



**THE RELATIONSHIP BETWEEN PERFORMANCE OF
NEUROMUSCULAR JUNCTION AND SOCIAL SKILLS
(CO-OPERATION, INTERACTION, INDEPENDENCE)
OF PRESCHOOLERS**

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Abstract:

This study investigated the relationship between neuromuscular junction and the social skills of cooperation, interaction and independence, after these variables had been detected and assessed in early childhood children. The sample consisted of 72 preschoolers (40 boys, 32 girls) aged 48 to 78 months. In order to assess whether or not there were kinetic difficulties in the neuromuscular juxtaposition of preschoolers, an array of eight motor tests was used (M-ABC Test, Henderson & Sugden, 1992). The Preschool and Kindergarten Behavior Scales (Merrell, 1994) was used to assess social skills. The results showed that the majority of children performed below the values of the risk zones, while 8.00% of the sample was found in the high-risk zone. No differences were found regarding gender and age regarding the onset of motor problems. Regarding social skills, it was found that most preschoolers had sufficient skills of cooperation, interaction and independence, while few were those with a shortage of these skills. In addition, the results showed a relationship between performance in MABC Test and social skills, but this was not statistically significant. The results of this research are consistent with other similar surveys, but they also contradict some others. Therefore, it is necessary to further investigate the issue due to the small sample of the survey.

Keywords: developmental disturbance of kinetic coordination, social skills, collaboration, interaction, independence, pre-school age

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1. Introduction

Neuromuscular junction refers to the coordinational function of the central nervous system, namely, in the determination and coordination of actions (neural, muscular) to achieve a desired resultⁱⁱ. According to this function, the perceptual mechanism is activated so that specific stimuli are perceived which are required for further responses, such as the visual and acoustic motor coordination (e.g., achieves a goal with the ball, responds in a motor – dancing way appropriately to the sounds that are heard, can take off his blouse in a reasonable time). The perceptual mechanism is activated to control the functioning of competing muscles so as to support each other in relation to the purpose of deliberate behavior instead of preventing or prohibiting it. The process may be inherent or acquired and can be activated consciously but also unconsciously.

Junction is an element of fitness associated with performance. It is the ability to empower special motor systems with a variety of sensory organs for effective movement (Gallahue 2002). The harmonious co-ordination of the synchronization, the rhythm and the sequence of the elements of the individual's movement is important for the articulated movement. Various parts of the body can be involved, such as an eye-foot fitting in the kicking of a ball or the climbing of the ladder. Eye-to-hand assembly is evident in fine kinetic activities such as the placement of beads in a rope, copying clay constructions, or rough motor activities such as snapping or batting of objects (Gallahue 2002).

There are many children who, without knowing that they have pathological causes, and although they meet the conditions for joining the activities of a formal school or kindergarten, fail to acquire or improve basic motor skills. This situation evolves and leads these children into a vicious circle (Zimmer, 2007) to avoiding motor activities with already existing motor problems becoming even more serious and prominent.

Motor clumsiness or motor coordination disorder is the lack of definition and coordination of basic motor skills and actions to achieve the intended motor outcome (Smith, Zelaznik, 2004). Children with motor clumsiness are usually spotted in preschool age when they cannot perform simple motor skills with precision even though they do not show any obvious neurological deficits or other pathological motor or sensory disorder (Stelios Mantoudis, 2017). Children with movement difficulties (Developmental Disturbance of Co-ordination) are considered to be those children whose overall mobility score in the Movement Assessment Battery for Children (MABC) is lower than the 5th position compared to the age-specific norms.

The clumsy child in preschool age is characterized by the difficulty of acquiring and successfully practicing motor skills that require precision, speed and neuromuscular junction. This difficulty is not limited to specific skills, which could be attributed to inexperience and ignorance but it is manifested in his/her free play,

ⁱⁱ Pedagogical Psychological Encyclopedia Dictionary (1990). *Coordination*, Athens, ed.: Greek Letters, vol. 8, p. 4598

everyday activities and self-service. The preschooler's clumsiness is not always apparent to parents who often attribute their motor failures to their young age and inexperience. The clumsy preschooler's difficulty in performing a variety of motor activities is evident from the first year of their school life. Concise clumsiness in preschool children may be a precursor to low academic performance and the emergence of psychological and developmental problems (Iversen, Knivsberg, Nodland, Ellertsen, 2006).

Skinner and Piek (2001) concluded that the group of adolescents with motor clumsiness had lower self-worthiness and higher levels of anxiety. Teenagers perceived themselves as less capable, with poorer social support and lower self-worth than younger children, and their anxiety was significantly higher than younger participants. Cummins, Piek and Dyck (2005) conclude that children's motor skills were an important predictor of their social behavior.

2. Literature review

Research results in school-age children have shown that these children who have difficulties in neuromuscular junction or motor coordination have been associated with withdrawal and isolation (Smyth & Anderson, 2000; Poulsen, Ziviani, Cuskelly & Smith, 2007; Jarus, Lourie-Gelberg, Engel-Yeger & Bart, 2011), difficulties in focusing attention (Chen, Tseng, Huc & Cermak, 2009), with behavior problems, emotional problems, depression, hyperactivity, lack of appropriate social skills, difficulty in conducting relationships with peers, reduced verbal intelligence, poor social communication (Schoemaker & Kalverboer, 1994, Dewey, 1994), stress, physical discomfort (Lingam, Jongmans, Ellis, Hunt, Golding & Emond, 2012, Sylvestre, Nadeau, Charron, Larose & Lepage, Kaplan, Crawford & Wilson, 2002).

The bibliographic review of Chen and Cohn (2003) showed that children with coordination problems run the risk of limited social participation in family social activities, neighborhood leisure activities, and physical and social activities at school. In addition, the poor self-perception and self-esteem of children with coordination problems can reduce their motivation to participate in activities. A similar survey (Kanioglou, Tsorbatzoudis & Barkoukis, 2005) in the Greek school for school age children showed that children with severe coordination difficulties showed higher scores in all four categories of divergent behavior (hyperactivity, lack of attention, stress and behavioral disorders).

Cairney, Hay, Veldhuizen, Missiuna and Faught (2010), studying the participation of children during free and organized games, over a period of three years (from the fourth to the sixth grade) found that there is a continuing activity deficit of these children as compared to the typically developed children in both organized and free activities. All of these studies refer to the relationship between neuromuscular junction and social skills of children of school age. The age group of preschool children

has also been the subject of studies, although surveys are comparatively fewer especially in Greece.

In particular, surveys indicate that there is a significant degree of coexistence of difficulties in motor coordination of emotional and behavioral problems, as well as an important relationship between attention focusing problems and maneuvering difficulties (Iversen, Knivsberg, Ellertsen, Nødland & Bade Larsend, 2006; Piek, Bradbury, Elsley & Tate, 2008). The combination of these difficulties (motor and social behavior) makes children particularly vulnerable to exclusion and isolation (vicious circle, Zimmer, 2007). Thus, motor coordination problems can easily increase the already significant risk of social exclusion.

Other studies (Bart, Jarus, Erez & Rosenberg, 2011; Liberman, Ratzon & Bart, 2013) concluded that children with mobility problems are less independent, mainly in terms of education, and less satisfied with their participation in play, social interactions and education, compared to children without mobility difficulties.

Bar-Haim and Bart (2006) concluded that children with poor motor skills exhibit a lower social gaming frequency and a higher incidence of social contraction than children with normal or high motor skills. Correspondingly, children with low motor skills demonstrate a higher frequency of solitary play than children with high motor skills.

In the Kennedy-Behr, Rodger and Mickan (2011) research on motor and social play for children of pre-school age, it was found that children with a likelihood of coordination disorder are engaged in games that are appropriate for younger age groups and have deficits in space management and material than children without coordination difficulties. It was also found that these children had more negative feelings and were more involved in aggressive incidents - either as offenders or as victims - and were more observers than active players.

Similarly, the same researchers (Kennedy-Behr, Rodger, Mickan, 2013a), investigating the relationship between participation in the game and the well-being of preschool children with or without coordination problems, found that the developmental age of the game varies considerably between the two groups. They also found that children with coordination problems are less involved in group games - and when they are divided into indoor and outdoor space, they are less involved in outdoor ones - they are more often involved in aggressive incidents (most occurring outside) and show more often negative face grimaces when involved in a negative interaction.

In conclusion, children with mobility difficulties encounter various psychosocial problems such as difficulties in conducting relationships with peers and social participation difficulties in activities that require movement, all of which causes low self-esteem, increased anxiety and tendency to isolate and withdraw.

It follows from the above that in the Greek bibliography there are few surveys concerning the age group of pre-school children on social skills and motor coordination, which in fact shows the necessity of carrying out this research.

The purpose of this paper is to study the motor coordination (neuromuscular junction) and the social behavior of pre-school children, as well as the relationship between these two variables, especially if the poor performance of motor coordination also exhibits low estimates of social skills or good performance of motor coordination also shows high estimates of preschooler's social skills.

3. Methodology of research

3.1 Sample

The sample in the present study consisted of seventy-two children (N = 72), 40 boys and 32 girls, attending kindergarten in the prefecture of Thessaloniki.

Table 1: The sample characteristics (frequencies and percentages) for gender and age (N = 72, 100%)

Characteristics		f	%
Gender	Boys	40	55,6
	Girls	32	44,4
	Total	72	100
Age	48 to 54 months – 4 - years- old	4	5,6
	55 to 66 months – 5 - years- old	27	37,5
	67 to 78 months – 6 - years- old	41	56,9
	Total	72	100

3.1 Measuring tools

A. Measuring tool for the Developmental Disturbance of Kinetic Coordination (Movement Assessment Battery for Children, Henderson & Sugden, 1992).

The Kinetic Movement Assessment Battery for Children (MABC, Henderson & Sugden, 1992) was used to evaluate the motor performance of children. This test has been used in a number of previous surveys (Coleman, Piek & Livesey, 2001; Junaid & Fellowes, 2006; Giagazoglou, Kabitsis, Kokaridas, Zaragas, Katartzi & Kabitsis, Zaragas 2009; Welsvelde, Peersman, Lenoir, Smits Engelsman & Henderson, 2008, Chow, Henderson & Barnett, 2001, Livesey, Coleman & Piek, 2007; Kourtessis, Tsougou, Maheridou, Tsigilis, Psalti & Kioumourtzoglou, 2008). This motor test is based on norms and is aimed at children from 4 to 12 years of age. It includes three modules: a) hand skills (manipulative skill); b) ball skills (object manipulation); and c) balance (dynamic and static). In total, it consists of 32 exercises, divided into four categories (eight exercises in each category) depending on the age of the children. Category 1 is used for children aged 4 - 6 years. For the purposes of this survey, Category 1 exercises were used to assess the motor performance of preschool children (4-6 years).

As children perform each exercise, they also receive a score of 0 to 5. The lower the score, the better their performance. The exercises on unity of hand skills are summed up and give the score of fine mobility. In the same way, the scores of exercises involving the ball skills module are summed up and give the score of object

manipulation, and the scores of the dynamic and static equilibrium exercises are summed up and give the score of balance. In the end, the scores of the eight exercises are summed up and give the total score. This total score can vary from 0 (for children without any kinetic difficulty) to 40 (for children with very severe kinetic difficulties). A child with a general motor score of less than 10 is not a problem. A child with a general kinetic score greater than 10 has some difficulties. A child with a general motor score of more than 14 shows severe motor problems. The test is designed to differentiate children from the motor performance and the differentiation thresholds are the 15th and 5th lowest percentage. Thus, a child whose kinetic performance drops below the 15th position, compared to the norms set for his age, is in a marginal state with some motor problems. If its motor performance drops below the lowest 5th position, it has serious motor problems.

B. Social Measurement Tool for Preschool Children (Preschool and Kindergarten Behavior Scales, Merrell, 1994).

The Preschool and Kindergarten Behavior Scales (PKBS, Merrell, 1994) were used to assess the social skills of children. This Scale is a behavioral observation tool used to evaluate social skills and problem behaviors in preschool children (3-6 years) and is complemented by parents or teachers. It is a standard tool developed specifically for use in the assessment of young children in a variety of environments and with a variety of behavioral information. This tool includes two separate Scales (categories): A) Social Skills (34 items) and B) Behavioral Problems (42 items).

The Scale of Social Skills in the present study appeared to be reliable and shows very good internal consistency as Cronbach reliability index was found to be 0.879. This particular tool for assessing social skills was also used in Greece, in a recent survey of Iosephides (2015), where the scale also showed very good internal consistency as Cronbach reliability index was 0.96.

3.2 Statistical analysis

Frequency tables and corresponding percentages were constructed and the principles of descriptive statistics (average, standard deviation, maximum and minimum) were applied to all survey variables.

A-Cronbach index was applied for the credibility of the questionnaire for the three variables of Social Co-operation, Social Independence and Social Interaction. A-Cronbach's credibility for the 12 questions of the Social Co-operation Questionnaire is .912, which shows that the questionnaire is of a good credibility and internal consistency, that is, the questions tend to measure the same thing (Social Co-operation).

A-Cronbach's credibility for the 11 questions of the Social Interaction questionnaire is .868, which shows that the questionnaire is of good reliability and has internal consistency, that is, questions tend to measure the same thing (Social Interaction). A-Cronbach's credibility for the 11 questions of the questionnaire on Social Independence is .857, which shows that the questionnaire is of good reliability and has

an internal consistency, that is, questions tend to measure the same thing (Social Independence).

The questionnaire partition reliability was applied, which refers to the correlation between measurements based on the first half of the questions for all the Social Co-operation questions and measurements based on the second half. For Social Collaboration, the reliability of splitting the 12 questions is .881 (Guttman Split-Half Coefficient), which shows that the scale is very reliable. The same process was carried out for the credibility of the partition of the 11 questions of Social Interaction and the 11 questions of Social Independence, where .868 and .740 respectively were found, indicating that the scales are very reliable.

Inter - rater reliability is given by the Kappa coefficient, and is based on a measurement of the agreement between the estimates of two different estimators (researchers - nursery teachers). The Kappa coefficient for the agreement of the estimates of the two researchers is 0.94 for motor clumsiness, and 0.91 for social skills, which shows agreement of a very high level among the estimators.

In order to control the hypothesis between the relationship of neuromuscular junction performance and social skills (co-operation, interaction and independence), a regression analysis was performed which reveals the predictability of one variable on the other, i.e if the poor performance of the neuromuscular junction (motor skill) provides low scores for social skills.

4. Results

4.1 Results on the performance of the Neuromuscular M-ABC Test

According to the manufacturers of MABC Test (Henderson & Sugden, 1992), the scores are registered in the eight tests cumulatively. A first general picture, distinguished by the overall table (1), shows that 40 children (56.00%) are below the values of the risk zones and these children seem to have a good skilful movement in general. There are 26 children (36.00%) in the risk zone who need intervention to improve their motor performance while 6 children (8.00%) are in the high risk area and need immediate intervention to improve their motor performance. In conclusion, a first image of the 72 children in the sample shows that a large proportion of 32 children (44.00%) should be involved in intervention programs to promote their motor performance. According to the manufacturers of the MABC Test kinetic test (Henderson & Sugden, 1992), we need to check the above table in a more detailed form, taking into account the age groups as well.

Table 2: Frequencies and corresponding percentages of the sample score of children
 (N = 72, 100.00%) in the total of eight MABC Test kits

Score	f	%	Score	f	%
2,00	1	1,4	10,00	8	11,1
3,50	1	1,4	10,50	1	1,4
4,00	1	1,4	11,00	3	4,2
4,50	1	1,4	11,50	2	2,8
5,00	1	1,4	12,00	2	2,8
5,50	4	5,6	12,50	3	4,2
6,00	4	5,6	13,00	2	2,8
6,50	1	1,4	13,50	5	6,9
7,00	2	2,8	16,50	1	1,4
7,50	1	1,4	18,00	3	4,2
8,00	3	4,2	26,00	1	1,4
8,50	5	6,9	26,50	1	1,4
9,00	7	9,7	Total	72	100,0
9,50	8	11,1			

Regarding children with motor problems, 11 boys and 7 girls were found in the risk group, with 15.3% and 9.7% respectively in the whole sample (30% of the 5-year-old boys and 28.5% 5-year old girls, 27.7% 6-year-old boys and 21.7% 6-year-old girls). These children, with an appropriate intervention program, can improve their motor skills. However, children with severe motor difficulties were also found, which suggests the existence of DDMJ. In the group of motor clumsiness, the same percentage of 4.2% was found in the whole sample (3 boys and 3 girls, namely 10% of the 5-year-old boys and 14.25% of the 5-year-olds, and 5.5% of 6-year-old boys and 8.6% of 6-year-old girls). Overall, in terms of age, 11.1% of 5-year-olds and 7.3% of 6-year-olds showed DDMJ (Developmental Disorder of Neuromuscular Junction). All the above are summarized in the following table (3).

Table 3: Summary table of frequencies and corresponding rates for the number of children experiencing motor difficulties

Age	Team Risk				Kinetic Clumsiness			
	Boys		Girls		Boys		Girls	
	F	%	F	%	F	%	F	%
4-years-old								
5-years-old	6	30	2	28,5	2	10	1	14,25
6-years-old	5	27,7	5	21,7	1	5,5	2	8,6
Total	11	27,5 (15,3)	7	21,9 (9,7)	3	7,5 (4,2)	3	9,4 (4,2)

4.2 Results in Social Skills (Cooperation, Interaction, Independence, Merrell, 1994)

According to the manufacturer of the social skills scale (Merrell, 1994) there are specific scores that classify children in four functional levels for each subclass separately. Based on these scores (see table 4), the results concerning the social skills of social co-

operation, social interaction and social independence are presented in the following frequency table.

Table 4: Frequency table for the four functional levels of social skills for the three sub-scales (A1, A2, A3), sex and age group (N = 72, 100%)

	Age	Functional Level							
		High Functioning		Average		Moderate Deficit		Significant Deficit	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
A1 Cooperation	4-years old		1		1	2			
	5-years old	4	2	12	3	4	2		
	6-years old	3	6	10	16	4	1	1	
A2 Interaction	4-years old				1	2	1		
	5-years old	5	1	8	3	5	3	2	
	6-years old	3	1	8	12	7	10		
A3 Independence	4-years old			1	2			1	
	5-years old	4	1	9	1	5	4	2	1
	6-years old	3	5	7	9	8	8		1

In general, most children, from the sample as a whole, showed adequate skills of Social Co-operation, Social Interaction and Social Independence, with 58.34%, 44.45% and 40.28% respectively, as they scored scores that rank them in the functional average level. Also, with regard to the competence of Social Co-operation, the children scored slightly better than the other two social skills, as the percentage of children with exceptional Social Cooperation skills (22.23%) was slightly higher than the percentage of children showed a modest deficit (18.05%). On the other hand, children with a modest Social Interaction deficit (38.89%) and Social Independence (34.73%) were more than those ranked at high performance (13.89% and 18.05% skills). Finally, it was found that there were also children, few in the whole sample, who showed a significant deficit of social skills, with the significant Social Insufficiency deficit (6.94%) being higher compared to the percentage of children with a significant Social and Social Interaction (1.38% and 2.77%, respectively). These results are summarized in the table below (5).

Table 5: Frequency distribution and relevant percentages for each operating level and the three sub-scales (A1, A2, A3) regarding the total of children (N = 72, 100%)

Functional Level	A1 - Social Cooperation		A2 - Social Interaction		A3 - Social Independence	
	F	%	F	%	F	%
	High Functional	16	22,23	10	13,89	13
Average	42	58,34	32	44,45	29	40,28
Moderate Deficit	13	18,05	28	38,89	25	34,73
Significant Deficit	1	1,38	2	2,77	5	6,94

In summary, taking into account both sex and age variables (Table 6), girls and three age groups experienced adequate social co-operation skills, with an average score of 32.50 for 4 years, 29.43 for 5 years and 30.91 for 6 years. As for boys, there was little differentiation, as older boys (5yrs and 6years) showed adequate social coaching skills with an average score of 30,25 and 29,17 respectively, while the younger boys (4yrs) showed a modest deficit with an average term score 21.50. Thus, from Table (6) it appears that 4-year-old boys showed low performance in the skill of Social Co-operation compared to girls, while older boys and girls (5years and 6years) showed similar performances ranging within the operating level average.

Table 6: Summary Table of Descriptive Statistics on (A1) Social Co-operation, Based on Gender and Age (N = 72, 100%)

	Gender	Age	Mean	St. Deviation	N
	A1 Social Cooperation	Boys	4-years old	21,50	2,12
5-years old			30,25	4,77	20
6-years old			29,17	5,65	18
Total			29,33	5,36	40
Girls		4-years old	32,50	2,12	2
		5-years old	29,43	5,47	7
		6-years old	30,91	4,29	23
		Total	30,69	4,43	32
Total		4-years old	27	6,58	4
		5-years old	30,04	4,87	27
		6-years old	30,15	4,95	41
		Total	29,93	4,98	72

Also, considering both gender and age variables in relation to the skill of Social Interaction (Table 21), it was again found that older boys (5 years old and 6 years old) had adequate Social Interaction skills with an average score of 24.30 and 24.22 respectively, while the youngest boys (4 years old) showed a moderate deficit with an average score of 14.00. The same was observed for girls as the older (5-year and 6-year-olds) scored an average score of 24,43 and 24,04 respectively, suggesting adequate Social Interaction skills, while the youngest girls (4yrs) showed a moderate deficit score 19.00. Thus, from Table (7) it appears that the smallest children (boys and girls) showed

low Social Interaction skills, while older boys and girls showed similar performances ranging within the operating average level.

Table 7: Summary Table of Descriptive Statistics on (A2) Social Interaction, based on Gender and Age (N = 72, 100%)

	Gender	Age	Mean	St. Deviation	N
A2 Social Interaction	Boys	4-years old	14	1,41	2
		5-years old	24,30	5,89	20
		6-years old	24,22	4,71	18
		Total	23,75	5,63	40
	Girls	4-years old	19	,41	2
		5-years old	24,43	5,15	7
		6-years old	24,04	5,08	23
		Total	23,81	5,01	32
	Total	4-years old	16,50	3,1	4
		5-years old	24,33	5,61	27
		6-years old	24,12	4,84	41
		Total	23,78	5,33	72

Finally, considering both sex and age variables in relation to the ability of Social Independence (Table 22), again, the older boys (5 years and 6 years) showed adequate social independence skills, with an average score of 27.60 and 27.00 respectively, while younger boys (4-year-olds) showed a moderate deficit with an average score of 19.00. For girls, there was little variation, as 4-year and 6-year-old girls showed adequate Social Independence skills with an average score of 24.00 and 26.52 respectively, while 5-year-old girls showed a moderate deficit with an average score of 24.00. Thus, from Table (8), 4-year-old boys appear to have lower Social Independence skills as opposed to girls, 5-year-old boys scored better than girls, while in the 6-year age group there was no difference between the two sexes as they showed similar performance.

Table 8: Summary Table of Descriptive Statistics Regarding (A3) Social Independence, Based on Gender and Age (N = 72, 100%)

	Gender	Age	Mean	St. Deviation	N
A3 Social Independence	Boys	4-years old	19	7,01	2
		5-years old	27,60	4,69	20
		6-years old	27	3,88	18
		Total	26,90	4,69	40
	Girls	4-years old	24	1,41	2
		5-years old	24	4,96	7
		6-years old	26,52	4,52	23
		Total	25,81	4,54	32
	Total	4-years old	21,50	5,06	4
		5-years old	26,67	4,93	27
		6-years old	26,73	4,20	41
		Total	26,42	4,62	72

4.3 Results on the relationship of performance to the M-ABC Test and all three social skills

The dispersion chart between performance in MABC Test and the set of social skills shows a negative linear relationship between the two variables. The equation is $y = 15,52 + (- 0,07x)$ where x is the overall performance in all three social skills of cooperation, interaction and independence and y performance in the MABC Test. The confidence interval of 95% for the regression line slope is $- , 147$ to $, 011$ (Table 9), as this interval contains the value 0, the slope does not differ significantly ($\beta = - , 202$, $t = - 1.725$, $p = 089$) from the horizontal line.

The fact that a negative relationship was found between these two variables shows that the lower the motor score in the M-ABC Test (showing the performance of the neuromuscular junction), the higher the score of all social skills. From the graphical representation of dispersion (Figure 1) we observe that most children who achieved a low motor score (10 and below) showed adequate social skills, achieving a total score of 68 and above. In other words, it was apparent that the motor skillful children showed high levels of social skills. However, few children were found who, while having achieved a low motor score, ie exhibited motor skills, showed a lack of social skills, achieving a total score of 67 and below.

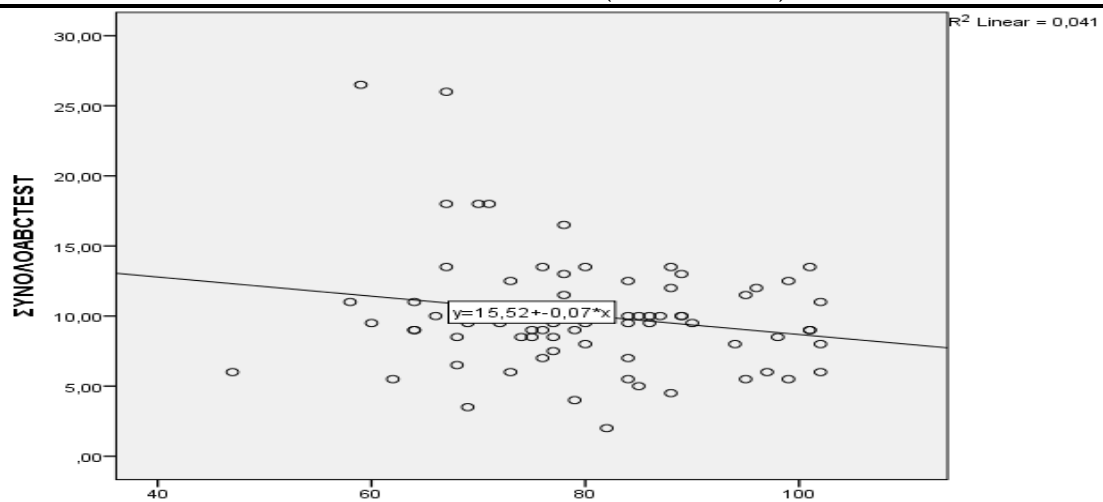
In addition, we notice that children who achieved a mobility score of 11 to 15, those who joined the risk group, had adequate social skills. Instead, children who achieved a high motor score of 16 and above and joined the group of motor skills, showed a lack of social skills. The greatest successes in social skills are associated with the lowest scores in the M-ABC Test.

Table 9: Results of linear regression regarding the performance M-ABC Test and the total of Social Skills (N = 72, 100%)

Model		Unstandardized Coefficients		Standardized Coefficients		95% Confidence Interval		
		B	St. Error	Beta	t	p	Lower Bound	Upper Bound
1	(Constant)	15,52	3,21		4,82	,001	9,108	21,933
	Total Social Skills	-,068	,040	-,202	-1,72	,089	-,147	,011

a. Dependent Variable: M-ABC Test

Graphic depiction 1: dispersion between the performance in M-ABC Test and the total of social skills (N = 72, 100%)



5. Conclusions, discussion, proposals

The majority of preschoolers appeared from the results, that they did not experience visual motor coordination problems. Specifically, in the present study the percentage of children experiencing severe motor coordination disorders was 8.00% (ie 6 children in the sample as a whole). In Greece, research has shown that the rate of motor clumsiness ranges from 0.9% to 15% (Tougo, 2007, Kourtessis, Tsougou, Maheridou, Tsigilis, Psalti, Kioumourtzoglou, 2008; Zaragas, 2009; Karabatzaki, 2002; Giagazoglou, Kabitsis, Kokaridas, Zaragas, Katartzi, Kabitsis, 2011; Arabatzis, 2015). In the international bibliography this percentage is close to 5% (Waelvelde, Peersman, Lenoir, Smits Engelsman, Henderson, 2008; Lingam, Jongmans, Ellis, Hunt, Golding, Emond, Missiuna, Gaines, Kaplan, Crawford, Wilson, 2002, Dewey, Wilson, 2001, Gillberg, Kadesjo, 2003, Sutton Hamilton 2002, Gubbay, 1975), while according to the American Psychiatric Society (APS, 1994, 2000) the percentage of motor clumsiness for children of the USA ranges from 5% to 10%.

Regarding the rate incidence of disorders of visual-motor coordination between the two sexes, the results showed that no differences were found, as severe motor weaknesses were shown in the same number of boys and girls (three boys and three girls). This result is in accordance with the surveys of Zaraga (2009) and Tsougu (2007), according to which there were no statistically significant differences in the occurrence of disorders of visual-motor coordination in relation to gender. According to previous studies (boys show more often Disorder Visual Motor Co-ordination with a ratio of one girl to two or three boys) (Kourtessis, Tsougou, Maheridou, Tsigilis, Psalti & Kioumourtzoglou, 2008; Missiuna, Gaines, Soucie and McLean, 2006). With regard to gender differences in relation to age, the results of the present study showed that in the five-year-old children group with motor clumsiness there was one girl to two boys, which is confirmed by the two above-mentioned surveys. However, the six-year-old children with mobility clumsiness seemed to be different as there were two girls to one

boy. This result contradicts the previous bibliography, but it is in accordance with Zaragas (2009) study, where six-year-old girls showed a double percentage of motor clumsiness compared to boys. A possible explanation for this result is the fact that this motor deficit may have existed at an earlier age and over time, coupled with a lack of motor experience and interest and inadequate exercise, to keep their motor skills poor by affecting in this way the percentages of motor clumsiness of these six-year-old girls. Finally, from the results of the present study it appeared that none of the four-year-olds had DVMC, which can be explained by the fact that the sample of four-year-olds was not adequate to produce safe conclusions as they were only four children.

As far as the social skills of preschoolers are concerned, the results of this survey showed that the majority of children showed adequate skills in Social Co-operation, Social Interaction and Social Independence. This result is in line with the research by Denham, Blair, DeMulder, Levitas, Sawyer, Auerbach-Major & Queenan (2003) that pre-school children display adequate social skills despite their young age making them cooperative, likeable to peers and adults rather than isolated, and in addition, adequate social skills are also a predictive factor for future social well-being at an older age. It has been found that knowledge of emotions has a beneficial effect on social relations with peers, which provokes their positive relationship with social skills, especially for self-promotion and cooperative behavior. Thus, accurate recognition and interpretation of the facial expressions of others helps children decide how they will interact positively with others and provide guidance for interpersonal transactions, which shows that the knowledge of sentiments sets the foundation for positive social behavior (Izard, Fine, Schultz, Mostow, Ackerman, Youngstrom, 2001). Another fact that is associated with important social skills is that of positive parenting. The proper upbringing and especially the greater involvement of the mother in family routines were found to correlate with cooperative behaviors of children, self-control behaviors and generally greater social skills, while family conflicts were found to be associated with behavioral problems (Koblinsky, Kovalanka, Randolph, 2006). Consequently, good knowledge of emotions and positive parenting can be a possible explanation of the concrete outcome of this research.

More generally, it appeared that children in the whole sample had sufficient motor skills and equally sufficient social skills. The fact that there was no significant relationship between motor performance and performance in social skills could be explained by the fact that children appeared to perform better in social compared to motor skills. Given the fact that the sample of children came from a private kindergarten, the adequate social skills they could have might be due to the socio-economic background of the family or the parental level of education, variables not explored in the present study. Indeed, in Iosifidis study (2015), it was found that the level of parental education and the socio-economic level of the family were positively correlated with social interaction, ie children's ability to maintain friendship, share emotions and emotions with others, and be more generally likeable by peers. In addition, the results of this research cannot be generalized, rather than giving a picture

of the trend of the sample in question, where it is a small and heterogeneous sample (gender and age).

This research attempted to approach the phenomenon of the Developmental Disorder of Kinetic Coordination and the level of social skills of preschool children, as well as the existence of a relationship between these two variables. As the results showed, there were children who experienced severe motoring difficulties but also low levels of social skills, namely social co-operation, social interaction and social independence. This leads to the need to realize how important and critical the knowledge of the impact of motor and social deficits and timely detection is aimed at improving these skills. In addition, there appeared to be little negative relation between the total performance in the array of eight M-ABC Test kinetic tests and the overall performance of the social skills of cooperation, interaction and independence, but which is marginal statistically significant which means that levels of high functionality in social skills are associated with lower scores in the M-ABC Test.

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