012), one task (one-leg balance) selected from the Movement ABC (Henderson & Sugden, 1992) and one task (putting a medicine ball) was selected from the Test of Physical Fitness (Fjørtoft et al.2012). Two tasks, balance on beam and balance on platform, were developed as a part of the project in order to assess aspects of dynamic balance. A similar task has been applied in previous studies (Kiphard, Schilling, 1974).

Fine motor skill

Building Bricks

12 square-shaped Duplo™ bricks were used to build a tower as fast as possible. The participant holds one brick in one hand and one brick in the other. At a signal the participant assembles the bricks together one after one until all 12 have been put together. Neither of the arms was allowed to rest on the table, and the bricks were held in the air all the time. Performance was measured by the time to complete the task.

Gross motor skill

One leg balance – right or left

The child stands on the right or left foot with the arms held freely at the sides. The test is performed with eyes open. The time start when one foot leaves the floor and stop if a fault occurs: moving the standing foot, heel or toe from its original place, touching the floor with the free foot, winding/hooking the free leg round the standing leg [22].

Balance on beam

The child begins with the feet parallel 10 cm from the beam (height at beginning: 26 cm, height at end: 13 cm, width: 13 cm, length: 300 cm; (Legnolandia, Italy, cod 011065, fig. 7). At a start signal the participant goes up and walks as fast as possible on the beam. The time is stopped when the participants arrives at the end of the beam. Time of execution and number of errors (every time the child goes down of the beam) are recorded.

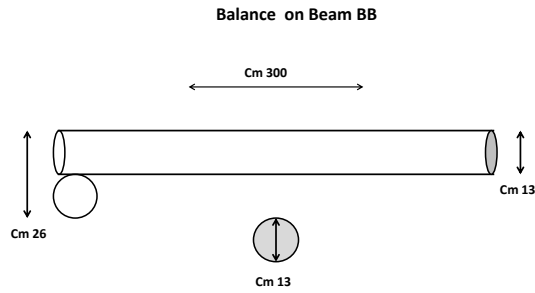


Fig. 13.7 - Schematic illustration of the balance on beam task

Balance on platforms

Each platform has diameter of 54 cm and height of 43 cm and is supported on a spring that allows lateral shifts of the platform (Legnolandia, Italy, Jumpy, cod. 011107); the circuit consists of 6 platforms separated by gaps of 60 cm (fig. 8). The child begins with the feet parallel near the first platform; at the start signal the child walks on the first platform and then jumps from platform to platform to the end of the circuit. The time is stopped when the participants jumps down from the last platform. Time of execution and number of errors (the child goes down from the platforms) were recorded.

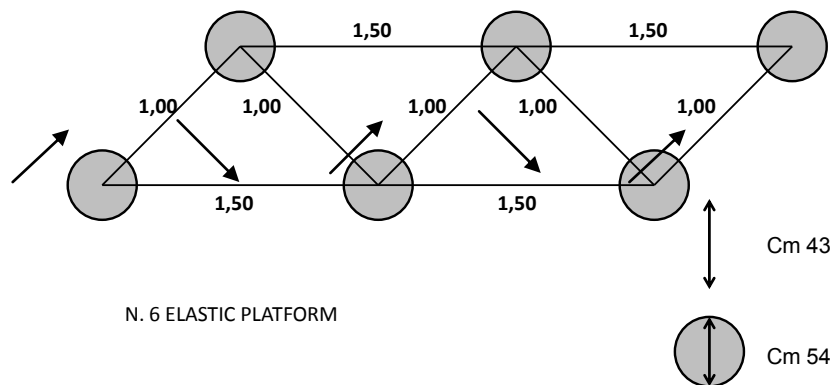


Fig.13.8 - Schematic illustration of the balance on platforms task

Heel to toe walking

This task is often called the tandem walking test and is considered a measure of dynamic balance capabilities. The children were required to walk down a straight line (4, 5 m) as fast as they could, placing their heel against the toes of the foot in each step (tandem). Performance was time to complete the line.

Putting a medicine ball

The child began with the feet parallel and a shoulder width apart, and held the medicine ball (diameter 20 cm, weight 1 kg; Giodicart, Italy, Cod. 5401, type Trial,) against the chest. The test item score (the better of 2 attempts) is the distance thrown with both hands simultaneously (in centimeters).

Data Reduction and Analysis

Wilcoxon rank-sum tests were applied to analyze differences in pre-test and post-test scores for the control and experimental group. The data were analyzed in SPSS (version 15) and statistical significance was set at $P < 0.05$.

Results

The means and standard deviations of the seven different motor tasks measures for each group over time are shown in Table 1. There were significant differences within the experimental group in four tasks (one-leg balance-left foot, balance on beam, balance of platform, and putting a medicine ball), i.e. they did perform better after the training period. There was no significant improvement in the control group, however, this group did score significantly worse at post-test in Heel-to-toe walking. No significant differences were found for both groups in Building bricks and One leg balance-right foot, but there was a tendency for the experimental group to improvement in the latter.

Test	Pre-test			Post-test			P
	Group	Mean	SD	95% CI	Mean	SD	
Building Bricks (sec)							
EXP	31.62	16.93		28.49	8.08		NS
CON	31.50	8.09		28.95	6.62		NS
One leg balance – Right (sec)							
EXP	14.37	11.40		20.59	27.86		NS
CON	15.20	11.27		17.85	15.82		NS
One leg balance - Left (sec)							
EXP	14.51	11.32		21.70	36.20		0.01
CON	14.51	10.99		18.15	12.09		NS
Balance-on-Beam (sec)							
EXP	16.26	14.79		8.32	4.52		0.001
CON	18.04	22.73		11.30	9.29		NS
Balance-on-Platform (sec)							
EXP	35.59	27.87		15.42	9.26		0.001
CON	37.05	33.16		28.84	15.73		NS
Putting medicine ball (cm)							
EXP	2.04	0.56		2.31	0.54		0.001
CON	2.20	0.49		2.30	0.33		NS
Heel to Toe Walking (HTW)							
EXP	33.02	11.47		32.55	11.45		NS
CON	32.47	15.12		42.68	10.18		0.003

Discussion

The present study explored the effects and specificity of 10 weeks with structured and unstructured playground activities on aspects of motor competence in five year old children.

The experimental group improved significantly in four of the seven tasks; Balance on Beam, Balance on Platform, Putting medicine ball and One leg balance (left foot). Although the results in One leg Balance (right foot) were not significant the experimental group improved 6 sec, compared to 2 sec of the control group. Both experimental and comparison group improved 3 sec in the task of Building Bricks and the control group obtained significant worse results in Heel Toe Walking task. Significant improvements in four of the six gross motor tasks were obtained by the group who participated in playground activities

The fundamental motor skills develop through learning and interaction of biological constraints and environmental factors and are not due to maturation, (Clark, 2007, Goodway & Brenta, 2003, Goodway, Suminski & Ruiz, 2003, Langerdorter & Robertson, 2002 a).

Children seem to naturally develop a rudimentary form of fundamental movement pattern, but mature fundamental motor skills are more likely to be achieved with specific practice, encouragement, feedback and instruction. (Gallahue, D. L., Ozmun, J. C. (2006) Understanding motor development: infants, children, adolescents, adults, 6th ed. Boston (MA), McGraw-Hill; Clark, J. E., Metcalfe, J. S. (2002). The mountain of motor development. In: Clark J. E., Humphrey J. H., editors. Motor development research and reviews. Vol. 2, Reston (VA). National Association of Sport & Physical Education, 163-190.)

There are several studies on improvements in motor skills after specially programmed physical and health education for school children, but often they are examining children with disabilities or movement impairment conditions. It is necessary additional research to investigate the conditions of improvement in motor skills in all children.

It is important to find the right condition to improve motor competence (75, 76, 77), as motor competence is positively associated with physical activity and inversely with sedentary activity in children (75).

The acquisition of a lot of motor skills in childhood provides the opportunity to try new physical activities later in life (78, 79).

On the other side, children's physical activity in early childhood may contribute to the acquisition of fundamental motor skills, through neuromotor development (Fischer et al, 2005; Okeley, Booth & Patterson, 2001b).

A lot of factors contribute to motor skills development: frequency, intensity and duration of physical activity, but little is known about the condition to modify the factors

associated with physical activity, and also a small increase in physical activity can be beneficial for health (81). Our results are particularly important to providing insight into motor competence, as a determinant of physical activity in children.

Acquisition of gross motor competence seems to be important also in relation with later cognitive development, especially working memory (Piek, Dawson, Smith & Gasson, 2008; Campos, Anderson, Barbu-Roth, Hubbard, Hertenstein & Withering

The practice of physical activity during childhood may contribute to an increased prevalence of participation in physical activity in the adult population (78, 79).

Two of the gross motor tasks assessed were also included as balance equipment in the playground area (fig. 7 AND 8). Improvement in these two tasks, balance on beam and balance on platform, may be due to increased experience on these specific tasks, during the activity of the experimental group. The children used 10 min per week in 10 weeks (i.e. 100 min) practicing this specific tasks. These findings are in line with Revie and Larkin (1993) reporting on significant effect of specific training i.e. the clumsy children in their study made specific improvements to the task actually thought. This perspective is supported by Edelman's theory on 'neural Darwinism' which argues that the process of learning can be explained as a selection that takes place within the neural system (Edelman, 1987, 1992). This is also supported by Kleim and Jones (2008).

The significant improvement found in the task Putting a medicine ball may not be regarded as a specific effect but as an effect of increased general physical activity of the program in the park. This task may be regarded as gross motor task and also Physical fitness task (Fjørtoft et al. 2012). It involves elements of muscle strength, endurance and coordination. It is possible to argue that the training in the mobility area may have given this 'transfer' effects. The children of the experimental group practiced activity in monkey bars, hanging bar, climbing a net, climbing a rope, a rope ladder and gymnastic ring. The study of Fjørtoft et al. (2012) indicates a high correlation between different physical fitness tasks (higher transfer). So in this respect it is possible to argue that there is higher motor ability in physical fitness tasks (Fleishman, 1966). Fleishman argue that: 'ability refers to the general trait of the individual which has been inferred from certain response consistencies (e.g. correlation) on certain kinds of tasks' (p.147/148).

The improvement on the one leg balance task for the experimental group may be due to the transfer of gross motor activity, for example increase in muscle strength in legs. It is important to note despite that both tasks did increase, respectively 6 and 7 seconds, only the left foot task showed a significant improvement. However, the same transfer in

learning was not found in the tasks Heel to toe Walking. This may indicate that increasing performance in this kind of task may need more balance training because this task is not commonly performed. It is possible to argue that this is not a functional task found in children's daily physical activity play pattern.

Fine motor skills

Participating in playground activities for the experimental group did not result in significant improvements in performance for the task Building Bricks, a task which measure aspects of fine motor skills (Leversen et al. 2012, Gallhue et al ., 2012, ref). The program in the playground was mainly focusing on training gross motor skills and the results demonstrate that increasing performance within fine motor skills may be regarded as specific (Haga et al. 2008).

Limitation of the study

Only 1 task for fine motor skill was adopted. It is necessary to continue to investigate on task specific activity and on transfer of competence in gross motor skills using more assessments systems. Longitudinal studies to investigate the role of free play and structured activity in acquisition of fundamental motor skills, the role of the mediation by educators during structured activity, the role of teachers during free play, the role of intensity, frequency and duration of activities are necessary, to better understand children motor development.

Conclusion

In our study we found out that the group who practiced gross motor activity in the playground for 1 hour a week for 10 weeks improved significantly in four of the six gross motor tasks, compared to the control group. These results could be important for the practical activity of the kindergartens and for parents. 30 minutes of free play and 30

minutes of structured activity once a week, for 10 weeks are sufficient time to produce improvement in gross motor competence.

The organization of structured activity, the methodology of execution and the repetition of the experience gave significant results, showing the effects of specificity of gross motor activity on gross motor competence, on specific tasks and not on fine motor competence.

Acknowledgments

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13 QUESTION B) “HOW MAY WE DEVELOP MOTOR SKILLS IN CHILDREN”?

13.3 STUDY 4B - PAPER: EXPLORING THE EFFECTS AND SPECIFICITY OF PLAYGROUND ACTIVITIES ON MOTOR SKILLS IN 5 YEARS OLD CHILDREN

FROM THE PAPER BY: P. Tortella, G.Fumagalli, H. Lorås, M. Haga, H. Sigmundsson

Introduction

The Levels of motor competence influence amount, intensity and level of physical activity performed by children. In turn, motor competence is built up on acquisition of both gross and fine motor skills. With this study we investigated in 110 five years old children the effects on motor skills of 10 sessions of outdoor motor activities played in the “Primo Sport 0246” playground (Treviso, Italy) where equipment and their distribution are controlled.

Methods

One hundred and ten children 5 years old from 4 kindergartens in Treviso, Italy were studied. Of these, 71 (experimental group) played once a week for 10 consecutive weeks (March to May) in the “Primo Sport 0246” playground. Activities were organized as 30 minutes of free play and 30 minutes of controlled structured activities; the tools available to the children (monkey bars, hanging bar, climbing a net, climbing a rope, a rope ladder, gymnastic rings, balance tools) were aimed at training gross motor skills. The control group did not attend the playground. All 110 children were analyzed before and at the end of the 10 session period with sets of procedures aimed at measuring gross and fine motor skills (1, 2, 3).

Results

Analysis of pre and post-training tests showed significant differences in the experimental but not in the control group in four gross motor tasks (one-leg balance-left foot, balance on beam, balance of platform, and putting a medicine ball). No significant differences were found in fine motor tasks.

Conclusions

The data indicate that a (relatively limited) experience at the “Primo Sport 0246” playground positively stimulates improvements of gross motor skills but not fine motor skills. As the program in the playground was mainly focusing on training gross motor skills the results may demonstrate that increasing performance within fine motor skills may be regarded as specific.

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Key words

playground, gross motor skills, preschool children

13 QUESTION B) “HOW MAY WE DEVELOP MOTOR SKILLS IN CHILDREN”?

13.4 OTHER RESULTS OF THE RESEARCH AT THE PLAYGROUND?

Here are the tables with the preliminary data of the results of motor skills improvement in three years of research:

The first part is dedicated to the Anthropometric data of the children participating at the research in the years 2012-2013-2014.

Age	Total		Boys		Girls	
	mean ± s.e.	n	mean ± s.e.	n	mean ± s.e.	n
Struct. Activity	5.61 ± 0.02	175	5.60 ± 0.03	86	5.62 ± 0.04	86
Free play	5.65 ± 0.03	107	5.71 ± 0.04	62	5.58 ± 0.04	45
Control	5.63 ± 0.02	142	5.64 ± 0.04	55	5.58 ± 0.03	66

Weight	Pre		Post		Δ pre-post		T Student paired p
	mean ± s.e.	n.	mean ± s.e.	n.	mean ± s.e	n.	
Structured Activity							
Total	21.74 ± 0.31	103	22.29 ± 0.35	95	0.721 ± 0.30	149	0,020s
Boys	21.33 ± 0.42	61	22.63 ± 0.56	55	0.159 ± 0.45	78	0,001
Girls	21.93 ± 0.40	55	22.63 ± 0.56	42	0.392 ± 0.76	66	ns
Free Play							
Total	21.10 ± 0.29	103	21.55 ± 0.32	95	0.36 ± 0.12	93	0.003
Boys	21.70 ± 0.38	61	21.94 ± 0.41	55	0.23 ± 0.19	55	ns
Girls	20.22 ± 0.41	77	21.01 ± 0.49	81	0.56 ± 0.09	38	0.000
Control							
Total	21.22 ± 0.27	135	21.84 ± 0.36	138	0.57 ± 0.17	131	0.010
Boys	21.78 ± 0.36	75	22.70 ± 0.39	75	0.83 ± 0.27	73	0.003
Girls	20.53 ± 0.36	60	20.81 ± 0.35	63	0.22 ± 0.16	58	ns

Height	Pre		Post		Δ pre-post		T Student paired p
	mean ± s.e.	n.	mean ± s.e.	n.	mean ± s.e	n.	
Structured Activity							
Total	1.15 ± 0.01	172	1.16 ± 0.01	158	0.014 ± 0.01	148	0.029
Boys	1.15 ± 0.01	86	1.15 ± 0.01	67	0.005 ± 0.01	70	ns
Girls	1.14 ± 0.01	86	1.17 ± 0.01	77	0.032 ± 0.01	78	0.000
Free Play							

Total	1.15 ± 0.01	86	0.16 ± 0.01	81	0.013 ± 0.01	93	0.000
Boys	1.16 ± 0.01	61	1.17 ± 0.01	55	0.012 ± 0.00	55	0.000
Girls	1.15 ± 0.01	42	1.15 ± 0.01	40	0.014 ± 0.01	38	
Control							
Total	1.15 ± 0.01	135	1.16 ± 0.01	138	0.017 ± 0.01	131	0.000
Boys	1.15 ± 0.01	75	1.17 ± 0.01	75	0.018 ± 0.01	73	0.000
Girls	1.14 ± 0.01	60	1.15 ± 0.01	63	0.016 ± 0.01	58	0.000

BMI	Pre		Post		Δ pre-post		T Student paired
	mean ± s.e.	n.	mean ± s.e.	n.	mean ± s.e	n.	p
Struct. Activity							
Total	16.48 ± 0.17	172	16.38 ± 0.17	158	-0.031 ± 0.17	148	ns
Boys	16.60 ± 0.25	86	16.34 ± 0.17	77	-0.328 ± 0.22	70	ns
Girls	16.36 ± 0.25	86	16.43 ± 0.29	81	0.235 ± 0.27	78	ns
Free Play							
Total	15.96 ± 0.15	103	15.89 ± 0.17	95	-0.090 ± 0.08	93	ns
Boys	16.16 ± 0.19	61	15.94 ± 0.21	55	-0.174 ± 0.12	55	ns
Girls	15.68 ± 0.24	42	15.83 ± 0.28	40	0.031 ± 0.08	38	ns
Control							
Total	16.13 ± 0.15	135	16.14 ± 0.16	138	-0.051 ± 0.11	131	ns
Boys	16.41 ± 0.21	75	16.59 ± 0.22	75	0.108 ± 0.19	73	ns
Girls	15.78 ± 0.21	60	15.61 ± 0.20	63	-0.251 ± 0.08	58	0.005

Waist	Pre		Post		Δ pre-post		T Student paired
	mean ± s.e.	n.	mean ± s.e.	n.	mean ± s.e	n.	p
Struct. Activity							
Total	55.49 ± 0.39	173	54.33 ± 0.40	158	-8.867 ± 0.36	149	0.017
Boys	56.03 ± 0.53	87	54.40 ± 0.48	77	-1.594 ± 0.44	71	0.000
Girls	54.94 ± 0.57	86	54.27 ± 0.63	81	-0.205 ± 0.55	78	ns
Free Play							
Total	56.01 ± 0.34	103	53.76 ± 0.42	95	-2.253 ± 0.22	93	0.000
Boys	56.60 ± 0.39	61	54.13 ± 0.48	55	-2.245 ± 0.29	55	0.000
Girls	55.15 ± 0.59	42	53.25 ± 0.74	40	-2.263 ± 0.34	38	0.000
Control							
Total	54.61 ± 0.36	135	54.45 ± 0.39	138	-0.314 ± 0.30	131	ns
Boys	55.13 ± 0.50	75	55.50 ± 0.56	75	0.159 ± 0.47	73	ns
Girls	53.96 ± 0.52	60	53.19 ± 0.52	63	-0.910 ± 0.32	58	0.006

Following are the table of the results in tasks of gross motor skills

Balance on right leg (secs)	Pre		Post		Δ pre-post		T Student paired
	mean ± s.e.	n.	mean ± s.e.	n.	mean ± s.e	n.	p
Structured Activity	17.32 ± 0.88	144	21.53 ± 1.52		4,203 ± 1.60		0,001
Free Play	17.58 ± 1.00	110	19.13 ± 1.42		1.55 ± 1.26		ns

Control	15.93 ± 0.89	129	19.14 ± 0.99		3.21 ± 1.02		0.002
<p>Notes: Data of PRE or POST with different treatments are compared with unpaired t Student In Struct Act vs Free Play: * indicates p <0.05; ** p< 0.01; *** p < 0.001 In Struct Act vs Control: § indicates p <0.05; §§ p< 0.01; §§§ p < 0.001 In Free Play vs Control: ° indicates p <0.05; °° p< 0.01; °°° p < 0.001</p>							

Balance on left leg (secs)	Pre		Post		Δ pre-post		T Student paired
	mean ± s.e.	n.	mean ± s.e.	n.	mean ± s.e	n.	p
Structured Activity	16.17 ± 0.85	145	23.90 ± 2.70		7.72 ± 2.84		0.007
Free Play	16.28 ± 1.18	110	19.53 ± 1.53		3.24 ± 1.39		0.022
Control	15.70 ± 0.77	129	21.41 ± 1.65		5.74 ± 1.72		0.001
<p>Notes: Data of PRE or POST with different treatment are compared with unpaired t Student In Struct Act vs Free Play: * indicates p <0.05; ** p< 0.01; *** p < 0.001 In Struct Act vs Control: § indicates p <0.05; §§ p< 0.01; §§§ p < 0.001 In Free Play vs Control: ° indicates p <0.05; °° p< 0.01; °°° p < 0.001</p>							

Balance bar (secs)	Pre		Post		Δ pre-post	T Student paired
	mean ± s.e.	n.	mean ± s.e.		mean ± s.e	p
Structured Activity	14.66 ± 0.88	162	11.73 ± 2.79		-2.45 ± 3.26	n.s.
Free Play	17.41 ± 1.31	76	11.50 ± 0.92 °°°		-4.911 ± 1.36	0.001
Control	14.95 ± 1.27	102	10.00 ± 0.55		-5.42 ± 1.10	0.000

Notes:
Data of PRE or POST with different treatment are compared with unpaired t Student
In Struct Act vs Control: § indicates p <0.05; §§ p< 0.01; §§§ p < 0.001

Balance bar (# of errors)	Pre		Post		Δ pre-post	T Student paired
	mean ± s.e.	n.	mean ± s.e.		mean ± s.e	p
Structured Activity	2.14 ± 0.16	165	1.24 ± 0.17		-0.79 ± 0.23	0.001
Free Play	2.50 ± 0.25	77	1.40 ± 0.19		-1.06 ± 0.31	0.001
Control	1.99 ± 0.20	100	1.25 ± 0.14		-0.88 ± 0.24	0.000

Notes:
Data of PRE or POST with different treatment are compared with unpaired t Student

Walking on elastic platforms	Pre		Post		Δ pre-post	T Student paired
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(secs)	mean ± s.e.	n.	mean ± s.e.	mean ± s.e	p
Structured Activity	35.76 ± 2.15	146	12.86 ± 0.76	-22.90 ± 2.03***	0.000
Free Play	33.31 ± 3.14	65	15.41 ± 1.18	-17.89 ± 2.75°°°	0.000
Control	28.98 ± 2.19	99	20.66 ± 1.14	-8.32 ± 1.85 §§§	0.007

Notes:
Data of PRE or POST with different treatment are compared with unpaired t Student
In Struct Act vs Free Play: * indicates p < 0.05; ** p < 0.01; *** p < 0.001
In Struct Act vs Control: § indicates p < 0.05; §§ p < 0.01; §§§ p < 0.001
In Free Play vs Control: ° indicates p < 0.05; °° p < 0.01; °°° p < 0.001

Walking on elastic platforms (# of errors)	Pre	n.	Post	Δ pre-post	T Student paired
	mean ± s.e.		mean ± s.e.	mean ± s.e	p
Structured Activity	0.81 ± 0.15	118	0.09 ± 0.06	0.72 ± 1.66	0.000
Free Play	0.37 ± 0.10	65	0.01 ± 0.01	-0.35 ± 0.10	0.001
Control	0.38 ± 0.11	99	0.20 ± 0.08	-0.18 ± 0.07	0.020

Notes:
Data of PRE or POST with different treatment are compared with unpaired t Student

Jumping on mats	Pre	n.	Post	Δ pre-post	T Student paired
	mean ± s.e.		mean ± s.e.	mean ± s.e	p
Structured Activity	4.42 ± 0.10 §§§	109	3.99 ± 0.15 §§	-0.48 ± 0.16§§	0.004
Free Play	4.12 ± 0.17	85	3.55 ± 0.22	-0.53 ± 0.25	0.040
Control	3.28 ± 0.19 °°	100	3.13 ± 0.19	-0.15 ± 0.22	n.s.

Notes:
Data of PRE or POST with different treatment are compared with unpaired t Student
In Struct Act vs Control: § indicates p < 0.05; §§ p < 0.01; §§§ p < 0.001

Long Jump (in meter)	Pre	n.	Post	Δ pre-post	T Student paired
	mean ± s.e.		mean ± s.e.	mean ± s.e	p
Structured Activity	0.82 ± 0.02	135	0.96 ± 0.02	0.14 ± 0.01	0.000
Free Play	0.89 ± 0.02	102	0.96 ± 0.02	0.07 ± 0.03	0.000

Control	0.88 ± 0.02		0.97 ± 0.01	0.09 ± 0.02	0.000
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student					

Running 20 meters (secs)	Pre		Post	Δ pre-post	T Student paired
	mean ± s.e.	n.	mean ± s.e.	mean ± s.e	p
Structured Activity	6.27 ± 0.09	135	5.90 ± 0.07	-0.37 ± 0.09	0.000
Free Play	6.13 ± 0.08	104	6.06 ± 0.08	-0.07 ± 0.06	n.s.
Control	6.15 ± 0.07	113	6.46 ± 0.58	0.31 ± 0.58	ns
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student					

Medicine ball (meters)	Pre		Post	Δ pre-post	T Student paired
	mean ± s.e.	n.	mean ± s.e.	mean ± s.e	p
Structured Activity	1.85 ± 0.04	147	2.13 ± 0.04	0.27 ± 0.05	0.000
Free Play	2.07 ± 0.05	113	2.15 ± 0.05	0.07 ± 0.05	n.s.
Control	1.98 ± 0.05	129	2.04 ± 0.05	0.05 ± 0.04	n.s.
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student					

Monkey bar (number of brachiations)	Pre		Post	Δ pre-post	T Student paired
	mean ± s.e.	n.	mean ± s.e.	mean ± s.e	p
Structured Activity	2.14 ± 0.23	152	5.81 ± 0.46*	3.67 ± 0.41	0.000
Free Play	3.16 ± 0.45	81	5.29 ± 0.62	2.13 ± 0.43	0.000
Control	2.82 ± 0.30	111	4.70 ± 0.42	1.87 ± 0.33	0.000
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student In Struct Act vs Free Play: * indicates p < 0.05; ** p < 0.01; *** p < 0.001					

Hanging to the bar (secs)	Pre		Post	Δ pre-post	T Student paired
	mean ± s.e.	n.	mean ± s.e.	mean ± s.e	p

Structured Activity	26.16 ± 1.79	125	28.24 ± 2.20§	2.08 ± 1.80	n.s.
Free Play	27.21 ± 2.50	74	23.21 ± 1.78	-3.99 ± 2.25	n.s.
Control	24.09 ± 2.60	106	22.20 ± 1.65	-1.89 ± 2.17	n.s.
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student In Struct Act vs Control: § indicates p < 0.05; §§ p < 0.01; §§§ p < 0.001					

Catching Bean Bag (x vs10)	Pre		Post	Δ pre-post	T Student paired
	mean ± s.e.	n.	mean ± s.e.	mean ± s.e	p
Structured Activity	5.50 ± 0.27	109	7.09 ± 0.22 *§	1.48 ± 0.23	0.000
Free Play	5.38 ± 0.29	85	6.35 ± 0.27	1.17 ± 0.29	0.000
Control	6.28 ± 0.26	95	6.31 ± 0.25	0.03 ± 0.31	n.s.
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student In Struct Act vs Free Play: * indicates p < 0.05; ** p < 0.01; *** p < 0.001 In Struct Act vs Control: § indicates p < 0.05; §§ p < 0.01; §§§ p < 0.001 In Free Play vs Control: ° indicates p < 0.05; °° p < 0.01; °°° p < 0.001					

Aiming & Catching with right hand	Pre		Post	Δ pre-post	T Student paired
	mean ± s.e.	n.	mean ± s.e.	mean ± s.e	p
Structured Activity	1.49 ± 0.17	109	1.03 ± 0.13	-0.50 ± 0.20	0.05
Free Play	1.05 ± 0.14	85	0.89 ± 0.14	-0.09 ± 0.18	n.s.
Control	1.54 ± 0.16	95	1.16 ± 0.11	-0.37 ± 0.17	0.05
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student					

Aiming & Catching with left hand	Pre		Post	Δ pre-post	T Student paired
	mean ± s.e.	n.	mean ± s.e.	mean ± s.e	p
Structured Activity	0.93 ± 0.11	109	1.00 ± 0.11	-0.04 ± 0.15	n.s.
Free Play	1.21 ± 0.14	85	0.61 ± 0.09*°	-0.62 ± 0.16	0.000

Control	1.08 ± 0.11	95	1.03 ± 0.12	-0.03 ± 0.15	n.s.
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student In Struct Act vs Free Play: * indicates p < 0.05; ** p < 0.01; *** p < 0.001 In Free Play vs Control: ° indicates p < 0.05; °° p < 0.01; °°° p < 0.001					

The following tables are related to fine motor skills.

Threading beans (secs)	Pre	n.	Post	Δ pre-post	T Student paired
	mean ± s.e.		mean ± s.e.	mean ± s.e	p
Structured Activity	63.45 ± 1.81	88	57.89 ± 2.05	-5.56 ± 1.87	0.004
Free Play	62.52 ± 1.98	73	58.72 ± 1.65	-3.81 ± 1.93	n.s.
Control	62.03 ± 1.36	81	58.84 ± 1.55	-3.19 ± 1.56	0.044
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student					

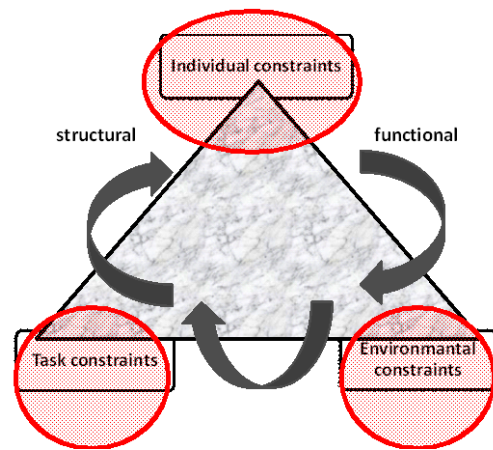
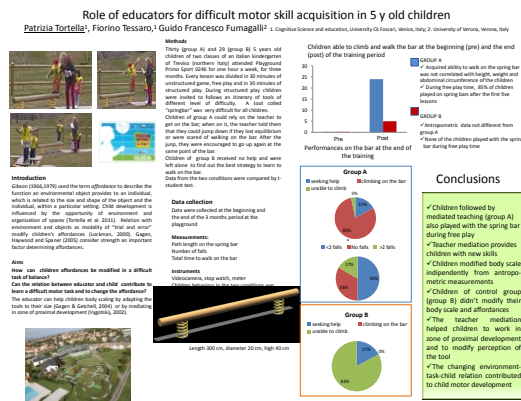
Posting coins with right hands (secs)	Pre	n.	Post	Δ pre-post	T Student paired
	mean ± s.e.		mean ± s.e.	mean ± s.e	p
Structured Activity	22.99 ± 0.46	89	22.21 ± 0.57	-0.78 ± 0.54	n.s.
Free Play	22.57 ± 0.45	89	22.45 ± 0.44	-0.12 ± 0.42	n.s.
Control	22.06 ± 0.31	86	22.37 ± 0.34	0.31 ± 0.38	n.s.
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student In Struct Act vs Free Play: * indicates p < 0.05; ** p < 0.01; *** p < 0.001 In Struct Act vs Control: § indicates p < 0.05; §§ p < 0.01; §§§ p < 0.001 In Free Play vs Control: ° indicates p < 0.05; °° p < 0.01; °°° p < 0.001					

Posting coins with left hands (secs)	Pre	n.	Post	Δ pre-post	T Student paired
	mean ± s.e.		mean ± s.e.	mean ± s.e	p
Structured Activity	25.94 ± 0.67	89	23.91 ± 0.46	-0.78 ± 0.54	n.s.
Free Play	25.86 ± 0.58	74	23.69 ± 0.47	-2.18 ± 0.49	0.05
Control	25.56 ± 0.50	86	23.63 ± 0.38	-1.93 ± 0.48	0.05
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student					

Building bricks (secs)	Pre		Post	Δ pre-post	T Student paired
	mean \pm s.e.	n.	mean \pm s.e.	mean \pm s.e	p
Structured Activity	28.60 \pm 1.03	88	28.78 \pm 2.04	0.18 \pm 0.09	n.s.
Free Play	30.98 \pm 1.16	72	30.24 \pm 0.96	-0.74 \pm 1.14	n.s.
Control	29.42 \pm 0.92	84	29.96 \pm 0.88	0.53 \pm 1.05	n.s.
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student In Struct Act vs Free Play: * indicates p < 0.05; ** p < 0.01; *** p < 0.001 In Struct Act vs Control: § indicates p < 0.05; §§ p < 0.01; §§§ p < 0.001 In Free Play vs Control: ° indicates p < 0.05; °° p < 0.01; °°° p < 0.001					

Platform (secs)	Pre		Post	Δ pre-post	T Student paired
	mean \pm s.e.	n.	mean \pm s.e.	mean \pm s.e	p
Structured Activity	40.61 \pm 1.68	56	40.08 \pm 1.57	-0.53 \pm 1.99	n.s.
Free Play	38.22 \pm 1.59	51	39.72 \pm 2.03	1.50 \pm 1.62	n.s.
Control	39.04 \pm 1.10	56	37.53 \pm 0.93	-1.51 \pm 1.20	n.s.
Notes: Data of PRE or POST with different treatment are compared with unpaired t Student In Struct Act vs Free Play: * indicates p < 0.05; ** p < 0.01; *** p < 0.001 In Struct Act vs Control: § indicates p < 0.05; §§ p < 0.01; §§§ p < 0.001 In Free Play vs Control: ° indicates p < 0.05; °° p < 0.01; °°° p < 0.001					

14 Question C) “IF AND HOW MAY WE DEVELOP COGNITIVE PROCESSES BY MEANS OF PHYSICAL ACTIVITY”?



Presented poster on 18-20 aprile 2013 *Biennial Meeting Society for Research in Child Development*, Seattle, USA.

Newell's model of constraints

Fig 14.1

The three types of constraints act always simultaneously and influence each other. In the following article the focus of attention is on the environment, on the task, and on individual constraints. In individual constraints Newell, (1986) suggests that the environment is a constraint that encourages or discourages movement and that the task constraint is external to the body and includes the goals of movement or activities.

14.1 STUDY 5 A - PAPER PERCEZIONE-AZIONE: IL RUOLO DELL'EDUCATORE NELLA ATTRIBUZIONE DI SIGNIFICATO ALL'AMBIENTE E AL COMPITO, CON BAMBINI DI 5 ANNI

FROM THE ITALIAN PAPER BY: Tortella P., Tessaro F., Fumagalli G., *Percezione-azione: il ruolo dell'educatore nella attribuzione di significato all'ambiente e al compito, con bambini di 5 anni*, in Cruciani M., Cecconi F., (a cura di) *Atti del Nono Convegno Annuale dell'Associazione Italiana di Scienze Cognitive (AISC)*, Università di Trento, Trento 2012, pp. 303-308, ISBN: 978-88-8443-452-4, <http://www.aisc-net.org/home/2012/11/24/atti-aisc12/>

Introduzione

Lo sviluppo del bambino è strettamente connesso con le opportunità offerte dall'organizzazione dell'ambiente e degli spazi (Tortella et al. 2011). Gibson usa il termine *affordance* per descrivere la funzione che gli oggetti nell'ambiente producono sugli individui, con la loro forma e la loro dimensione all'interno di un particolare setting (una tazzina piena di caffè invita a essere afferrata per il manico, una superficie orizzontale invita una persona a sedersi, mentre una verticale no). La visione ecologica di percezione e azione si basa sulla percezione diretta dell'ambiente. Attraverso la percezione degli oggetti e delle superfici ci configuriamo le *capabilities* e mediante le *affordances* agiamo su di essi. La relazione tra individuo e ambiente è intrecciata a tal punto che la persona valuta ambiente e oggetti non per le loro caratteristiche standard ma in relazione a se stessa (Gibson, 1979). Per esempio, un bambino percepisce se può salire una scala considerando non l'altezza oggettiva dello scalino ma l'altezza soggettiva, in relazione alle proprie dimensioni del corpo (body scaling) (Haywood, Getchell, 2009). Quando il bimbo cresce e si sviluppa la sua percezione di *affordances* cambia, al variare delle nuove *capabilities*, anche se le caratteristiche fisiche dell'oggetto rimangono le stesse. Il fatto di compiere azioni è un aspetto importante per lo sviluppo del sistema percezione-azione. La visione ecologica ritiene che noi percepiamo *affordances* piuttosto che caratteristiche degli oggetti. Ci si chiede quanto questo sia in relazione alle dimensioni del nostro corpo. Warren (1984), ha osservato che gli adulti percepiscono la possibilità di salire le scale basandosi sulla differenza tra la lunghezza della loro gamba e quella del gradino. Konczak (1990) sostiene che le *affordances* degli anziani nel salire le

scale sono più correlate con la loro forza e flessibilità che con la lunghezza delle loro gambe. Nel caso dei bambini Ulrich, Thelen & Niles (1990) hanno osservato che i neonati scelgono gradini più bassi dei bambini più grandi, senza alcuna relazione con le lunghezze antropometriche degli arti. Adolph, Eppler e Gibson (1993) hanno confermato che i neonati sono già in grado di percepire le *affordances*. Le *affordances* dei bambini si modificano attraverso il contatto diretto con gli oggetti e l'ambiente, attraverso le modalità di conoscenza di "prove ed errori" (Lockman, 2000). Gagen, Haywood & Spaner (2005) ritengono che la forza sia un fattore importante, al pari delle dimensioni del corpo al fine di determinare le *affordances*. Sono tuttavia necessarie ulteriori ricerche per determinare i fattori che influiscono maggiormente nelle scale di riferimento dei soggetti. E' necessario anche esplorare meglio in che misura i soggetti siano guidati nelle loro azioni dalle caratteristiche dell'oggetto o dalle *affordances*. Il movimento facilita lo sviluppo della percezione (Ratey, 2008) e il controllo posturale e dell'equilibrio sono un esempio di percezione-azione in un ecosistema. Per raggiungere l'equilibrio dobbiamo continuamente modificare gli schemi di risposta motoria, in accordo con le informazioni percettive.

Ipotesi

L'acquisizione della competenza motoria dell'equilibrio è un processo di apprendimento che può essere facilitato o inibito dall'esperienza del bambino e/o dal comportamento dell'educatore. Nell'ambito dell'educazione motoria l'educatore può aiutare i bambini nel body scaling utilizzando attrezzi appropriati alle dimensioni dei piccoli, (Gagen & Getchell, 2004) oppure mediando le loro attività, ossia ponendo le condizioni affinché i bimbi possano agire a livello di "zona di sviluppo prossimale" (Vygotskij, 2002). Con questi due comportamenti egli manipola l'interazione tra il bambino e il compito, incoraggiandolo a un modello di movimento più avanzato. L'esperienza motoria sviluppa le capacità percettive e queste sono importantissime nel determinare le azioni. Abbiamo condotto uno studio presso il parco giochi Primo Sport 0246 di Treviso, un luogo specificamente studiato per lo sviluppo motorio dei bambini da 0 a 6 anni (Tortella P., Durigon V., Cappellari D., Fumagalli G, 2011). Abbiamo osservato mediante telecamere fisse l'utilizzo dei diversi attrezzi da parte di 59 bambini di 5 anni. La nostra attenzione è

stata richiamata dalla “barra su molle”, un attrezzo utile per lo sviluppo delle capacità di equilibrio dinamico e statico, che consiste in una barra di legno cilindrica lunga 300 cm, di diametro 20 cm, alta dal suolo 40 cm e fissata a terra con due molle laterali. La maggior parte dei bambini, durante i momenti di gioco libero al parco evitava questo attrezzo. Ci siamo chiesti se fosse stato possibile modificare le *affordances* dei bimbi, rispetto a questo strumento, per poter favorire in loro l’apprendimento di compiti difficili, sviluppando così la competenza motoria dell’equilibrio, mantenendo inalterate le caratteristiche dell’oggetto. Abbiamo così deciso di verificare se specifiche procedure di interazione bambino/educatore potevano influire sulle *affordances* e sulle capacità dei bambini di apprendere il difficile compito di camminare in equilibrio sulla “barra a molle”, senza modificare l’altezza della barra.

Metodologia

Lo studio è stato condotto presso il parco giochi Primo Sport 0246 di Treviso. 59 bambini di 5 anni di una scuola dell’infanzia locale hanno frequentato il parco giochi per 10 settimane, una volta alla settimana per 1 ora e trenta. Ad ogni visita i bambini giocavano liberamente per 30 minuti; nei successivi 30 minuti i bambini venivano guidati dagli educatori ad utilizzare gli attrezzi, secondo un ordine preciso. Venivano dedicati cinque minuti all’utilizzo della “barra con molle”. I 59 bambini sono stati divisi in due gruppi. Ai bambini del gruppo A (n=30) gli educatori offrivano un aiuto minimo (i bambini potevano appoggiarsi al gomito dell’educatore) per riuscire a salire e rimanere in equilibrio sulla barra, per poi poterci camminare sopra. Ai bambini del gruppo B (n. 29) non veniva dato alcun aiuto, veniva detto loro che potevano utilizzare l’attrezzo nel modo che a loro piaceva di più.

In entrambi i gruppi gli educatori incoraggiavano positivamente i bambini. All’inizio e alla fine dei 10 incontri sono state effettuate le seguenti misurazioni: a) lunghezza del percorso effettuato camminando autonomamente sulla “barra con molle”; b) numero di cadute; c) tempo totale impiegato a compiere l’intero percorso sulla barra. Strumenti: telecamera, cronometro, metro. Sono state utilizzate 3 telecamere fisse, una in alto e due ai due lati della barra, funzionanti durante tutto il tempo di permanenza al parco dei

bambini. Sono state osservate le attività alla “barra con molle” di ciascun bambino, durante il gioco libero, durante il gioco guidato e durante i test.

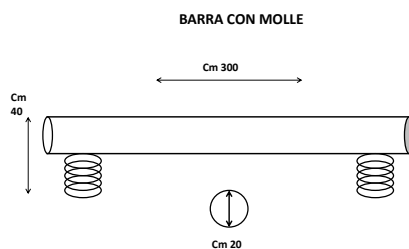


Fig. 14.2 La barar a molle

Risultati

Al test iniziale nessuno dei 59 bambini era capace di salire sulla barra e di riuscire a fare almeno un passo senza cadere. Alla fine delle 10 visite sono state osservate significative differenze tra i due gruppi. Nel gruppo A l'80% dei bambini riusciva a salire autonomamente sulla “barra con molle”, il 17 % chiedeva aiuto e il 3% non voleva salire sulla barra. Il 100% dei bambini che salivano sulla barra autonomamente camminava per tutto il percorso (il 33% senza cadere; 50% con 1-2 cadute; il 17% cadendo più di due volte). Non abbiamo trovato correlazione tra la capacità dei bambini di salire sulla barra e di camminarci sopra e misure antropometriche (peso, statura, BMI). Durante i 30 minuti di gioco libero l'85% dei bambini sceglieva il gioco “barra con molle”, dopo le prime cinque visite al parco. Nel gruppo B, alla fine dei 10 incontri solo il 17% dei bambini saliva sulla barra in maniera autonoma ma nessuno di loro riusciva a fare più di un passo. Abbiamo trovato una correlazione tra l'altezza dei bambini e la capacità di salire sulla barra. Tutti i bambini hanno sviluppato diverse strategie di utilizzo del gioco, alternative al camminare sopra, in equilibrio: strisciare in appoggio sulla pancia, passare cavalcioni, passare sotto. Tutti i bambini del gruppo B, osservati durante il gioco libero evitavano la “barra con molle”.

Conclusione

Un supporto dato in *zona di sviluppo prossimale* ha contribuito alla modifica delle *affordances* dei piccoli, indipendentemente dalle loro misure antropometriche e dalle caratteristiche della “barra con molle”; i bambini non supportati hanno avuto un lievissimo miglioramento nelle *affordances* correlato alle misure antropometriche; le esperienze di successo dei bambini supportati hanno incrementato la loro motivazione ad apprendere, contribuendo ad aumentare i loro tentativi di riuscire a camminare in equilibrio sulla barra, durante il gioco libero; i continui e ripetuti tentativi di salire e camminare in equilibrio sulla “barra con molle” hanno permesso ai bambini di sviluppare successivamente la loro capacità di equilibrio.

L’educatore può intervenire in “zona di sviluppo prossimale”, attraverso la mediazione tra il bambino e il compito, modificando le *affordances*, lasciando invariato l’oggetto di attenzione.

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THE FOLLOWING IS THE SAME ARTICLE AS BEFORE IN FORM OF ABSTRACT

14.2 STUDY 5B - PAPER - DIFFICULT MOTOR SKILL ACQUISITION IN 5 Y OLD CHILDREN CAN BE MODULATED BY EDUCATORS

Tortella P., Fumagalli G., *Difficult motor skill acquisition in 5 y old children can be modulated by educators*, Science & Sport, 29,(S), S49-50. (referee+if. **0,537**) ISSN 0765-1597. Journal on line: <http://www.sciencedirect.com/science/journal/07651597/29/supp/S>

Article on line: [http://ac.els-cdn.com/S0765159714002378/1-s2.0-S0765159714002378-main.pdf?_tid=6e6b8ecc-591d-11e4-bdf2-](http://ac.els-cdn.com/S0765159714002378/1-s2.0-S0765159714002378-main.pdf?_tid=6e6b8ecc-591d-11e4-bdf2-00000aab0f26&acdnat=1413894547_1622b8bda8ca8d4772156ba279708d09)

[00000aab0f26&acdnat=1413894547_1622b8bda8ca8d4772156ba279708d09](http://ac.els-cdn.com/S0765159714002378/1-s2.0-S0765159714002378-main.pdf?_tid=6e6b8ecc-591d-11e4-bdf2-00000aab0f26&acdnat=1413894547_1622b8bda8ca8d4772156ba279708d09)

Oral presentation on 16-18 ottobre 2014 1st International Congress on Children's Physical Activity and Sport, Liege, Belgium.

Introduction

Expansion of affordances and acquisition of new possibilities for action depend on motor learning and development. Adolph considers affordances as continuous, probabilistic functions, representing an individual's likelihood of successful performance, across environmental increments. With this study we addressed the question of how the relation between educator and child in a difficult motor task, involving a process of expanding affordances, contributes to the acquisition of new possibilities for action.

Methods

Sixty children 5 years old from 2 kindergartens in Treviso (Italy) were studied while performing structured and unstructured physical activity during one hour lessons at a common playground; frequency of lessons was 1/week and the total period of observation was three months. Children of group A could rely on a teacher to get on a very difficult tool, a bar supported by two mobile springs; the teacher told them that they could jump down if they lost balance or were scared of walking the bar. After the jump, they were

encouraged to go up again at the same point of the bar. Children of group B received no help and were left alone to find out the best strategy to accomplish the task. Time and number of errors were measured and children were video recorded.

Results

At the beginning no children were able to climb on the bar. At the end of the 10 lessons 20% only of the children of group B were able to climb on the bar by themselves, and none was able to walk. In group A, 80% of the children climbed on the bar by themselves, 17% requested help and three % could not climb. During free play, only children of group A used the spring bar.

Conclusions

The data indicate that teacher-mediated experiences promote child expansion of body scale and affordances. The data also suggest that successful experiences encourage autonomous child training thus further expanding perception of motor skill competence.

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Key words

Playground, affordance, motor development

Enlightening considerations

During the activities in the Primo Sport 0246 playground, three video-cameras recorded the movement and the behaviors of the children. It became soon evident that during the free play sessions, a very limited number of children explored the diverse possibilities of utilizing the spring bar. At the beginning I had the intention to remove it but before doing it I decided to see if a different approach to the tool, mediated by the teacher could encourage the children to use it.

Indeed the task of walking on the elastic beam is very complicated because the bar is 1- unstable; 2- placed at approx 40 cm from ground level and thus difficult to climb for 5 years old children. I decided to use a scaffolding approach for the climbing procedure; when on the bar, the child had to move by him/her-self without any physical help from me. On the other hand I encourage them and when they said "I am not able to walk!" I suggested them to make a beautiful jump down and then to climb up at the same spot, again with my support. With this proposal the children enjoyed themselves very much. This task required time to be executed and the children were asked to concentrate, wait, observe, pay attention, collect perceptual experiences by visual and motor system also when they were waiting for their turn. This procedure increased the percentage of children that become able to perform the task at the end of the visit period at the playground (column POST in the table), decreased both the number of errors and the time required to complete the walking distance on the spring bar. Indeed the values of "Time at spring bar" and "Errors at spring bar" are strongly reduced in the POST tests in the "Structured activity" group and only slightly in the other two groups (see table).

Apart from the numeric data showing increased competence in performing the difficult balance test, it was interesting to observe the behavior of these children during the free-play time at the playground. It was surprising to notice how resistant were the "scaffolded" children to frustration: despite their efforts of using the bar (both climbing and walking) were defeated, they kept trying enjoying the activity even if unsuccessful. Children that were "not scaffolded" avoided using the spring bar during the free play time.

In addition I also noticed that when a child was able to climb the bar through the scaffolding of the teacher provided often exclaimed "I did!!!". Furthermore the parents of these children (that I interviewed at the end of the 10 visits) told me that their children

were continuously asking them to observe how "they were skilled" in jumping or walking in balance at home. The children also asked the parents several times to accompany them at the playground because they wanted to show them how skilled they were become.

In accordance with Adolph and Gibson (previous chapters) experiences provide learning. The control group did not have scaffolding by teacher. It is important to notice that the fundamental observations were done in 2012, when the playground was not well known, yet; thus, it is unlikely that the playground was extensively used outside the project (we verified this aspect with questionnaires). Data from questionnaires of later years (2013 and 2014) reported that the playground is becoming a major attraction/interest for pre-schooler of Treviso and that children frequent it often in the afternoon with their families. Related to health and development, this is a big success; respect to the research it makes it difficult to evaluate whether skill progression in children is due to the participation to our project or to visiting the playground in the afternoon with their parents and friends.

The study of this difficult balance task highlights new important aspects that may have contributed to balance skills improvement in children: self perception of competence (Stodden, 2008), self esteem, self efficacy and metacognition (Haga, 2008). I find very interesting to notice that the children exclaimed "I did!!" when they were "scaffolded" by the teacher to climb the beam.

What happened seemed to be in a child like if he had perceived to be competent in actions in which the child was not competent, yet! How was it possible?

Gibson uses the term affordance to indicate new possibilities for action and these possibilities for action are related to the body, to perception of possibilities that promotes action. For Gibson these possibilities are related to perception of possible actions, but in this case there were not possible action and the children needed almost five lessons to learn to climb the bean and to walk on, in balance. In any case this perception of competence seems to have given the children enthusiasm and desire to learn. They often told to me: *"I know that if I keep training I will learn!"*. This sentence was spontaneously given to me by children participating to "post-activity focus groups" and was reported in several occasions by their teachers and parents.

Riflessioni illuminanti

Lo studio analizzato si riferisce all'anno 2012, primo anno di realizzazione del progetto al parco, che ancora non era ben conosciuto dalle famiglie. Dai questionari esaminati nel 2012 si evince che i bambini non frequentavano il parco nel pomeriggio, mentre dagli ultimi questionari riferiti agli anni 2013-14 emerge che molti bambini/e frequentano il parco al di fuori dell'orario scolastico. Se questo aspetto rappresenta un successo per il loro sviluppo motorio, per la salute dei bambini e per il parco giochi è per chi fa ricerca un'aggiunta di ulteriori incontrollabili variabili da considerare.

Durante il progetto del 2012 tre telecamere erano attive e riprendevano l'intero parco e tutte le attività realizzate dai bambini. Osservazioni successive hanno permesso di evidenziare alcuni aspetti che non erano stati notati durante gli incontri. Anche nel gioco dell'arrampicata (Monkey bar - brachiazioni) si era osservato attraverso analisi delle videoregistrazioni che nessun bambino cercava quell'attrezzo durante il gioco libero e che sembrava addirittura che esso venisse accuratamente evitato (parlo di questo in un altro capitolo).

Nell'anno 2012 i bambini sono stati suddivisi in due gruppi: 1 gruppo sperimentale (bambini supportati (scaffolding) dall'insegnante) e gruppo di controllo (bambini non supportati (scaffolding dell'insegnante)). Il compito consisteva nel salire su una barra con le molle, altamente instabile con l'obiettivo di attraversarla. Lo scaffolding consisteva nell'insegnante che offriva al bambino la propria spalla per appoggiarsi e aiutarsi a salire sulla barra, alta 40 cm da terra. L'insegnante poi si spostava e il bambino provava a camminare da solo. Se non ci riusciva, l'insegnante gli suggeriva di fare un "bellissimo" salto e di risalire, di nuovo supportato, nel punto in cui aveva effettuato il salto, per proseguire il percorso che continuava così fino alla fine. I bambini quindi non cadevano dall'asse ma effettuavano un bellissimo salto!

Attraverso le telecamere si è osservato che i soli bambini del gruppo sperimentale, aiutati dall'insegnante in un'attività in zona di sviluppo prossimale, quando giocavano liberamente andavano alla barra con molle, mentre i bambini dell'altro gruppo evitavano quell'attrezzo.

I bambini del gruppo sperimentale tentavano e ritentavano di salire sull'asse e sembrava volessero a tutti i costi imparare. Il compito in quel particolare attrezzo era molto difficile poiché esso è alto 40 cm e si muove in tutte le direzioni, con una superficie di appoggio

rotondeggiante e ristretto. L'insistenza e la caparbieta dei bambini del primo gruppo nell'apprendere a salire su quel gioco si notava, in particolare, quando erano chiamati per fare merenda o per andare al pulmino, per il rientro. I bambini del gruppo sperimentale dovevano essere sollecitati a venire diverse volte, poiche erano troppo impegnati in cio che stavano facendo. I bambini dell'altro gruppo, appena giungeva il momento della merenda, correvano immediatamente nell'"arena di bambini".

I continui fallimenti collezionati dai bambini del gruppo sperimentale durante le prove libere sembravano non influire nel loro entusiasmo e nella loro voglia di imparare.

Essi sorridendo provavano e riprovavano incuranti degli insuccessi, sino pero a imparare. Adolph e Gibson confermano che l'esperienza promuove apprendimento di nuove skills. Alcuni elementi importanti erano apparsi anche durante l'osservazione diretta delle attivita. Spesso i bambini del gruppo sperimentale, una volta saliti sull'asse con il supporto (scaffolding) dell'insegnante, esclamavano: "Ce l'ho fatta!", evidenziando un enorme sorriso di gioia. La cosa mi ha immediatamente colpito molto, dal momento che in verita i bambini erano riusciti a salire sull'asse, ma aggrappandomi a me, mentre io con il mio corpo cercavo di assecondare i loro movimenti per favorire la salita, anche se senza mai farlo direttamente prendendoli, ad esempio, per mano. La mia percezione dunque era di averli aiutati a salire, mentre la loro era di essere riusciti a salire. Era come se non fosse importato come erano arrivati la sopra. C'erano arrivati e questo bastava per conferire successo all'impresa. La loro percezione di competenza mi e sembrata molto importante, poiche presumo possa essere stato lo stimolo all'entusiasmo e alla voglia di apprendere. L'aspetto sorprendente e che non si trattava di percezione di una competenza reale, ma di una competenza futura, anticipata dalla percezione di potercela fare. Durante un focus group, mentre chiedevo ai bambini se si erano divertiti, cosa avevano imparato e come si fa ad imparare molti di loro (solo nel gruppo supportato dall'insegnante e alle attivita in zona di sviluppo prossimale) rispondevano: "io so che se mi esercito imparo!!!) I genitori mi hanno successivamente riferito che anche a casa i bambini riferivano la stessa cosa e alla fine del progetto chiedevano loro di accompagnarli al parco per mostrare loro cosa avevano imparato. Diverse componenti sono entrate in gioco, a mio avviso, nell'esecuzione di questo gioco: percezione di competenza futura? Autostima? Autoefficacia? Aspetti meta cognitivi?

14 QUESTION C: “IF AND HOW MAY WE DEVELOP COGNITIVE PROCESSES BY MEANS OF PHYSICAL ACTIVITY”?

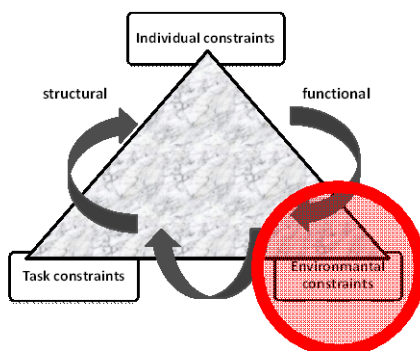


Fig. 14.3

In this study the focus of attention is on the beliefs of parents regarding physical activity and cognitive development (environment) in a kindergarten in Verona.

14.3 STUDIO 6 - PAPER - HEALTH, PHYSICAL ACTIVITY AND EXECUTIVE FUNCTIONS IN 3-5 YEARS OLD CHILDREN. THE OPINIONS OF THE PARENTS. : SALUTE, ATTIVITÀ FISICA E FUNZIONI ESECUTIVE NEI BAMBINI DA 3 A 5 ANNI. LE OPINIONI DEI GENITORI.

FROM THE PAPER BY: Tortella P., Pernice B., Health, physical activity and executive functions in 3-5 years old children. The opinions of the parents. : Salute, attività fisica e funzioni esecutive nei bambini da 3 a 5 anni. Le opinioni dei genitori. in *Formazione & Insegnamento – European Journal of Research on Education and Teaching* (a cura di R. Minello). Lecce, Pensa MultiMedia (accettato, in press).

Keywords

Health, physical activity, executive functions, preschoolers, parents.

Parole chiave

Salute, attività fisica, funzioni esecutive, bambini in età prescolare, genitori.

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Abstract

This research would like to investigate on parents beliefs and practices about physical activities in their children. The questionnaires administered during a “special physical activity day” in a kindergarten of northern Italy highlights that parents believe physical activity for their children as very important but evidences discrepancies between what declared and what practiced about physical activities. In spite of parents believing to be competent about physical activity the results are very far from the recommendations of the International organization for health. It is therefore necessary to provide training activity to empower the parents on their role in children physical development.

Durante “il giorno speciale per l’attività fisica” in una scuola dell’infanzia dell’Italia del nord sono stati somministrati ai genitori dei bambini dei questionari per indagare credenze e pratiche in merito all’attività fisica dei loro bambini. Nonostante i genitori credano molto importante la pratica dell’attività fisica per i loro figli emergono discrepanze tra quanto dichiarato e quanto praticato. Sebbene i genitori si considerino competenti nell’attività fisica i risultati sono molto distanti da quanto raccomandato dalle organizzazioni internazionali sulla salute. Si ritiene necessario, pertanto, provvedere a dei percorsi formativi per sensibilizzare i genitori al loro ruolo nello sviluppo fisico dei figli.

Introduction

A good health contribute to the quality of life and is one of the most important human right. Children have the right to play, to participate to recreational activities appropriate to the age and to take part to cultural, artistic, recreational and leisure activity (U.N. Convention on the Rights of the Child 1989).

What does “health” mean? The American Academy of Pediatrics (AAP 1997) states that “*every child should have the opportunity to grow and develop free from preventable illness or injury*”.

The International Classification Functioning ICF (WHO 2001) considers health in a new way, as a social aspect not limited to the medical and biological point of view. Related to this it becomes important to consider context and environmental factors as fundamental aspects of health, which is considered as the ensemble of body functions, body structure, activity and participation. All children should have equal opportunities and capabilities (Sen 1999) and governments, parents, educators and teachers have a fundamental role in building context and environment adequate for children in order to promote their development and well being.

The practice of physical activity in early childhood promotes health with major advantages for the musculo-skeletal system (Janz et al. 2001, 2004) and reduction of the risk of overweight and obesity (Moore et al. 2003; Fischer et al. 2005; Jago et al. 2005). Accordingly, the National Association for Sport and Physical Education (NASPE 2013), the American Heart Association (AHA 2013) and the American Association of Pediatrics (AAP 2013) recommend at least 60 minutes of unstructured physical activity and 30-60 minutes daily structured physical activity of mild to moderate intensity. WHO (2013) recommends that the new European policy framework Health 2020 includes actions to prevent and tackle overweight, obesity and under nutrition, through the development of a physical activity promotion strategy alongside nutrition action plans.

Why is physical activity so important?

The practice of physical education and sport is considered a fundamental right for all since more than three decades (UNESCO 1978).

Practicing physical activity promotes the development of fundamental motor abilities, and to be competent contributes to a better perception of the self. (Haywood, Getchell 2009; Zelazo, Zelazo & Kolb 1972). A motor competent child is more motivated to practice more physical activity for longer time and at higher intensity levels (Hands, Rose, Parker & Larkin 2010; Tortella, Tessaro, Fumagalli 2012; Kjelsas, Sigmundsson, Stensdotter, Haga 2011). Children with low perception of motor competence become less active, may not develop or maintain health-related physical fitness (Wrotniak, Epstein, Dorn 2006) and do not improve motor skill competence (Stodden, Goodway, Langendorfer, Robertson, Rudisill, Garcia & Garcia 2008). In addition, as lack of motor competence is associated to low levels of physical activities, these children are exposed to high risk of obesity that further contributes to a decrease in aerobic fitness and exercise capacity, due to the vicious cycle of inactivity (Knoeplfli et al. 2008)

What is the relation between executive functions and health?

Physical, social, and emotional health contribute to the “well being” of the prefrontal cortex, because stress, lack of sleep, loneliness, lack of exercise, each damage EFs. Prefrontal cortex plays a prominent role in the neural circuit of executive functions (EFs) (Braver, Cohen, & Barch 2002). EFs are also called “*executive control*” or “*cognitive control*”.

Working memory, inhibition, (response inhibition, self-control-resisting temptations and resisting acting impulsively) interference control (selective attention and cognitive inhibition) and cognitive flexibility (to see from different perspectives, to be creative “thinking outside the box”, to adapt quickly to changed circumstances) are considered “*the core EFs*”. (Davidson, Amso, Anderson & Diamond, 2006).

Reasoning, problem solving and planning are built from the higher order EFs (Lunt, Bramham, Morris, Bullock, Selway, Xenitidis & David, 2012).

All these functions are fundamental top down mental processes and are important to every aspect of life.

Why are EFs so important for preschoolers?

Self control and focused attention are critical for school readiness (Morrison, Ponitz & McClelland 2010) and seems to be more associated with school readiness than are IQ (Blair & Razza 2007). Working memory and inhibitory control predict success in math and reading competence from preschool through university (Borella, Carretti & Pelgrina 2010).

It has been reported that children with poor EFs have difficulties in establishing positive teacher-student and child-to-child relations (Hamre & Pianta 2001).

Inhibitory control, early in life is predictive of adult good quality of life. Children who at age of 3-11 had better inhibitory control (were able to wait their turn, less easily distracted, more determined, less impulsive) when adolescent/adult have better physical (less likely to be overweight) and mental health (less addiction problems), earn more, are less likely to commit a crime, and were happier as adults (Moffitt 2011, Diamond 2014).

What are the connections between physical activity and cognitive processes?

With lack of physical health or fitness people may become poorer in reasoning and problem solving, worst in discipline and self-control, lose memory (Chaddock, Pontifex, Hollman & Kramer 2011). Evidences for a bidirectional relationship between physical (aerobic) activities and levels of EFs in children/adolescents has been provided by several authors and data are reviewed in Best (2010).

The relationship between EF and physical activities has been further addressed by Diamond (2012), (Diamond & Lee 2011) who showed that different sport activities produce different outcomes on EFs. The strongest effects are associated to Tae-kwon-Do (Lakes & Hoyt 2004) and weakest with aerobic training (Davis et al. 2011; Kamijo et al. 2011; Tuckman & Hinkle 1986) and yoga (Manjunath & Telles 2001). The reasons why some activities are more potent than other in modifying EF levels is still debated; it has been postulated that practicing dancing sports and movement with music make children happy and proud, address social, cognitive, emotional and physical needs and thus promote the best school outcomes (Diamond 2014).

What can parents and educators do?

The research data strengthens the relevance of physical activity in improving EFs, but also highlight that “quality” rather than “quantity” of physical activity is the real issue (Diamond 2014). Conditions that positively affect and optimize EFs and academic outcomes are the following (Diamond 2013): children must be passionate about the activity and the activity must energize the child to work harder, the educator should be enthusiastic and charismatic to galvanize children’s interest; the children must repeat the experiences, in similar but always more difficult and enthusiastic situations. On the contrary, stresses, sadness, lack of physical health or fitness, loneliness impair EFs (Diamond 2014). It is important for the child to develop the belief, understanding that through effort he/she can succeed and avoid setbacks or failures. (Bandura 1994). In summary, educators should not focus narrowly on academics alone, but also address children emotional, social and physical needs (Diamond 2010, 2013, Diamond & Lee 2011).

Motivation

Despite all recommendations from international organization and the beneficial effects of physical activities on school readiness and on the future quality of life, preschoolers have very little activities based on movement and spend the largest part of their time at kindergarten and at home in sedentary behavior (Cardon, Labarque, Smits & De Boudeaudij 2009). The beliefs of teachers and parents define their practices. In a previous research we analyzed the daily activities of six nurseries of a region of northern Italy, (156 children followed by 20 educators) and compared them with what the educators said about their beliefs and the activities organized for the children. The results demonstrated a great difference between what was perceived as relevant and what was performed, suggesting that a major limitation for adequate motor activity levels in nurseries is the lack of specific education by teachers (Tortella, Callegari, Tessaro, Fumagalli, 2011). Increased education of the teachers on the issue of motor activities and experience improve children levels of physical activity (Dowda, Brown, Melder, Pfeiffer, O’Neill, Addy & al., 2009). Data in the literature also indicate that often the educators

consider motor development and physical fitness less important for children than school readiness (Brown et al. 2009). Rarely teachers encourage children to be physically active and organize activities to increase physical play (Brown et al. 2009). Several authors (De Corby, Halas, Dixon, Wintrup, & Janzen 2005; Morgan & Bourke 2005) point out that teachers are likely to discourage children motor activities because of the fear of accidents, lack of interest, previous negative experiences, insufficient experience in the field of physical activity for preschoolers.

In general there is a common agreement in the literature about the relevance of encouraging the practice of physical activity in children and creating new opportunities involving both teachers and parents.

Methods

Context: a special event (3 hours), dedicated to physical activity for 3-6 years old children, was organized in a kindergarten in a city of Northern Italy. The parents were invited to observe their 45 sons/daughters during the event that was organized by 135 student of the high school (teacher curriculum) of the same institute. The students were divided in 12 groups, each organizing in a selected zone of the garden of the school activities related to dexterity, mobility or balance. The 45 children were also divided in 12 groups, each one playing for 20 minutes in a zone and then moving to a next one till the end of the 3 hours.

Questionnaires were administered to the children parents (45) to investigate on their beliefs about the physical activity for children. Some parents suggested the questions of the questionnaire, highlighting what was important for them.

Results

The questionnaires investigated: 1- education and occupation of the parents; 2- expectation and beliefs of parents about physical activities; 3- activities performed by the children; 4- Involvement of parents in child physical activities.

Table 14.4: education and occupation of the parents.

Mother education	%	Father education	%
Middle school	5.3	Middle school	10.3
High school	42.1	High school	41.0
University	50.0	University	48.7
Post Graduate	2.6	Post Graduate	0.0

Mother occupation	%	Father occupation	%
Housekeeper	2.7	Housekeeper	13.5
Employed (public)	24.3	Employed (public)	40.5
Employed (private)	45.9	Employed (private)	43.2
Self-employed	21.6	Self-employed	0.0
unemployed	5.5	Unemployed	2.8

Expectation and beliefs of parents about physical activities.

Parents find very relevant for their children to practice physical activity (100% relevant/very relevant) and the majority of them (75%) considered that at least 60 to120 minutes should be dedicated to physical activities every day (table 2). Concerning physical activities (PAs) performed at school, 45% of parents considered adequate an engagement of 2 hours/week and 36.4% of parents an engagement of 4 hours/week.

Table 14.5: Parents beliefs about practice of physical activity by children under 6 years.

How is relevant for children under 6 years to practice physical activity	%	How long should the child under 6 y practice physical activity in a day (minutes)	%	How long should the child under 6 y practice physical activity in a kindergarten during a week (minutes)	%
very relevant	18.2	At least 30	15.9	At least 60	9.1
extremely relevant	81,8	At least 60	38.6	At least 120	45.5
		At least 120	36.4	At least 180	9.1
		At least 150	9.1	At least 240	36.3

The majority of the parents considered playing, socialization, movement control and body coordination the most relevant aspects of school PAs. Minor interest was devoted to the learning of a sport discipline and to the possible relaxing aspects of movement (Table 3)

Table 14.6

Relevance of items concerning physical education (min 1- max 5)	1	2	3	4	5
Playing	0	0	11	23	66
Socialization	0	0	2	41	57
Movement control	0	4	8	36	52
Body coordination	0	0	12	36	52
Getting in touch with nature (if nor raining)	0	0	16	36	48
Discipline/self-control	0	7	18	32	43
Sense of rhythm and music	2	9	25	30	34
Learning a sport discipline	5	19	41	20	20
Relaxing	7	5	40	28	20

Data are % of responses

For the majority of the parents fun and positive effects on growth were the item most expected from children PAs (table 4). Expectations were high also for the effects on socialization and discipline. The effects of personal feeling and self-esteem of the child were also positively considered. Parents did not think that PA induced hyperactivity, stress or nervousness nor that children get into competition with each others because of PAs.

Table 14.7: Parents expectations on effects that regular physical activities should elicit on child.

Type of effect	Disagree in total	Disagree in part	Agree in part	Agree	Agree in total
Has fun	0	0	2	27	71
Grows better	0	0	4	30	66
Good for socialization	0	0	2	43	55
Becomes disciplined	0	0	7	42	51
Child is calm and sleeps well	0	2	19	35	44
Feels better	0	2	23	36	39
Acquires self-esteem	0	0	14	52	34
Expresses emotions freely	0	7	20	48	25
Learns to control emotions	2	2	11	61	24
Gets into competition with other children	9	14	34	34	9
Becomes hyperactive	76	21	0	0	3
Becomes stressed	65	26	9	0	0
Becomes nervous	72	25	3	0	0

Data are % of responses

Almost all the parents (table 6) asserted that PA organized by school were good at teaching children to abide the rules and respect the roles and to learn the team spirit and to overcome obstacles (table 5). Few parent considered PA a tool for learning competitiveness and none a cause of aggressiveness, anger, sadness and tenderness.

Table 14.8: Parent expectations of experiences and reactions that the physical activities organized by the school should elicit in child.

Type of experience/reaction	% positive answers
Comply with the rules	86
Team spirit	80
Respect of the roles	77
Overcome obstacles	73
Joy	66
Meeting and knowing other children	66
Self-confidence	59
Know your own limits	55
Collaboration	50
Competitiveness	39
Overcome own limits	32
Altruism	16
Empathy	9
Fear	2
Aggressiveness	0
Anger	0
No special emotion	0
Sadness	0
Tenderness	0

Data are % of responses

About the conditions that may interfere with participation of children to physical activities almost all the parents excluded fatigue and excess of other commitments (Table 6). More likely obstacles may originate from family organization. The majority of parents did not considered TV watching of playing electronic games a real obstacle to dedication to PAs, nor their cost or lack of space/opportunities

Table 14.9: Parent opinion on conditions that hamper child physical activities.

Condition	Disagree in total	Disagree in part	Agree in part	Agree	Agree in total
Too tired	18	27	48	2	5
Children are already busy with many activities	73	18	11	0	0
Family organization does not allow regular physical activities	20	11	36	27	7
Physical activities are expensive	45	30	23	5	0
There are no places or structures for child physical activities	68	23	2	2	5
Child is not interested in physical activities	68	14	9	5	4
Electronic games and TV are preferred by children	50	14	20	9	7
Physical activities at school are enough; child must relax at home	70	30	0	0	0
My child does not like physical activities because I am sedentary	85	8	5	2	0
My child does not like physical activities because they do not have mates to play with.	77	15	3	0	0
I do not like that my son gets dirty as she plays	84	14	2	0	0
I do not like that my child gets dirty as he/she plays	89	9	2	0	0
I found difficult to stop the child watching TV or playing electronic games	70	23	5	2	0

Data are % of responses

The majority part of parents (78%) (table 7) would like to be involved in events of organized motor activities or play with their children at least once a month, for 2 hours, but only a few of them (30%) would like to be involved by the school in projects of PA

for their child (Table 7). Less than half (40%) of the parent expected the school to provide instructions to parents about PA with children. Only 29% wished the school to offer PA opportunities beyond the school day, probably because most of them (82%) found not difficult to organize physical activities outside the school. Almost all of the parents agreed with their partner on the relevance of PA for the child well-being and 2/3 of them considered him/her-self competent for helping child to be physically active.

Table 14.10: Relationship between parents and organization of physical activities for children

Statement	Disagree in total	Disagree in part	Agree in part	Agree	Agree in total
We are parents well trained in helping child to be physically active	52	14	23	9	2
It is difficult to organize with my husband/wife the physical activities of the child outside the school	52	20	16	9	2
I and my husband/wife have different opinions on relevance of physical activities for our child	80	9	6	5	0
I wish the school may offer opportunities of children physical activities beyond the school day	18	30	23	20	9
I wish/expect the school to provide instructions to parents about organization of games aimed at improving physical activity levels of child	12	30	18	38	2
I would like to be involved by the school on physical activity projects for my child	11	25	34	16	14
I would like to be involved in events of organized motor activities/plays with my child at least once a month, for a couple of hours	0	10	12	2	76

NB: Data are % of responses

Activities performed by the children.

One third of the interviewed parents asserted that their children practice PA in playgrounds and sport clubs nearby home for more than 180 minutes during the week, and almost a similar amount of parents referred that children played physically active games only one hour or less during the week (Table 8).

Table 14.11: Physical activity practiced by children during the week in playgrounds, sport clubs, nearby home.

How long in a week does your child practice physical activity in playgrounds, sport clubs, nearby home (minutes)	%
< 60	15.9
= 60	13.6
= 120	15.9
> 120	22.8
> 180	31.8
	100.0

The major part of the parents (table 9) referred that their children watched television and pc for 60 minutes/week and 39% of them for 60 minutes on Saturdays and Sundays. The most part of the time dedicated to watching TV and PC is during week end.

Table 14.12: Time spent watching television or pc in a week or on Saturdays and Sundays.

How long does your child watch television, pc, in a week (minute)	%	How long does your child watch television and pc, on Saturdays and Sundays (minutes)	%
< 60	24.4	< 60	23.3
= 60	55.6	= 60	39.5
= 120	20.0	3= 120	27.9
> 120	0.0	> 120	7.0
= never	0.0	= never	2.3

Parenting: involvement of parents in child physical activities.

Only one third of the parents spent 30 minutes per day walking with the child at least every other day (Table 10). A consistent fraction of the parents did not practice a sport discipline together with the child nor spent a lot of time watching the child playing. In most cases parents physically played with child at home or outside (during the good season) for 30 minutes once or twice a week.

Table 14.13

Day(s) playing sport/physical activities with the child during the week	Never	1 d	2-3 d	4-5 d	5 d
Walking for at least 30 min	19	45	21	10	5
Physical games at home (playing with ball, running, dancing, etc) for at least 30 min	18	28	31	12	11
Physical games outside during the good seasons (playing with ball, running, etc) for at least 30	9	19	43	22	8
Practicing a sport discipline with own child for at least 30 min	57	35	3	5	0
Watching the child during a sport activity	36	40	17	7	0

NB: Data are % of responses

Discussion

The most important aspects related to the physical activity of the children, are for their parents, in order of importance: to play, to coordinate the body, to get in touch with nature, to control physical movement, to develop the physical sense of rhythm and music, to learn a sport discipline, to relax, to grow better. As social aspects they consider important: to socialize, to learn discipline and self control, to comply with the rules, to learn team spirit, to respect the roles, to overcome obstacles, to meet and know other children, to learn to collaborate, altruism; c) As personal aspects they consider: to be fun, to acquire self esteem, to be calm and sleep well, to feel better, to express emotion freely, to learn to control emotions, to improve self confidence, to know and overcome own limits, to improve empathy, to overcome the fear.

All of the parents believe that to practice physical activity is very relevant for the children. The major part of them suggest to practice from 60 to 120 minutes a day of activity but they also assert that their children should practice physical activity in kindergarten at least from 120 to 240 minutes a week. How much physical activity do the children practice? They really practice in playgrounds, sport clubs and nearby home, from 60 to more than 180 minutes physical activity a week.

The parents believe to be well trained in helping children to be physically active; they don't need instruction about physical activity from the school and they don't find it difficult to organize activities outside of school. Father and mother declare to be each others in agreement with the most important aspects of physical activity. The informal moment outside home, in the good season seem to be the best opportunity for practicing physical activity, together with their children.

Parents state that physical activity at school is not enough and that if the son gets dirty while he/she is playing, this is not a problem for them... The major part of parents would like to be involved in events of organized motor activities or play with their children, at least once a month, for 2 hours, but only few of them would like to be involved by school on physical activity projects for their child and wish to get opportunity from the school.

They major part of them don't practice sport with the child, don't watch child playing, and walk at least only 30 minutes with the child, during a week.

Some condition that may hamper physical activity are for parents that the children are

already busy with many activities, there are not places or structures for child physical activities, children are sometimes not interested in physical activities. They don't find physical activities for children expensive.

The results highlights that despite the parents believe physical activity for their children as very important there are some discrepancies between what declared and what practiced. The parents believe to be competent about physical activity but results are very far from the recommendation of the International organization for health. The children seem to move very less respect what recommended. NASPE, AHA, AAP, recommend at least 60 minutes of unstructured physical activity and 30-60 minutes daily structured physical activity of mild to moderate intensity, while the parents say that their children move from 60 to more than 180 minutes, in a week!

It would be very important furthermore to focalize with parents the importance of physical fitness and motor skills development (dexterity, mobility, balance), the need of repeated experiences, the importance of the enjoyment of their children, during the activity and the role of the adults. Parents and educators should be enthusiastic and charismatic to galvanize children's interest. They should encourage children to be physically active and organize activities to increase physical play, motivating the children. Some authors, (Adolph 2012) state that to distribute the time of physical activity is more effective for learning skills than massed practice, and children can utilize every moment, during the day, in kindergarten or at home, to move. It is necessary to promote opportunities for kindergartens and parents, to increase physical activity. Periodic events, like "physical activity days" for children are very positive to develop the passion and the enthusiasm of parents and teachers. If parents are motivated to practice physical activity with their children or to create occasion for them the children became also more motivated (Diamond 2013). Parents usually think that children are active at kindergarten (Brown 2009) and they often don't know what really children do. In the questionnaire there were no questions about the physical activity practiced, during preschool time. The group of parents that helped to organize the questionnaire didn't find a question about the physical activity at kindergarten. We don't know if it may depend on the fact that the parents didn't think important what their children do at kindergarten, or if they didn't know what their children do. There is the common assumption that the children develop following a universal series of increasingly stages (Gesell 1946) but intercultural studies reveal that the development is related to the experiences, the effects

of the socio-cultural context, the effects of the environment and of his/her personal characteristics (Hill & Hurtado 1996).

The present research highlights that the physical activity seems to be intended by parents as a “natural” activity, that doesn’t need to be organized. It is therefore necessary to implement physical educational training to help parents and also preschool teachers to be more responsible of the children development.

As researchers highlight it is necessary that physical activity become a regular activity. The international associations for Health recommend daily activity from all people from 0 to 100! Only a regular practice of physical activity can help children in their development! Parents and teachers must be responsible about their role in physical, cognitive, health development of their children. It is also necessary to create opportunity for appropriate physical education training programs for teachers and parents, to make them aware of the importance of physical activity for health, for physical, social, psychological and cognitive development, in the way to provide the right capabilities for all children. It is necessary to consider physical activity as a fundamental aspect of children development and it requires methodology, regularity, knowledge.

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14 QUESTION C) “IF AND HOW MAY WE DEVELOP COGNITIVE PROCESSES BY MEANS OF PHYSICAL ACTIVITY”?

The following paper is a preliminary theoretical study.

14.4 STUDY 7 - PAPER – MENTE E CORPO NELLA RELAZIONE EDUCATIVA NELLE SCUOLE DELL’INFANZIA: LO SVILUPPO DELLE CAPABILITIES PER UNA BUONA QUALITÀ DELLA VITA/MIND AND BODY IN THE EDUCATIONAL RELATIONSHIP IN KINDERGARDEN: THE DEVELOP OF CAPABILITIES FOR A GOOD QUALITY OF LIFE

Tortella P., *Mente e corpo nella relazione educativa nelle scuole dell’infanzia: lo sviluppo delle capabilities per una buona qualità della vita/Mind and body in the educational relationship in Kindergarden: the develop of capabilities for a good quality of life*, in *Formazione & Insegnamento – European Journal of Research on Education and Teaching*, “Capability approach: Interactions and Practice of Development, (a cura di R. Minello), Lecce, Pensa MultiMedia, marzo 2013, 1, 121-125.

23-25 ottobre 2013, Tortella P, *Congress Lifelong Learning Programme*, Bucarest, Romania

Abstract

Infancy is a period of total dependence by adults. To provide the capabilities correlated to welfare is necessary to point the attention on environment on space organization, and on social-cultural context, key factors in the development processes, according to the ecological perspective. The period 0-6 is considered “the imprinting” for his consequences on the development and on health. Cross cultural studies highlights how motor skills are depending on experience. Different types of children’s care provide different development. It is important to promote physical activity in kindergarden, where Italian children stay a lot of time, in order to improve health, to foresee dangers, prevent chronic disease.

The beliefs of teachers have a very important role in children development. The aim of the research are: 1. to know the beliefs of teachers about motor development; 2. to know how teachers organize motor activity and environment in kindergarten of Italy; 3. to define a theory body-mind of teachers; 4. to promote motor activity in kindergarten; 5. to help teachers to project “evidence based” motor activities .

L’infanzia è un periodo di totale dipendenza dagli adulti. Il periodo 0-6 è considerato di “imprinting” per le sue conseguenze nello sviluppo e nella salute. Le *capabilities* per promuovere il benessere si sviluppano tenendo conto di ambiente fisico e di contesto socio-relazionale, elementi fondamentali per lo sviluppo, secondo la prospettiva ecologica. Studi cross-culturali mettono in luce quanto le competenze motorie siano dipendenti dall’esperienza. Differenti tipi di cura del bambino promuovono bambini differenti. E’ importante promuovere l’attività motoria nelle scuole dell’infanzia, dove i bambini italiani trascorrono molto del loro tempo al fine di migliorare la salute, la capacità di prevedere pericoli, prevenire la malattia cronica. Le pratiche di cura delle insegnanti sono guidate dalle loro credenze e teorie. L’obiettivo di questa ricerca è: 1. conoscere le credenze e le teorie degli insegnanti sullo sviluppo motorio; 2. conoscere come loro organizzano l’attività motoria e l’ambiente delle scuole dell’infanzia; 3. definire una teoria corpo-mente nella relazione educativa; 4. promuovere la pratica dell’attività motoria nelle scuole dell’infanzia; 5. favorire negli insegnanti la capacità di progettare attività motorie “evidence based”.

Introduzione

Amartya Sen (2011) utilizza il concetto di *capabilities* come capacità e capacitazioni che permettono il raggiungimento di *funzionamenti* di rilievo, quali ad esempio la scelta della “migliore vita possibile”. La sua prospettiva che tutela gli aspetti centrali dei diritti umani pone l’attenzione sulla necessità di promuovere benessere generale soprattutto per gli svantaggiati. Sen intende il soggetto svantaggiato colui/colei che non dispone di *capabilities* per acquisire ciò di cui ha bisogno o addirittura non ne conosce l’esistenza. *Qualità della vita* significa per l’economista stare bene e avere la libertà di acquisire lo “stare bene”. Nussbaum (2002) ha predisposto un decalogo di capacità umane includendo

salute (capacità di stare bene), corpo (capacità di curarsi del proprio corpo), gioco e piacere (capacità di provare piacere per ciò che si fa e di giocare) quali aspetti fondanti la qualità della vita sin dalla prima infanzia. L'infanzia, momento di "imprinting" del cervello (Storfer, 1999), è una condizione in cui libertà e *capabilities* spesso mancano, in cui il bimbo è totalmente dipendente dalla figura adulta e dall'ambiente.

Il tema della *salute*, in particolare, è stato affrontato anche dall'O.M.S. che la intende come condizione di completo benessere fisico, mentale, sociale. L'I.C.F., International Classification Functioning (2002), è una classificazione che descrive lo stato di salute delle persone nel loro contesto ambientale utilizzando come indicatori attività e partecipazione dei soggetti. *Ambiente fisico* e *contesto socio-relazionale* sono strettamente correlati con le opportunità del soggetto di attività e partecipazione.

L'ambiente fisico può favorire o rendere difficile il realizzarsi di determinati comportamenti motori, cognitivi, sociali, affettivo-relazionali. È stato osservato che la disposizione dei materiali all'interno di una stanza promuove comportamenti motori analoghi in gruppi di bambini dai 3 ai 6 anni che frequentano lo spazio in momenti diversi e in condizione di gioco libero. Al variare della disposizione dei medesimi materiali i gruppi di bambini variano comportamento in modo omogeneo, riproducendo lo stesso comportamento, in sincronia, pur utilizzando lo spazio in momenti diversi. (Tortella, Tessaro & Fumagalli, 2011).

Il contesto socio-relazionale, in particolare la presenza di compagni e l'interazione con un educatore influisce in maniera determinante sia nello sviluppo delle competenze sociali e relazionali che in quelle motorie. L'atteggiamento dell'educatore può, infatti, modificare le *affordances* dei bambini anche rispetto a un compito motorio, la percezione delle proprie capacità e modificare il loro senso di autoefficacia, incrementando la motivazione ad apprendere (Tortella, Tessaro & Fumagalli, 2012 a).

La pratica di attività di movimento è particolarmente importante per la sua funzione di prevenzione di patologie cardiocircolatorie, endocrinologiche, osteoarticolari in età adulta, correlate con l'obesità infantile, cui si associa la mancanza di attività motoria (WHO, 2007). L'attività motoria può contribuire anche a migliorare la depressione e altre patologie psicologiche (Paluska, & Schwenk, 2000).

Capabilities e infanzia

L'infanzia è il periodo più critico per lo sviluppo delle capacità fondamentali della persona. L'intrecciarsi di aspetti dello sviluppo cognitivo- affettivo-socio-relazionale-motorio, è strettamente dipendente dalle persone che curano il bambino/a (Kartner, Keller & Chaudhary, 2010).

Attraverso gli studi cross-culturali (Keller, 2007) viene messo in risalto che la scelta delle competenze da sviluppare in un bambino/a è strettamente legata a fattori culturali, sociali, ambientali. Le modalità di cura e di educazione dei piccoli si sviluppano a partire dai valori culturali, dalle pratiche, dalle credenze.

L'adulto è mediatore di significati e di esperienze e il suo comportamento, ad esempio durante il gioco influisce sull'esperienza del piccolo/a. Lavelli (2007) evidenzia che nella nostra società occidentale chi accudisce il piccolo/a di sei, nove mesi mentre gioca con un oggetto, tende a orientare l'attenzione verso l'oggetto stesso, spiegando al bimbo/a alcune sue caratteristiche e mostrandogli ripetutamente come funziona. Questo tipo di comportamento che Bruner (1987) e Kaye (1989) definiscono *scaffolding* sviluppa nel bambino/a la capacità di spostare l'attenzione dall'oggetto all'adulto che si cura di lui e di iniziare a comprendere le sue intenzioni. Trevarthen e Hubley (2007) considerano questo comportamento sociale *intersoggettività secondaria*. Attraverso questa tappa dello sviluppo sociale il bambino/a inizia a comprendere gli stati affettivo-emozionali dell'adulto ponendo le basi alla capacità di cooperare con gli altri (2007).

Keller (2012) evidenzia che nelle comunità rurali l'obiettivo educativo perseguito è di *autonomia di azione*, mentre nelle società occidentali di *autonomia psicologica*. Le conseguenze nello sviluppo del bambino/a sono tempi diversi di sviluppo delle capacità. Anche gli studi di Hill e Hurtado (1996) evidenziano che lo sviluppo motorio avviene in tempi molto differenti a seconda del tipo di esperienza vissuta dal bambino/a. I bambini/e delle comunità Nso del Camerun (Keller, 2007) iniziano a camminare mediamente a 8 mesi, i piccoli del gruppo Ache' dell'Equador fanno i primi passi a 24 mesi, nella nostra società occidentale a 12 mesi. La differenza di tempi è dovuta a diversità di pratiche di cura e ambiente.

Gli effetti sullo sviluppo motorio del contesto socio-culturale sono visibili sin dalla primissima infanzia, ma proseguono anche nei livelli di scolarizzazione successiva. I bambini, in Italia, trascorrono gran parte della loro giornata nelle scuole dell'infanzia.

Nonostante WHO (2007) e OMS raccomandino un'ora al giorno di attività motoria per lo sviluppo di sane abitudini di vita le attività di movimento vengono considerate soprattutto strumento per lo sviluppo dei processi cognitivi, emozionali, affettivi, e poco considerate come elemento preventivo per la promozione della salute dei piccoli (Indicazioni Nazionali del Curricolo per l'infanzia, 2012).

Le ricerche Save the children, (2012) evidenziano che in Italia il 73% dei genitori dichiara che i propri figli trascorrono pochissimo tempo all'aperto, per mancanza di spazi e di sicurezza e che un bambino su quattro trascorre almeno 3 ore al giorno davanti alla televisione o al computer. Le opportunità di movimento in orario extra scolastico, per bambini in età prescolare sono pochissime e giudicate troppo costose per un quinto dei bambini italiani. I genitori del 57% di bambini obesi o in sovrappeso e poco attivi non credono sia necessario che i propri figli pratichino maggiore attività motoria (2012). Anche quando vi sono le possibilità per la pratica di attività di movimento i bambini e i ragazzi preferiscono attività sedentarie (Vara & Epstein, 1993), suggerendo che nonostante l'infanzia sia un periodo molto cruciale per lo sviluppo di un comportamento attivo la consapevolezza dell'importanza preventiva dell'attività motoria per la salute è molto bassa, nonostante le raccomandazioni (Trost & Loprinzi, 2008; WHO, 2007). Le scuole sembrano incontrare difficoltà nell'utilizzo dell'attività motoria per la promozione della salute anche per problemi dovuti a difficoltà degli insegnanti per: impreparazione, timore di incidenti, mancanza di interesse e di esperienza nell'attività motoria con i bambini, esperienze precedenti negative, insufficiente livello di conoscenza e esperienza (De Corby, Halas, Dixon, Wintrup, & Janzen, 2005; Morgan & Bourke, 2005).

La letteratura relativa alla strutturazione di ambienti facilitanti l'attività motoria è molto scarsa (Moore et al., 2010), soprattutto in Italia.

Anche Boscolo (1997) è concorde nell'affermare che le credenze di genitori e insegnanti determinano i comportamenti e gli atteggiamenti con i bambini. Anche le conoscenze influiscono sulle pratiche, come messo in evidenza da uno studio di Tortella, Tessaro & Fumagalli, (2012b) realizzato negli asili nido del Trentino, che mette in risalto un'incongruenza tra gli obiettivi di sviluppo dei bambini dei nidi dichiarati come perseguiti dalle educatrici e quelli effettivamente perseguiti attraverso le attività realizzate.

Problema

La mancata considerazione del valore del corpo e del movimento ai fini della promozione e del mantenimento della salute integrale della persona comporta un vuoto di pratiche in ambito educativo e di cura.

Nell'ottica di promuovere una buona qualità della vita, come prospettato da Amartya Sen (2011) sembra indispensabile osservare lo sviluppo dei funzionamenti fondamentali già in tenera età. I bambini/e in età prescolare trascorrono molte ore della loro giornata nelle scuole dell'infanzia e questo tempo, per molti di loro rappresenta l'unica opportunità di movimento e di gioco con coetanei. Il periodo infantile in età 3-6 anni spesso viene sottovalutato e considerato da genitori e insegnanti secondo una prospettiva "maturazionista" (Cristofoli, 2012) che considera il bambino/a un soggetto che cresce esclusivamente secondo tempi biologici e che non tiene conto di influenza di ambiente fisico e socio-relazionale. Sembra mancare il riconoscimento dell'importanza dello sviluppo dei processi motori nei bambini/e e anche i libri sull'argomento sono per lo più fondati su credenze e pratiche culturali che su dati di ricerca (Klingberg, 2013).

Nel 2010 il numero di bambini/e sotto ai cinque anni di età in condizioni di obesità e sovrappeso è stato stimato in 42 milioni, di cui 35 milioni appartenenti a paesi in via di sviluppo. Bambini/e obesi e in sovrappeso tendono a rimanere obesi e in sovrappeso anche da adulti e hanno una altissima probabilità di contrarre patologie molto gravi (WHO, 2013).

Nonostante l'O.M.S. stia avviando una campagna per la promozione dell'attività fisica e di uno stile di vita sano negli ambienti educativi le credenze, abitudini e pratiche ne sottovalutano ancora l'importanza.

Si ritiene allora importante avviare un percorso di ricerca-azione con le insegnanti delle scuole dell'infanzia, al fine di dare valore alle loro pratiche e di contribuire all'elevazione della consapevolezza e della conoscenza relativa all'importanza dello sviluppo motorio in un'ottica integrale di sviluppo affinché le *capabilities* possano essere promosse sin dalla prima infanzia.

Quali sono le teorie implicite ed esplicite delle insegnanti delle scuole dell'infanzia rispetto allo sviluppo motorio del bambino/a? Quale relazione sussiste tra sviluppo motorio e sviluppo cognitivo e sociale, nelle istituzioni osservate? Quali sono le credenze

e le pratiche messe in atto nelle scuole dell'infanzia? Come riuscire a promuovere percorsi riflessivi per le insegnanti sulla pratica dell'attività motoria?

Ipotesi

Le insegnanti delle scuole dell'infanzia considerano lo sviluppo motorio del bambino/a un evento naturale, che procede per fasi, per maturazione biologica, indipendente dalle esperienze e dall'ambiente fisico e socio relazionale. Corpo e movimento sono visti come strumenti utili per perseguire competenze cognitive, affettive, sociali ma nella pratica mancano progettazione delle attività e chiara consapevolezza degli obiettivi da perseguire. Non si attribuisce la dovuta importanza alle pratiche legate alla corporeità e al movimento in relazione alla promozione di salute, di sane abitudini di vita, in funzione di una buona qualità della vita. Un percorso di ricerca-azione può contribuire ad una maggiore consapevolezza e conoscenza delle insegnanti e dei genitori sul tema dello sviluppo motorio-corporeo dei bambini/e.

Metodologia

Si attiva un percorso di ricerca-azione con complessivamente 35 scuole dell'infanzia delle città di Verona, Treviso e Ferrara.

Analisi dei dati mediante Grounded Theory (Glaser & Strauss, 1967).

Strumenti

Manuale distribuito alle insegnanti con un progetto di attività motoria da realizzare

Interviste a genitori e insegnanti

Focus group

Diario (insegnanti)

Piattaforma web di raccordo tra le varie scuole e le diverse città.

Richiesta finale di produzione di due incontri di attività motoria che serviranno per proporre nuovi percorsi ad altre insegnanti.

Risultati attesi

Ci si attende di:

- a) promuovere lo sviluppo di processi di pensiero che aiutino le insegnanti a ragionare in una logica evidence based nelle loro proposte didattiche;
- b) elevare la consapevolezza dei genitori sull'importanza degli aspetti legati allo sviluppo motorio del bambino/a.
- c) conoscere le teorie implicite ed esplicite dei genitori e le pratiche messe in atto rispetto allo sviluppo motorio dei loro bimbi/e;
- d) costruire una teoria riguardante le concezioni implicite ed esplicite delle insegnanti delle scuole dell'infanzia, rispetto alle attività di movimento.

Altre considerazioni

La triangolazione (Tessaro, 2002, 2011) di osservazioni (educatrici, genitori, ricercatrici) aiuta a comprendere meglio i diversi effetti del contesto nei bambini/e. La ricerca permette anche, come effetto secondario, di: 1. conoscere le pratiche domestiche di cura dei figli/e, rispetto allo sviluppo motorio anche di famiglie straniere residenti nel territorio.

Ai genitori verranno chieste le autorizzazioni per poter video riprendere i bambini/e durante le normali attività educative.

Conclusioni

Il presente lavoro si colloca entro un vuoto di conoscenze relative alla relazione educativa nelle scuole dell'infanzia, riferita allo sviluppo motorio. Gli studi evidenziando quanto

esso sia essenziale per lo sviluppo globale della persona per favorire la piena realizzazione delle capabilities dei bambini/e.

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14 QUESTION C: “IF AND HOW MAY WE DEVELOP COGNITIVE PROCESSES BY MEANS OF PHYSICAL ACTIVITY ”?

This is a theoretical approach at the question

14.5 STUDY 8 - PAPER – HOW CAN TEACHERS CONTRIBUTE TO DEVELOP EXECUTIVE FUNCTIONS THROUGH MOTOR ACTIVITY?

Tortella P., Fumagalli G., Tessaro F., *How can teachers contribute to develop executive functions through motor activity?* Margiotta U., Raffaghelli J., Saulescu E., Icleanu R. (Editors), Proceedings of the *International Conference: transforming the educational relationship: intergenerational and family learning for the lifelong learning society, Lifelong Learning Programme, (2013)* pp. 204-209;

Key Words

Motor activity, children, executive functions, proximal zone, playground

Abstract

Why are executive functions so important? Can motor activity contribute to develop the executive functions? How can teachers help children in improving their school readiness? The aim of this work is to investigate on these questions and to study 5 years old children after ten weeks of motor activity program in a playground.

Introduction

Why are executive functions so important? Can motor activity contribute to develop the executive functions? Executive functions (EFs) are control functions needed when we

have to concentrate, think and avoid to act on impulse. These functions depend on a neural circuit in which the prefrontal cortex plays a fundamental role (Anderson, Jacobs & Anderson, 2008; Bialystok & Craik, 2005; Lunt et al., 2012). The EFs are: inhibition (inhibitory control), working memory, cognitive flexibility, (Miyake et al., 2000) reasoning, problem solving and planning (Christoff, Ream, Geddes & Gabrieli, 2003; Collins & Koechin, 2012; Lunt et al., 2012). They predict school readiness, academic success, career, (Prince et al., 2007) marriage, (Eakin et al., 2004) mental and physical health (Dunn et al., 2010; Kusche, Cook & Greenberg, 1993). EFs predict success in math and reading throughout all school years (Gathercole et al., 2004).

There is scientific evidence supporting the approaches of aerobic exercise, martial arts and exercising bimanual coordination for improving EFs in the early school years (Hillman et al., 2008; Chaddock, et al., 2011). There are not yet studies of the benefit of sports for EFs, and is reasonable to think that sport might be very benefit, thanks to challenge EFs (requiring sustained attention, working memory), (Diamond, 2011).

How can teachers help children in improving their school readiness?

Teachers have an important role in improving executive functions. Some fundamental aspects of teaching are: presenting a new challenge when a child is ready for a new one, invite children to take turns instructing or checking one another, helping children when they get upset to stop, to say what the problem is and how they feel and invite them to construct an action plan, implement clearer rules and routines, reward positive behavior, and redirect negative behavior, encouraging the developing of verbally skilled strategies for emotion regulation, repeating practices to produce the benefits, inviting children to wait to play until another child is finished (Diamond, 2011). It is fundamental to know that exercise plus character development are efficacious in improving EFs (Lakes & Hoyt, 2004).

Public school curricula play an important role in preschool children development, particularly in intervening early to improve EFs. Loneliness (Cacioppo & Patrick, 2008), stress (Arnsten, 1998) and lack of physical fitness (Hillman, Erickson & Kramer, 2008) impair prefrontal cortex function and EFs. To improve EFs and school outcomes is necessary to engage children's passionate interests, bringing them joy and pride, giving

them a sense of belonging and social acceptance, and opportunities to repeatedly practice EFs at progressively more-advanced levels.

The playground, a space for improving motor skills and EFs.

To improve health and motor activity is important to propose spaces and opportunity of activity. Play in outdoor spaces improves the welfare of children (Ginsburg, K., R. 2007) and particularly stay in green park improve children's attention and concentration skills. Significant experiences depend on frequency, intensity and duration of the motor activity (Klingberg et al., 2005).

Some studies of Tortella et al. (2012) reveal that child perception of difficult in free or structured motor tasks affects on the level of his motivation and self efficacy.

Excessive requests produce frustration and abandonment of the game. The educator can help the child both by modifying the organization of the tools in the environment, changing the spaces and by scaffolding children in proximal zone (Vygotskij, 1978).

Lakes & Hoyt (2004) show that motor activity contributes to cognitive development (executive functions) when motor activity is associated with awareness and meta cognitive processes. the largest increase of executive functions level has been noticed during formal, non formal and informal activities, accompanied by passion and enthusiasm (Hirt, Devers, & McCrea, 2008). Our study is held in a playground near Treviso, a special space called Primo Sport 0246. The concept of the park is for providing motor development in children from 0 to 6 y. old. It is structured in functional areas of motor skills (balance, manuality, mobility) (Tortella, et al., 2011).

How can motor activity provide the development of executive functions in children?

Young children show notable gains in their abilities to volitionally control their attention, impulses, thoughts and emotions across early childhood (Blair & Diamond, 2002, 2007, 2008; Hughes & Ensor, 2011).

Motor activities promoting autonomy through EF lens, activities practiced in small groups, activities scaffolded 1:1 coaching, help the development of EFs (Zelazo, 2013). Better EFs are shown when we are happy, physically fit and feel socially supported (Diamond, 2012).

Methodology

In this paper we wrote the design of the research, we are conducting.

Five kindergartens of Treviso (north Italy) with 190 children of 4-5 years old are involved:

- A Experimental group of 5 y old children (n. 40) is attending the playground 10 weeks, 2 hours each time; each session is organized in 30 minutes of free play and 30 minutes of structured play;
- B control group of 5 y old children (40) who is not coming in the playground;
- C control group (n. 40, 5 y old children) who is coming in the playground 10 weeks, 2 hours each time; each session is organized in 30 minutes of free play and 30 minutes of structured play;

The educators:

- help children of group A to play in proximal zone (Vygotskij, 1978);
- Tell the children (only group A) to observe the activity of another child and to start his activity when the other child has arrived to a certain point.
- Children are educated to wait.

Children are measured with pre and post motor and cognitive tasks, after 10 weeks: ABC movement test (Henderson, Sugden, & Barnett 2007), II edition; Tortella and Fumagalli motor and cognitive tests; day night test (Gerstadt, Hong, Diamond, 1994), Haga tests (2009).

Questionnaire are administered to parents and teachers. Focus groups are made with parents and teachers.

Conclusions

With this study we propose to compare to groups of children of 5 y old after a period of ten weeks of different methodology of motor activity. We assume to obtain improvement in EFs and in motor skills in group A, thanks to the different educational style of the teacher, in line with the premises.

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14 QUESTION C: “IF AND HOW MAY WE DEVELOP COGNITIVE PROCESSES BY MEANS OF PHYSICAL ACTIVITY”?

14.6 STUDY 9 – ARE THERE IMPROVEMENTS OF COGNITIVE PROCESSES WITH THE ACTIVITIES AT THE PLAYGROUND?

The ability to suppress a non desirable behavior and to answer in an appropriate way is very important in real life and children with ADHD are the example of the consequences of lack of it (Diamond, 2013). In literature this is referred to inhibitory control, sometimes called interference control (MacLeod, 1991). Interference control is consider the ability to suppress a dominant response related to perceptual stimuli while selecting and executing in the task a competing conflicting subdominant response (Diamond, 2010; Barkley, 1997; Kipp, 2005); this ability is included in the set of executive functions.. For young children the most widely use task to measure interference control is the Day-Night test (D&N; Gerstadt et al., 1994), generally suitable for children age 3.5-7.

In our study the children were 5 years old; the details of the test are described in the methodological chapter. Here I present the preliminary results obtained with this test; note that the data are from a very limited number of children and that, for a better evaluation of the ability, other tests should be associated to the D&N . On the other hand, this preliminary study is interesting as a starting point for the discussion.

The tests are administered to children coming at the playground once for week for 10 weeks; the children were exposed to 30 min of structured activity and to 30 min of free play (Experimental) or to 60 min of free play (Free Play). I also tested children of schools that did not come to the playground (Control). Number of errors in the D&N test were measured in individual session in a quiet room at the child’s school; I measured the responses before (PRE) and at the end (POST) of the 10 visits to the park (or at similar dates for the schools that did not come to the park). In this presentation I anticipate some of the results obtained from children evaluated with D&N test only (sub-study 1) or comparing results obtained with the D&N test and with the performance at a very difficult balance test (sub-study 2)

Pitfalls of the study

Only the number of errors in D&N test was considered and not the time of execution; this was a limit since that time required for answering is probably a sensitive parameter for evaluation of 5 years old children.

In addition it must be considered that the children population we dealt with was very heterogeneous in terms of cultural and physical predisposition. Several times I found difficult to explain the task to children that were speaking little Italian: in these cases it was difficult to determine whether they had difficulties with the language, with the task, or with their cultural habits. Diamond et al. (2007) suggest that language skills sometimes positively relate to D&N accuracy. Some children of different cultures, especially coming from Ghana, Nigeria were speaking a good Italian. After explaining them that they had to tell me “day” when I showed them the moon and “night” when I showed them the sun, they looked at me, laughing slightly, continuing to observe me, and told me repeatedly day when they saw the sun and night when they saw the moon. Other children told me: "But this is the sun, it means “day” not night". I explained them that it was a rule of the play and that every play has a rule, but he/she did not agree and did not perform well. I also tried, during the practical trials to ask the children how they said “moon, sun, day, night” in their language, but I was not sure that this helped their understanding.

I excluded from the analysis those cases where such biases were evident, but sometimes it was really difficult to reach a conclusion.

Sub-study 1)

The data shown in table a are from children of the 2013 and 2014 groups; I included in the analysis only the children that were also assessed in all other motor tasks. For this reason the number of children is limited as compared to the total available population of the two years. However it is interesting to observe that both the experimental and control group showed a significant improvement in the task. The improvement in the free play group was not significant.

Evaluation of changes cognitive skills

Day & Night test table a					
	n	Pre	Post	Pre - Post	p of
Pre vs Post					
Experimental 0.004	44	5.02 ± 0.08	2.33 ± 0.48	2.76 ± 0.91	
Free Play n.s	52	4.51 ± 0.74	3.84 ± 0.69	0.67 ± 0.80	
Control 0.004	45	5.84 ± 0.88	2.91 ± 0.48	2.94 ± 1.10	

- 1) All the “pre” values are not statistically different
- 2) The post” values of Experimental and Control are not statistically different
- 3) The “post” value of Free Play is slightly different from Experimental (p. 0.058)

Table 14.1

The means ± s.e. of the Experimental group declines from 5.02 to 2.33; the decrease of number of errors suggests an improvement of the inhibition function. A similar result occurred in the Control group, from 5.84 to 2.91. The improvement of the Free Play group was statistically not significant. From the data it is impossible to identify a cause-effect relationship between physical training and changes in executive function (as assessed by the D&N test).

As a theoretical exercise, we may speculate that the improvement in the Experimental group may be due to physical activity and in the control group to other situations that occurred at school that we don't know. The free play did not increase significant and in this case we may argue that free play is not useful to increase inhibitory control. We may also argue that the improvement both in the experimental and in the control school may be due to other aspects associated to the activities they did in the playground ad at school, such as something in the methodology of teaching or some qualitative aspects of the activities they performed. Anyway, while we can argue that during free play there was not improvement of inhibitory control in the other two conditions it is necessary to repeat the study with other experimental conditions, in accordance with the literature, looking at possible cause.

Sub-study 2)

Then I compared the number of errors done by children in the D&N test with their capacity to walk on the spring bar. As explained before, this is a very difficult task that required scaffolding for climbing and walking on a mobile bar (spring bar). I considered only the children that climbed on the bar and then I considered their capacity to walk along the bar; by this approach the children can be divided in “able” and “not able”; children that were able at PRE test were also able at POST test; children that were not able at PRE test were either able or (still) not able at POST test.

Only children of the 2014 group were considered. The data are shown in table 14.2.

I found that both the results at D&N test and the capacity to walk along the spring bar increased in all the groups. The % of children that were able to walk on the bar increased in all three groups and was 100% in the Experimental group. The number of D&N errors done by children that were able to walk at the POST test decreased significantly in both the control and experimental group (see row “Able at test” in columns POST). The children that were able to walk at POST test in the Experimental group did 2.20 errors at the D&N test; those of the Control group did 2.65 and those of the Free Play did 3.15 errors. We also wanted to know whether the initial performance on the spring bar had any correlation with the ability to perform the D&N test three month later, when the tests were repeated at the end of the experiments.

Structured activity: The children who were already able to walk at PRE test did 4.90 at PRE test and improved to did 2.71 three months later. Their companions who were not able to walk on the spring bar at the PRE test made 4.64 errors at PRE test and only 1.22 errors three month later (POST column)

Table B	Structured activity		Free Play		Control	
n. of children	49		51		59	
	PRE	POST	PRE	POST	PRE	POST
Able to walk on the spring bar %	63.6	100.0	47.1	62.7	49.1	77.9
Day & Night n. errors						
All	4.81±0.7	2.20±0.4	4.50±0.7	3.54±0.6	6.15±0.8	3.00±0.5
Able at test	4.90±1.1	2.20±0.4	3.62±0.9	3.15±0.8	6.88±1.3	2.65±0.5
Not able at test	4.64±1.0	All able	5.30±0	3.47±1.1	6.24±1.2	4.23±1.3
Able at PRE test		2.71±0.6		3.54 ± 0.8		3.00 ± 0.7
Not able at PRE test		1.22±0.3		3.55 ± 0.9		2.66 ± 0.6
ALL						
NOT able at PRE test while at POST test:						
Able		1.22 ± 0.3 all able		3.42 ± 1.0		1.93 ± 0.6
Still not able				3.69 ± 0.5		3.40 ± 1.5
Time at spring bar	69.2 ± 3.8	29.6 ± 2.0	71.8 ± 5.7	48.8 ± 3.9	69.6 ± 3.0	51.6 ± 3.3
Errors at spring bar	5.28 ± 0.2	3.97 ± 0.9	5.91 ± 0.5	4.65 ± 0.4	5.73 ± 0.4	4.91 ± 0.3

Notes:

Able at test: a child that was able to perform the balance task on the elastic beam

Not able at test: a child that was not able to perform the balance task on the elastic beam

Able at PRE test: the data collected at POST are referred to those children that were able to perform the balance task on the elastic beam

NOT able PRE test and at POST testable/still not able: the data collected at POST are referred to those children that were NOT able to perform the balance task on the elastic beam at PRE test and that at time of POST test were either able or still unable to perform the balance task.

Table 14.2

Free play: Children who were able to walk on the bar at PRE test (47.1% of the children of the group) did 3.62 at the first D&N test and 3.15 three months later. The children that were not able to walk on the bar at the beginning of the study did 5.30 errors on the D&N test; when I examined them three month later I divided them in two groups: those that had learned to walk on the bar and those that did not. The first made 3.42 errors, the second subgroup (still not able) made 3.69 errors at the final D&N test.

Control: Children not able to walk on the spring bar at pre test and able at post test made 6.88 errors at PRE test for D&N test and 3.00 at the POST test; children who were not able to walk at pre test but have learned to do it, moved their D&N errors from 6.24 to 1.93; those who did not learn the balance task changed the B&N results to 3.40.

In conclusion it seems that that a more relevant increase in day/night test performance occurred in children who became able to perform the difficult balance task at the end of 10 weeks, independently from the physical activity program they were exposed to.

The numbers of children examined in the various conditions was not sufficient to allow us to argue evidence, but it is anyway an important stimulus for reasoning and planning next research. The preliminary results are insufficient but are however representative of the actual findings, that are opening the question of the role of physical activity and other components in cognitive processes. Also in this case more observations are required as well as refinement of the procedure during the test.

Sub-study 3

As a further analysis on the possible role of training/educational procedures employed for the physical activity in modifying executive functions (as assessed by the D&N test), we examined the effects of two related educational approaches to address difficult balance task.

Indeed, the children of two schools participating to the 2014 research project received two different approaches when facing the difficult balance task of the spring bar. Both the groups of children were scaffolded by the physical educator during the activity at the bar, but the scaffolding was different for the two schools.

School 1: the children were scaffolded to climb the beam; after that the physical educator moved apart and never encouraged them. He/she never told to the children: “Fantastic! You are very good!” The physical educator only told them: “ok, you can see that you are learning”.

School 2: the children were scaffolded to climb the beam; then the physical educator provided continuous encouragement by systematically saying: “Fantastic, you are very good! You see that you can learn everything, very very good!; what a beautiful jump! And others”

The data from the two schools are shown in Table c

Table c

	Structured activity					
	Total of 2 schools		School 1		School 2	
	49		24		25	
n. of children	PRE	POST	PRE	POST	PRE	POST
% Able to walk on the spring bar	65.3	100.0	53.2	100	76.0	100
Day & Night n. errors						
All	4.81 ± 0.7	2.20 ± 0.4	4.25 ± 0.9	2.79 ± 0.8	5.36 ± 1.1	1.64 ± 0.3
Able at test	4.90 ± 1.1	2.20 ± 0.4	3.84 ± 1.4	2.79 ± 0.8	5.63 ± 1.4	1.64 ± 0.3
Not able at test	4.64 ± 1.0	all able	4.72 ± 1.3	all able	4.50 ± 1.9	all able
Time at spring bar	69.2 ± 3.8	29.6 ± 2.0	64.0 ± 5.9	30.1 ± 2.5	72.8 ± 5.8	29.2 ± 2.5
Errors at spring bar	5.28 ± 0.2	3.97 ± 0.9	5.30 ± 0.6	2.95 ± 0.3	5.26 ± 0.3	4.96 ± 1.7

Table 14.3

Although the number of children is still too low to obtain conclusive data, it is interesting to note that children of school 2 (children scaffolded with encouragement) obtained in their D&N test better results (1.64 for school 2 and 2.79 for school 1) and a larger improvement (difference between pre and post was 3.72 for school 2 and 1.46 for school 1)

Concerning the improvement in the performance on the balance task, school 2 performed in terms of time and improvement of time required for walking the bar (pre 72.8 post 29.2) of school 1 (pre 64.0 post 30.1), whereas school 1 performed better in terms of n. of errors at the bar.

Although the data may suggest that some correlation may exist between the improvements of D&N and spring bar balance tests as a function of the physical activity teaching protocol used, we need more data and controls to reach the validity of the suggestions.

Conclusions

Our preliminary results indicate that the correlation between executive functions and the acquisition of gross motor skills are very difficult to be determined. On the other hand

they also suggest that different educational approaches to the acquisition of difficult motor task may affect also maturation of executive function. Along this indication I will continue and plan my future researches.

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14.7 STUDY 10 - FOCUS GROUP WITH THE TEACHERS OF PRIMARIES SCHOOLS.

I organized a focus group with the teachers (n. 16) of a primary schools attended by the children that the two years before were participating to the project in the playground PRIMO SPORT 0246.

The teachers were asked if they found some differences between children that were attending the playground two years before and other children in the classroom, related to school readiness (first and second class of primary school).

The statements of the teachers during focus group were recorded. Categories of the several concepts were built and the following are the results. I report more information in the Italian version, in the following chapter.

Executive Functions
Better school readiness
better to draw
Able to wait
Memory
Autonomy (able to organize themselves alone and in group)
Creativity (Memmert, 2011).
Special orientation
Able to learn how to learn
Other cognitive functions
Empathic abilities → theory of mind
Changes in behavior
Active participation, very propositive
Following changes in teacher's behavior
Following changes in parent's behavior
Motor development
Development of motor skills and in body schema

In another preliminary study a questionnaire was administered to two teachers of two classes of primary schools (first class) in a little town close to Mantua, that were attended by the children that participated the year before to a special motor training program. The teachers were asked to give a score to each children of the class, referring to the following skills. The teachers did not know which children participated to the program the previous year and both the teachers were teaching in both the two classes (Baggio et al., 2013). Following there are the results. The teachers attribute more competences to children that the previous year participated to the motor program, than to the other children. They notices better performance, especially in spatial orientation, collaboration with other children, respect for the rules, ability to wait, attention, draw.

It is interesting to notice that the results are in line with the previous focus group results and these may be interesting preliminary date. It would be interested to further investigate on these specific aspects highlighted by the teachers.

Results of the questionnaires to teachers.

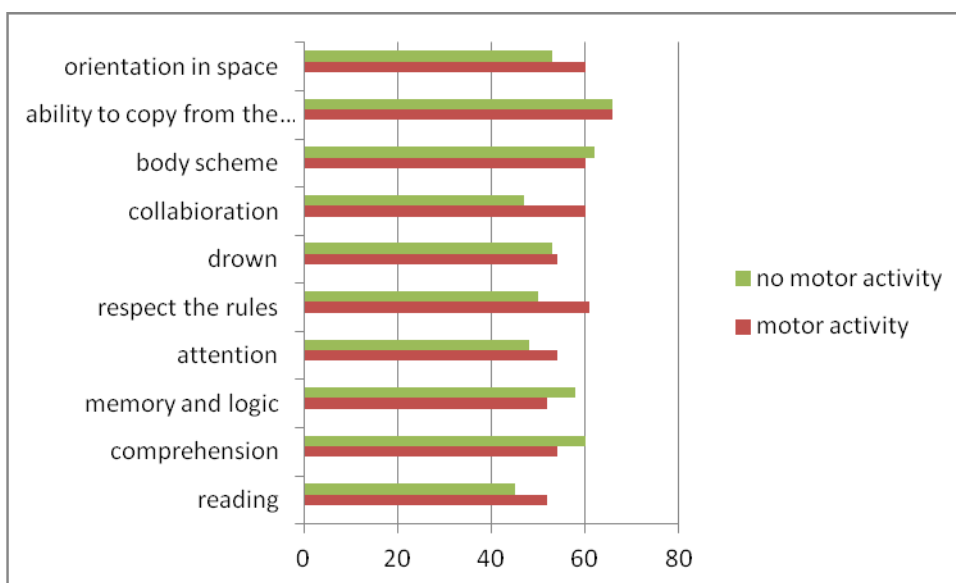


Fig. 14.14

15 ALTRE OSSERVAZIONI QUALITATIVE

15.1 STUDY 11 - UNO STUDIO SULL'ASSE ORIZZONTALE DEL PARCO GIOCHI

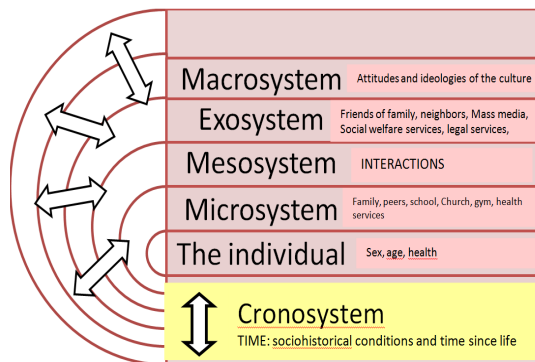


Fig 15.1: Ecological theory

Lo strumento di ricerca utilizzato permette di cogliere alcuni aspetti della realtà. Osservare la realtà da più punti di vista permette di ottenere un quadro più ampio. In alcuni casi ciò che si trova è più legato all'oggettività, in altri casi ai valori personali attribuiti dal soggetto alle esperienze che vive. Gran parte di questo scritto non viene tradotto in inglese, poiché il semplice atto di tradurre in parte *tradisce* alcuni aspetti della comunicazione qualitativa che si vogliono condividere. La traduzione in inglese della tesi mi ha portato a una scrittura neutra, per essere letta da persone straniere che fanno parte di un altro contesto non solo linguistico ma anche culturale. A questo punto, nel finale di questo lavoro riprendo la mia lingua per esprimere dei concetti veicolati anche dalle mie emozioni. Ho toccato con mano che in una ricerca c'è sempre la propria parte emozionale che entra in gioco e che deve essere considerata, proprio perché costituisce il significato profondo che viene attribuito alle cose vissute. Il nostro stato emozionale, passionale influisce nella nostra ricerca-azione, poiché aggiunge le nostre emozioni e la comunica anche alle persone con cui si interagisce. Come sostiene Bronfenbrenner, tra l'individuo e gli altri sistemi vi è una costante interazione e influenza reciproca.

Questa parte è dedicata a quei fatti occorsi durante il periodo di ricerca, che mi hanno particolarmente colpito e che ritengo essere essenziali per meglio comprendere la relazione tra sviluppo motorio e sviluppo cognitivo. Assieme a questi dati riporto anche alcuni dati numerici non ancora pubblicati e altri risultati di tipo qualitativo, che contribuiscono a chiarire ulteriormente lo studio, o forse lo rendono più complesso??!!

In quest'ottica di osservazione prendono risalto i vari sistemi, individuati da Bronfenbrenner nella teoria ecologica (1979). Presento, includendo i vari livelli di analisi, una sintesi storica delle principali attività realizzate, degli aspetti accessori che mi sono sembrati più rilevanti e degli ultimi dati di ricerca. Dal punto di vista del micro sistema, cioè dell'ambiente immediatamente circostante l'individuo è importante esaminare la possibilità offerta dalla famiglia, dalla chiesa, dal territorio circostante, dalle associazioni, per comprendere le potenzialità di sviluppo in atto.

La parte più appassionante dello studio ha avuto luogo presso il parco giochi PRIMO SPORT 0246, un luogo di attività non formale e informale (Tortella, 2013) negli anni 2011- 2012 – 2013 – 2014.

Mi è stato chiesto da Verde Sport, una associazione del gruppo Benetton di Treviso, di progettare uno spazio dove i bambini, fino a 6 anni di età potessero praticare attività fisica. Ho realizzato uno studio e ho costruito un progetto, (Tortella et al., 2011) in cui il parco è suddiviso in aree di attività: manualità, mobilità, equilibrio. La scelta delle aree è collegata alle competenze motorie fondamentali di un bambino (WHO, 2014) che avrebbero potuto esercitarsi al parco, sia mediante gioco libero, sia mediante attività strutturata. Il parco è stato realizzato, con mio grande stupore, nella primavera 2010: non pensavo che sarebbe diventato un parco reale. L'anno successivo ho iniziato ad organizzare le attività didattiche per le scuole dell'infanzia e ho osservato i bambini in presenza e videoregistrando tutte le attività. Questo mi ha permesso di richiedere la modifica di un gioco del parco, che non era adatto a bambini dell'età 0-6 anni. Una delle attività previste prevedeva che i bimbi/e effettuassero le brachiazioni, cioè camminassero con le mani. Questa struttura, nell'area della manualità era alta 2,30 m. Preciso che al momento della scelta dei giochi del parco mi è stato dato un catalogo dal quale avrei potuto individuare quelli più adatti alle mie esigenze. Avevo quindi scelto anche in base alle indicazioni di età consigliata date nel catalogo. Al test iniziale, che prevedeva di contare il numero di pioli di spostamento dei bambini avevo visto che quasi tutti si spostavano al massimo di 1 piolo, ma la maggioranza dei bambini stava immobile, appesa. La distanza tra i piedi e il pavimento gommato, antitrauma era di circa 1 m e

questo mi aveva fatto pensare che i bambini potessero avere paura di farsi male. Ho provveduto dopo poco a fare mettere un materasso che riducesse la distanza dai piedi al terreno a 20-30 cm. Non ho comunque visto miglioramenti nell'esecuzione delle *brachiazioni*: i bambini/e effettuavano al massimo 0-1 passaggio alla fine dei tre mesi di attività. L'anno successivo ho chiesto che il gioco venisse abbassato di 50 cm. Così facendo la distanza dei piedi dei bambini dal terreno era diventata di 20-30 cm, la stessa dell'anno prima dai piedi al materasso. Ai test iniziali avevo osservato, con mio grande stupore che i bambini, in media, riuscivano ad eseguire *brachiazioni* per 2-3 pioli e alla fine del periodo arrivavano in media a 5-6 pioli. Riporto i risultati dei test alle *brachiazioni* dell'anno 2011 solo gruppo sperimentale pre – post test e della media dei tre anni successivi (2012-2013-2014)

	2010/11	N	2012-2013-2014	N	2012-2013-2014	N	2012-2013-2014	N
	Gruppo unico	38	Gruppo sperimentale	152	Gruppo gioco libero	74	Gruppo controllo	106
Pre-test	0,23		2,14		3,16		2,82	
Post-test	0,89		5,81		5,29		4,70	

Table 15.1

I dati mi portano alla considerazione della teoria delle affordances di Gibson, (1982) ben studiata da Karen Adolph, (in press) che ha messo in risalto come i bambini poco competenti in una specifica competenza motoria abbiano un diverso livello di percezione del mondo e di conseguenza di azione. Le affordances sono considerate delle possibilità di azione e dipendono da quello che percepisco. Il fatto di non avere osservato (i conteggi sono stati effettuati successivamente guardando i video, da due persone in modo indipendente, che si sono poi confrontate sui risultati. Per ogni discordanza è stato rivisto accuratamente il video, fino a trovare un accordo) miglioramenti nel numero di *brachiazioni* effettuate nell'anno 2010/11 tra prima (distanza di 1 m dal suolo) e dopo

(distanza di 20-30 cm) dal suolo suggerisce due ipotesi: 1) i bambini sono caduti in precedenza e hanno sperimentato la profondità 2) i bambini hanno lo sguardo all'altezza da circa 2 m dal suolo, anche se i loro piedi sono di fatto distanti 20-30 cm dal materasso. L'ipotesi che avanza è che nel secondo caso l'effetto della percezione visiva sia più potente della percezione tattile, dei piedi, o della rappresentazione motoria dell'azione. I bambini, infatti, pur in questa condizione di assoluto non pericolo (l'esperto era sempre presente, pronto ad intervenire in caso di pericolo in entrambi i casi) non sono stati in grado di apprendere. Dalle osservazioni video, che osservavano i bambini durante il gioco libero, non si vedeva nessun bambino cimentarsi nel gioco. Negli anni successivi, invece, durante il gioco libero i bambini tornavano su quel gioco e lo provavano e riprovavano. Indipendentemente dai risultati del post test, che possono essere dovuti ad incremento di capacità relativo all'allenamento, nel pre-test è significativa la differenza tra i gruppi, a indicare che qualche cosa possa essere successo, per giustificare il basso rendimento in pre e post test del gruppo di bambini dell'anno 2012. I bambini durante i momenti in cui si chiedeva loro cosa era piaciuto di più e cosa era piaciuto di meno dicevano che questo gioco non era loro piaciuto. Se veniva chiesto perché non era loro piaciuto rispondevano che era difficile. E' interessante notare come i bambini che ora arrivano al parco non possano sapere come era strutturato il gioco precedentemente, ma le persone che hanno avuto modo di sperimentare la situazione hanno sicuramente un bagaglio esperienziale molto fornito.

The video camera allows to observe the modality of play in children, during free play. It has been observed that in 2012 no children frequented a tool, called "Monkey bar", which is an opportunity to move by brachiations, hanging on bars. Children were assessed at this tool prior realizing a physical activity program of 10 h in the playground and the children were able to move only 0-1 bars. The tool was 2.30 m high and the company who sold it guaranteed that the tool was appropriate for children up to 2 years. I put under the bars a mattress, to reduce the distance between the feet of the children and the floor, that at the beginning, without mattress was about 1 m high. After this I found no difference in performance of children at "monkey bars". I supposed it could be due to the mechanism perception-action and that the visual system may be prevalent compared to the perception system (tactile, proprioceptive). In other words, while the child was hanging his/her head

was at about 2 m high and I suppose that this could be the reason of incapacity of children to move on this tool. The following year I made cutting the tool and now it is 1 m lower. I have the results of the assessment of the following two years that show that children are in average able to execute from 2 to 3 brachiations at the pre test and at the post test, after 10 weeks they perform average around 5, and the control group, without training performs around 4 bars.

Partecipazione di persone esterne al progetto di attività del parco

Durante gli incontri al parco vi erano anche nonni e genitori con bambini più piccoli di 3 anni, che giocavano. Veniva detto loro di non entrare nelle zone dove vedevano bambini seguiti da insegnanti specializzati e spiegato loro il progetto che si andava realizzando. Il fatto di osservare i bambini della scuola dell'infanzia giocare negli spazi e con i giochi difficili era molto stimolante per i piccoli di 1-2 anni, che costringevano i nonni a seguirli nei luoghi loro proibiti! In realtà, al termine delle attività i piccoli accedevano ai giochi usati dai "grandi". L'importanza dell'imitazione sia nel caso di bambini piccoli che hanno frequentato il parco con i nonni, sia nelle scuole dell'infanzia dove i piccoli e i medi osservavano i grandi (le ricerche sono state effettuate per lo più con bambini di 5 anni) si è poi rilevata importante anche negli anni successivi. I bambini, infatti, costringono poi genitori e nonni ad accompagnarli al parco. In una delle scuole dell'infanzia che hanno partecipato per alcuni anni al nostro studio quest'anno (2014-15) le insegnanti hanno comunicato ai genitori dei bambini grandi che non avrebbero presentato domanda per il nuovo progetto, per altri progetti in corso. I genitori si sono riuniti e hanno fatto una richiesta formale al dirigente scolastico di poter inoltrare domanda. Ho ricevuto poi la telefonata di un rappresentante dei genitori che riferiva che i bambini del gruppo dei grandi della scuola, che rappresentava, che per due anni avevano osservato i loro compagni andare con gioia al parco giochi della Ghirada, e ora che era giunto finalmente il loro momento erano disperati dalla impossibilità di poter partecipare a delle attività così belle. Anche i genitori erano risentiti del fatto che non ci fossero più prospettive di praticare attività fisica, per i loro bambini e mi spiegavano i mancati benefici alla salute fisica e mentale connessi a questa scelta delle insegnanti.

Attività fisica presso il parco giochi PRIMO SPORT 0246 di Treviso

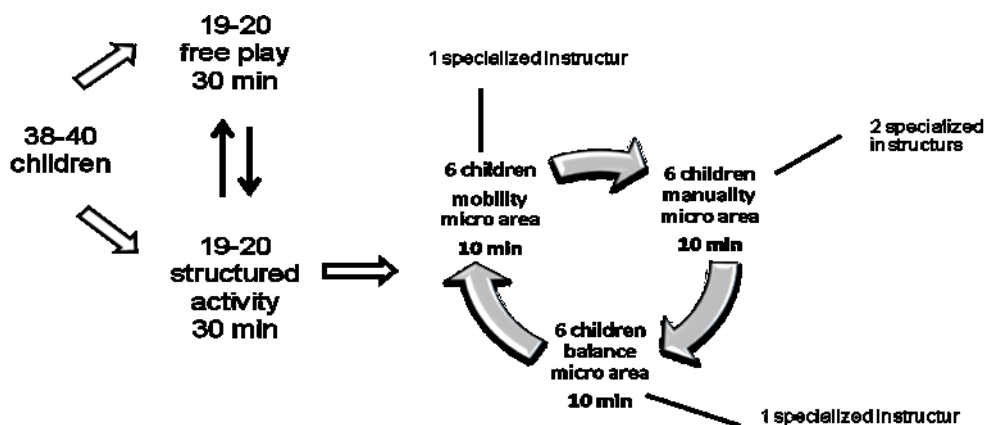
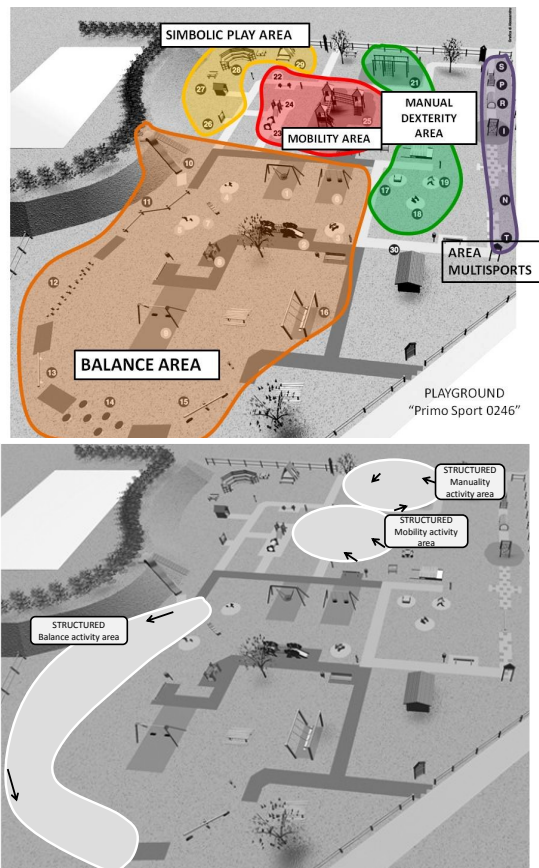
Le attività realizzate al parco giochi negli anni precedenti seguivano un protocollo di lavoro sperimentale, che è poi confluito in una pubblicazione (vedi articoli precedenti). Veniva mandata una circolare a tutte le scuole dell'infanzia di Treviso, invitandole a partecipare alla ricerca sullo sviluppo motorio e cognitivo dei bambini, realizzata presso il parco giochi PRIMO SPORT. Tra le numerose scuole interessate venivano scelte random alcune scuole che assumevano il ruolo di sperimentale (scuola che veniva al parco per 10 incontri, seguendo un protocollo predefinito), controllo gioco libero (scuola che veniva al parco per 10 incontri effettuando per tutto il tempo gioco libero), controllo (scuola che non veniva al parco giochi). I bambini dei tre gruppi di scuole venivano valutati all'inizio e alla fine dei dieci incontri, (mediamente tre mesi dopo) con test standardizzati motori e cognitivi, per indagare la relazione tra attività fisica, sviluppo motorio e sviluppo cognitivo.

Protocollo di attività fisica al parco.

Il protocollo consisteva in 10 incontri di attività motoria, presso il parco giochi la Ghirada di Treviso. I bambini venivano trasportati al parco, grazie ad un servizio pulmini messo a disposizione gratuitamente dal Comune di Treviso, una volta alla settimana per dieci settimane. Il tempo di permanenza al parco era di 2 ore complessive. La routine della giornata consisteva in:

- 1) arrivo dei bambini, loro ricevimento da parte di personale esperto nell'attività motoria per l'infanzia del CONI di Treviso, coordinato da me. I bimbi/e arrivavano al parcheggio e camminavano per un quarto d'ora circa per arrivare al parco;
- 2) ritrovo presso l'"arena di bambini", una struttura in legno semicircolare su cui si sedevano i bimbi/e.
- 3) Mentre i bambini erano seduti si chiedeva loro se erano contenti di essere venuti al parco, che cosa avrebbero voluto fare e queste domande avviavano un entusiasmante dialogo. Veniva poi detto loro che avrebbero fatto diversi tipi di giochi e che si sarebbero sicuramente divertiti.

4) La classe, in media composta da 30 bambini veniva suddivisa in due gruppi. Il gruppo A avrebbe fatto gioco libero per 30 minuti, mentre contemporaneamente il gruppo B avrebbe realizzato attività strutturata in alcune aree del parco (manualità, mobilità, equilibrio) contenenti giochi appositamente predisposti a formare un percorso. Il gruppo B, dell'attività strutturata veniva suddiviso in tre piccoli sottogruppi e ogni sottogruppo era assegnato all'area manualità, mobilità o equilibrio.



Mentre il gruppo A giocava liberamente nel parco per 30 minuti consecutivi il gruppo B, suddiviso in tre gruppetti, assegnati a tre zone diverse del parco, realizzava attività strutturata, permanendo 10 minuti in ogni zona e al segnale di cambio passando in una zona successiva, fino al completamento dei 30 minuti. Dopo 30 minuti il gruppo A che aveva giocato liberamente andava a fare l'attività strutturata e il gruppo B che aveva fatto attività strutturata andava a fare gioco libero.

Al termine delle attività ci si ritrovava nell'arena dei bambini/e" e veniva distribuita una semplice, salutare merenda, con una bottiglietta d'acqua. Dopo la merenda i bimbi/e potevano riprendere a giocare liberamente in tutto lo spazio del parco, fino al termine del tempo. In media giocavano ancora una ventina di minuti. Un po' prima del termine dell'orario ci si ritrovava presso l'arena dei bambini/e" per raccontare cosa era stato fatto, quali giochi erano piaciuti di più e quali di meno e altre cose. Ci si salutava e gli esperti motori accompagnavano i bimbi e le loro insegnanti al pulmino. Durante le attività al parco il ruolo delle insegnanti era di osservazione a distanza dei bambini. Veniva detto loro di intervenire solamente nel caso di situazioni pericolose. La soglia di pericolo è stato osservato essere molto diversa tra insegnante e insegnante e questo aspetto è molto importante nelle possibili esperienze di un bambino. A tal proposito riporterò più avanti una intervista realizzata con una delle scuole di cui un'insegnante aveva manifestato perplessità sulla sicurezza dei giochi.

Si è visto dallo studio della letteratura quanto sia influente il ruolo dei genitori e degli insegnanti nello sviluppo motorio dei bambini. Ritengo importante scrivere le note che seguono perché aiutano a comprendere, dal punto di vista qualitativo il percorso di ricerca realizzato. Scrivo di seguito alcune note di diario, annotate dopo l'incontro con una scuola coinvolta nella ricerca. Si trattava di un gruppo di insegnanti di bambini che seguivano il percorso di 10 incontri di attività motoria strutturata. Stavamo osservando insieme i bimbi/e che giocavano e ho chiesto loro cosa avessero osservato durante i momenti di **gioco libero** dei bambini.

15 ALTRE OSSERVAZIONI QUALITATIVE

15.2 STUDY 12 - CONSIDERAZIONE / STUDIO QUALITATIVO. INTERVISTE E FOCUS GROUPS CON INSEGNANTI E GENITORI DEI BAMBINI AL PARCO SUL TEMA DEL PERICOLO/ CONSIDERATIONS – A QUALITATIVE STUDY. TEACHER AT THE PLAYGROUND AND THE FEAR OF DANGER FOR CHILDREN, A FOCUS GROUP WITH PARENTS OF CHILDREN ATTENDING THE PLAYGROUND.

In these studies it emerges that the socio emotional cultural environment influence beliefs and style of teaching.

Dal diario di bordo 11 marzo 2014

... Che i bambini all'inizio stavano su giochi tipo scivolo, altalena, e poi hanno mano a mano preso confidenza con giochi più impegnativi e alternativi. Oggi per esempio, per la prima volta si arrampicavano sui rami di un albero basso, posto con il ramo pendente dalla parte della collinetta, vicino allo scivolo verde. Provavano in uno, due bambini, sui rami disponibili. Non hanno osservato differenze tra bambini e bambine. Hanno visto che alcuni bambini che a scuola non facevano tante cose al parco si muovono molto meglio. Il punto di forza che segnalano è che al parco possono fare le cose che a scuola non fanno, ad es. andare sullo scivolo al contrario, arrampicarsi sulla capanna,

Ho chiesto come stavano loro, insegnanti. Mi hanno risposto che erano molto contente dell'esperienza perché hanno messo in dubbio anche alcune loro pratiche. Si sono chieste come mai a scuola sono così rigide nelle possibilità motorie offerte ai bambini. Vedendo come si usa lo spazio al parco, infatti, hanno pensato di poter usare in modo differente anche i loro spazi e giochi. Una maestra ha poi detto che la loro collega, oggi assente, ha paura di tutto, anche a scuola e non solo rispetto al motorio. Lei stessa si agita in presenza della collega. Ho fatto notare che se si agita lei, figuriamoci i bambini ... ho chiesto se fosse possibile sostituirla, ma mi hanno risposto che è lei stessa che non vuole farsi sostituire. Ci tiene a venire al parco, ma quando viene è un disastro. L'insegnante ha poi aggiunto che a lei dispiace molto quello che succede con la collega, quando è presente al parco, perché il suo punto di riferimento sono i bambini e così facendo invece vengono penalizzati.

Ho notato che le insegnanti presenti, in particolare la coordinatrice apprezzano molto il fatto che i bambini sperimentino situazioni nuove e creative a tal punto che li fotografavano mentre erano sull'albero, mentre rotolavano giù dalla collinetta (riconosciuto altro punto di forza dalle insegnanti). Ho notato veramente un apprezzamento degli aspetti insoliti del movimento, anche da parte delle insegnanti.

Ho chiesto alle insegnanti cosa pensano i bambini del parco e mi hanno riferito che sono entusiasti, che quando tornano a scuola raccontano. Una bambina, che all'inizio non voleva venire e che ci aveva fatto chiamare dal papà costringe ora la famiglia tutti i sabati ad andare al parco Primo Sport, con grande gioia di tutti. I genitori sembrano essere molto contenti e soddisfatti.

Le insegnanti dicono che avrebbero bisogno di percorsi formativi per meglio capire cosa succede durante l'attività motoria. Mi rendo conto che è importante nel prossimo incontro con i genitori spiegare bene bene le competenze motorie e quelle cognitive, il progetto del parco, i risultati della ricerca e le ricadute sugli apprendimenti delle funzioni esecutive dei bambini.

Dopo la chiacchierata con le insegnanti ho chiesto ad un insegnante esperto motorio che aiutava nel coordinamento delle attività come vedeva gli insegnanti e in particolare quella segnalata come "paurosa".

Dal diario di bordo (18 marzo 2014)

... quando i bambini tentano di arrampicarsi sulla tenda di legno arriva di corsa, li sgrida e li fa scendere.

Ho chiesto come vede i bambini e mi ha detto che li vede molto migliorati, soprattutto nella barra con le molle, dove all'inizio non riuscivano a salire e ora la percorrono tutta senza cadere. C'è un'atmosfera molto bella e entusiastica da parte sia dei collaboratori, che dei bambini, che delle maestre. Anche gli altri collaboratori riferiscono lo stesso.

La volta successiva l'insegnante è venuta da me e ha raccontato delle sue paure rispetto in particolare ad un gioco del parco, la capanna di legno.



Fig. 15.2 - Attrezzo per gioco simbolico

I bambini amano salire sul tetto, arrampicandosi sui mezzi tronchi che formano una specie di pedana di appoggio per i piedi. Quando arrivano sopra scendono aggrappandosi ad una fune. L'insegnante era terrorizzata da questa attività e mi ha chiesto di mettere un nastro, tipo quelli per cantieri, per isolare il gioco. Le ho risposto che non era possibile e che il gioco era protetto da una pavimentazione antitrauma specifica. Erano poi ormai quattro anni che migliaia di bambini vi salivano e nessuno era mai caduto. Mi ha poi confessato che aveva preso una grande paura a scuola, quando anni fa una bambina era caduta e si era fatta male. Da quella volta l'insegnante, che si sentiva un po' colpevole dell'incidente, è diventata iper protettiva. Alla fine dei dieci incontri ho incontrato il

genitori dei bambini e delle bambine, insieme agli insegnanti, per raccontare come era andata l'esperienza al parco. Con mia grande sorpresa l'insegnante in questione ha preso la parola dicendo ai genitori si è trattato di un'esperienza molto importante, che ha modificato il loro modo di rapportarsi con i bambini. Ha poi spiegato ai genitori che all'inizio le insegnanti temevano che i bambini si facessero del male, poiché nella loro scuola non avevano attrezzature simili e nemmeno un parco per uscire e giocare all'aperto. Ha poi raccontato di avere osservato i bambini giocare e di essersi accorta che quando stavano per fare qualche cosa di pericoloso si fermavano prima di arrivare al punto di massima difficoltà e tornavano indietro. Poi ha aggiunto che stava molto vicino fisicamente ai bambini per poter intervenire in caso di difficoltà, e che ad un certo punto un bambino le ha risposto: “ma insomma, maestra, guarda che io so cosa devo fare, non ti preoccupare per me!” A quel punto si è un po' allontanata e dopo aver realizzato che i bambini avevano imparato tante cose nuove si era rilassata. Consigliava ai genitori di imparare ad osservare i loro figli. Si è trattato di un'esperienza molto interessante, che ancora una volta ha messo in risalto la relazione dinamica, reciproca tra educatore e bambino/a, che agisce su entrambi i soggetti e ognuno dei due può modificare il comportamento dell'altro ed essere a sua volta modificato dall'altro, fino a modificarsi entrambi.

Accanto all'aspetto dello sviluppo motorio, anche l'aspetto cognitivo viene vissuto attraverso le personali credenze e storie di vita. Come evidenziato anche dalla letteratura il contesto culturale influisce a tal punto che si viene a modificare anche lo sviluppo motorio di un bambino.

Riporto alcune note di diario riprese da un incontro con genitori di bambini di un'altra scuola coinvolti nella ricerca.

Avevo preparato la presentazione in power point, in cui intendevo spiegare in cosa consisteva l'attività fisica e altro. Quando sono arrivata a scuola ho subito notato che nelle prime due file erano sedute solo mamme africane. Ci saranno state una quarantina di persone, comprese le insegnanti e la dirigente. Appena visto in chi consisteva il gruppo ho chiuso il computer e ho chiesto alle mamme di raccontarmi come fosse stato lo sviluppo motorio dei loro figli. Avevo ottenuto all'inizio risposte convenzionali fino al momento in cui ho chiesto: “quali pratiche avete messo in atto per fare crescere i vostri figli sani e forti?” Ad un tratto una mamma nigeriana si è alzata premettendo: “adesso non ridete altrimenti mi arrabbio, ma questa cosa la devo raccontare !”

Riporto una parte di discussione sbobinata, risalente a maggio 2013, che mi sembra importante per meglio comprendere cosa significhino il ruolo della cultura di riferimento, l'ambiente, le pratiche, nello sviluppo motorio. In rosso e in azzurro sono evidenziati gli interventi di alcune mamme di culture diverse.

g. (mamma Nigeria, villaggio). Nigeria
p. per lei cosa bisogna fare perché un bambino piccolissimo possa crescere sano e forte? Cosa si fa con il bambino piccolo, piccolo? Cosa fa al suo bambino quando è piccolo, piccolo?

g. (mamma Nigeria, villaggio). piccolo come quasi mese?
P: due mesi, due tre mesi

g. (mamma Nigeria, villaggio). ride. Io posso dire che sono cattiva, non sono cattiva. Ride ... lascia perdere ... ridono
p. dimmi

g. ride
p. no, vai

g. ride
p. chiedo a voi perché avevo dei filmati da portarvi ma ho portato slides, ma vedendo qui invece avrei dovuto scegliere ... altre, ma non le ho qua e volevo parlare con loro ...

g. (mamma Nigeria, villaggio). il mio paese quando nasce bambini, quando nasce ospedale, quando torni a casa è nostra tradizione se vuoi fare a bambini doccia quando finisci di fare doccia usa acqua calda per massaggiare tutto il corpo deve girare questa mano per girare altra mano, in piedi, quando finisce tutto usa mano per, così no ce l'hai per, usa mano per premere la testa, prendi bambini due piedi e usa fai toccare terra sette volte, soffia orecchio, quando tua mamma ti parla devi ascoltare, soffia altro orecchio, quando tuo papà ti parla devi ascoltare, così ... ride ... ridono
p. perfetto, lo so, non ho i filmati qui, ti ho chiesto per questo, invece Lei cosa fate dalle vostre parti quando nasce un bambino piccolo? Cosa si fa? Fate così anche voi come lei?

g. no
p. come fate voi?

g. noi diamo da mangiare
p. ma perché cresca sano e forte ... a noi interessa che cresca sano e forte ... cosa si fa?

g. da noi bambini già all'asilo fanno sport
p. facciamo tre mesi, 2 mesi, 1 mese.
p. come si fa per farlo diventare forte?

g. gioca con gli altri bambini
ridono
p. voi cosa fate quando è appena nato per farlo diventare sano e forte, ci sono delle pratiche che voi avete? Lei dice: lo prendiamo per i piedi, lo buttiamo giù, lo muoviamo ...

g. (mamma Nigeria, villaggio). fai ginnastica, anche massaggio
p. ascoltiamo

g. (mamma Nigeria, villaggio). massaggi, olio piedi, massage
p. massaggio

g. (mamma Nigeria, villaggio). mostarda, olio vegetale, tutte le mattine massaggio, sole, ginnastica fare, mano così, piedi così,
p. incrociate mani e piedi e tirate dietro.

g. (mamma Nigeria, villaggio). Fare croce
p. quanto hanno i bambini

g. 3 mesi, noi fare così sempre ci piace. (mamma Bangladesh)
p. anche lei fa le stesse cose?

g. (mamma Bangladesh) tutto uguale
g. (mamma Nigeria, villaggio). tanti bambini non sono uguali. Il bambino è tanto piccolo per capire se è forte o non è forte, perché noi africane di solito portiamo sempre dietro. Quando dai da mangiare metti dietro, quando ha fame dai da mangiare poi noi metti dietro, così tu

puoi fare. Se è forte o no noi non sappiamo. Anche quando bambino è malato, come mio fratello ha avuto problema e non mangia e non è sangue. Mia madre non ha portato ospedale, ha portato dove questo anziani che fanno medicina hanno fatto a mio fratello di più di 100 punti . non c'era sangue, solo acqua. È guarito adesso sta bene ha trenta anni. Io mai stata in ospedale in Africa adesso venuto qui in Italia ho approfittato e sono andata. Noi non sappiamo se bambino.. ogni giorno noi prega, Dio grazie ho visto oggi, dai bambino da mangiare, metti dietro e devi fare.

p. a quanti anni iniziano a camminare?

g- 4 mesi bambino siedi, 5 mesi gattonano

p. a che età li mettete in piedi la prima volta?

g. mia figlia a quasi 7 anni in Africa posso andare a mercato mi compri le cose e mi torni a casa.

p. quando tu prendi bambino e lo metti in piedi.

g. gattona. Lo devi mettere in modo che mia figlia ha camminato a 9 mesi qualche cosa, il fratello 10 mesi. Ha camminato dietro di me perché sono ricoverata.

p. camminano presto. Volevo sentire una mamma italiana. Lei ci ha detto che prende le mani, lo tira dietro, incrocia. Le mamme italiane, fate così anche voi?

g. no

p. no. Cosa fa una mamma quando nasce. Come si chiama lei?

g. Meggy

p. cosa fa una mamma italiana. Cosa fa con un bimbo di due mesi, dove lo metteva durante la giornata un bimbo di due mesi?

g. io ho avuto due gemelli.

p. anche lei prendeva il bambino gli girava le braccia, lo prendeva per le gambe ...

g. no , però l'ho messo tanto giù, quello si

p. dove?

g. per terra, sul tappeto

p. da solo?

g. no inizialmente sul lettone. Li ho mossi volontariamente, magari qualche massaggio perché a me piace farli.

p. a che età hanno cominciato a camminare?

g. 10 mesi maschio, 11 la femmina. Gattonare 6 e 7.

p. le altre mamme, a che età hanno iniziato a camminare i vostri figli?

g. 13, 14 mesi

p. mamme, facciamo un giro. A che età ha camminato il suo bimbo, sua bimba?

g. 12 mesi, 12, 10-11, 13, 14-14, circa 12 mesi, 9 e 10, 10, 13, 11, 12, 13, 14, prima dei 13, 10, 11,

g. la prima la tenevo nel cesto e poi per terra. Come diceva ... noi abbiamo la palestra, invece.

p. la palestra ...

g. la seconda facevo fare degli esercizi come piegare le gambe, così, oppure un po' girarla, la mettevo così,

p. la prendeva per i piedi?

g. no

p. perché no?

g. perché no!

p. domanda per tutti? Perché voi non prendevate i bambini per i piedi, così? Per loro è una pratica importante..

g. questa cosa qui che prendono i bambini per i piedi e fanno così mi faceva paura, mi dava l'idea, speravo di no, non per paura di cadere

p. con una mano va preso, non con due mani, giusto?

g. con una mano

g. non è per paura che mi cadesse. Primo appena nato avevo questa cosa, paura che fosse uno shock troppo per la spina dorsale e invece raddrizzare ...

p. cosa fate voi?

g. messi su a pancia così da qua, dove c'è deve fare con mano fino a sedere, deve girare, dal collo tirare fino a sedere prima di mettere in piedi, per toccare ...

p. secondo lei non ci sono problemi per la schiena?

g. no, per come siamo fatti, no. Io sono cicciona ma posso saltare.

p. questa pratica rinforza il bambino, lo fa diventare più forte?

g. quando ho fatto il corso di massaggio, quando è nata mia figlia adesso a Motta di Livenza ho insegnato a mamme italiane. Mi hanno detto di fare vedere. Tante hanno paura. Quelle che hanno paura hanno fatto. Tante hanno paura, non fa male a nessuno

p. pensiamo che adesso questi bambini che vengono presi così e tutte le loro pratiche sono i nostri olimpionici che vincono le olimpiadi. Abbiamo a che fare, la gran parte dei nostri campioni adesso viene da questi posti e da piccoli sono stati allevati con delle pratiche che non sono le nostre. Cosa pensa lei di un bambino che viene lasciato appena nato nei seggiolini, tutto il tempo? Lasciato lì a guardare. E' un buon sistema?

g. perché quando tu quelli che ho detto adesso, se non hai male subito tu.. tu hai toccato subito il corpo. Sai se c'è qualcosa che non va. E' per quello adesso fai quando la mia figlia le posso lavare schiena e poi mettere crema e lei mette crema.

Perché appena nata deve fare piano piano, usa per fare così da qua fino qua. Quando finisce tu sai che c'è qualcosa che non va fai altra mano e deve fare così, anche piede deve fare così

P. quindi se non riesce tu sai che c'è qualcosa che non va

g. se piange c'è qualcosa che non va e devi portare in ospedale per sapere se rotta, se ce l'ha infezione

p. quindi queste pratiche che voi fate sono importanti per capire lo stato di salute del bambino.

g. sì, mio marito sa fare di più di me. È per quello, quando io faccio è lui che fa il bagno. Io va da lui. Lui quando era piccolo suo nonno fare davanti a lui. Suo nonno ... lui mette bambino qua per fare doccia. Lui non mette bambino così.

p. perché non lo lascia da solo nella vasca piccolina?

g. mette piedi così se diamo la sedia bassa, fai sederti, metti la testa, prima lavi la testa, sciacqua, prima di lavare. Noi dobbiamo usare olio rosso, per fare che fa venire fuori cosa di lui o lei. Poi usare sapone. Prima devi usare olio.

p. una domanda. Per irrobustire il collo come viene trattato il bambino appena nato, a un mese, per il collo, come tenete il bambino?

g. quando finisce di fare doccia acqua calda, no tanto caldo. Usa per massaggio testa caldo, non tanto che tu puoi mettere caldo. Metti asciugamano, prema, usa per massaggi la testa, anche collo, tutto il corpo fino a piedi

p. ma il collo quando avete in braccio il bambino lo tenete con la mano o viene lasciato ...

g. metti mano così, sempre la mano ...

p. sempre tenuto con la mano

g. quando noi metti dietro noi usiamo un'altra sciarpa per mettere su cotto, così collo non va. Quando bambino metti dietro sempre sciarpa sopra, per tenere il collo.

p. allora, lei avevo delle cose che io avevo nei filmati. Ha detto delle cose che sono delle pratiche. Voi già capite questo . ci sono già delle differenze nel modo di intendere il movimento, lo sviluppo motorio. Sviluppo motorio, quando un bambino cresce e sviluppa il corpo parliamo di sviluppo motorio. Appena nascono i bambini vengono accolti e in una cultura che in Italia funziona così, in Germania in un altro, in Nigeria..Da dove vieni della Nigeria?

g. dinissiti

p. che lingua parli in Nigeria?

g. io parlo inglese

p. la tua lingua proprio quale sarebbe?

g. io sono cresciuta in villaggio e so parlare bene mio dialetto

p. quale sarebbe'?

g. non so il nome

p. chi viene da una zona ha delle abitudini. Tu vieni dalla Guinea? Lei ha abitudini diverse. Lei dice che se un bambino non è trattato così non possiamo sapere se sta bene. Loro sanno se il loro bambino è sano perché fanno queste pratiche con il corpo. Deve essere girato, tirato, preso per i piedi. Se il bambino piange è un bambino che ha qualche problema e devono correre all'ospedale.

Da noi o in Germania se una mamma facesse una cosa del genere, probabilmente non tutti sarebbero d'accordo. Perché sembra qualcosa di strano perché da noi il bambino viene preso, messo nel infant seat, rimane lì tutto il giorno a guardare la mamma, non si muove più e il tempo passa. Andiamo da loro. Loro non lo prendono così. Lo tenete nel seggiolino tutto il giorno?

g. no

p. dove lo tenete?

g. nel letto

p. lo mettete per terra.

g. no, non è possibile

p. non è possibile metterlo per terra, voi lo mettete per terra?

g. chi non ha materasso non può. Noi in Africa. Io non posso dire bugia, mio papà ... se io devo dormire su materasso. Dormiamo sulla terra.

p. ma scusate. Tu hai detto che lo mettevi per terra. Tu non li hai i materassi?

g. in che senso?

p. però, come mai?

g. in Africa chi non ha i soldi per comprare materasso deve dormire.. io a casa non ho soldi per comprare materasso. Devo dormire a casa mia.

p. ma il bambino te lo tieni addosso o lo metti per terra?

g. no che io devo dormire a terra, proprio, devo mettere qualcosa per dormire.

g. durante il giorno ...

g. a, durante il giorno, secondo me il tempo dietro.

P. voi lo tenete dietro e se devi lavorare dove lo metti il bambino. Se devi pulire le verdure dove lo metti?

g. lo metto dietro, anche se devo correre.

p. una mamma tipica italiana dove lo mette il bambino se deve preparare le verdure?

g. per terra.

p. tu prendi il bambino. Allora tu prendi il bambino lo metti per terra da solo, ti giri e fai tutte le altre cose ... ok, voi invece, lo mettete sul letto?

g. 2, 3 mesi lo lascio sempre nel letto (africa)

p. ok, allora sono venute fuori alcune cose. Vedete che già da alcune cose, poi qui si potrebbe andare a vedere proprio i particolari. A chiedere tante cose, ma capite che c'è un'idea di sviluppo motorio che è diversa. Per loro se il bambino non sa fare delle cose è un bambino malato. Da noi non esiste che un bambino viene tirato, preso per i piedi, perché si ammala. Noi abbiamo l'idea che se si fa questo un bambino si ammala

g. però loro devono vedere se è sano e se piange lo portano in ospedale, noi usciamo dopo tre giorni dall'ospedale dove in teoria i controlli li hanno già fatti.

p. però se inizia a piangere il tuo bambino non è che lo prendi per le gambe e vai a vedere cosa fa!

g. no, ridono ..

g. piange quando vai a casa, sulla strada.

p. il punto è che attraverso il corpo, muovendolo in un certo modo capite se è sano o no. Da noi non si usa. anche il medico non lo prende e lo gira, lo tira ... per i piedi

g. si infatti, anche il pediatra non lo fa ...

g. no in modo che io sto dicendo, capito ... noi lo tira così però questo io posso fare come esempio, perché la dove ho fatto il corso di massaggio sanno come io sono e pensano. La signora che insegna a noi ha visto che cosa ho fatto. Ha fatto mia figlia davanti a lei.

p. come dicevo questi sono bambini che poi vanno alle olimpiadi.

g. in africa 16 anni fa qualcuno ha messo bambino su marsupio. Passati tutti anziani che erano fuori hanno detto questo bambino è male e hanno cominciato ad insultarla. Vuoi fare come inglesi, adesso messo su marsupio, anche io non sapevo cos'era e hanno cominciato a insultarla.

p. perché?

g. hanno detto stacci attenta, questo bambino male! Hanno cominciato a insultarla.

p. perché hanno cominciato ad insultarla?

g. tu vuoi fare, adesso messo su marsupio. Ho visto insultare signora.

p. perché?

g. perché marsupio non è come dietro. Non lo so hanno detto che non va bene, non è comodo come dietro.

p. capite le pratiche. Io sto chiedendo questo perché non c'è una cosa giusta e una cosa sbagliata, qualcosa di più bello e meno bello. Ognuno a seconda di dove vive, dell'ambiente dove è ha delle pratiche diverse. C'è una cultura diversa e per ciascuno la propria cultura è quello che dovrebbe essere. Perché se per lei è importante tirarlo perché se sta male se ne accorgono deve essere cos' perché se non è così anche le persone stesse che vedono una madre che tratta un bambino così la sgridano. Da noi se succedesse che c'è una madre per la strada per prende un bambino e inizia a trasportarlo così ... ma arriva la polizia e o va a prendere per maltrattamenti ...

g. una mia amica che ha sposato italiano suo marito ha chiamato polizia per lei.

Ridono

g. ha chiamato polizia...

p. questo me lo sta ammazzando ... invece per loro sono delle pratiche per irrobustire il bambino. Io ho visto dei filmati, c'è Heidi Keller è una docente con cui collaboro, tedesca. Lei è antropologa e va in India, Cameroon. Ho dei filmati e le mamme spiegano che perché il bambino possa crescere forte il bambino deve essere tenuto in braccio già appena nato, non mettono niente sul collo, perché se il collo è libero diventa più forte. Lo scuotono tutto il tempo a ritmo, con molto ritmo perché facendo così il collo diventa più forte. Sono bambini che a due mesi sono capaci di stare seduti da soli. A 8 mesi camminano.

g. io ho visto un bambino africano. A 4 mesi già stava seduto.

p. a 2 mesi stanno seduti. A 1 anno ho il filmato che vanno in giro con i machete a pulire i sentieri.

g. se a 1 anno e mezzo un bambino non cammina in mio paese (Nigeria) lega tutte due gambe e cade. Lega piedi insieme a cane. Cane tira lui. Quando inizia bambino sembra quasi motorino, perché cane cammina forte.

g. il bambino come lo legghi?

g. lega, cane, se no usa qualcosa per spazzare la maledetta che c'è. Un anno e sei mesi che un bambino non cammina non va bene, no.

p. c'è qualcosa che non va bene, c'è qualche problema. Bisogna capire

g. se un anno e mezzo non cammina qui bisogna andare in Africa. Bambino deve camminare per forza.

p. bisogna togliere il motivo per cui non cammina

g. ad esempio mia mamma tenendo i miei figli notava che erano molto precoci nel tenere la testa su di noi, rispetto a quello che eravamo noi. È anche vero forse che ...

p. loro proprio li prendono così, devono muovere il collo, perché se mettono la mano qua sul collo non si sviluppa abbastanza il collo. Qui nel Cameron, si chiamano Nso, li girano, gli passano intorno, fanno come diceva lei ... sono bambini che a 8 mesi camminano perché è importante che imparino a camminare in fretta. In Africa dove non c'è l'asfalto ci possono essere animali pericolosi, no?

g. (Nigeria) deve correre!

p. bisogna che corra. Non è che uno possa essere lì fino a 20 mesi ad aspettare a camminare, bisogna che corra velocemente e anche molto preso, per cui a 8 mesi è un problema veramente di ambiente. In quell'ambiente un bambino piccolo deve imparare prima possibile a essere autonomo. Giusto?

g. si

Tanto è che la Keller ha visto che c'è uno sviluppo dell'autonomia in questi posti in Camerun, dove lei ha studiato che è molto più avanzato. Sono bambini molto più autonomi. Se noi prendiamo un bambino di 5 anni che è cresciuto qua e lo portiamo da noi è un bambino che ha 10 anni in più dei nostri perché è abituato ad una autonomia che lo porta a fare delle cose, va a pulire i sentieri a 1 anno, che da noi non esiste, neanche gli diamo il coltello ma neanche da guardare. Li hanno in mano dei macheti così che si alzano e vanno a pulire e nessuno oserebbe non darglieli. Glieli devono dare. Se non lo fai il bambino muore. È un problema di sopravvivenza.

g. ma devono essere stimolati, ovunque sia, il bambino, secondo me.

p. stimolati, lei ti ha detto quali stimoli usa, allora lei dice devono essere stimolati. Ma da noi come mai non li stimoliamo. Perché da noi camminano a 13 mesi, 15... mediamente 13, 14 mesi

nella nostra cultura e la mediamente invece cominciano molto presto, lei è stata buona a dire 10 mesi, ma iniziano molto presto a camminare.

g. si, anche prima a 9 mesi

p. come mai

g. non per cattiveria. Se io fare un anno bambino e a un anno non cammina se io lascia stare la quando a gattonare viene da me io lo mando indietro.

p. se ha un anno non cammina? Noi siamo fortunati se a un anno cammina! Eppure geneticamente siamo tutti uguali come mai queste differenze?

g. troppo iperprotettivi

g. il fatto che si sfrutti più una parte dell'altra. Ad esempio io quella che ha camminato a 10 mesi ha parlato un po' dopo, invece quella che mi ha camminato a 12 mesi aveva un linguaggio un po' più precoce. È vera questa cosa qui che si sviluppa più il linguaggio che l'aspetto motorio?

p. questo è uno dei tanti detti, noi ce la diciamo in un altro modo. Questo è un altro modo per dire: ragioniamo un altro. Noi diciamo: se si sviluppa prima da un punto di vista motorio in genere ha qualche ritardo da un punto di vista linguistico. Al contrario la bambina che parla tanto bene dal punto di vista motorio è un pochino ... imbranata. Tutto sommato che cosa preferiamo noi? Preferiamo un bambino che parla tanto precocemente e da un punto di vista motorio è imbranato o preferiamo un bambino che cammina a 8 mesi e però non parla fino a 3 anni? Cosa preferiamo noi?

g. non ho capito la domanda

p. cosa preferiamo noi, cosa preferite voi,

g. non ho capito cosa..

p. te lo dico: preferisci un bambino che non parla ma che a 8 mesi cammina e si sposta autonomo con il machete e pulisce oppure un bambino che parla subito ma cammina a 20 mesi?

g. venti mesi sarà un anno e mezzo?

p. un anno e mezzo, che cammina a un anno e mezzo. Cosa preferisci tu?

g. di solito i bambini come sono cresciuti non lo so. Quando cammina, cammina già.

p. spieghiamo meglio, perché da noi in Italia si dice una cosa. Lei mi diceva adesso. C'è un'idea: che ci sia una relazione, una compensazione. Cioè se un bambino cammina presto si pensa che sia un bambino che parla più tardi. Oppure il contrario se parla presto ci si aspetta che si muova più lentamente però quando poi il bambino va a scuola e le cose cambiano. Se il bambino si muove poco in genere si pensa che sia un bambino che anche da un punto di vista intellettuale ha qualche problema, quindi cambia la relazione..

g. mmm

g. al mio paese (Nigeria, villaggio) che io sempre dire verità. Che mi guardano domani male non mi interessa. Dove c'è da dove sono nata se un bambino a 2 anni non parla ci sono padri che ha tradito lui. Se non parlato deve dire sempre. Deve confessare. c'è un motivo. Si chiedono cosa hai fatto per fare questo bambino non parla ancora a 2 anni. Hai fatto qualcosa per fare stare lui zitto. Deve confessare. La mamma deve rispondere a suo marito.

p. come fa per farlo parlare? Deve confessare.

g. la mamma deve rispondere suo marito. Deve rispondere.

....g. (Nigeria villaggio). Ogni uomo ha suo modo diverso. Io sono cresciuta così e sto insegnando ai miei figli.

... G (Nigeria villaggio). Tu non hai tempo per rimani a casa. Devi uscire per trovare qualche cosa da mangiare. Deve mettere bambino dietro. Non hai tempo per rimani a casa.

... g. noi africane se per esempio io lei cammina troviamo una signora italiana che sta spingendo suo figlio. A, buon giorno, quanti mesi ha? 16 mesi, 17 mesi ha appena iniziato a camminare. In Africa questa vai, capito, perché

...

g. se lei ha girato le scuole. Io non lo so io sono della Croazia. L'unica cosa che combatto è che per me non è una cosa normale che nelle 8 ore non si fa nessun movimento tipo attività motoria ecc. ecc. quest'anno per grazie di chi o Patrizia o qualcuno che l'ha fatto, hanno fatto quella bella cosa Ghirada ... non so chi..

p. sono io..

g. a, è lei!? Bello

g. è una cosa bellissima, perché offre la cosa, ci vuole. Io sono d'accordo che nelle scuole dell'infanzia e dopo elementari dappertutto serve una materia tipo palestra, dove uno ... ora ci stanno che si sfogano

Legenda: In rosso le mamme africane; in blue: mamme ex-Jugoslavia; In nero; Genitori italiani;
p: Patrizia

I dati sopra riportati mettono in evidenza che lo sviluppo motorio è embedded, cioè strettamente dipendente dall'ambiente, embodied, soggetto alle limitazioni personali e encultured, modellato dalla cultura di cui si fa parte, come specificato nella rivisitazione della letteratura scientifica riportata all'inizio di questa tesi,

Rispetto alla relazione tra sviluppo motorio e capacità scolastiche presento, di seguito, alcuni esperienze, relative a come questa questione viene percepita dai genitori e dagli insegnanti.

15 ALTRE OSSERVAZIONI QUALITATIVE

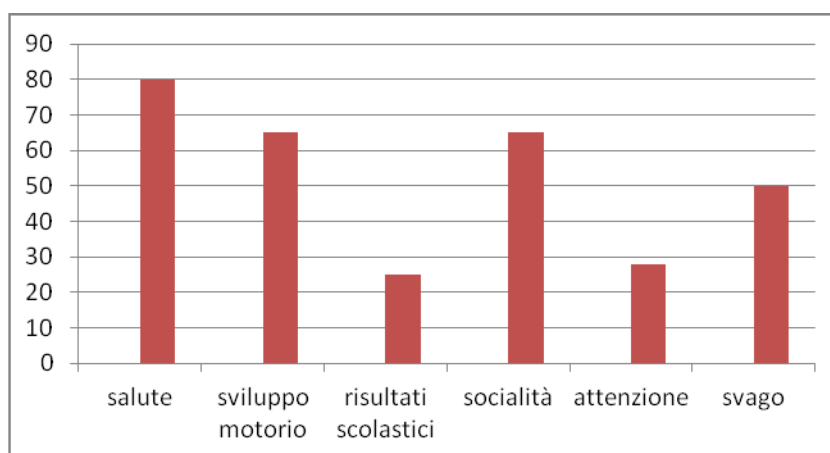
15.3 STUDY 13 – ATTIVITÀ FISICA E SUCCESSO SCOLASTICO/ PHYSICAL ACTIVITY AND SCHOOL READINESS

Questionnaires were administered to the parents and teachers of children now attending the primary school that participated to the playground activities one and two years previous, to investigate on their opinions about the positive or negative effects of physical activity of the children. Both teachers and parents find that physical activity promote some important school competence. Teachers, at a higher level evidence the positive association they found between physical activity and some aspects related to executive functions and other cognitive processes.

Riporto le tabelle riassuntive, espresse in percentuale dei risultati dei questionari somministrati ai genitori dei bambini che hanno frequentato il parco giochi e che stanno frequentando la scuola primaria e ai rispettivi insegnanti.

Tabella 15.2

Quali sono secondo Lei gli aspetti conseguenti alla pratica dell'attività motoria? %
Somministrato solo ai genitori (35)



I genitori enfatizzano i benefici relativi alla salute, sviluppo motorio, socialità e svago e riconoscono come un pò meno associati benefici in risultati scolastici e attenzione.

Le tabelle che seguono riportano invece i risultati dei questionari somministrati sia a genitori (sinistra) sia agli insegnanti dei relativi bambini/e (destra) della scuola primaria

Tabella 15.3

Potrebbe l'attività motoria aiutare lo sviluppo delle seguenti capacità? %

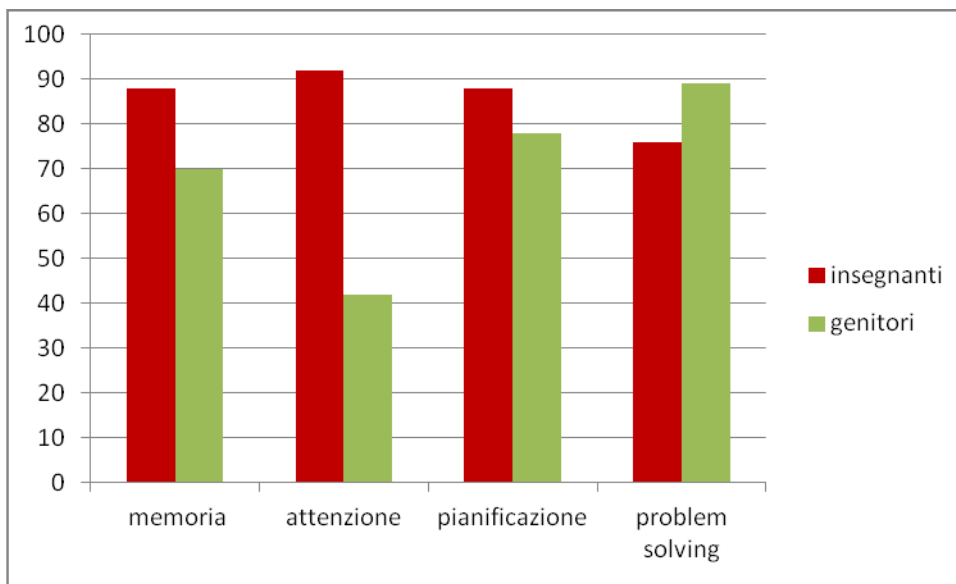


Tabella 15.4

Quali attività possono favorire lo sviluppo delle capacità di apprendimento scolastico? %

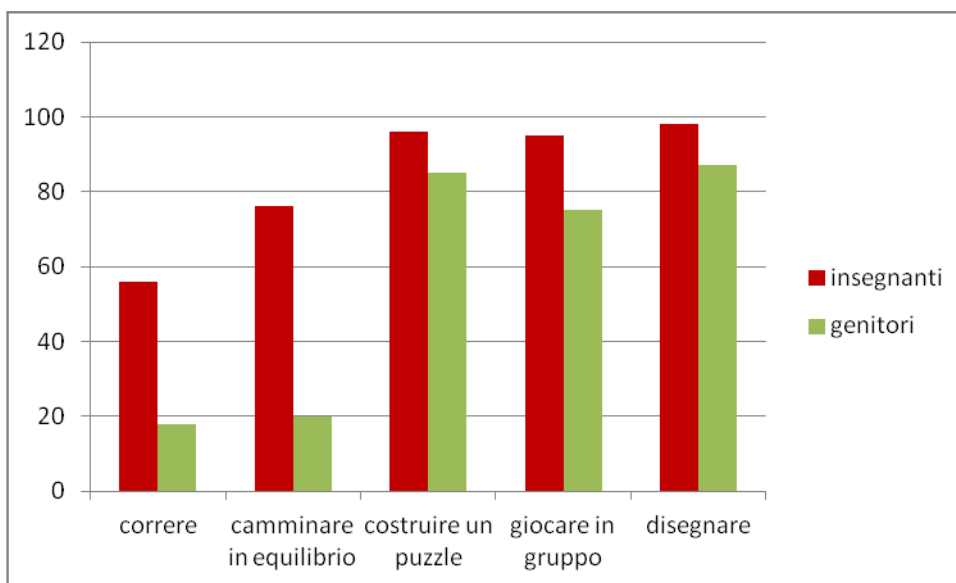
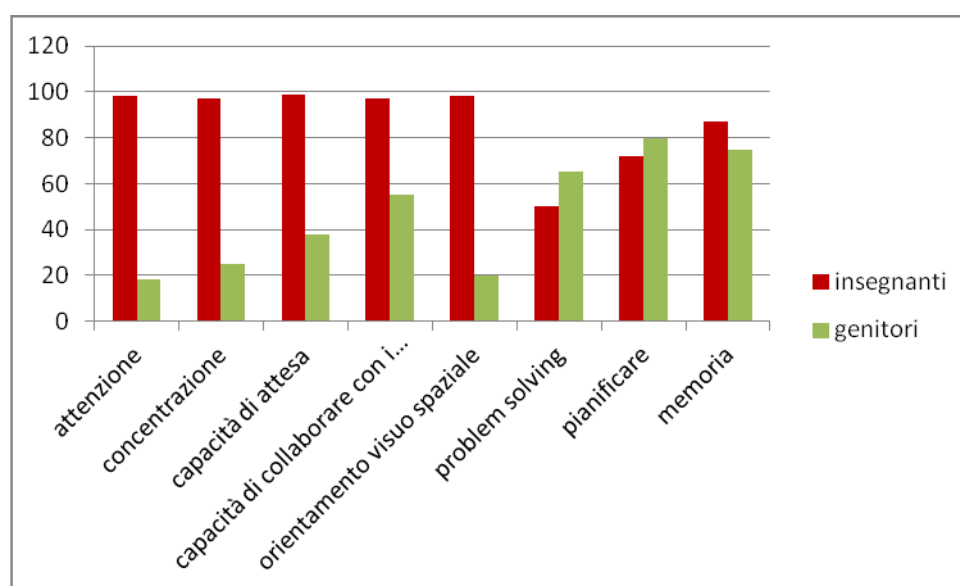


Tabella 15.5

Quali capacità possono essere migliorate con l'attività motoria?%



Dai questionari emerge che vi è una certa considerazione dell'attività motoria rispetto alle capacità scolastiche con una visione ottimistica da parte degli insegnanti. I genitori hanno una percezione più bassa degli insegnanti rispetto a modifiche che l'attività motoria può apportare a valori cognitivi.

Con gli stessi insegnanti è stato anche realizzato successivamente un incontro di approfondimento sull'importanza dell'attività motoria.

Focus groups

Sono stati realizzati due incontri/focus groups, nei due circoli didattici di affluenza dei bambini. Non sono stati registrati, perché si pensava che il registratore avrebbe potuto inibire gli insegnanti, che non erano stati avvisati in precedenza di questo. Si è dunque provveduto ad annotare quanto detto. Ho pensato di non richiedere agli insegnanti un incontro registrato, volevo evitare che la situazione potesse farli sentire in difficoltà e scoraggiarli dal partecipare all'incontro. In genere gli insegnanti faticano a venire agli incontri "non obbligatori" e se partecipano è perché sono intrinsecamente motivati. Volevo contribuire alla loro motivazione creando quindi uno spazio di racconto e di

discussione che non potesse in alcun modo generare domande in merito a: “ che ricerca fanno, perché, cosa fanno di quello che diciamo...” Trattandosi della prima volta che avrei visto gli insegnanti mi è sembrato importante favorire il senso di accoglienza e condivisione senza fare emergere in modo evidente l’aspetto della ricerca che stavo conducendo. Ho poi provveduto a comunicare, durante l’incontro, che stavo realizzando uno studio sulle tematiche trattate e la loro reazione ha sconfessato i miei timori. In realtà sembravano essere molto favorevolmente interessati a questo aspetto e questo mi ha fatto pensare ad organizzare poi successivi incontri e ad avviare dei percorsi di ricerca-azione, grazie alla scrittura di un piccolo libro (Tortella et al., 2012, 2014). La necessità di realizzare questo incontro è anche dovuta al fatto che l’anno prima avevo provato a distribuire dei questionari, attraverso il dirigente scolastico e le segreterie, ma forse a causa del mancato rapporto diretto con gli insegnanti, ne avevo ricevuto solo pochi compilati. Questo aveva portato a chiedermi se ciò fosse stato la conseguenza di mancato interesse rispetto all’argomento della relazione tra attività motoria e sviluppo cognitivo o se vi fossero stati altri fattori quali ad esempio la mancanza di tempo. Da questi presupposti derivava la scelta di gestire la giornata con i mezzi disponibili, dal momento che la necessità primaria era che gli insegnanti partecipassero.

Ai due incontri hanno partecipato insegnanti affluenti complessivamente da 4 scuole primarie di Treviso, dove sono confluiti bambini e bambine provenienti da 6 scuole dell’infanzia. Le classi primarie erano miste di bambini/e che l’anno precedente avevano partecipato alle attività del parco e altri che non avevano partecipato. Ai due focus groups erano presenti complessivamente 16 insegnanti delle classi prima e seconda primaria e 20 insegnanti delle classi successive. Gli incontri sono stati condotti dalla sottoscritta, che ha invitato i docenti accordandosi con la dirigente scolastica, per fare con loro un incontro di approfondimento sull’importanza dell’attività motoria all’aperto. La partecipazione anche di docenti delle classi successive alla prima e seconda può fare pensare che l’argomento trattato sia stato accolto con interesse. Dopo una parte iniziale di presentazioni ho avviato la discussione sull’attività motoria in relazione al successo scolastico la sintesi di quanto riportato dagli insegnanti è la seguente, predisposto in base ad una riorganizzazione delle affermazioni fatte dagli insegnanti per categorie:

(n 16) INSEGNANTI DI DIVERSE DISCIPLINE CHE SEGUONO I BAMBINI TRANSITATI DALLA SCUOLA DELL'INFANZIA ALLA PRIMARIA NELLE CLASSI PRIMA E SECONDA.

Partecipazione in gruppo

Vede un grande legame di gruppo, coalizzati,

Ha introdotto il lavoro libero perché si sanno organizzare molto bene. In palestra lavorano con teli, cerchi, È una PALESTRA vivente, sanno organizzarsi, creare autonomamente. Si coordinano in gruppi spontanei Per trasportare oggetti in equilibrio.

Hanno angolo lettura e sono sempre molto molto ordinati e organizzati. Non leggono mai da soli ma si mettono in gruppo e discutono sulle immagini o sul testo del libro. Fanno conversazione tra loro.

Fanno gruppo. Le uscite al parco sono state molto di aiuto in questo. hanno avuto modo di frequentarsi tra bambini della stessa età, poiché di solito lavorano con età differenti e non si conoscono fra loro nelle diverse sezioni.

Ha visto differenze tra la prima uscita e l'ultima, nella capacità di fare gruppo, alla fine sapevano già cosa dovevano fare.

Si sono abituati ad ascoltare e stare in gruppo, organizzarsi anche in ambiente sconosciuto come la piscina. Poi quando entrano in acqua è tutto un caos..

Capacità empatiche

Si aiutano tra di loro, capiscono quando gli altri hanno bisogno e sono disponibili

Ricchezza di proposte, creatività

ricchi di proposte

molto creativi

Partecipazione attiva

non tacciono mai

punto di vista motorio

Anche allenatore di rugby ha notato che è una classe molto avanti da un punto di vista motorio

Durante la mattina ogni tanto esco in corridoio e li faccio correre, sfogare

HA NOTATO CHE SOPRATTUTTO GLI STRANIERI QUANDO SONO A CASA STANNO ANCHE LE DOMENICHE A CASA, NON SI TROVANO CON NESSUNO E I BAMBINI DICONO CHE GUARDANO LA TELEVISIONE E GIOCANO ALLA PLAY STATION.

Ho visto che i bambini che si muovono di meno sono quelli che poi quando si muovono cadono di più.

Schema corporeo

HANNO UNA EVIDENTE DIFFERENZA NELLA MANUALITA'

RICONOSCONO LA DESTRA NELLA FIGURA CHE HANNO DI FRONTE. QUASI TUTTI CONOSCONO LA MANO DESTRA E LA MANO SINISTRA E SANNO VEDERE LA STESSA MANO NELLA PERSONA DI FRONTE. Non ha mai visto fare questo in bambini, solo con questo che provengono da parco giochi.

Sono avanti nelle prestazioni scolastiche

Riconoscono il quadretto grande, si orientano nel foglio, nello spazio, sanno saltare i quadretti e ha dovuto accelerare il programma di sempre perché erano molto avanti.

Hanno capacità di mantenere il ritmo

Sanno aspettare il loro turno e organizzazione

In mensa si alzano a turno organizzandosi tra loro per versarsi l'acqua da soli

Fanno gioco libero e si sanno organizzare autonomamente. Si propongono giochi semplici e tutti gestiscono insieme. L'ADIFFERENZA CON GLI ALTRI BAMBINI CHE NON PROVENGONO DAL PARCO E' MOLTO EVIDENTE IN QUESTO.

Hanno capito i tempi di attività, riposto, attesa

Si mettono spontaneamente in fila e rispettano il loro turno

NON ENTRANO IN CLASSE FINO A CHE NON ARRIVO. SANNO ASPETTARE E PAZIENTARE. In genere gli altri bambini non attendono e bisogna sempre dire loro cosa fare. A questi no.

SANNO METTERSI IN FILA DA SOLI

A scuola lavorano molto sulla capacità di attesa. Hanno sezioni miste. I bambini prima dell'esperienza al parco dovevano sempre avere qualche cosa da fare, altrimenti non stavano fermi. Dopo l'esperienza al parco invece sanno attendere anche se non hanno da fare qualche cosa.

Nessuna differenza nel rito: mettersi in fila, salire uno alla volta, come in piscina fanno al parco e negli altri luoghi.

Capacità di orientamento spaziale

MOLTISSIMO EVIDENTE E' LA CAPACITA' DI ORIENTAMENTO SPAZIALE

Gli altri spesso scrivono a specchio, da destra a sinistra. Con questi bambini non è mai successo.

Sanno cosa sono i quadretti, stanno negli spazi, saltano il quadretto, anche due e chiedono alla maestra. Contano quando saltano i quadretto, 1,2...

Sanno trovare il centro di un'immagine e il centro del foglio,

sanno collocare oggetti al centro o nei diversi punti del foglio,

DIFFERENZA PIU' ELEVATA è che sanno riprodurre cornicette e orientare lettere nel verso giusto.

I bambini che provengono dalle scuole private hanno molte difficoltà.

Si orientano bene, senza fatica anche quando vedono le frecce, capiscono subito.

Sarebbe bello vedere se e come con un percorso sistematico queste difficoltà dei bambini si possono recuperare. Maestra chiede aiuto in questo.

SI ORIENTANO NELLO SPAZIO, CONTANO I QUADRETTI

METTONO LE FIGURE SUL FOGLIO

SANNO COSA E' DENTRO E COSA E' FUORI

Memoria

Gichiamo in giardino, in ambienti viventi e non viventi e sanno riconoscere subito gli animali e li trovano. Sanno trasferire quello che dico in classe in giardino. Dove arriva la sabbia c'è l'acqua e loro in giardino cercano...

Autonomia

SONO AUTONOMI

Raggiungono autonomia

I bambini di 5 anni vanno in piscina e una volta venivano due genitori ad aiutarli a cambiarsi negli spogliatori, ora invece non abbiamo chiamato nessuno perché sono diventati dopo l'esperienza al parco cos' autonomi che non vogliamo nessun genitore. Sanno cosa devono fare e si organizzano tra loro autonomamente.

Capacità di imparare ad imparare

Sfruttano ogni occasione per promuovere apprendimento, anche quando devono salire sul pulmino è un'occasione di apprendimento motorio!

Cambiamenti negli insegnanti

Anche le insegnanti hanno maturato un'attenzione diversa. Adesso escono sempre in giardino, prima no

Cambiamenti nei genitori

*Anche i genitori accettano che i bambini si sporchino, perché noi diciamo loro che è perché hanno lavorato tanto. Li abituiamo a questo. abbiamo i ricambi. (lavorando si impara)
I genitori si fidano di noi.*

Le macro categorie possono essere così rappresentate:

(n 16) INSEGNANTI DI DIVERSE DISCIPLINE CHE SEGUONO I BAMBINI TRANSITATI DALLA SCUOLA DELL'INFANZIA ALLA PRIMARIA NELLE CLASSI PRIMA E SECONDA.

Partecipazione in gruppo

Capacità empatiche
Ricchezza di proposte, creatività
Partecipazione attiva
motorio
Schema corporeo
Sono avanti nelle prestazioni scolastiche
Sanno aspettare il loro turno e organizzazione
Memoria
Autonomia
Capacità di imparare ad imparare
Cambiamenti negli insegnanti
Cambiamenti nei genitori
Capacità di orientamento spaziale
Capacità di imparare ad imparare

Se si rileggono le categorie costruite con quanto evidenziato dalla letteratura scientifica precedentemente presentata emerge che vengono considerati importanti dagli insegnanti aspetti relativi sia alle **funzioni esecutive**, cui si possono ricondurre le seguenti categorie:

Funzioni esecutive

Sono avanti nelle prestazioni scolastiche
Sanno aspettare il loro turno e organizzazione
Memoria
Autonomia
Creatività (Memmert, 2011).
Orientamento spaziale
Capacità di imparare a imparare

Altre funzioni cognitive rilevate

Capacità empatiche → teoria della mente

Modifiche nel comportamento

Partecipazione attiva

Cambiamento negli insegnanti

Cambiamento nei genitori

Sviluppo motorio

Motorio, schema corporeo

In un altro studio è stato somministrato un questionario a due insegnanti di due classi di scuola primaria di un paese vicino a Mantova, dove sono confluiti i bambini che l'anno precedente hanno partecipato ad un progetto di attività motoria. Alle due insegnanti viene chiesto di dare un punteggio a ciascun bambino della classe, in ordine alle capacità sotto elencate. Le insegnanti non sapevano quali bambini avevano partecipato al progetto l'anno precedente ed entrambe erano insegnanti delle due classi (Baggio et al., 2013). Di seguito vengono riportati i risultati, in cui si vede che vengono attribuite maggiori capacità, che si possono ricondurre alle funzioni esecutive ai bambini che l'anno precedente avevano fatto parte del progetto motorio, in particolare relativamente a: orientamento nello spazio, collaborazione con i compagni, rispetto delle regole, attenzione, capacità di lettura, disegno. Le capacità di orientamento nello spazio, collaborazione con i compagni, rispetto delle regole, attenzione, disegno, sono state menzionate anche dagli insegnanti coinvolti nei focus groups.

In verde sono indicati i punteggi attribuiti dalle insegnanti, rispetto agli aspetti riportati, ai bambini che negli anni precedenti non hanno partecipato agli incontri di attività fisica, mentre in rosso ai bambini che hanno partecipato.

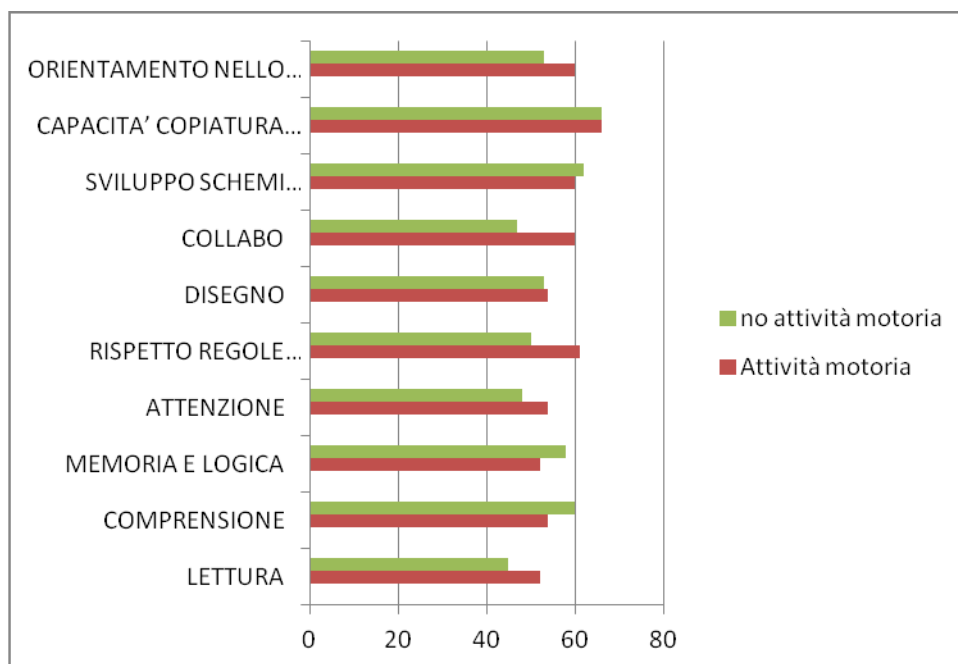


Tabella 15.6

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PART IV -SUMMARY OF RESULTS, DISCUSSION AND CONCLUSIONS

16 SUMMARY OF RESULTS

The second part of the thesis, related to the practical research has been developed through some empirical studies, already published, other not published yet, and some considerations.

From the first part of the study, from the analysis of the current international literature it emerges that physical activity is the link to motor development, physical fitness and mental health and physical activity is also the link to cognitive processes, school readiness, mental health.

The second part of the thesis, regarding the empirical study and in a context of ecological theory (Bronfenbrenner) and Newell's model of constraints, tries to answer to the questions derived from the aim of the research: a) "What is the role of the environment in developing physical activity in preschool children? b) "How may we develop motor skills in children"? c) "If and how may we develop cognitive processes by means of physical activity"?

Studies related to the first question:

"What is the role of the environment in developing physical activity in preschool children?"

Study 1 - "Prospettiva ecologica: importanza di ambiente e contesto nello sviluppo motorio dei bambini - Ecological perspective: importance of environment in child motor development

From this study it emerges that most of the teachers in nurseries/kindergarten in northern Italy have an education corresponding to high school level. They are not used planning

and what they declare to do in practice is not correspondent with what they really do with children. Their educational intentions are also not corresponding with their activities. Teachers seem not to be aware that children need to have the most wide range of motor opportunity, to promote motor development. This is particularly important for their children that stay until 10 hours a day in the nursery, spending the entire day with them. They do not pay attention to equally organize environment and activities to promote equally the development of manual dexterity, balance and mobility skills, which build up motor development. The activities are more concentrated in manual dexterity, fine motor skill and not in mobility, gross motor skill. They seem to consider the child in a maturation perspective and not consider the importance of experience, social relation and environment in child development.

**Study 2 - Motor cognition during free play in 3 years old children builds up on factors involving space organization and social interaction/
L'organizzazione di spazi e ambiente contribuisce a costruire la cognizione motoria , durante il gioco libero, nei bambini di 3 anni**

In this study it emerges that the organization of the tools in the environment, during free play influences motor behavior and physical activity. In the specific context, when the circles were disposed in one corner of the room children played each other, manipulating the circles in several ways. Manual dexterity activity was prevalent and also the social play. Often children played in couple or small group. In the other condition where the circles were placed on the floor of the whole room children spent most of the time running, jumping, and never manipulated the circle. They played alone and never in couple or little group for the entire time of the lesson. The prevalent area of motor skill was mobility. The pedometer, to measure the number of steps the children did during the activity revealed that children move more during in the situation of circle placed in the whole floor respect in the other condition of circle piled in a corner of the room. Summarizing the organization of space/environment has significant impact on physical behavior of children involved in free play; the choice of tools available for free play modulates intensity of physical activity; spatial distribution of tools in the environment

determines their unstructured use and the levels of physical activity inducible in children; observation of pairs by children can prime group responses during unstructured play.

Studies related to the second question

“How may we develop motor skills in children”?

Study 3 - New environments for the education of 0-6 years old children: what teachers think about the playground for formal and non formal education. Nuovi spazi per l’educazione dei bambini da 0 a 6 anni: cosa pensano gli insegnanti del parco giochi come luogo di educazione formale e non formale.

In this study it emerges that teachers argue that children practice physical activity in kindergarten only one hour a week. The activity practiced is organized in manual dexterity, mobility and balance.

They consider the playground as a good environment for to increase child development, especially for social skills, psychological health, motor development, self esteem, autonomy, new experiences, new relations, movement, motor skill, manual dexterity. The playground may be an educational tool but teachers suggest that it would be important to organized activities in connection to school programs and propose structured activities combined with free play. They also highlight the importance to listen to the voice of the children, asking them their consideration about what they are doing. Concluding, teachers declare the importance of indoor and outdoor opportunities to promote physical activity, but they dedicate only few time, 1 h a week for children motor activity.

Study 4 - PAPER IN PREPARATION: Exploring the effects of 10 hours playground activity on motor competence and physical fitness in 5 year old children/Esplorando gli effetti di 10 ore di attività fisica per lo sviluppo di competenze motorie al parco giochi, in bambini di 5 anni.

In this study we show that 1 hour a week for 10 weeks activity mixed structured and free play, improved significantly four gross motor skills: one leg balance, balance on beam, balance on platform, putting medicine ball. The study was organized with three groups of children from 6 schools. Two groups (a and b) came to the park once per week for ten weeks: when at the park, group (a) was exposed to 30 min of structured activity and 30 min of free play, whereas group (b) had 1 hour of free play; the third (c) group never came to the park with the exception of two days used for testing at the park. The tests were in part fine- and gross-motor skill measurements, were taken at school and in the park at the beginning and the end of the study; they included in the ABC, a collection of tests of motor competences defined by the University of Cambridge and extensively used by the international scientific community; another part of the tests were defined in collaboration with the group of Prof Sigmundsson of the University of Trondheim, Norway; finally, some of the tests implying the use of the instruments of the park had been set up by myself. Most of the improvements were seen in group (a) while limited improvements were seen in groups (b) and (c). In some cases children of control group that never come to the playground increased more than the free play group, possibly depending on the activity practiced at school. The standardized tests confirmed that there was transfer between gross motor activities but not from gross- to fine-motor skills. Future perspectives and directions: It is necessary to continue to investigate on task specific activity and on transfer of competence between gross motor skills using more assessments systems. Longitudinal studies to investigate the role of free play and structured activity in acquisition of fundamental motor skills, the role of the mediation by educators during structured activity, the role of teachers during free play, the role of intensity, frequency and duration of activities are necessary, to better understand children motor development.

Studies related to the third question:

If and how may we develop cognitive processes by means of physical activity?

Study 5 - Percezione-azione: il ruolo dell'educatore nella attribuzione di significato all'ambiente e al compito, con bambini di 5 anni/ Difficult

motor skill acquisition in 5 y old children can be modulated by educators.

In this study we experienced the great role of training in zone of proximal development (Vygotsky): scaffolding by a teacher provided the increase of motor skills required for addressing a difficult motor task and was associated to increased perception of self-efficacy and of competence.

The difficult task consisted in the use of a spring bar where the difficulty consisted in (a) climbing on the unstable bar and (b) walking on it. I provided scaffolding by allowing the child to use my shoulder during the climbing attempts; once on the bar, the child was encouraged to move and to transform the loss of balance in an amusing moment by jumping down the bar. At difference with what happened with “not scaffolded” children, these children quickly learned the task. In addition they used the instrument during free playing even before they were able to use it and kept trying to use it even if unsuccessful. In several case the children exclaimed “I did it!” even if they were helped (scaffolded) by my in their first attempts, suggesting an anticipation of perception of competence.

Several components seem to be interacting in this task and will be object of future studies: perception related to future competence, self esteem, meta-cognition and linked to the knowledge to learn how to learn.

Study 6 - Health, physical activity and executive functions in 3-5 years old children. The opinions of the parents.

In this study it emerges that the majority of parents considered playing, socialization, movement control and body coordination the most relevant aspects of school physical education. Minor interest is devoted to the learning of a sport discipline and to the possible relaxing aspects of movement. For the majority of the parents fun and positive effects on growth were the item most expected from children Pas. Expectations were high also for the effects on socialization and discipline. The effects of personal feeling and self-esteem of the child were also positively considered. Parents did not think that physical education induced hyperactivity, stress or nervousness nor that children get into

competition with each others because of physical activity. It is important to consider that the expectations of the parents are very much influenced by culture. About the expectance of a relation between physical activity and stress, for example in Indonesia parents find a high correlation and this may be one of the reasons of low level of physical activity in Indonesian children (Rahayu, 2014).

Almost all the parents asserted that physical activity organized by school were good at teaching children to abide the rules and respect the roles and to learn the team spirit and to overcome obstacles. Few parent considered physical activity a tool for learning competitiveness and none a cause of aggressiveness, anger and sadness. About the conditions that may interfere with participation of children to physical activities almost all the parents excluded fatigue and excess of other commitments. More likely obstacles may originate from family organization. The majority of parents did not considered TV watching of playing electronic games a real obstacle to dedication to physical activity, nor their cost or lack of space/opportunities.

The majority part of parents (78%) would like to be involved in events of organized motor activities or play with their children at least once a month, for 2 hours, but only a few of them (30%) would like to be involved by the school in projects of physical education for their child. Less than half (40%) of the parent expected the school to provide instructions to parents about PA with children. Only 29% wished the school to offer physical activity opportunities beyond the school day, probably because most of them (82%) found not difficult to organize physical activities outside the school. Almost all of the parents agreed with their partner on the relevance of physical activity for the child well-being and 2/3 of them considered him/her-self competent for helping child to be physically active.

One third of the interviewed parents asserted that their children practice physical activity in playgrounds and sport clubs nearby home for more than 180 minutes during the week, and almost a similar amount of parents referred that children played physically active games only one hour or less during the week. They referred that their children watched television and pc for 60 minutes/week and 39% of them for 60 minutes on Saturdays and Sundays while most of the parent report that the time dedicated to watch TV and PC is larger during the week end. Only one third of the parents spent 30 minutes per day walking with the child at least every other day. A consistent fraction of the parents did not practice a sport discipline together with the child nor spent a lot of time watching the

child playing. In most cases parents physically played with child at home or outside (during the good season) for 30 minutes once or twice a week.

The results highlights that despite the parents believe physical activity for their children as very important there are some discrepancies between what declared and what practiced. The parents believe to be competent about physical activity but results are very far from the recommendation of the International organization for health. The children seem to move very less respect what recommended. NASPE, AHA, AAP, recommend at least 60 minutes of unstructured physical activity and 30-60 minutes daily structured physical activity of mild to moderate intensity, while the parents say that their children move from 60 to more than 180 minutes, in a week!

The present research highlights that the physical activity seems to be intended by parents as a “**natural**” activity, that doesn’t need to be organized. It is therefore necessary to implement physical educational training to help parents and also preschool teachers to be more responsible of the children development.

Study 7- *Mente e corpo nella relazione educativa nelle scuole dell’infanzia: lo sviluppo delle capabilities per una buona qualità della vita / Mind and body in the educational relationship in Kindergarten: the develop of capabilities for a good quality of life*

This is a theoretical study that highlights on the importance of providing children the capabilities to develop well as infancy is a period of total dependence of adults. Care givers must therefore be aware of their important role in child development. It is therefore important to promote physical activity in kindergarten, in the way to offer to all children the opportunities they need to develop in health. In this way the kindergarten may be of support also to socio-economical disadvantaged families and fully achieve their goals in the society.

Study 8 - How can teachers contribute to develop executive functions through motor activity?

This is a theoretical study that highlights on the importance of executive functions and their implementation through physical activity in children development. It also highlights the possible positive association between physical activity and school readiness.

As part of my studies, I planned a project to be executed in the playground Primo Sport 0246 and involving a specific motor activity program and the assessments of the children before and at the end of the training periods.

Study 9 – Improvement in cognitive processes at the playground?

I make some introductory considerations about the Day & Night test (D&N) administrated to children attending the playground activities to assess their inhibition competence. Although the test has been designed for older children, it is considered adequate also for 4-6 years old children. On the other hand it must also be considered that the test requires full understanding of the Italian language (a condition that may not be true for some of the immigrant children); in addition we notice that some of the non Italian children were deeply surprised about the task and almost refused to provide the “wrong” answered. For this reason I had to exclude form the analysis many data and for some of the data used, I am not fully sure that the response was totally independent from language and cultural biases.

Although all together the data need methodological refinement and increase in number, they indicate that significant improvements can be observed between two time points separated by 3 months. As for study 4, the children were divided in three groups (Experimental, Free Play and Control). The Experimental and Control groups showed significant improvements (i.e. reduction in number of errors); the Free Play group was not significantly different at the two time points.

We also compared changes in performance n the D&N in relation to the capacity of children to perform the difficult balance task described in study 5. At difference with what described in that study, here the children were all scaffolded to climb the bar and the

differences related to their walking capacity only (those children that were not able to climb the bar even if scaffolded by the teacher were not considered in this study).

Also in this case, children of the control and Experimental group performed better than the Free play group in the D&N test, while the Experimental group performed best in the balance task. A tendency of better D&N results depending of the acquisition of skill on the bar appeared from the data but requires confirmation by further studies.

The most interesting data were obtained by analyzing the results obtained from the experimental group. This consisted of two subgroups who received different scaffolding during the walking, with one group carefully attended and encouraged and the other left without encouragement. The data indicate that both the ability to walk on the unstable bar and the scores in the D&N test increased more in the attended group, suggesting that methodology of teaching a physical activity may interfere with development of executive function. This will be the object of my future studies.

Study 10 – Focus group with the teachers of primaries schools

I organize a focus group with the teachers (n. 16) of the primary schools who were teaching to children that had previously participated to the research project at the playground PRIMO SPORT 0246 in the years before.

The teachers were asked if they found some differences relative to school readiness between children that had experienced structured activities at the playground and other children who did not and were now in the same class (first and second class of primary school). Teachers reported that children who had participated to the physical activity project showed better levels of the following competences: a) referred to Executive Functions: better school readiness, better to draw on the paper, able to wait, memory, autonomy (able to organize themselves alone and in group), spatial orientation, able to learn how to learn; b) referred to other cognitive functions (theory of mind): Empathic abilities → Changes in behavior, Active participation, very propoitive, adjusting to changes of teachers and parent behaviors; c) referred to motor development: Development of motor skills and body schema.

Study 11 - Other qualitative observations: A study at the “monkey bars” tool in the playground.

The video camera allows observing the modality of playing of children during free play. I noticed that in 2012 no children used a tool, called “Monkey bar”, which is an opportunity to move by *brachiations*, hanging on bars. Children were assessed at this tool in 2012 and they showed to be able to move for 1 brachiation at his/her best. The tool was 2.30 m high and the company who sold it guaranteed that the tool was appropriate for 3 years old children. To reduce the impact and the height of the fall from the bar, I put under the bars a very thick mattress (the distance from the feet of the child and the floor without the mattress was > 1 meter!). Despite the reduction of the height was now < 50 cm, there was no change in the performances of children at “monkey bars”. I then decided to modify the instrument and by reducing its height of 70 cm. Following this change, the children started to use spontaneously the instrument and do brachiating (seen with cameras); the children tested were able to execute from 2 to 3 brachiations already at the pre test and this value increased to 5 at the post test, (after 10 visits at the park); also children of the control group (who never came to the park for the 10 visits) were able to perform approx 4 brachiations.

I suggest that this change in the use of the instrument may be related to the mechanism of perception-action and that the visual system, when hanging on the bar, may be prevalent compared to the perception system. In other words, the child was hanging and his head was at about 2 m from the floor and this was scaring to the child and caused incapacity to move on this tool. By lowering the height of the bars (now at 1.60 m from the floor) the child adjusts more easily to the height and can dedicate him/her self to the task of brachiating.

Study 12 - Considerations – a qualitative study. Teacher at the playground and the fear of danger for children, a focus group with parents of children attending the playground.

In these studies it emerges that the socio emotional cultural environment influences beliefs and style of teaching.

Study 13 – Physical activity and school readiness/ attività fisica e successo scolastico.

Questionnaires were administered to the parents and teachers of children attending the primary school that had participated to the playground activities one and two years before. Both teachers and parents found that physical activity promoted some important school competence. Teachers appeared more strongly convinced than the parents of the positive effects of the playground experience on the school readiness of their pupils.

In addition we investigated the opinion of teachers and parents of children that experienced a specific motor activity intervention at the kindergarten organized with the same teaching methodologies used at the playground. As above, both parents and teachers noticed that children that received “physical education” experience showed increased levels of school readiness and of the same cognitive parameters described in study 10

17 RIASSUNTO DEI RISULTATI

La seconda parte della tesi è stata sviluppata mediante studi empirici in parte già pubblicati e in parte ancora in preparazione.

Dall'analisi della letteratura emerge che l'attività fisica è connessa allo sviluppo motorio, al fitness fisico e al benessere mentale; inoltre sempre più evidenze indicano un collegamento tra attività fisica, sviluppo cognitivo e competenze scolastiche. In questa seconda parte della tesi, sviluppata nel contesto della teoria ecologica (Bronfenbrenner) e nel modello di Newell, cerchiamo di fornire risposta alle questioni emergenti nell'ambito di interesse: a) quale è il ruolo dell'ambiente nello sviluppo motorio del bambino in età prescolare?; b) come facilitare lo sviluppo delle competenze motorie?; c) "se e come si possono sviluppare capacità cognitive mediante l'attività fisica"

Studi collegati alla prima domanda:

Il ruolo dell'ambiente nello sviluppo motorio del bambino in età prescolare

Lavoro 1 **"Prospettiva ecologica: importanza di ambiente e contesto nello sviluppo motorio dei bambini"**

Nel lavoro 1 conduciamo un'analisi sulle scuole dell'infanzia del Trentino. Il primo dato rilevante è che il titolo di studio posseduto dalla maggioranza delle insegnanti è il diploma di scuola media superiore. Non sono quindi né specificamente educate né abituate a pianificare le proprie attività ed emerge una chiara dissociazione tra ciò che esse ritengono importante e quanto in realtà attuano con i bambini. Ne risulta che mentre le insegnanti ritengono molto importante il fatto che i bambini facciano attività motoria. Manca nel corpo insegnante la conoscenza del fatto che lo sviluppo motorio richieda l'esposizione a ripetute e variegata esperienze motorie. Questa mancanza è particolarmente importante in considerazione del fatto che i bambini spendono anche 10 ore al giorno a scuola in loro compagnia. Non viene data quindi attenzione a creare le condizioni ambientali e le opportunità di fare pratica motoria nelle aree della manualità, della mobilità e dell'equilibrio. La maggior parte delle attività proposte e svolte riguardano la motricità fine delle mani. Un'attenta valutazione dei convincimenti fa

trasparire l'idea che il bambino "maturi" da solo senza che sia valutata adeguatamente l'importanza per lo sviluppo del fare esperienza sia in ambito motorio che psico-sociale.

Lavoro 2 "L'organizzazione di spazi e ambiente contribuisce a costruire la cognizione motoria, durante il gioco libero, nei bambini di 3 anni".

In questo studio dimostriamo come l'organizzazione dello spazio e gli attrezzi/giochi messi a disposizione dei bambini abbiano un forte impatto sul tipo di attività fisica svolta spontaneamente dagli stessi. In un contesto di gioco libero in cui nella stanza sono disponibili cerchi il tipo di gioco realizzato variava a seconda della disposizione dei cerchi stessi. In particolare il gioco diventava preferenzialmente simbolico-manuale se i cerchi, all'inizio del gioco, erano raccolti ammassati in un angolo della stanza (per il resto vuota); si trasformava in attività motoria sostenuta (mobilità) se i bambini trovavano i cerchi sparsi per terra. In quest'ultima condizione il gioco consisteva prevalentemente nel correre saltando e correndo da un cerchio all'altro. A differenza di quanto avveniva nella prima condizione, il gioco era prevalentemente individuale. Abbiamo utilizzato i pedometri (misuratori di passi inseriti sui pantaloncini dei bambini) per quantificare le differenze tra le due condizioni di gioco e abbiamo potuto così dimostrare che la disposizione degli oggetti nella stanza come pure la presenza di oggetti di gioco diversi dai cerchi avevano un profondo effetto sulla quantità di movimento fatto dai bambini nel corso dell'attività di gioco libero. Nel lavoro concludiamo che la scelta degli strumenti/giochi a disposizione di bambini durante i momenti di gioco libero influenza significativamente l'intensità e la quantità di attività fisica che essi conducono.

Studi collegati alla seconda domanda:

Come possiamo facilitare lo sviluppo di competenze motorie nei bambini?"

Lavoro n.3: Nuovi spazi per l'educazione dei bambini da 0 a 6 anni: cosa pensano gli insegnanti del parco giochi come luogo di educazione formale e non formale.

In questo studio si rileva il desiderio degli insegnanti di aumentare la frequenza al parco dei bambini. Le visite al parco sono organizzate dalla direzione del parco e consentono alle scuole coinvolte nella ricerca di portare le classi di bambini di 5 anni al parco 1 volta

alla settimana per 10 settimane nel periodo marzo-maggio; l'attività praticata riguarda prevalentemente la manualità, la mobilità e l'equilibrio.

L'opinione delle insegnanti è che il parco sia un ambiente ottimo per favorire lo sviluppo di diverse competenze nel bambino in particolare quelle motorie, sociali e psicologiche. Inoltre l'attività condotta è ritenuta importante per migliorare l'autostima e l'autonomia. Il parco può quindi essere considerato uno strumento didattico ma viene segnalata l'importanza di organizzare le attività in connessione con i programmi scolastici e insistono sull'importanza di associare a momenti di gioco libero momenti di gioco strutturato.

Inoltre sottolineano l'importanza di ottenere e ascoltare le opinioni dei bambini stessi attraverso interviste e altre forme di attività che consentano ai bambini di esprimere le proprie impressioni e convincimenti. In conclusione, gli insegnanti esprimono il proprio convincimento sull'importanza di realizzare attività motorie sia in ambiente aperto che all'interno degli edifici scolastici ma non si discostano, sul lato pratico, dalla tradizione di dedicare a questo tipo di attività circa 1 ora alla settimana.

Lavoro n. 4 Esplorando gli effetti di 10 ore di attività fisica per lo sviluppo di competenze motorie al parco giochi, in bambini di 5 anni.

In questo studio dimostriamo come l'esperienza al parco giochi Primo Sport 0246 di 1 ora alla settimana per 10 settimane consecutive induce un significativo miglioramento di alcune competenze "grosso motorie", in particolare: equilibrio su una gamba, camminare sulla barra d'equilibrio, saltare su piattaforme mobile e lancio della palla medica da 1 Kg. I bambini considerati sono stati suddivisi in tre gruppi: il gruppo (a) veniva al parco 1 volta alla settimana per dieci volte e l'ora a disposizione era suddivisa in 30 minuti di gioco strutturato e trenta di gioco libero; il gruppo (b) occupava le 10 esperienze effettuando ogni volta 1 ora di solo gioco libero; il gruppo (c) non è mai venuto al parco ad esclusione di due volte, all'inizio e alla fine dello studio, per effettuare le misurazioni. Queste sono state effettuate sia a scuola che al parco all'inizio e alla fine dello studio; in parte erano misurazioni che fanno parte dell'ABC test (un insieme di test di capacità sia grosso- che fino- motorie sviluppate dall'Università di Cambridge, UK), in parte realizzate con la collaborazione del gruppo del Prof Sigmundsson di Trondheim, Norvegia e in parte da me messe a punto utilizzando gli attrezzi del parco. Il lavoro al

parco è stato prevalentemente di tipo grosso-motorio. Il gruppo (a) è quello che mostra i miglioramenti più marcati, riferiti particolarmente alle attività grosso-motorie. Miglioramenti scarsi o mancanti sono stati riscontrati nei gruppi (b) e (c). In qualche caso i bambini di quest'ultimo gruppo mostravano comunque miglioramenti importanti, a livello di quelli dei gruppi che hanno effettuato attività al parco, forse perché alcune delle competenze misurate sono "allenabili" anche con altre forme di esercizio effettuato a scuola o spontaneamente. I dati dei test confermano che vi è trasferimento di competenze tra attività grosso-motorie ma non tra queste e le competenze fino-motorie. Prospettive future: sarà necessario approfondire gli studi sia aumentando la casistica che incrementando le capacità di misurazione delle competenze motorie. L'obiettivo sarà soprattutto di analizzare in modo più approfondito il problema del trasferimento di competenze tra attività diverse, il significato di gioco libero e attività strutturata, il ruolo dell'insegnante e della sua mediazione (in particolare durante il gioco libero), l'importanza di durata e intensità come elementi per l'incremento delle competenze motorie.

Lavoro n. 5 - Percezione-azione: il ruolo dell'educatore nella attribuzione di significato all'ambiente e al compito, con bambini di 5 anni.

In questo studio abbiamo sperimentato l'importanza del lavoro in "zona di sviluppo prossimale" (Vygotsky) per l'acquisizione di competenze necessarie per affrontare con successo compiti motori di elevato livello di difficoltà e come il successo sia associato ad aumento di autostima e di percezione di competenza da parte del bambino.

Il "compito difficile" consisteva nel riuscire (a) a salire su un'asse d'equilibrio mobile (appoggata su molle) e (b) a camminare per tutta la sua lunghezza. I bambini sono stati assistiti da me esclusivamente nella fase di salita: il mio aiuto consisteva unicamente nell'offrire appoggio passivo (con il gomito) durante la fase di salita; una volta sull'asse il bambino/a veniva incoraggiato a camminare e, nel caso di perdita d'equilibrio, a trasformare il momento di difficoltà in gioco effettuando un "bel salto giù dall'asse". A differenza di quanto accadeva con gli altri bambini, quelli a cui ho offerto "scaffolding": a) hanno imparato tutti nel giro di poche lezioni a camminare speditamente e senza errori lungo l'asse; b) utilizzavano il gioco dell'asse con le molle anche durante i 30 minuti di gioco libero ancor prima di aver acquisito la capacità di svolgere oilm compito; c) in

queste fasi di gioco libero provavano e riprovavano ripetutamente anche in presenza di ripetuti insuccessi. In diversi casi i bambini esclamavano con viva soddisfazione frasi del tipo “Ce l’ho fatta a salire” anche se ciò era avvenuta grazie al mio appoggio dimostrando di percepire il possesso della competenza prima della sua reale acquisizione.

Diversi aspetti sono da approfondire relativamente a questa situazione sperimentale. In particolare intendo sviluppare in futuro studi riguardanti: la percezione anticipata di competenza, l’autostima, la meta-cognizione e il collegamento tra apprendimento e conoscenza di come fare ad imparare.

Lavoro n. 6 - Salute, attività fisica e funzioni esecutive nei bambini da 3 a 5 anni. Le opinioni dei genitori.

Da questo studio emerge che è opinione della maggioranza dei genitori che il significato dell’educazione fisica scolastica sia di consentire al bambino di giocare, socializzare, imparare a controllare il proprio movimento e a coordinarsi. Meno interesse è rivolto all’apprendimento di una disciplina sportiva e ai possibili effetti rilassanti dell’attività motoria mentre, al contrario, l’aspettativa è alta per quanto riguarda la possibilità di divertirsi e di esercitare un effetto benefico sullo sviluppo, sulla socializzazione e sulla disciplina; sempre interessanti ma non prioritarie sono le attese per quanto riguarda l’autostima. Infine i genitori non ritengono che l’educazione fisica induca eccitazione, iperattività o stress né che possa causare una crescita dello spirito di competizione generalizzato nei confronti dei coetanei. Quasi tutti i genitori concordano nell’asserire che l’attività fisica organizzata in ambiente scolastico aiuta ad imparare il rispetto delle regole e lo spirito di gruppo e a superare gli ostacoli. Un numero limitato di genitori ritiene che lo sport sia strumento per apprendere lo spirito di competizione e nessuno ritiene che possa essere causa di aggressività, rabbia o tristezza.

Per quanto riguarda le possibili cause che limitano la partecipazione a programmi di attività motoria, praticamente tutti escludono la fatica o altri impegni concomitanti, pochi considerano la TV o i giochi elettronici quali possibili ostacoli come pure gli eventuali costi o la mancanza di spazi. I più invece trovano nelle difficoltà organizzative familiari la causa più rilevante. Il 78% dei genitori vorrebbe essere coinvolto in eventi di attività motoria organizzata o in giornate ludiche motorie almeno 1 volta al mese per circa due ore ma solo il 30% si dice disponibile ad essere coinvolto con la scuola in progetti di

attività motoria. Circa il 40% dei genitori vorrebbe ricevere istruzioni dalla scuola in merito alle attività motorie dei propri figli e solo il 29% gradirebbe ricevere un'offerta più ampia di possibilità di attività motoria da parte della Scuola (anche perché 82% ritiene che non sia così difficile organizzarsi con offerte prodotte esternamente alla scuola).

Praticamente tutti i genitori concordano tra loro sull'importanza dell'attività fisica per lo sviluppo e il benessere del proprio bambino/a e 2/3 di loro ritiene di essere sufficientemente preparato ad aiutare il bambino ad essere fisicamente attivo.

Circa 1/3 dei genitori intervistati dichiara che i propri figli sono fisicamente attivi giocando in parchi giochi o in associazioni sportive per circa 180 minuti alla settimana; una stessa proporzione invece afferma che i propri figli sono attivi per non più di 60 minuti alla settimana. Dichiarano inoltre che i bambini/e guardano la televisione o il pc per circa 60 min alla settimana e circa il 40% afferma che ciò avviene anche nei weekend; la maggioranza afferma invece che il tempo dedicato a TV e PC è maggiore nei weekend. Solo un terzo dei genitori dedica almeno 30 minuti a giorni alterni per camminate fatte con i bambini e la maggior parte afferma di non partecipare attività sportiva con i figli né di dedicare una quantità risibile di tempo ad osservare i bambini mentre giocano fuori casa. Nella maggioranza dei casi i genitori praticano giochi di movimento con i propri figli per meno di 30 minuti una o due volte alla settimana in casa o fuori (tempo permettendo). I risultati mettono in luce come i genitori siano coscienti dell'importanza per i propri figli dell'attività fisica, non siano però altrettanto attenti nell'imporre la pratica. Essi si ritengono esperti per quanto riguarda il movimento dei propri figli ma mettono in pratica molto meno di quanto richiesto dalla maggiori associazioni internazionali: mentre NASPE, AHA, AAP e OMS raccomandano per i bambini della fascia prescolare almeno 60 minuti al giorno di attività fisica nella forma di gioco non-strutturato e 30 di gioco strutturato al giorno, i genitori riportano per i propri figli livelli di 60-180 min alla settimana!

E' importante considerare che le attese dei genitori sono anche molto legate al background culturale degli stessi; a titolo d'esempio si consideri che i genitori in Indonesia ritengono invece che l'attività fisica e lo sport siano dannosi in quanto inducono stress nei bambini, per i quali sono preferite attività sedentarie (Rahayu, 2014).

Lo studio evidenzia come i genitori abbiano una visione "naturalistica" dell'attività fisica dei propri figli, cioè ritengano che non sia necessario organizzarla. Poiché essi stessi riportano dati di livelli assolutamente insufficienti, il lavoro evidenzia come anche i genitori abbiano bisogno di specifici programmi di apprendimento del ruolo dell'esercizio

fisico nell'infanzia e di come implementarlo, preferibilmente attraverso la collaborazione con il sistema scolastico.

Studi collegati alla terza domanda:

Se e come si possono sviluppare capacità cognitive mediante l'attività fisica"

Lavoro n. 7 - *Mente e corpo nella relazione educativa nelle scuole dell'infanzia: lo sviluppo delle capabilities per una buona qualità della vita.*

Si tratta di uno studio teorico sull'importanza di fornire ai bambini le possibilità di svilupparsi durante l'infanzia, trattandosi del periodo della vita di totale dipendenza dall'adulto. Chi ha responsabilità del bambino/a deve essere conscio dell'importanza del proprio ruolo. Visto il tempo trascorso, le scuole dell'infanzia devono promuovere l'attività fisica in modo da mettere a disposizione di tutti i bambini pari opportunità di uno sviluppo sano. In questo modo la scuola può non solo aiutare i bambini delle famiglie meno abbienti (con minori opportunità extrascolastiche) ma anche assolvere al meglio il proprio ruolo all'interno della società.

Studio 8 - *Come possono gli insegnanti contribuire allo sviluppo delle funzioni esecutive attraverso l'attività motoria?*

Si tratta di uno studio teorico sull'importanza delle funzioni esecutive e sull'attività fisica quale strumento di implementazione delle stesse. Viene inoltre sottolineata l'importanza delle funzioni esecutive per il successo scolastico.

Nello studio traccio le linee per la realizzazione di un progetto da condurre al parco Primo Sport 0246 atto a misurare gli effetti di specifici programmi didattici di attività motoria al parco sullo sviluppo di funzioni esecutive misurate con i test psicometrici.

Studio 9 - **Miglioramenti delle funzioni esecutive con l'attività al parco?**

E' necessario fare alcune considerazioni introduttive sul test Giorno e Notte (D&N) utilizzato per valutare le competenze inibitorie dei bambini al parco Primo Sport 0246. Benché il test sia stato messo a punto per valutare tale capacità in bambini di 6-10 anni, esso è considerato adeguato anche per bambini di età inferiore come quelli da me studiati. Occorre però sottolineare come il test richieda una buona comprensione della lingua italiana, condizione che può non essere presente in alcuni dei bambini "immigranti" che sono iscritti alle scuole primarie di Treviso; inoltre ho notato come alcuni dei bambini fossero molto sorpresi dalla mia richiesta di fornire risposte "opposte all'evidente" e, in alcuni casi, si sono apertamente rifiutati di fornire la risposta "sbagliata". Per questo motivo ho dovuto escludere dall'analisi diversi casi e molti ne rimangono in cui non posso essere certa che la qualità della risposta non possa essere stata alterata da motivi linguistici e/o culturali. Infine è da tenere conto che, avendo effettuato il test a scuola e non in laboratorio, mi sono limitata a raccogliere il numero di risposte esatte senza misurare il tempo necessario per fornire la risposta; si tratta di un parametro che alcuni esperti ritengono possa contribuire a rendere più sensibile ed accurato il test D&N.

Nonostante queste premesse il fatto che sarà necessario in future migliorare sia gli aspetti metodologici che il numero delle osservazioni, i dati segnalano che vi è un miglioramento significativo tra due misurazioni effettuate a tre mesi circa di distanza. Come nel caso dello studio 4, I bambini sono stati suddivisi in 3 gruppi (Sperimentale, Gioco Libero e Controllo). I bambini dei gruppi Sperimentale e Controllo mostrano un miglioramento significativo del test (cioè riduzione del numero di errori), mentre il gruppo Gioco Libero non si modifica in modo significativo tra le due misurazioni.

Abbiamo anche analizzato le variazioni di performance nel test D&N in relazione alle capacità di eseguire il difficile compito motorio descritto nello studio 5. A differenza di quanto descritto nello studio 5, qui i bambini sono tutti "aiutati" a salire sulla barra (scaffolding) e quello che ho misurato è stata la capacità di completare il tragitto sulla barra mobile (capace/non capace), il tempo impegnato e il numero di errori (cadute dalla barra) commessi. I bambini che non erano capaci di salire sulla barra benché aiutati non sono stati presi in considerazione.

Anche in questo caso i bambini dei gruppi Sperimentale e Controllo hanno conseguito punteggi migliori nel test D&N rispetto al gruppo Gioco Libero; da notare che il gruppo Sperimentale è stato anche molto più efficiente degli altri nell'imparare il difficile

compito motorio. In generale si nota una tendenza a ottenere punteggi migliori nei test D&N da parte dei bambini che sono capaci e/o imparano a camminare sull'asse mobile nel corso delle 10 visite al parco. I dati necessitano di conferma.

Un'altra osservazione molto interessante ci viene dall'analisi del gruppo Sperimentale. Esso consiste di bambini di due scuole diverse ai quali ho offerto due diversi metodi di "scaffolding". Mentre per entrambi lo scaffolding per salire sull'asse era identico, in una scuola ho poi seguito i bambini incitandoli e aiutandoli verbalmente come descritto nello studio 5, mentre per quelli dell'altra scuola mi sono limitata a essere presente senza però fornire alcun incoraggiamento. I dati indicano che sia le capacità di cammino sull'asse (tempo impiegato) che la performance al test D&N migliorano di più nel gruppo a cui ho fornito scaffolding durante il cammino. Ciò suggerisce che la metodologia utilizzata per insegnare un compito motorio può influenzare lo sviluppo di capacità inibitorie (funzioni esecutive). Questa ipotesi sarà approfondita negli studi affronterò dopo la conclusione di questo corso di dottorato.

Studio 10 – Focus group con le insegnanti delle scuole primarie

Ho organizzato un focus group con 16 insegnanti della scuola primaria nelle cui classi erano presenti alcuni dei bambini che avevano partecipato al gruppo sperimentale dei progetti condotti al parco. Alle insegnanti ho chiesto se notavano differenze nei loro alunni tra quelli che avevano fatto l'esperienza al parco e gli altri. Tutte le insegnanti concordano nell'affermare che i bambini con l'esperienza al parco sono migliori sotto diversi aspetti. Ho raccolto le loro risposte suddividendole in categorie nelle quali i bambini si distinguono: a) capacità riferite a funzioni esecutive: migliori preparazione scolastica, capacità di scrittura, capacità di attesa, memoria, livello di autonomia (capacità di organizzarsi da solo o in gruppo), orientamento spaziale, capacità di imparare a imparare; b) capacità riferite a altre funzioni cognitive: abilità empatiche, partecipazione attiva, molto propositivi, capacità di adattarsi ai diversi comportamenti di insegnanti e genitori, c) capacità riferite al campo motorio: avanzato sviluppo di capacità motorie e di consolidamento dello schema corporeo.

Studio 11- **Altre osservazioni qualitative: uno studio sulla barra orizzontale del parco giochi**

Le videocamere del parco ci consentono di osservare, anche al di fuori delle visite per la ricerca, il comportamento dei bambini che frequentano il parco Primo Sport 0246. Nel 2012 ho notato che quasi nessun bambino si cimentava a fare brachiazioni con lo strumento della scala orizzontale (Monkey bar in inglese). In realtà quando ho misurato nel 2012 i bambini che partecipavano alla ricerca ho notato che quasi nessuno era in grado di compiere brachiazioni (muoversi appesi tra le sbarre della scala orizzontale), al massimo riusciva qualcuno a farne una. In realtà lo strumento (dichiarato idoneo per bambini di 3 anni!) era alto 2.30 metri e la distanza tra i piedi del bambino appeso e il suolo (coperto da speciale materiale elastico) era di circa 1 metro. Per ridurre l'impatto della caduta, ho fatto inserire sotto alla scala orizzontale un materasso molto spesso in modo che la distanza tra i piedi dei bambini appesi e il materasso fosse ridotta a circa 50 cm. Ciò nonostante, lo strumento rimaneva inutilizzato nel gioco libero e i bambini testati facevano sempre al massimo 1 brachiazione lungo la scala prima di cadere. A quel punto si è deciso di ridurre l'altezza della scala orizzontale e di portarla a 1,60 m. Dopo questo cambiamento abbiamo assistito a un drastico cambiamento della quantità d'utilizzo dell'apparecchio nelle ore libere e nel numero di brachiazioni effettuate dai bambini testati. La media di brachiazioni saliva così a circa 3 per giungere a livelli di 5 dopo le 10 sedute di attività al parco. Da notare che anche i bambini che sono stati misurati al parco ma che non hanno effettuato le 10 sedute di "allenamento" (gruppo Controllo) mostravano la capacità di fare 3-4 brachiazioni.

La mia idea è che il cambiamento nell'utilizzo dello strumento sia collegabile al meccanismo di percezione-azione e che, quando il bambino è appeso a di sopra del suolo, le informazioni fornite dal sistema visivo prevalgano rispetto al sistema percettivo. In altre parole, il bambino che è appeso con la testa situata a 2 metri dal suolo è spaventato per l'altezza a cui si trova anche se la distanza tra piedi e materasso è inferiore. Abbassando l'altezza della scala orizzontale (a 1.60 m) il bambino si adatta con più facilità all'altezza e può dedicare la sua attenzione e le sue energie al compito di muoversi appeso tra le sbarre.

Studio 12 - Considerazioni/studio qualitativo. Interviste e focus groups con insegnanti e genitori dei bambini al parco sul tema del pericolo

In questo studio si apprezza come i contesti emozionale e culturale influenzino le credenze e lo stile d'insegnamento

Studio 13 - Attività fisica e successo scolastico

Lo studio è simile a quanto riportato nello studio 10 ma la metodologia utilizzata è stata quella dei questionari. In questo caso si è chiesto a insegnanti e genitori di fornire la loro opinione sul possesso da parte dei loro bambini delle capacità già elencate a proposito dello studio 10. Sia i genitori che gli insegnanti dei bambini che hanno avuto l'esperienza delle 10 visite al parco riportano valori più alti di quelli che non hanno partecipato anche se le valutazioni degli insegnanti sono più alte rispetto a quelle dei genitori.

Inoltre un'analogha indagine è stata effettuata presso insegnanti e genitori di bambini della scuola primaria che, nel corso della scuola dell'infanzia, avevano partecipato ad uno specifico programma di attività motoria organizzato presso la locale scuola seguendo metodologia didattica analoga a quella utilizzata al parco. Anche in questo caso si registra la constatazione delle insegnanti e dei genitori di un migliore sviluppo di capacità cognitive utili per il successo scolastico per quei bambini che hanno partecipato al corso di attività motoria.

18 OVERALL DISCUSSION AND CONCLUSION, PRACTICAL IMPLICATIONS AND DIRECTIONS FOR FURTHER RESEARCH.

In this study I tried to find the evidence related to an open question since ancient-time: body-mind, a question still permeated by cultural beliefs and bias. The investigations reveal a relationship between physical activity, cognitive processes and academic achievement. Various types of physical activity are effective in promoting cognitive processes, but it is not easily identifiable protocol work, to understand what are the factors involved in physical activity that promote development. The evidence, however, are insufficient, since most studies have not been performed with randomization and have other limits. The questions that remain open and that will also be considered in my future research are:

- 1) what types of physical activities promote the development of cognitive processes and school achievement?
- 2) the need to carry out studies with randomized samples;
- 3) the conditions under which the frequency, intensity and duration of physical activity promotes development of motor skills and cognitive functions;

In addition to the limited effective evidence relating to a possible association between physical activity, cognitive processes and school achievement some researchers (Diamond, Tomporowski, Fish) suggest that the increase in cognitive processes and academic skills (mathematics, Italian) can be not due to physical activity in itself, but other factors, in the presence of physical activity will be decisive factors in promoting cognitive development. This hypothesis arises from the fact that success in cognitive development has also been observed following protocols regarding not only physical activities but other activities that evidence in common some aspects. Only in traditional Tae-Kwon-Do it has been found an increase of executive functions. What was the difference between the two sports? It was only the training methodology. In the case of the traditional sport some aspects were emphasized, such as attention, concentration, self-discipline, self-analysis (meta cognition), while in the modern sport, the emphasis was on the development of motor skills and technology. Some aspects seem to be crucial in the development of cognitive, physical activities (Tae-Kwon-Do) and other activities (Tools of the Mind):

- a) children who had a lower starting level of executive functions at the pre cognitive test benefit more than peers with higher level of cognitive functions at post cognitive test (Flook et al., 2010; Kray & Karbach , 2009; Lakes / Hoyt, 2004).
- b) The best results in increasing of EFs emerged when children were pushed at the higher level of EF skills (Davis, et al., 2011; Diamond et al., 2007; Manjunath & Telles, 2001).
- c) The task must be continually increasing, to avoid the activity become boring. In addition when children are asked to do better they are more motivated to improve. Ericsson, Nandagopal, & Roring, (2009) found that working in Vygotsky (1978) “zone of proximal development” is the best condition to do something at the right level of competence, to increase.
- e) Klingberg et al., (2005) evidences that **repeated practice is the key to improve**.
- f) Diamond et al. (2007), Lillard & Else-Quest, 2006; Riggs et al., 2006 argue that to improve EF it is fundamental that the proposed activities are embedded in all activities and are not only a module, as in the case of school curricula

Other relevant aspects are:

- **Private speech:** For Vygotsky (1978) private speech is considered a precursor of verbal thinking; Luria, 1979; Berk & Winsler, 1995; Galperin, 1992. Private speech helps children to regulate overt and mental behaviors. Siegler, 1989. In Tae-Kwon-Do training included traditional phase requiring the children to make a self (private speech) of what they were doing, remembering the rules that were to follow, and checking the consistency with what was happening and in the "Tools of the Mind "children had to say in a low voice what they were doing and if this corresponded to what they should do.
Shared activities: (Vygotsky, 1978). Sharing activities partners contribute to share the mental processes and categories involved.
- **Self-regulatory functions:** (Vygotsky,1978) Regulating other children’s behavior children practice other and self-regulatory functions and contribute to the development of meta-cognitive abilities (Bodrova & Leong, 1996).
- **Symbolic play:** for Vygotsky, Berk & Winsler, 1995; Bodrova & Leon, 1996, play is necessary for imaginary situations, roles and rules. The play is considered a good way to acquire self-regulated skills.

- **Dramatic play:** it is the most important activity (Bodrova & Leong, 1998a; 1999). Teachers help children to expand the roles in a theme (Jensen, 1981).
- **Metacognitive aspects** are involved in some of the mentioned aspects.

Tompson et al. (, 2011, in press) argues that the complex relationship between physical activity and school achievement can involve other mediators and suggest the inclusion of meta-cognitive factors in understanding the possible causes. This aspect is also reflected in the indications given by Diamond. Fish (2011) suggests a possible role of creativity in the development of executive functions. Dietrich (2004) shows that creativity is also developed in the prefrontal area.

It remains to understand in the possible associations between physical activity and school achievement, if this may also depend on the method used, which in itself requires cognitive engagement, and / or whether and if so, what are other factors to produce the development of cognitive processes. Open questions are then: "What is the role of perceived competence, self-efficacy, meta cognition in the development of cognitive processes?"

The combination of the evidence relating to the relationship between physical, cognitive processes and school achievement, and the empirical studies reported in this thesis has opened up an area of research to be explored. It seems to be important to investigate on what cognitive processes are involved in a child, when he says: "I did it! If I train I learn! These phrases are very important for children. when they pronounced the phrases they seem to be very powerful and feel to be strengthened. It seems knowledge of a future competence, a sort of anticipation of the result (Pygmalion effect) which then leads them to realize a number of practices aimed to achieve the goal. It is like a preview image of success, a kind of vision that promotes the development of their processes, which guide their actions. The activities carried out in the playground, on the elastic beam produced the following results (preliminary):

18.1 STUDY 1

Experimental group. Results from pre and post day-night test from 5.02 to 2.33 (significant improvement).

Control group. Results from pre and post day-night test from 5.84 to 2.91 (significant improvement).

Free play group: Results from pre and post day-night test from 4.51 to 3.84 (no significant improvement)

The improvement may be due in the experimental group to physical activity and in the control group to other conditions.

The free play did not increase significant.

The improvement both in the experimental and in the control school may be due to other aspects associated to the activities they did in the playground and at school, such as something in the methodology of teaching or some qualitative aspects of the activities they performed.

It is necessary to repeat the study with other experimental conditions, in accordance with the literature, looking at possible cause.

18.2 STUDY 2

Children of structured group improved more in day-night test (2.20 errors post test) than children of other groups (3.54 free play and 3.00 control group).

We found a more relevant increase in day/night test in children who become able to perform elastic beam at the end of 10 weeks, independently from the reason of increasing in elastic beam. In the structured group it may be due to the specific training and in the control group not, because the children of this group never attended the playground. We cannot understand the reasons of the improvement.

Also in this case we did not find improvement in the group of free play.

The numbers of children examined in the various conditions was not sufficient to allow us to argue evidence, but it is anyway an important stimulus for reasoning and planning next research.

18.3 STUDY 3

Children (of structured activity) school 2 (children scaffold with encouragement) obtained better results in post test day-night (pre 5.36 post 1.64) than children of school 1 (scaffold with no encouragement) (pre 4,25 post 2,79).

Improvement of school 2 in post day-night test may be due to the different kind of training, and I cannot say that it may depend also from the improving in balance skill, as the result in time and number of errors are incoherent.

Also in this case the data are insufficient to promote evidence and it is necessary to implement the researches.

Our preliminary studies, non sufficient for several reasons to become evidence anyway suggest that improvement in cognitive control may be due to other conditions and not only and necessarily to physical activity. It is necessary to implement the research.

What is in common between the studies carried out to the park and the features essential to the development of executive functions, developed by different authors?

2) shared. Kids at the park had to wait their turn controlling partner in front of them. They could start when he had completed the task.

3) Self regulation of behavior. The boy / girl that on the balance beam was about to lose his balance was invited to make a great jump, and then to go up again from where it has jumped. It was important for the child to regulate, control his body at the time of the decision to jump, in order not to fall.

6) meta-cognitive factors emerge on many occasions, when the child says "I did it! If I practice, I learn! "Or when he mentally repeats the rule of when to start, or what to do when the child is about to lose his balance.

In conclusion, through the work of the thesis it has emerged the importance of:

1) pay attention to the physical environment (circles). This previous study led to the design of a playground organized into functional areas of motor activity (manual dexterity, mobility, balance);

2) the need to plan and structure the activities in the development of motor and cognitive skills of children. In the free game I did not find increase of motor or cognitive skills;

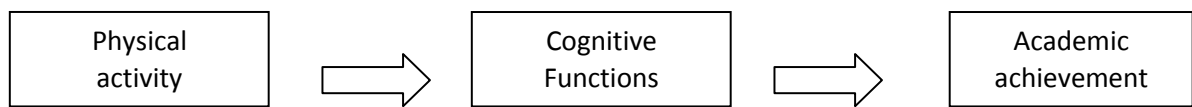
3) the fundamental role of care givers in the promotion of development. The importance of teachers who support children in zone of proximal development. The studies highlights

that educators and preschool teachers are unprepared in promoting motor skills in children and they are also not aware of the importance of their role in child development.

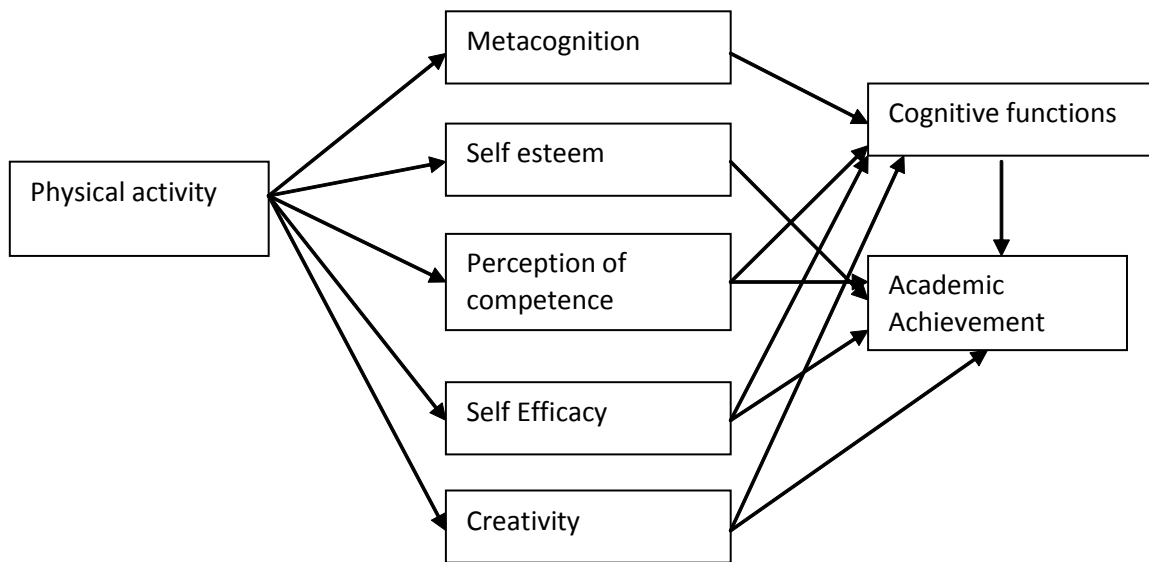
4) the positivity of an action-research involving children, teachers and parents to promote their awareness of the importance of their role in motor and cognitive development.

It remains to investigate on the aspects involved in the link between physical activity and development of school achievement: characteristics of motor activity, methodological aspects, self-esteem and self-efficacy, children's perception of future competence, meta-cognition. All these should be investigated to better understand their possible role as mediators.

The initial schema was:



Now it can be



Strengths and limitations of the original research

The main strengths are:

- the use of a mixed method qualitative and quantitative;
- some studies were repeated for two years (some results have been already examined, such as those related to day-night test and elastic balance beam while other data have not been examined yet, such as the motor tests);
- some qualitative data are coming from longitudinal studies of groups of children that the previous two years attended the playground PRIMO SPORT 0246;
- the great opportunity to observe children in a playground that has become a sort of open laboratory, where it is possible to observe children in an ecological environment;
- the continuous increasing involvement and participation in the research from kindergarten and the involvement of parents will allow us to continue in the research-action utilizing motor and cognitive assessment that will give us the opportunity to obtain, with large numbers of children the opportunity to generalize the results in child development. Three years ago parents and teachers were not unlike to assess the children, and I needed time to assure them that the children had been tested in a funny, recreational and ecological context, using ecological tests, that were perceived by the children as very beautiful plays. I noticed that children liked very much to be tested, because they liked to play with an adult that gave complete attention and importance to them. This moment was seen by children as a special important desired moment. It happened that I went in a kindergarten and a child came to me asking if I could test him, because when I tested his friends he was absent. I decided to test him, even if I could not use the data, just to meet his desire and I was very happy for that.
- the research-action is developing and I was asked by Verde Sport to write a book dedicated to the teachers with the aim to encourage them to promote physical activity (Tortella et al., 2012) This book had a great success and 100 teachers from Treviso and Verona participated last year in an experimental activity, using the book. I am evaluating the data collected at the end of that trial. Verde Sport asked me to write a second book, dedicated to physical activity and cognitive processes which will be printed soon in 2014 (Tortella et. al., 2014).

- possibilities of future researches in the playground, in the kindergartens of Verona and Treviso.
- the studies carried out in the playground involved teachers and parents from Treviso and I was asked to design a playground with the same concept also for Rome and three more little playground in kindergartens of Verona. There will be possibilities to develop research also in these new playgrounds, where children of kindergarten will be able to play every day and to do structured activity as well. These playgrounds open new opportunities for new research projects.

Limitations

- Most of the studies are preliminary studies, realized with few numbers of children, few instruments of assessment. It is necessary to repeat the studies with a higher number of children, different kinds of methodology and assessment's tools.
- It was important to observe the question of the thesis from the views of parents, teachers, children, but it is necessary to focus on a specific question, in the way to be more accurate.
- It was very difficult to test the children: in some cases I had special trained physical educators that helped me in some motor tests and I had to invalidate some results, because of errors by educators.

Practical implications

The research-action has involved teachers, parents, and children and has developed new interest in knowledge of what is possible to do to promote physical and mental health in children. The results of the research are useful to promote new researches. Kindergartens and municipalities are asking to design new playgrounds and to plan physical activities for children. All these consequences of these three years of research contribute to improve physical activity and related physical and mental health in children.

19 DISCUSSIONE, CONCLUSIONE, IMPLICAZIONI PRATICHE, INDICAZIONI PER RICERCHE FUTURE

Con il presente lavoro si è cercato di trovare le evidenze relative a una questione aperta ancora dai tempi antichi, la relazione mente-corpo, domanda tuttora circondata da credenze culturali e pregiudizi. Le ricerche mettono in luce una relazione tra attività fisica, processi cognitivi e capacità di apprendimento scolastico. Vari tipi di attività fisica si dimostrano efficaci nella promozione di processi cognitivi, ma non sono ben identificabili i protocolli di attività, per comprendere quali siano i fattori insiti nell'attività fisica che promuovono sviluppo. Le evidenze presenti sono comunque insufficienti, poiché la maggioranza degli studi non è stata effettuata con randomizzazione o con controllate metodologie di indagine. Le domande tuttora aperte, e le indicazioni che coincidono con i futuri sviluppi della ricerca sono:

- 1) quali tipi di attività fisica promuovono lo sviluppo di processi cognitivi e di capacità di apprendimento scolastico?
- 2) necessità di effettuare studi con campioni randomizzati;
- 3) a quali condizioni di frequenza, intensità e durata dell'attività fisica si promuove sviluppo di competenze motorie e di funzioni cognitive?

Alla luce delle scarse efficaci evidenze concernenti una possibile associazione tra attività fisica, processi cognitivi e capacità di apprendimento scolastico alcuni ricercatori (Diamond, Tomporowski, Pesce) suggeriscono che l'incremento di processi cognitivi e di capacità scolastiche (matematica, italiano) possa essere dovuto non all'attività fisica in sé ma alla presenza di altri fattori, che in presenza di attività fisica diventano determinanti nel promuovere lo sviluppo cognitivo. Questa ipotesi nasce dal fatto che successi nello sviluppo cognitivo siano stati osservati anche in seguito a protocolli di lavoro non motori (Diamond) che però presentano in comune, con quelli motori, alcuni aspetti. Ricordo l'esempio del Tae-Kwon-Do tradizionale e moderno: solo nel primo caso si assisteva a incremento di funzioni esecutive. Che cosa differiva tra i due sport? Unicamente la metodologia di lavoro. Nel primo caso si enfatizzavano alcuni aspetti, quali l'attenzione, la concentrazione, l'autodisciplina, l'autoanalisi (metacognitiva), mentre nel secondo caso l'accento era posto sullo sviluppo delle competenze motorie e degli aspetti tecnici dello sport.

Dalla sintesi dei diversi studi della letteratura sopra presentati emergono i seguenti aspetti, che sembrano essere decisivi nello sviluppo di processi cognitivi e che si ritrovano sia in alcune attività fisiche (Tae-Kwon-Do), che in altre attività (Tools of the Mind).

- a) i bambini che in partenza presentano un livello di funzioni esecutive più basso sono avvantaggiati nello sviluppo delle stesse e sembrano migliorare di più e più velocemente rispetto ai loro compagni che hanno in partenza livelli maggiori (Flook et al., 2010; Karbach & Kray, 2009; Lakes / Hoyt, 2004).
- b) i migliori risultati di sviluppo di funzioni cognitive si osservano quando i bambini sono nella condizione di doversi impegnare molto. Quando viene richiesto un livello d'impegno molto elevato, i bambini sembrano essere più motivati, resistenti alle frustrazioni e meno soggetti a noia o demotivazione (Davis, et al., 2011; Diamond et al., 2007; Manjunath & Telles, 2001).
- c) L'insegnante ha, infatti, il compito di mantenere alta la motivazione dei bambini variando spesso la proposta motoria o di altro tipo e incrementando continuamente le difficoltà.
- d) Ericsson, Nandagopal, & Roring, (2009) sostengono che lavorare in zona di sviluppo prossimale (Vygotsky, 1978) sia la migliore condizione per l'apprendimento e lo sviluppo di funzioni esecutive. Il ruolo dell'insegnante diventa decisivo nello scaffold degli allievi.
- e) è necessario che le attività proposte siano ripetute (Klingberg et al., (2005). Nel caso dell'attività fisica, frequenza, intensità e durata delle esperienze sono ancora punti oscuri rispetto alla relazione con lo sviluppo cognitivo.
- f) Diamond et al. (2007), Lillard & Else-Quest, 2006; Riggs et al., 2006 sostengono che qualunque proposta per lo sviluppo di funzioni esecutive debba essere incorporate nelle normali attività del curriculum scolastico o della vita del bambino.

Altri aspetti rilevanti, trovati nel "Tools of the Mind" (Diamond), sono:

- 1) **parlare a se stessi**. Per Vygotsky il "private speech" è un precursore del pensiero verbale, mentre per Luria, 1979; Berk & Winsler, 1995; Galperin, 1992 aiuta i bambini a regolare il comportamento mentale. Nel Tae-Kwon-Do tradizionale una fase obbligatoria dell'allenamento prevedeva che i bambini facessero un'autoanalisi (private speech) di quello che stavano facendo, ricordando le regole che dovevano seguire e verificando la congruenza con quanto stava accadendo e nel "Tools of the

Mind” i bambini dovevano dire a voce alta cosa stavano facendo e se questo corrispondeva a quello che avrebbero dovuto fare.

- 2) **Attività condivise.** Condividendo le attività i partecipanti condividono anche gli stati mentali e le categorie varie coinvolte (Vygotsky, 1978).
- 3) **Auto regolazione del comportamento.** Regolare il proprio comportamento e quello degli altri (funzioni auto-regolatorie), per Vygotsky significava incrementare lo sviluppo di funzioni meta-cognitive. Nel Tai-Kwon-do tradizionale i bambini dovevano osservare il comportamento dell'avversario e potevano intervenire solo quando sbagliava qualche cosa. Nel “Tools of the mind” i bambini osservavano il lavoro del compagno per poi aiutarlo a correggere gli errori.
- 4) Gioco simbolico. Vygotsky, Berk & Winsler, 1995; Bodrova & Leon, 1996 ritengono che immaginare situazioni, ruoli diversi e regole diverse sia un ottimo sistema per sviluppare competenze di auto regolazione.
- 5) Gioco drammatico. Per Bodrova & Leong, 1998a; 1999 ritengono fondamentale per un bambino rappresentare un ruolo, seguendo il profilo (suoi relativi comportamenti) dopo aver pianificato. Pianificare, prima di eseguire è importantissimo, soprattutto se lo si fa utilizzando carta e colori, perché questo aiuta a stimolare la memoria.
- 6) fattori meta-cognitivi. Si trovano citati in accompagnamento a diversi aspetti riportati nei punti sopra. Tomporowsky et al. (in press) affermano che nella complessa relazione tra attività fisica e capacità di apprendimento scolastico possano intervenire altri mediatori e suggeriscono di includere i fattori meta-cognitivi nella comprensione delle possibili cause. Questo aspetto si ritrova anche nelle indicazioni date da Diamond (2013). Pesce (2011) ipotizza un possibile ruolo importante della creatività, nello sviluppo di funzioni esecutive. Dietrich (2004) evidenzia che la creatività si sviluppa anch'essa nell'area prefrontale.

Resta da comprendere quindi come avvengano le possibili associazioni tra attività fisica e capacità di apprendimento, se questo passaggio possa dipendere anche dalla metodologia utilizzata, che in sé richiede impegno cognitivo e/o se e eventualmente quali siano altri fattori a produrre sviluppo di processi cognitivi. Le domande aperte sono quindi: “quale è il ruolo di percezione di competenza, autoefficacia, meta cognizione nello sviluppo dei processi cognitivi?”

Dall'intreccio tra le evidenze relative alla relazione tra attività fisica, processi cognitivi e capacità di apprendimento e le ricerche empiriche, riportate nella tesi si è aperto uno spazio di ricerca da esplorare per indagare quali processi, derivanti dall'attività fisica si esprimano dietro alle frasi: "Ce l'ho fatta! Se mi esercito imparo! Si tratta di frasi importanti poiché a partire dai momenti in cui sono state pronunciate qualcosa di molto potente nei bambini è cambiato, accrescendo in loro un grande senso di potenza e di successo, una consapevolezza di aver già raggiunto una competenza futura, una sorta di anticipazione del risultato (effetto Pigmalione) che li porta poi a mettere in atto una serie di pratiche mirate per il raggiungimento dell'obiettivo. Una anticipazione dell'immagine del successo, una sorta di visione che promuove lo sviluppo dei loro processi, che guida le loro azioni.

Alcuni dati interessanti derivano dall'esperienza realizzata al parco giochi, sull'asse con le molle, che ha prodotto i seguenti risultati (se pur preliminari):

- 1) nello studio 1 i bambini del gruppo sperimentale, (che hanno seguito un percorso controllato di attività motoria) e i bambini del gruppo di controllo (che non hanno praticato attività motoria) hanno ottenuto entrambi un miglioramento nei risultati del day/night test, cioè un miglioramento delle capacità di autocontrollo, mentre nei bambini (gruppo del gioco libero) non si è evidenziato alcun miglioramento. In questo studio si può pensare che l'attività fisica non sia il fattore determinante di incremento di processi cognitivi, poiché il miglioramento è stato ottenuto anche nel gruppo che non praticava attività motoria. D'altro canto non si è rilevato nel gruppo dei bambini che praticavano attività fisica attraverso il gioco libero. E' anche possibile però ipotizzare che il tipo di attività fisica praticato o il diverso tipo di metodologia (attività strutturata+gioco libero in un caso e solo gioco libero nell'altro) possa aver contribuito alla differenza di risultati. Non siamo in grado di ipotizzare cosa abbia contribuito al miglioramento dei risultati nel gruppo di controllo, che non ha mai frequentato il parco giochi. Si può supporre che possa trattarsi di una differenza di metodologia di conduzione delle diverse attività giornaliere. Tutti e tre i gruppi di bambini seguivano a scuola lo stesso protocollo di attività educative, che però non sono state osservate.
- 2) nel secondo studio si è rilevato un risultato più elevato al day-night test nei bambini che hanno imparato ad eseguire il task della barra con le molle, dopo 10 settimane, indipendentemente dal motivo per cui hanno imparato. Risultavano infatti migliori

al test motorio della barra con molle sia i bambini del gruppo sperimentale, sia quelli del gruppo di controllo, che non avevano mai frequentato il parco.

Anche in questo caso non si comprende come sia avvenuto il miglioramento alla barra con le molle da parte di bambini che non hanno frequentato il parco (gruppo di controllo). Resta da indagare se nei pomeriggi gli stessi bambini vi si siano recati con i genitori. Questo aspetto è difficilmente indagabile, anche se i genitori dei bambini dei diversi gruppi affermano, nei questionari, che portano i bambini al parco mediamente una volta alla settimana.

Anche in questo caso non si è in grado di capire se sia la migliorata competenza motoria di eseguire il test sulla barra con le molle a contribuire al miglioramento al test cognitivo day/night o se siano subentrati altri fattori, comuni ad entrambi i gruppi, nel determinare l'incremento di sviluppo.

Anche in questo caso nei bambini del gioco libero non si è assistito a nessuno sviluppo. L'attività fisica praticata durante il gioco libero non ha prodotto incremento di sviluppo di capacità motorie al test alla barra con le molle, né di processi cognitivi.

Nello studio 3 due gruppi di bambini si allenavano ad imparare ad eseguire il task della barra con le molle con il supporto dell'insegnante, in zona di sviluppo prossimale. Il gruppo n. 1 eseguiva la prova e l'insegnante rimarcava il compito, il gruppo 2 veniva supportato dall'insegnante anche con incoraggiamenti e complimenti che rimarcavano il successo ottenuto mano a mano dai bambini. Entrambi i gruppi sono migliorati nel test della barra con le molle. Il gruppo n. 2 supportato con incoraggiamenti ha ottenuto dei migliori risultati al test day-night.

In questo caso si può affermare che il miglioramento al test motorio si è avuto in entrambi i gruppi, ma solo in uno si è rilevato incremento di processi cognitivi. Si può anche in questo caso affermare che non sembra essere il miglioramento di competenza motoria associato a miglioramento al test cognitivo. Sembra invece che un diverso tipo di approccio metodologico sia stato efficace.

I risultati, pur se preliminari e con notevoli limiti, sembrano evidenziare che non vi sia associazione diretta tra attività fisica strutturata e incremento di processi cognitivi. Si ipotizza che il ruolo della metodologia utilizzata possa essere rilevante. Si può anche affermare che il gioco libero, senza intervento dell'adulto non contribuisce allo sviluppo

delle competenze motorie né al miglioramento del day/night test. Tutti gli studi vanno ripetuti con maggiori bambini e con maggiore controllo delle variabili.

Quali aspetti comuni presentano gli studi effettuati al parco e le caratteristiche fondamentali per lo sviluppo di funzioni esecutive individuate da diversi autori?

- 1) **Attività condivise.** I bambini al parco dovevano aspettare il proprio turno controllando il compagno davanti a loro e potevano partire quando egli/ella aveva terminato il compito.
- 2) **Auto regolazione del comportamento.** Il bambino/a che sull'asse con le molle stava per perdere l'equilibrio veniva invitato ad effettuare un bellissimo salto, per poi risalire dal punto in cui era sceso. Era importante, per il piccolo/a, autoregolarsi, controllare il proprio corpo nel momento di decisione di saltare, ai fini di non cadere.
- 3) fattori meta-cognitivi entrano in gioco in diversi momenti, quando il bambino esclama "ce l'ho fatta!" "Se mi esercito imparo!" o si ripete mentalmente la regola di quando partire, o di cosa deve fare nel momento in cui sta per perdere l'equilibrio.

La percezione di successo di competenza futura non è contemplato negli aspetti sollevati dai diversi autori, relativamente allo sviluppo di processi cognitivi, mentre invece è ritenuta un aspetto fondamentale per lo sviluppo di competenze motorie da Stodden (2007).

I risultati di questa tesi sono poco chiari, sia perché sono preliminari, con molti limiti vari, sia perché mettono in evidenza la possibile presenza di fattori intermediari tra attività fisica e competenze motorie, da indagare.

Concludendo, attraverso gli studi della tesi si è constatata l'importanza di:

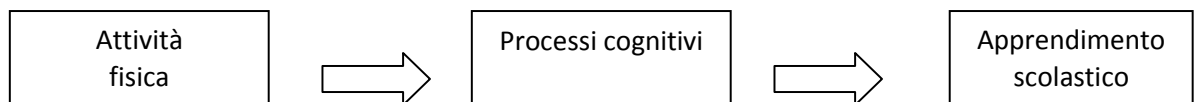
- 1) prestare attenzione all'ambiente fisico (cerchi) che ha portato alla progettazione di un parco giochi organizzato in aree funzionali di attività motoria (manualità, mobilità, equilibrio);
- 2) necessità di attività progettata e strutturata nello sviluppo di competenze motorie e cognitive dei bambini. Nel gioco libero non si è visto incremento di competenze;
- 3) ruolo fondamentale dei caregivers nella promozione di sviluppo. Si è vista l'importanza di insegnanti che supportano i bambini in zona di sviluppo prossimale. Rispetto a questo punto si rileva che educatori e insegnanti in età prescolare sono impreparati rispetto a modalità didattiche di promozione di competenze per lo

sviluppo motorio e cognitivo dei bambini e rispetto all'importanza del loro ruolo nello sviluppo dei piccoli;

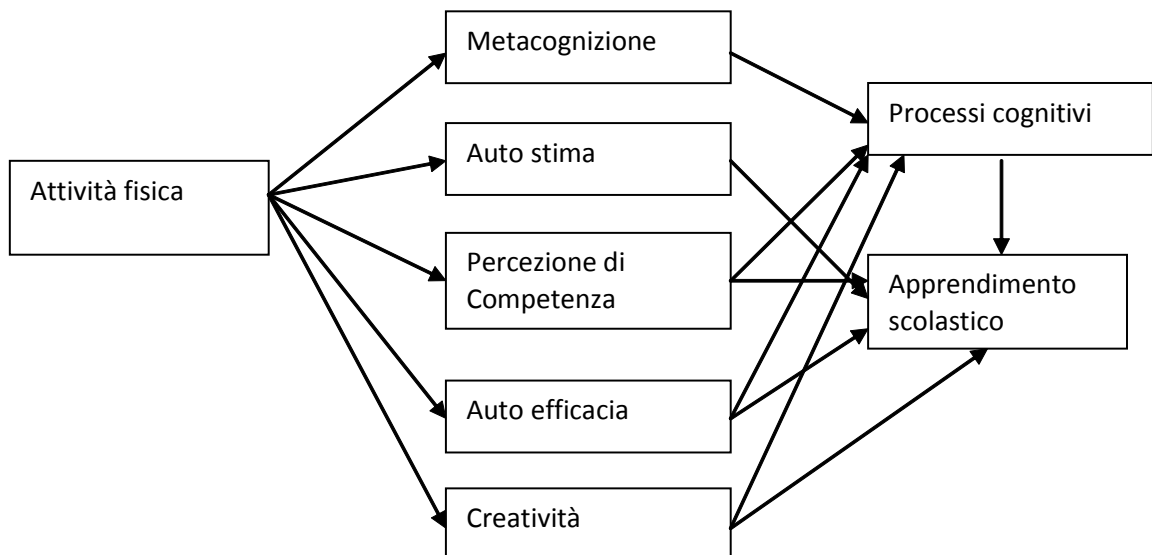
- 4) positività di una ricerca-azione che coinvolga bambini, insegnanti, genitori per la promozione della loro consapevolezza dell'importanza del loro ruolo nello sviluppo motorio e cognitivo dei bambini.

Rimane ancora da ricercare per comprendere quali siano gli aspetti di congiunzione tra attività fisica e sviluppo di processi cognitivi. Tipi di intervento motorio, aspetti metodologici, autostima ed autoefficacia dei bambini, percezione di competenza futura, metacognizione dovrebbero essere indagati per meglio comprendere il loro possibile ruolo di mediatori, nella connessione tra attività fisica e processi cognitivi.

Lo schema presentato all'inizio della tesi:



si può ora ricostruire in un modo diverso



Punti di forza e limiti della ricerca.

I principali punti di forza sono:

- 1) utilizzo di metodologia mista qualitativa e quantitativa;
- 2) Alcuni studi sono stati ripetuti per due anni (alcuni risultati sono già stati esaminati, come quelli riguardanti la relazione tra day-night test e barra con le molle e altri sono in lavorazione);
- 3) alcuni dati qualitativi derivano da studi longitudinali effettuati su gruppi di bambini che erano stati osservati alla scuola dell'infanzia e ora sono alla scuola primaria;
- 4) grande opportunità di utilizzare un parco giochi come laboratorio aperto di ricerca, con bambini che lo frequentano nell'ambito delle loro normali attività quotidiane;
- 5) il continuo, crescente coinvolgimento nella ricerca di scuole dell'infanzia e il coinvolgimento di genitori che permettono di continuare la ricerca-azione utilizzando valutazioni motorie e cognitive che ci permetteranno, quando avremo alti numeri di bambini di ottenere risultati generalizzabili. Tre anni fa genitori e insegnanti non erano favorevoli nelle valutazioni dei bambini e ho avuto bisogno di tempo per assicurare loro che i bambini sarebbero stati valutati in un contesto divertente, giocoso e nell'ambito delle loro normali attività, usando test che comprendono giochi che possono essere normalmente praticati e che a loro piacciono molto. Ho anche notato che ai bambini piaceva molto “giocare” ai test perché apprezzavano molto essere seguiti in un rapporto esclusivo dall'adulto, che in quel momento dedicava a loro tutta la sua attenzione. Una volta sono andata in una scuola dell'infanzia e un bambino è arrivato di corsa da me chiedendomi se potevo fargli i tests, poiché il giorno della somministrazione era assente. Non avevo necessità di farlo, ma ho dedicato al bambino una mezzora, per soddisfare i suoi desideri e sono stata molto contenta di questa richiesta. L'insegnante mi ha poi confermato che erano giorni che il bambino chiedeva quando sarei andata per fare i test anche a lui.
- 6) la ricerca-azione ha prodotto grandi sviluppi e Verde Sport mi ha chiesto di produrre un libretto, dedicato alle insegnanti per promuovere la pratica dell'attività motoria. E' stato scritto il libro “Favorire la pratica dell'attività motoria”, nel 2012 e nel 2014 ne è stato richiesto un altro, “Attività fisica nella scuola dell'infanzia e

funzioni esecutive”. Sono in atto sperimentazioni di questi libretti per indagare sull’utilizzo che ne viene fatto dalle insegnanti.

- 7) possibilità di future ricerche nel parco giochi e nelle scuole dell’infanzia di Treviso e Verona.
- 8) cambiamento di considerazione dell’attività fisica da parte di insegnanti e genitori.

Limiti

- 1) Molti studi sono preliminari, realizzati con un numero basso di bambini, con pochi test di valutazione delle singole competenze. E’ indispensabile ripetere gli studi con numeri più grandi di bambini, più metodologie di valutazione e più test specifici che focalizzino sugli aspetti indagati.
- 2) Difficoltà nella somministrazione dei tests standardizzati, per l’alto numero di bambini e per tutte le possibili varianti intervenute.
- 3) E’ stato molto importante in questo percorso di tesi indagare sui vari aspetti della tematica, conoscere il pensiero di insegnanti, genitori, bambini per avere un quadro teorico e empirico della situazione. Se questo è stato un punto di forza allo stesso tempo è stato un limite, poiché non vi è stata una focalizzazione accurata del tema di ricerca.

Implicazioni pratiche

La ricerca-azione, che ha costituito il quadro di riferimento dello studio ha promosso sviluppo di conoscenze nei bambini, nei genitori e negli insegnanti. Si assiste sempre più, nelle zone di Treviso e Verona ad un incremento di richieste di formazione di insegnanti e genitori, interessati a conoscere cosa fare per promuovere nei loro figli un sano sviluppo.

Il loro ampio coinvolgimento ha contribuito alla diffusione di nuove conoscenze e ha creato nuovi obiettivi. Diverse scuole dell’infanzia mi hanno chiesto di progettare per loro parchi Primo Sport 0246. Attualmente ci sono due parchi PRIMO SPORT 0246 in Italia, uno a Treviso e l’altro a Roma e tre mini parchi nelle scuole dell’infanzia di Verona. Il piccolo cambiamento culturale generato dalle pratiche contribuisce ad attivare in genitori

ed educatori una visione ecologica che presta attenzione ad ambiente, contesto, caratteristiche del bambino. Le ricadute di questo cambiamento di attenzione e incremento di conoscenza possono apportare delle modifiche nella giornata dei piccoli, soprattutto nei nidi e nelle scuole dell'infanzia, dove essi trascorrono gran parte della loro giornata. Una maggiore pratica di attività fisica contribuisce alla prevenzione della salute e potrebbe contribuire allo sviluppo dei processi cognitivi.

Reference:

Pesce, C. (2012). Shiftive the focus from quantitative to qualitative exercise characteristics in exercise and cognition research. *J. Sport and Exercise Psychology*, 34(6), 766-86.

Tomprowski, P., D., McCullick, B., Pendleton, D., M. & Pesce, C. (in press). Exercise and children's cognition: the role of exercise characteristics and a place for meta-cognition.

Le altre referenze sono nell'elenco generale della prima parte della tesi.

20 PAPERS DISCUSSED IN THE THESIS

Question of research:

- a) “What is the role of the environment in developing physical activity in preschool children?”
- b) “How may we develop motor skills in children?”
- c) “If and how may we develop cognitive processes by physical activity?”

QUESTION A) “WHAT IS THE ROLE OF THE ENVIRONMENT IN DEVELOPING PHYSICAL ACTIVITY IN PRESCHOOL CHILDREN?”

1) Prospettiva ecologica: importanza di ambiente e contesto nello sviluppo motorio dei bambini/

Tortella, P., Tessaro, & F., Fumagalli, G. (2012). *Prospettiva ecologica: importanza di ambiente e contesto nello sviluppo motorio dei bambini*, in Cruciani M., Cecconi F., (a cura di) *Atti del Nono Convegno Annuale dell’Associazione Italiana di Scienze Cognitive (AISC)*, Università di Trento, 213-218. <http://www.aisc-net.org/home/2012/11/24/atti-aisc12/>

2) Motor cognition during free play in 3 years old children builds up on factors involving space organization and social interaction.

Tortella, P., Tessaro, F., & Fumagalli, G. (2011). *Motor cognition during free games in 3 years old children builds up on factors involving space organization and social interaction*, in *Le scienze cognitive in Italia 2011, Aisc 2011, Atti dell’ottavo convegno Nazionale Associazione Italiana di Scienze Cognitive, Tecnologia, scienze umane e scienze della salute*, (a cura di Angelo Rubinacci, Angelo Rega Nicola Lettieri), Napoli: Università degli Studi Federico II, <http://www.aisc-net.org/home/category/e-book-corner/>, pp. 189-193.

QUESTION B) "HOW MAY WE DEVELOP MOTOR SKILLS IN CHILDREN"?

3) New environments for the education of 0-6 years old children: what teachers think about the playground for formal and non formal education. Nuovi spazi per l'educazione dei bambini da 0 a 6 anni: cosa pensano gli insegnanti del parco giochi come luogo di educazione formale e non formale

Tortella, P. (2013). New environments for the education of 0-6 years old children: what teachers think about the playground for formal and non formal education. Nuovi spazi per l'educazione dei bambini da 0 a 6 anni: cosa pensano gli insegnanti del parco giochi come luogo di educazione formale e non formale, in *Formazione & Insegnamento – European Journal of Research on Education and Teaching*, 161-170.

4) Exploring the effects of 10 hours playground activity on motor competence and physical fitness in 5 year old children

Tortella, P., Tessaro, F., Fumagalli, G., Lorås, H., Haga, M., & Sigmundsson, H; *paper in preparation*

5) Tortella, P., Fumagalli, G., Lorås ,H., Haga, M., & Sigmundsson, H. (2014). **Exploring the effects and specificity of playground activities on motor skills in 5 years old children**, *Science & Sport*, 29(S), S50. (referee+if. 0,537)ISSN 0765-1597. Journal on line: <http://www.sciencedirect.com/science/journal/07651597/29/supp/S>

QUESTION C) "IF AND HOW MAY WE DEVELOP COGNITIVE PROCESSES THROUGHOUT PHYSICAL ACTIVITY"?

5) Tortella, P., Tessaro, F., & Fumagalli, G., **Percezione-azione: il ruolo dell'educatore nella attribuzione di significato all'ambiente e al compito, con bambini di 5 anni**, in Cruciani M., Cecconi F., (a cura di) *Atti del Nono Convegno Annuale dell'Associazione Italiana di Scienze Cognitive (AISC)*, Università di Trento, 303-308, <http://www.aisc-net.org/home/2012/11/24/atti-aisc12/>

6) Tortella, P., Fumagalli, G. (2014). **Difficult motor skill acquisition in 5 y old children can be modulated by educators**, *Science & Sport*, 29,(S), S49-50. ISSN 0765-1597. Journal on line: <http://www.sciencedirect.com/science/journal/07651597/29/supp/S>

Article on line: http://ac.els-cdn.com/S0765159714002378/1-s2.0-S0765159714002378-main.pdf?_tid=6e6b8ecc-591d-11e4-bdf2-00000aab0f26&acdnat=1413894547_1622b8bda8ca8d4772156ba279708d09

7) Tortella, P., Pernice, B., **Health, physical activity and executive functions in 3-5 years old children. The opinions of the parents.** Salute, attività fisica e funzioni esecutive nei bambini da 3 a 5 anni. Le opinioni dei genitori. in *Formazione & Insegnamento – European Journal of Research on Education and Teaching* (accettato, in press).

8) Tortella, P. (2013). *Mente e corpo nella relazione educativa nelle scuole dell'infanzia: lo sviluppo delle capabilities per una buona qualità della vita*/Mind and body in the educational relationship in Kindergarden: the develop of capabilities for a good quality of life, in *Formazione & Insegnamento – European Journal of Research on Education and Teaching*, (1), 121-125.

9) Tortella, P., Fumagalli, G., & Tessaro, F. (2013). **How can teachers contribute to develop executive functions through motor activity?** Margiotta U., Raffaghelli J., Saulescu E., Icleanu R. (Editors), *Proceedings of the International Conference: transforing the educational relationship: intergenerational and family learning for the lifelong learning society, Lifelong Learning Programme*, 204-209.

STUDIES NOT PUBLISHED YET.

10 Study – **Improvement in cognitive processes in the playground?**

11) Study – **Focus group with the teachers of primaries schools**

12) Study - **Other qualitative observations: A study at the “monkey bars” tool in the playground.**

13) Considerations – **a qualitative study. Teacher at the playground and the fear of danger for children, a focus group with parents of children attending the playground.**

In these studies it emerges that the socio emotional cultural environment influence beliefs and style of teaching.

14) Study – **physical activity and school readiness** / attività fisica e successo scolastico.

21 PUBLICATIONS BY THE AUTHOR

21.1 INTERNATIONAL PUBLICATIONS BY THE AUTHOR: ARTICLES IN INTERNATIONAL PEER-REVIEWED JOURNALS

Tortella, P., Pernice, B., Health, physical activity and executive functions in 3-5 years old children. The opinions of the parents. : Salute, attività fisica e funzioni esecutive nei bambini da 3 a 5 anni. Le opinioni dei genitori. *Formazione & Insegnamento – European Journal of Research on Education and Teaching*. Lecce, Pensa Multi Media, (accettato, in press).

Tortella, P. (2013). New environments for the education of 0-6 years old children: what teachers think about the playground for formal and non formal education. Nuovi spazi per l'educazione dei bambini da 0 a 6 anni: cosa pensano gli insegnanti del parco giochi come luogo di educazione formale e non formale. *Formazione & Insegnamento – European Journal of Research on Education and Teaching*. 161-170.

Tortella, P. (2013). *Mente e corpo nella relazione educativa nelle scuole dell'infanzia: lo sviluppo delle capabilities per una buona qualità della vita/Mind and body in the educational relationship in Kindergarden: the develop of capabilities for a good quality of life. Formazione & Insegnamento – European Journal of Research on Education and Teaching*. 1, 121-125.

Tortella, P., (2011). La mente in azione: formazione alla corporeità e alle emozioni dell'insegnante di scienze motorie / Mind in action: Training physical educator to sense emotions and the body. *Formazione & Insegnamento – European Journal of Research on Education and Teaching*. 1- 6.

Tortella, P., (2011) Recensione Marc Jeannerod, Motor Cognition. What actions tell the self, in *European Journal of Research on Education and Teaching*. 1-4.

21.2 INTERNATIONAL PUBLICATIONS BY THE AUTHOR: ABSTRACTS IN INTERNATIONAL PEER-REVIEWED JOURNALS

Tortella, P., Fumagalli, G., Lorås, H., Haga, M., & Sigmundsson, H. (2014). Exploring the effects and specificity of playground activities on motor skills in 5 years old children, *Science & Sport*, 29(S), S50. Journal on line: <http://www.sciencedirect.com/science/journal/07651597/29/supp/S>

Tortella, P., & Fumagalli, G. (2014). Difficult motor skill acquisition in 5 y old children can be modulated by educators, *Science & Sport*, 29,(S), S49-50. <http://www.sciencedirect.com/science/journal/07651597/29/supp/S>

Tortella, P., Callegari, L., Tessaro, F., & Fumagalli, G. (2011). Survey on motor activity in nurseries in Trentino, *The Journal of Sports medicine and physical fitness*, 51, S1. 1-3

Tortella, P., Bortolameazzi, F., Bertinato, L., & Fumagalli, G. (2010). Space organization in unstructured games influences physical activity levels in 3 y old children, *Science & Sport*, 25, 33.

Tortella, P., Bortolameazzi, F., Fumagalli, G. (2010). Influences on environment on development in children's motor skills, *Journal of sport science*, 18, S21.

Tortella, P., Bortolameazzi, F., Fumagalli, G. (2010). Analysis of motor behavior of 3 y old children during unstructured games: role of space organization, *The Journal of Sports medicine and physical fitness*, 50, S1, 1-3, 10.

21.3 ORAL PRESENTATIONS AT INTERNATIONAL CONGRESSES

16-18/10/2014 (Relazione orale): Exploring the effects and specificity of playground activities on motor skills in 5 years old children, International Congress on children's physical activity and sport, Liege (Belgium)

16-18/10/2014 P. (Relazione orale): Difficult motor skill acquisition in 5 y old children can be modulated by educators, International Congress on children's physical activity and sport, Liege (Belgium).

23-25 ottobre 2013, (Relazione orale) How can teachers contribute to develop executive functions through motor activity? Congress Lifelong Learning Programme, Bucarest, Romania;

21.4 Poster presentations at international congresses

18-20/4/2013 P. Tortella, F. Tessaro, G. Fumagali, Role of educators for difficult motor skill acquisition in 5 y old children, 2013 SRCDB Biennial, Seattle, Washington, USA.

13-17/10/2012, P. Tortella, F. Tessaro, C. V. Chiamulera, G. F. Fumagalli, Levels of physical activity of pre-school children is influenced by space organization, Annual Meeting Neuroscience, New Orleans USA.

07-09/06/2012, Tortella P., Fumagalli G., Tessaro F., Motor behavior during free game in 3 years old children builds up on factors involving space organization and social interaction, “International Conference of Infant Studies”, Minneapolis, Minnesota, USA.

28-29 maggio 2010, 1st European Congress on “Physical Activity and Health among 0-6 y.o. Children, Epinal, France – Poster Presentation

21.5 STAGES ABROAD

Prof. H. Sigmundsson, Prof. Haga Department of Psychology, SVT Faculty, NTNU Norges teknisk-naturvitenskapelige universitet, 7471 Trondheim, Norway, 10-20/09/2012, 9-15/12/2012, 17-21/06/2013, 28/10-7/12 2013, 2/3-7/4 2014.

3-10/09/2011 Prof. Bonatti L., Department of Psychology, University Pompeu Fabra, Barcelona, (Spagna).

11-15/10/2012 Prof. ssa Striano T., Department of Psychology, Hunter College, Hunter College New York (USA)

1-7/06/2011 Prof.ssa Karen Adolph, Baby & Child, Department of Psychology, NYU New York University, New York (USA)

1-10/11/2010 Prof.ssa Karen Adolph, Baby & Child, Department of Psychology, NYU New York University, New York (USA)

21.6 Designing the Primo Sport 0246 playgrounds for children 0-6 years old

2014 Primo Sport 0246, Kindergarten “A. Grigolli Bresciani” Cerea (VR), Italy.

2014 Primo Sport 0246, Kindergarten “Angeli Custodi”, Gargagnago (VR), Italy.

2013 Primo Sport 0246, Roma

2012 Primo Sport 0246, Kindergarten Bambi & Bimbi, via della Campagna, Pescantina, Verona.

2010 Primo Sport 0246 Treviso.

21.7 PUBLICATIONS IN ITALIAN

Testo con più autori

Tortella, P., & Fumagalli, G. (2014, ottobre) Attività fisica e funzioni esecutive nella scuola dell’infanzia. Consigli agli *insegnanti delle scuole dell’infanzia su come promuovere la salute e il successo scolastico dei nostri bambini*. Libreria dello sport, MI.

Tortella, P., Calidoni, P., Tessaro, F., Borgogni, A., & Fumagalli, G., *Favorire la pratica dell’attività motoria da 3 a 6 anni*, Minerva Edizioni, Bologna 2012.

Curatele

Tortella, P., Durigon, V., Cappellari, D., & Fumagalli, G. (2011). *Parco Giochi “Primo-Sport 0246” Il parco per lo sviluppo senso motorio del bambino*, Libreria dello Sport, Milano.

Bertinato, L., Donati, D., Durigon, V., Fumagalli, G. & Tortella P. (2009). *Parco giochi e sviluppo senso motorio, linee guida*, Edizioni Sapere, Padova.

Capitoli di libri in lingua italiana

Tortella, P., Tessaro, F., & Fumagalli, G. (2012). *Percezione-azione: il ruolo dell'educatore nella attribuzione di significato all'ambiente e al compito, con bambini di 5 anni*, in Cruciani M., Cecconi F., (a cura di) *Atti del Nono Convegno Annuale dell'Associazione Italiana di Scienze Cognitive (AISC)*, Università di Trento, Trento, 303-308 <http://www.aisc-net.org/home/2012/11/24/atti-aisc12/>

Tortella, P., Tessaro, F., & Fumagalli, G. (2012). *Prospettiva ecologica: importanza di ambiente e contesto nello svi-luppo motorio dei bambini*, in Cruciani M., Cecconi F., (a cura di) *Atti del Nono Convegno Annuale dell'Associazione Italiana di Scienze Cognitive (AISC)*, Università di Trento, 213-218. <http://www.aisc-net.org/home/2012/11/24/atti-aisc12/>

Tortella, P. (2012). *Premessa*, in Miracolo, R., *Disprassia, Organizzazione Motoria ed Esercizio in Età Evolutiva. La rieducazione motoria del bambino disprassico*, Ed. Sapere, Padova.. 5-8.

Tortella, P. (gennaio-febbraio 2012). *Parco giochi Primo Sport 0246: il parco di tutti, il parco di ciascuno*, *Paesaggio Urbano – Urban Design*, 34-35.

Tortella, P., Tessaro, F., & Fumagalli, G. (2011). *Motor cognition during free games in 3 years old children built up on factors involving space organization and social interaction*, in *Le scienze cognitive in Italia 2011, Aisc 2011, Atti dell'ottavo convegno Nazionale Associazione Italiana di Scienze Cognitive, Tecnologia, scienze umane e scienze della salute*, (a cura di Angelo Rubinacci, Angelo Rega Nicola Lettieri), Napoli: Università degli Studi Federico II. 189-193.

Tortella, P. (giugno 2011). *Il gioco fattore di crescita motoria se...*; in Tortella, Moghetti, Maffei, Buzzavo, Durigon, Da Dalt, CONI Treviso, Fumagalli, *Primo Sport – L'ambiente e il movimento ideali per crescere sani*, Edizioni Libreria dello Sport, Milano. 42-65.

Tortella, P., & Buzzavo, G. (giugno 2011). *PrimoSport 0246: il parco giochi per i più piccoli*; in Tortella, Moghetti, Maffei, Buzzavo, Durigon, Da Dalt, CONI Treviso, Fumagalli, *Primo Sport – L'ambiente e il movimento ideali per crescere sani*, Edizioni Libreria dello Sport, Milano. 65-87.

Tortella, P. (2011). *I come e i perché facilitare la pratica dell'attività motoria*, in Tortella, Moghetti, Maffei, Buzzavo, Durigon, Da Dalt, CONI Treviso, Fumagalli,

Primo Sport – *L'ambiente e il movimento ideali per crescere sani*, Edizioni Libreria dello Sport, Milano. 93-123.

Tortella, P., & Fumagalli, G. (2011). *Lo sviluppo motorio del bambino da 0 a 6 anni*, in P. Tortella, V. Durigon, D. Cappellari, G. Fumagalli, Parco Giochi Primospport 0246 *il parco per lo sviluppo senso motorio del bambino*, Edizioni Libreria dello Sport, Milano. 13-23..

Tortella, P., & Fumagalli, G. (2011). *Progettazione e organizzazione delle attività motorie per la fascia di età 0-6 anni: la strutturazione degli spazi per giocare*, in P. Tortella, V. Durigon, D. Cappellari, G. Fumagalli, Parco Giochi Primospport 0246 *il parco per lo sviluppo senso motorio del bambino*, Edizioni Libreria dello Sport, Milano. 24-51.

Tortella, P. (2011). *Il Parco Giochi Primo Sport 0246: il parco per tutti il parco per ciascuno*, in P. Tortella, V. Durigon, D. Cappellari, G. Fumagalli, Parco Giochi Primospport 0246 *il parco per lo sviluppo senso motorio del bambino*, Edizioni Libreria dello Sport, Milano. 52-84.

Tortella, P. (2009). *Lo sviluppo motorio del bambino da 0 a 6 anni*; In: Bertinato L., Donati D., Durigon V., Fumagalli G. e Tortella P. *Parco giochi e sviluppo senso motorio, linee guida*, Edizioni Sapere, Padova. 21-32

Tortella, P. (2009). *Progettazione ed organizzazione delle attività motorie per la fascia d'età 0-6 anni*, In: Bertinato L., Donati D., Durigon V., Fumagalli G. e Tortella P., *Parco giochi e sviluppo senso motorio, linee guida*, Edizioni Sapere, Padova. 33-42

Tortella, P. (2009). *Il parco giochi come strumento per lo sviluppo del bambino/a da 0 a 6 anni: organizzazione funzionale in aree tematiche e piazzole*, In: Bertinato L., Donati D., Durigon V., Fumagalli G. e Tortella P., *Parco giochi e sviluppo senso motorio, linee guida*, Edizioni Sapere. 33-42.

Tortella, P. (2009). *Lo sviluppo del bambino da 0 a 6 anni*, in Bertinato L., Donati D., Durigon V., Fumagalli G. e Tortella P., *Parco giochi e sviluppo senso motorio, linee guida*, Edizioni Sapere. 21-32.

Tortella, P. (2009). *Progettazione e organizzazione delle attività motorie per la fascia di età 0-6 anni*, in Bertinato L., Donati D., Durigon V., Fumagalli G. e Tortella P., *Parco giochi e sviluppo senso motorio, linee guida*, Edizioni Sapere. 33-42.

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21.8 CAPITOLI DI LIBRI IN LINGUA INGLESE

Tortella, P., Fumagalli, G., & Tessaro, F. (2013). *How can teachers contribute to develop executive functions through motor activity?* Margiotta U., Raffaghelli J., Saulescu E., Icleanu R. (Editors), *Proceedings of the International Conference: transforming the educational relationship: intergenerational and family learning for the lifelong learning society, Lifelong Learning Programme*. 204-209;

Tortella, P. (2011). *Play and motor development*, in Tortella, Moghetti, Maffeis, Buzzavo, Durigon, Da Dalt, Coni Treviso, Fumagalli, Primo Sport, *Surroundings and activities just right for growing up well*, Edizioni Libreria dello Sport, Milano. 41-65.

Tortella, P., & Buzzavo, G. (2011). *Primo Sport 0246: playgrounds for early years*, in Tortella, Moghetti, Maffeis, Buzzavo, Durigon, Da Dalt, Coni Treviso, Fumagalli, Primo Sport, *Surroundings and activities just right for growing up well*, Edizioni Libreria dello Sport, Milano. 65-87.

Tortella, P. (2011). *Motor activity practice*, in Tortella, Moghetti, Maffeis, Buzzavo, Durigon, Da Dalt, Coni Treviso, Fumagalli, Primo Sport, *Surroundings and activities just right for growing up well*, Edizioni Libreria dello Sport, Milano. 93-122.

21.9 RELAZIONI ORALI A CONVEGNI E CONGRESSI NAZIONALI.

11-13 settembre 2014 relazione orale *Attività in zona di sviluppo prossimale tra lo sviluppo delle competenze motorie e delle capacità di apprendimento scolastico: una sperimentazione nelle scuole dell'infanzia*. SIREF Summer school. Università A. Cusano.
16-17 dicembre 2013 relatrice presso Università di Urbino del seminario "Favorire la pratica dell'attività motoria 0-6 anni".

12-14 settembre 2013 presentazione *“Attività motoria per l’infanzia e sviluppo cognitivo. Cosa ne pensano i genitori”* in Summer School *“Contesti cooperativi per generare opportunità. Apprendere, formare, agire nel corso della vita: capacità, democrazia, partecipazione”*. SIREF, Lecce.

21-23 marzo 2013 presentazione *“New environments for the education of 0-6 years old children: what teachers think about the playground for formal and non-formal education”* in Summer School *“Competenze, Capacità e Formazione permanente. Le politiche educative e formative alla luce dei nuovi scenari”*. Roma, SIREF, Università UNICUSANO.

27/02/2013 AIAPP Roma, relatrice *Parchi e spazi per lo sviluppo motorio e cognitivo nell’infanzia*.

3-5 dic 2012 AISC Roma, relatrice *Percezione-azione: il ruolo dell’educatore nella attribuzione di significato all’ambiente e al compito, con bambini di 5 anni*

3-5 dic 2012 AISC Roma, relatrice ., *Prospettiva ecologica: importanza di ambiente e contesto nello svi-luppo motorio dei bambini*.

6-8 settembre 2012 presentazione *“Mente e corpo nella relazione educativa nelle scuole dell’infanzia: lo sviluppo delle capabilities per una buona qualità della vita/Mind and body in the educational relationship in Kindergarden: the develop of capabilities for a good quality of life”*. Summer School, *“Capability: competenze, Capacitazione e Formazione*. Dopo la crisi del Welfare, Venezia-Mestre, Società Italiana di Ricerca Educativa e Formativa, Università Cà Foscari di Venezia, 2012.

1-2 dic 2011, AISC Milano, relazione *Motor cognition during free games in 3 years old children builds up on factors involving space organization and social interaction*

29 novembre 2011, Università degli Studi di Cassino, seminario *“ Il ruolo dell’ambiente nello sviluppo delle competenze motorie della prima infanzia”*.

15 ottobre 2011, San Sepolcro (Arezzo) seminario *“Crescere e convivere con la diversità”*; titolo della presentazione: *“Attività e partecipazione: il ruolo del contesto nella disabilità”*

12-14/09/2011 Rovereto, *Summer school “La formazione degli insegnanti. Evidences based research and european benchmarks 2020*.

27 aprile 2010, Arezzo, *“Stessi giochi, stessi sorrisi”* Convegno Nazionale sull’organizzazione delle attività motorie per l’infanzia e l’handicap, Giunta Provinciale di Arezzo; titolo della presentazione: *Lo sviluppo delle competenze senso motorie nel parco giochi*;

21.10 PRESENTAZIONE DI POSTER A SEMINARI E CONVEGNI NAZIONALI

30 settembre – 2 ottobre 2010, P. Tortella, F. Bortolameazzi, G. F. Fumagalli, “*Analysis of motor behaviour of 3 y old children during unstructured games: role of space organization*”, 2nd National Congress of Italian Society of Movement and Sport Sciences, Torino

29 settembre 2011, P.Tortella, Luana Callegari, Fiorino Tessaro, Guido Fumagalli
3° Convegno Nazionale SISMES, *Survey on motor activity in nurseries in Trentino*,
Università di Verona

Estratto per riassunto della tesi di dottorato

Studente: Patrizia Tortella matricola: 955889

Dottorato: Scienze della Cognizione e della Formazione

Ciclo: 26

Titolo della tesi: Physical activity in development of motor skills and cognitive processes in preschool children: consequences in school readiness.

Abstract in lingua italiana

La ricerca scientifica ha dimostrato che attività fisica e processi cognitivi si intrecciano in funzioni esecutive, correlate a loro volta con le capacità di apprendimento.

Con questa tesi si affrontano le relazioni esistenti tra sviluppo motorio e processi cognitivi utilizzando una metodologia mixed method. I dati quantitativi sono stati ottenuti da un totale di 986 bambini (3-5 anni) da 24 scuole delle provincie di Verona, Treviso e Trento; la ricerca ha coinvolto 118 insegnanti e 500 genitori.

I dati evidenziano che gli incrementi di alcune competenze motorie si correlano con lo sviluppo di processi cognitivi e le metodologie didattiche applicate. Determinante per lo sviluppo di competenze nel bambino è la percezione di successo. Rilevazioni empiriche da parte degli insegnanti indicano che i miglioramenti in alcune funzioni esecutive da parte degli alunni sottoposti a specifici programmi didattici motori persistono nei primi anni di scuola primaria.

Abstract in English

Recent scientific evidences indicate that physical activity and cognitive processes both contribute to enhancement of executive functions, a set of prefrontal cortex properties that contribute to academic and personal achievements. This thesis investigates the connections between motor development and cognitive processes by a mixed method approach. The quantitative data have been obtained from 986 children (3-5 years old) from 24 kindergarten of Verona, Treviso e Trento (Northern Italy); the study has involved 118 teachers and 500 parents.

The results suggest that development of motor and cognitive competences are intermingled and depend on careful use of appropriate teaching methodologies. The perception of success appears to be the driving force for skills development. Empirical

observations by primary school teachers suggest that the improvements in executive functions induced by a controlled motor training at pre-school persist in the first year of primary school.

Patricia Tordella

