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Original Article

RELATIONSHIP OF ANXIETY AND SELF-ESTEEM WITH DEVELOPMENTAL COORDINATION DISORDER IN SCHOOLCHILDREN

RELAÇÃO DA ANSIEDADE E DA AUTOESTIMA COM O TRANSTORNO DO DESENVOLVIMENTO DA COORDENAÇÃO

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RESUMO

Baixos níveis de competência em habilidades motoras apresentam como consequência o surgimento do Transtorno do Desenvolvimento da Coordenação (TDC) e, as dificuldades motoras tendem a interferir negativamente em aspectos socioemocionais podendo resultar em ansiedade e baixa autoestima. O presente estudo analisou a relação entre competência motora, ansiedade e autoestima. Participaram do estudo 138 estudantes, com faixa etária de 10 a 15 anos, que responderam a três questionários, o *Adolescent Motor Competence Questionnaire* (AMCQ), a Escala de Autoestima de Rosenberg e a versão em português do Inventário de Ansiedade Traço-Estado (IDATE). Além dos estudantes, participaram do estudo 127 pais que responderam ao questionário de Transtorno do Desenvolvimento da Coordenação - Brasil (DCDQ). Para análise foi utilizada a estatística descritiva, na comparação entre grupos utilizou-se o Teste *t* de *Student* e para a correlação, utilizou-se o teste Correlação de Pearson e o Qui-quadrado, respectivamente. Os resultados indicaram que quanto maior a competência motora percebida, menor os níveis de ansiedade e maiores os níveis de autoestima. Dessa forma, conclui-se que escolares com suspeita de TDC por apresentarem baixa competência motora percebida, os níveis de ansiedade são maiores e o níveis de autoestima menores, comparados com os escolares sem suspeita de TDC

Palavras-chave: Competência motora. Problemas emocionais. Escolares.

ABSTRACT

Low levels of competence in motor skills result in the emergence of the Developmental Coordination Disorder (DCD); motor difficulties tend to negatively interfere with socio-emotional aspects and can lead to anxiety and low self-esteem. The present study analyzed the relationship between motor competence, anxiety and self-esteem. A total of 138 students participated; aged 10 to 15 years, they answered three questionnaires: the Adolescent Motor Competence Questionnaire (AMCQ), the Rosenberg Self-Esteem Scale, and the Portuguese version of the State-Trait Anxiety Inventory (STAI). In addition to the students, 127 parents joined in the survey by answering the Developmental Coordination Disorder – Brazil (DCDQ) questionnaire. For analysis, descriptive statistics were used; to compare groups, Student's t-test was applied, and, for correlation, Pearson's correlation test and the Chi-square test were adopted, respectively. The results indicated that the greater the perceived motor competence, the lower the anxiety levels and the higher the self-esteem levels. Thus, it is concluded that schoolchildren with suspected DCD, due to their low perceived motor competence, have higher levels of anxiety and lower levels of self-esteem, compared to students without suspected DCD.

Keywords: Motor competence. Emotional problems. Schoolchildren.

Introduction

According to Stodden et al.[1], motor competence is defined in terms of proficiency in fundamental motor skills strictly related to physical activity, and exercising can contribute to stimulating the development of motor skills in young children. Motor competence is related to several developmental factors, especially in childhood, being fundamental for children's engagement in motor and sporting activities throughout their lives; in this sense, it raises physical fitness levels and reduces the body mass index[2].

Stodden et al.[1] emphasize that motor competence is influenced by multiple factors: social environment, physical education classes, socioeconomic status, parental influence and climate. These factors, according to the author, will have a role in determining which children will be successful and which will not be so successful in relation to the development of motor skills, and this will determine whether or not they will continue doing physical activities, depending on their levels of competence in motor skills. Furthermore, low levels of competence

in motor skills result in the emergence of the Developmental Coordination Disorder (DCD), also known as dyspraxia, which is defined by motor difficulties of an intellectual, sensory, primary and neurological nature[3].

The Diagnostic and Statistical Manual of Mental Disorders – 5th edition[4] presents the criteria for identifying DCD, which will provide the necessary support to reaching a possible diagnosis: (a) when the acquisition and execution of coordinated motor skills are below what is expected for the age, (b) a deficit in motor skills significantly and persistently interferes with performance or participation in daily activities, (c) initial symptoms appear early in the development period and, (d) deficits in motor skills are not explained by intellectual and visual disabilities, and are not attributed to any neurological condition that affects movement.

DCD must be diagnosed by means of a clinical (medical) summary and (developmental) history, physical examination, school reports, and individual assessment through standardized tests, whose psychometrics are adequate and culturally appropriate. It is worth noting that DCD is most often diagnosed after 5 years of age, and there is great diversity in the age at which many motor skills are acquired[4].

Also according to the DSM-54, in early childhood, the disorder can be identified through delays in motor milestones, or when the child tries to hold a fork, a knife, to button clothes, or to play with a ball. In second childhood, difficulties occur in motor aspects, as when the child puts together puzzles, and, in adulthood, difficulties are present when one learns new tasks that require complex/automatic motor skills, such as driving a car.

This difficulty in executing motor actions is considered a motor learning deficit, as it impairs the ability to learn and automate motor skills[5]. The main harm of DCD is related to movement; Gallahue, Ozmun and Goodway[6] state that movement is a vital function, as all the actions we perform at work or during leisure time occur through movement, becoming essential for development during childhood, and there is no other way to develop it other than by moving.

Okuda et al.[7] argue that students with DCD presented delays in fine motor coordination compared to their peers of the same chronological age, in addition to showing difficulties in the tasks of grasping and pressing objects, and visual-spatial coordination, which can be explained by their fine motor coordination being below expected for their age and level of education. When children perceive themselves as not very competent, they tend to give up or lose interest in trying new skills, especially if they experience difficulties, which in turn limits the development of new psychomotor skills[8].

However, children with movement difficulties/motor difficulties may also present cognitive difficulties and emotional problems such as depression[9], anxiety[3], decreased self-esteem, and lack of motivation. Because it significantly impairs the execution of simple, everyday tasks, these children are often more anxious, have low self-esteem and feel distressed[5].

Motor disorders tend to interfere negatively, contributing to the emergence of emotional problems related to anxiety[10], which is an emotion manifested by feelings of tension, preoccupation in thoughts, and excessive concern about what will happen in the future[11], or even in relation to self-esteem, which is an evaluative aspect of self-concept and is part of a set of thoughts and feelings referring to the individual themself, and may have a positive (self-approval) or negative (depreciation) orientation[12].

DCD, according to Missiuna, Rivard and Pollock[13], has led to social isolation, given one's low self-confidence or a tendency to avoid physical activities, with low motor performance influencing personal motivation, causing various losses, such as social isolation, frustration and rejection of challenging tasks, such as sports that require different motor skills[14]. Thus, a low perception of motor competence is related to a lower level of physical activity and poor physical fitness related to health, leading to weight gain and obesity[1].

Characteristics related to academic difficulties not explained by a learning disorder, behavioral problems, coping with bullying, obesity or low self-esteem may be connected to

DCD[15], as it has been evidenced that children with motor coordination difficulties tend to have fewer friendships and not be called to participate in games and fun activities with their peers. Therefore, it is necessary for parents, teachers and society in general to have knowledge about motor development or the motor pattern that children have and search for information about the disorder, in order to reduce the losses that can be caused by DCD, especially those related to emotional problems that may arise.

In this sense, given the lack of studies on DCD related to emotional problems, and considering the importance of gaining knowledge about this disorder, as well as about whether its presence influences the emergence of emotional issues such as anxiety and low self-esteem, this study aims to analyze the relationship between motor competence, anxiety and self-esteem in children and adolescents.

Methods

Sample

All students attending the 6th to the 9th grades at a state school in the city of Maringá, PR, aged between 10 and 15 years old, of both sexes, were invited to participate in the study. In this way, around 600 questionnaires were sent out to be answered by the students and their parents; however, some students ended up forgetting to answer, and there were some whose parents did not authorize their participation and did not fill out the questionnaire that should be completed. Therefore, 138 students participated in the research – 68 girls and 70 boys –, in addition to 127 parents – taking into account that 11 of the parents accepted their child's participation but did not complete the questionnaire that should have been answered by them.

Instruments

As research instruments, the Adolescent Motor Competence Questionnaire (AMCQ)[16] was used, which evaluates the motor competence perceived by children and adolescents themselves. The AMCQ consists of 26 questions covering everyday motor skills, in a Likert scale format. For questions of a negative nature, the answer "always" is worth 1 point, "often", 2 points, "sometimes" is worth 3 points, and "never", 4 points. The positive questions are 1, 2, 4, 6, 7, 8, 9, 11, 12, 15, 17, 20 and 24; whereas the negative ones are questions 3, 5, 10, 13, 14, 16, 18, 19, 21, 22, 23, 25 and 26. The questionnaire identifies the interviewee with name, date of application, date of birth, and sex.

The children or adolescents are classified as having low perception of motor competence (less than or equal to 79 points), average competence (80 to 85 points), and high perception of motor competence (greater than and equal to 86 points). The maximum AMCQ score is 104 points, with a higher score indicating a higher level of motor competence. A score of 83 or below indicates suspected motor difficulty. To account for response bias, fifteen items are worded negatively. The inverse items are scored as follows: Never (4), Sometimes (3), Often (2) and Always (1).

Parental perception of motor competence was collected using the Developmental Coordination Disorder Questionnaire – Brazil (DCDQ-BR)[17]. It consists of 15 items divided into three subscales: Control during movement, Fine motricity/Writing, and General coordination. To fill out the DCDQ-BR, parents were instructed to compare their children with other children of the same age.

The items describe typical motor performance in various activities and are scored on a five-point Likert scale, starting with "not at all like your child", score 1, up to the description "extremely like your child", score 5. The parents check the answer that best describes their child's performance on that task. The total score was calculated by adding the scores for each

question, ranging from 15 to 75 points. The time to complete the questionnaire was on average 10 to 15 minutes.

Once the questionnaire was filled out, the scores for each item were added together to provide the final score. The maximum score, adding the points from the three areas, is 75; higher indices represent better motor competence. The DCDQ-BR has a high reported internal consistency (= 0.92), sensitivity (= 0.73) and test-retest reliability (= 0.97)[17]. These data will be used to estimate those children with probable DCD (pDCD) and probable non-DCD (pNDCD), based on the cutoff recommendations by Wilson et al.[18].

These scores are used to classify children into the "probable DCD" and "probable non-DCD" categories. The DCDQ was designed for children aged 5 to 15 years, with different recommended cutoff scores for the three age groups (5.0-7.11 years, 8.0-9.11 years and 10.0-15.6 years). The recommended cutoff points are shown in Table 1.

Children aged 5 years to 7 years and 11 months	15 - 46 signs of DCD or suspected DCD 47 - 75 probable non-DCD
Children aged 8 years to 9 years and 11 months	15 - 55 signs of DCD or suspected DCD 56 - 75 probable non-DCD
Children aged 10 to 15 years	15 - 57 signs of DCD or suspected DCD 58 - 75 probable non-DCD

Table 1. Recommended cutoff scores
Source: Prado et al[19]

To facilitate the understanding of this classification for the present study, we will use the term suspected DCD for students with suspected DCD, and the term no suspected DCD for students who probably do not have DCD, as we believe it improves reading and clarity about DCD.

To assess the students' self-esteem, the Rosenberg Self-esteem Scale[20] adapted by Hutz and Zanon[21] for Brazil was used. This scale consists of ten items, six aimed at a positive view of oneself, and four directed at a self-deprecating view. It aims to analyze the individual's overall self-esteem, being a one-dimensional scale composed of 10 statements that address a set of feelings of self-esteem and self-acceptance. The statements were categorized on a four-point Likert scale (1=totally disagree to 4=totally agree). Items with a negative connotation (3, 5, 8, 9 and 10) must be scored inversely, so the higher the indices, the greater the individual's perception of self-esteem; the final score can vary from 10 to 40 points.

And, to investigate the anxiety level of the adolescents, the Portuguese version of the State-Trait Anxiety Inventory (STAI) by Spielberger, Gorsuch and Lushene[22], translated and adapted for Brazil by Biaggio and Natalício[23], was used. The STAI is made up of two distinct scales: one identifies the trait, and the other, the state of anxiety. Each scale has 20 questions. Answers can range from 1 to 4, where: 1 = almost never; 2 = sometimes; 3 = often; and 4 = almost always. For each scale, the individual was instructed to read each item and select the answer that best corresponded to their state. The sum of the values in each answer (final score) can vary from 20 to 80 points and is characterized as a level of anxiety, with 20 to 40 points being equivalent to a low level of anxiety; 41 to 60 points, an average level of anxiety, and 60 to 80 points, a high level of anxiety.

Procedures

As for procedures, the research was submitted to the Ethics Committee for Research with Human Beings (COPEP), with approval opinion No. 6.421.089. Initially, authorization to carry out the survey was requested from the school and parents and/or legal guardians of the students. Data collection took place at the school, after signing of the Free and Informed

Consent Form, for approximately two weeks, with the students having the option of answering the questionnaire in printed form or through the Google Forms digital platform.

Statistical Analysis

Descriptive statistical analysis (mean and standard deviation) was used to analyze the data. For comparison between groups (suspected DCD and no suspected DCD; male and female) Student's t test was used, whereas for correlation and association, Pearson's correlation test and the Chi-square test were used, respectively.

Results

Table 1 presents the perceived motor competence of the students, with those with low perception, average perception and high perception of perceived motor competence.

Table 1. Description of the number and percentage of students with low, average and high perception of motor competence

	Perceived motor competence					
	Low perception	Average perception	High perception	Total	$\chi 2$	P
	f (%)	f (%)	f (%)			
Female	35 (51.5)	17 (25.0)	16 (23.5)	68 (100.0)	0.76	0.68
Male	34 (48.6)	22 (31.4)	14 (20.0)	70 (100.0)		
Total	69 (50.0)	39 (28.3)	30 (21.7)	138 (100.0)		

Note: Legend: $\chi 2$ chi-square test.
Source: the authors.

It is observed that 51.5% of the girls had a low perception of motor competence, 25.0% had an average perception, and 23.5% had a high perception of motor competence, that is, more than one third of them had a low perception of perceived motor competence. As for the boys, 48.6% had a low perception of competence, 31.4% had an average perception, and 20.0% had a high perception of perceived motor competence. Overall, 50.0% of the students have low perception, 28.3% have average perception, and 21.7% have high perception of perceived motor competence, that is, only one in five students perceive themselves as highly competent.

Table 2 presents a comparison between levels of anxiety and self-esteem in students with suspected DCD and those without suspected DCD.

Table 2. Correlation between motor competence, anxiety and self-esteem among students with suspected DCD and with no suspected DCD

Suspected DCD (n=65)		Anxiety	Self esteem
	Mean±SD	r (p value)	r (p value)
Perceived motor competence	76.34±8.80	**-0.34* (.05)**	**0.36* (.00)**
Anxiety	51.44±6.90		**-0.25* (.04)**
Self esteem	26.47±5.77		
No suspected DCD (n=62)			
Perceived motor competence	81.83±6.95	-0.16 (.22)	**0.28* (.00)**
Anxiety	50.09±7.92		**-0.52* (.00)**
Self esteem	28.48±5.93		

Note: Legend: SD = Standard Deviation; N = number; * = Significant difference ($p<0.05$).
Source: the authors.

The results evidence that, for the perceived motor competence of those students with suspected DCD, there is a significant inverse and/or negative correlation with anxiety (r = -

0.34; $p < 0.05$); a significant positive correlation was also observed between motor competence and self-esteem ($r = 0.36$; $p < 0.05$), and a significant negative correlation between anxiety and self-esteem ($r = -0.25$; $p < 0.05$).

For students with no suspected DCD, perceived motor competence had a significant positive correlation with self-esteem ($r = 0.28$; $p < 0.05$), and self-esteem had a negative correlation with anxiety ($r = -0.52$; $p < 0.05$), a fact that occurred with students with suspected DCD.

Table 3 presents the means, standard deviations and a comparison of DCD prevalence, anxiety, self-esteem and the subscales of control during movement, fine motricity/writing and general coordination between boys and girls.

Table 3. Comparison of perceived motor competence, anxiety and self-esteem between boys and girls

	Sex		*p value*
	Female	Male	
	Mean ± SD		
Perceived motor competence	78.54±8.63	79.80±7.92	0.42
Anxiety	51.08±7.41	50.00±7.31	0.68
Self esteem	26.11±5.83	29.00±5.32	0.80
Control during movement	19.77±6.18	22.36±5.92	0.41
Fine motricity/Writing	15.06±4.05	15.21±3.48	**0.04***
General coordination	17.85±4.93	18.69±4.75	0.74
Total	52.69±13.28	55.82±12.86	0.59

Note: Legend: SD = Standard Deviation; N = number; * = Significant difference ($p<0.05$).
Source: The authors.

The results showed that boys had a better score than girls in perceived motor competence, with girls having a higher level of anxiety and lower self-esteem. The parents of boys evaluated them with better rates in the domains of "control during movement", "fine motricity/writing" and "general coordination"; thus, the boys had a higher total score, although only the fine motricity/writing domain registered a statistically significant difference.

Table 4 compares the results of students with and without suspected DCD, also comparing anxiety and self-esteem between these two groups of students.

Table 4. Description of means, standard deviations and comparisons between students with suspected DCD and those with no suspected DCD

	Suspected DCD	No suspected DCD	P value
	Mean±SD		
Perceived motor competence	76.43±8.80	81.83±6.95	**.03***
Anxiety	51.44±6.90	50.09±7.92	.21
Self esteem	26.47±5.77	28.48±5.93	.72

Legend: SD = Standard Deviation; N = number; * = Significant difference ($p<0.05$).
Source: The authors.

A higher and statistically significant score was found in the perceived motor competence of students with no suspected DCD compared to those with suspected DCD. On the Other hand, students with suspected DCD had higher scores related to anxiety and lower scores related to self-esteem compared to students with no suspected DCD.

Table 5 presents the results of the correlations between perceived motor competence and the subscales of control during movement, fine motricity/writing and general coordination related to anxiety and self-esteem.

Table 5. Correlation between perceived motor competence and the subscales of control during movement, fine motricity/writing and general coordination related to anxiety and self-esteem

	Perceived motor c.	Self esteem	Anxiety	Movement control	Fine motricity/Writing	General coord.	Total
Perceived motor c.	-	**0.36***	**-0.27***	0.34	**0.37***	**0.36***	**0.33***
Self esteem	-	-	**-0.39***	**0.25***	**0.22***	**0.21***	**0.20***
Anxiety	-	-	-	-.07	-.06	-.14	-.11
Mean	79.18	27.58	50.53	21.09	15.14	18.28	54.27
SD	8.27	5.74	7.35	6.16	3.76	4.84	13.11

Note: Legend: * = Significant difference ($p<0.05$); SD = standard deviation; C. = Competence; Coord. = Coordination.
Source: The authors.

Perceived motor competence presents a moderate positive correlation with self-esteem (r = 0.36) and, according to parental perception, with the fine motricity/writing (r = 0.37) and general coordination (r = 0.36) subscales. There was a negative correlation between perceived motor competence and anxiety (r = -0.27), that is, the greater the perceived motor competence, the lower the anxiety levels. It is also observed that perceived motor competence did not present a significant correlation with the subscale of control during movement (r = 0.34).

In the parents' perception, self-esteem showed a low significant positive correlation with the subscales of control during movement (r = 0.25), fine motricity/writing (r = 0.22) and general coordination (r = 0.21); therefore, the greater the self-esteem, the greater the control during movement, fine motricity/writing and general coordination. Self-esteem showed an inverse correlation with anxiety (r = -0.39), meaning that, the higher the self-esteem, the lower the anxiety levels; on the other hand, students who have lower self-esteem may have higher levels of anxiety.

Discussion

The data showed that over 50.0% of the students rated themselves as having low perceived motor competence, a result very similar (51.2%) to that reported by Barros et al.[24], who added that this finding occurs regardless of socioeconomic level. Important evidence is that, at this age (10 to 15 years), students have a greater capacity to evaluate their motor competence, a fact that does not occur at younger ages[25,26], exemplifying that children aged between 4 and 10 years have a perception of high motor competence, which is an evaluation that does not correspond to their actual motor competence. Therefore, age seems to be an essential factor in evaluating one's perceived motor competence, with older children being more realistic about their motor competence[27].

It was found that students with better perceived motor competence had lower levels of anxiety and self-esteem; this result can be explained by the fact that students, when they perceive themselves as having a low perception of motor competence and/or motor difficulties, perceive themselves as less competent in relation to their physical capabilities compared to their peers, increasing their level of anxiety[3,10,28] and decreasing their self-esteem[5]. Therefore, motor difficulties tend to negatively affect the socio-emotional aspects of children with low motor

competence or DCD[11]; there is even emerging evidence that motor behavior may be related to task-specific anxiety in children with DCD[29].

When it comes to parental perception, the results showed that parents of boys rated them with greater motor competence compared to the evaluation made by parents of girls on all subscales (control during movement, fine motricity/writing and general coordination) of motor competence. These significant differences between genders in self-perceptions may be related to several factors, especially adolescence itself, which is seen as a critical period during which physical, social and emotional changes occur, generating negative self-perceptions that can intensify[30,31]; therefore, developmental changes associated with puberty can threaten girls' perceptions of their physical/motor self[31], although superior performance as to boys' throwing and catching skills has already been verified[32].

The difference between anxiety and self-esteem levels between students with suspected DCD and students with no suspected DCD is supported by the findings of Missiuna et al.[33] and Zwicker; Harris; Klassen[34], who pointed out that children with DCD have lower self-efficacy and competence in the physical and social domains, in addition to exhibiting more pronounced symptoms of anxiety and depression when compared to children without suspected DCD. Draghi et al.[11], when comparing symptoms of anxiety and depression in children with DCD and children with no suspected DCD, found greater anxiety and depression in children with DCD; however, the authors state that there was no causality in the fact of detecting DCD that results in clinical symptoms of anxiety and depression. This finding shows that children with DCD have a greater number of vulnerable factors that can lead to increased symptoms of anxiety and depression[15] or low self-confidence[13].

Students with DCD, due to their motor difficulties, are sometimes labeled as lazy or arrogant, which results in mental health problems, low academic performance, insecurity and lack of self-esteem[3]. It is believed that, for this reason, students with suspected DCD present higher levels of anxiety and low self-esteem; additionally, due to motor difficulties, they tend to move away more easily from physical activities, which have diverse benefits for mental health, reducing mild and moderate levels of depression and anxiety[35]. This finding is important when it comes to the need for interventions to improve psychosocial well-being, even in adults with DCD, which should focus on reducing anxiety and building self-efficacy and resilience, with special attention to domains related to movement[29].

The limitations of this study occur, firstly, due to the scarcity of studies that correlate DCD with emotional problems, specifically with anxiety and self-esteem. Furthermore, the range and size of the sample, and the instruments used to evaluate motor performance may have affected the interpretation of the results. In order to strengthen further research, it is suggested that instruments that consider the identification and risks of symptoms of anxiety and low self-esteem in children with DCD be included, aiming to provide more accurate and practical data.

The findings of the present study may serve as a means to give a new direction to research in this field, in order to identify whether DCD influences emotional problems, in addition to raising awareness among parents, teachers and society in general about the importance of this disorder related to emotional problems. In practical terms, it is worth highlighting the need for actions with intervention programs and projects involving students who exhibit low perception of motor competence.

Conclusion

It is concluded that students with good perceived motor competence have better levels of self-esteem and lower levels of anxiety compared to those with probable DCD. When comparing the level of anxiety and self-esteem between the sexes, a lower level of anxiety and

higher self-esteem was identified in boys. Students with suspected DCD had higher levels of anxiety and lower levels of self-esteem.

In view of the results, it is suggested that new research with intervention programs and projects be conducted with a view to verifying the influence of DCD on the anxiety and self-esteem of children and adolescents, in order to reduce the losses that can be caused by the disorder.

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