

Drawing as an investigative element in the cognitive development of children with ADHD learning to swim

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Abstract: This study targets the investigation of the cognitive appropriation of notions of space, known as executive function (EF), for students who suffer from ADHD aged 7 to 9 years old and who participated in an experimental program to learn to swim. With a theoretical framework based on the genetic epistemology of Jean Piaget, this study uses drawing as a tool to graphically represent what was practised (plane of actions), internalised, and therefore learnt. The results of the comparisons of the drawings before and after the partaken in a swimming experimental program show a structural leap of the cognitive functions from the kids with ADHD, that bypass the perceptive structuring, adequated to the sensorimotor period, to a representative structuring, in accordance with the preoperative period. Therefore, swimming, an activity that stimulates all sensory-perceptual and motor sets of the exerciser, becomes a high-level educational element, making it an important resource for the development of successful action strategies in the learning processes of children with ADHD.

Key words: Learning swimming. ADHD. Drawing. Spatial notion.

EL DIBUJO COMO ELEMENTO DE INVESTIGACIÓN DEL DESARROLLO COGNITIVO DE NIÑOS CON TDAH SOMETIDOS A EXPERIENCIAS DE APRENDIZAJE DE NATACIÓN

Resumen: Este estudio investiga la apropiación cognitiva de las nociones espaciales constituidas cómo función ejecutiva (FE), por niños escolares que presentan TDAH, con edades comprendidas entre 07 a 09 años, submetidos a un programa experimental de aprendizaje de natación. Fundamentado en la epistemología genética de Jean Piaget, se utilizó el dibujo como posible elemento para representar en forma gráfica lo que fue practicado



(en el plano de la acción), interiorizado y por lo tanto aprendido e incorporado desde el punto de vista motriz. El resultado del análisis comparativo de los dibujos de antes y después de la participación en el programa experimental de aprendizaje de natación, demostró un avance en el desarrollo estructural cognitivo de los niños con TDAH, que pasaron de una fase inicial estructurada por la experiencia perceptiva, propia del período sensorio-motor, para otra más avanzada, estructurada en elementos representativos, propios del período pre-operatorio. Se concluye que la práctica de natación, por ser una actividad que moviliza todo el aparato sensorio-perceptivo y motor del practicante, se convierte en un elemento con un alto poder educativo, tornándose en uno de los condicionantes del desarrollo de estrategias de acción muy adecuadas para intervenir en el proceso de enseñanza-aprendizaje en niños con TDAH.

Palabras clave: Aprendizaje de natación. TDAH. Dibujo. Noción espacial.

INTRODUCTION

Moraes (2012, p.16) asserts that the current stage of our society is “the era of disorders”, based on the observation of numerous pathological descriptions designed to identify and diagnose behaviours that are considered inappropriate, among which Attention Deficit Hyperactivity Disorder (ADHD) stands out in childhood.

According to Rotta, Ohlweiler, and Riesgo (2006), ADHD is better defined as a neurobehavioral syndrome, the main characteristics of which, according to Okuda, Pinheiro *et al.* (2011), are inattention, psychomotor agitation, and impulsivity. These characteristics may vary to a greater or lesser degree according to the ADHD subtype, viz.: predominantly inattentive; predominantly hyperactive/impulsive; or combined.

Together, the damages and inconveniences caused by the parents, colleagues and teachers given the characteristics of hyperactivity, impulsivity and the attention deficit reflects in the studies, regarding children diagnosed with ADHD, discourses on exclusion, the lack of perspective, and the elimination of difference, abnormality, and the pathological, as Moraes (2012) highlights.

The disorder, or, more properly, the unforeseen and unfavourable situation of learning something that accompanies ADHD, is not specifically and exclusively related to the systematic content of school subjects. These difficulties can also be found in the learning of any other activities related to the daily life of children (ROSSI, 2008).

Nonetheless, school is the place in which ADHD symptoms become most explicit because the child is required to obey the norms common to all other children and because his or her attention is required more systematically and for longer periods of time (MORAES, 2012).

In the teaching-learning context, the epidemiological studies on children with ADHD report a high incidence of comorbid psychiatric disorders Rodhe; Mattos (2003), among which Developmental Coordination Disorder (DCD) is the most relevant for the objectives of this study. For a broader dimension of the weight of comorbidities on ADHD, it is estimated, according to Folquitto (2009), that only 30% of children with ADHD do not exhibit any comorbidity.

Magalhães, Nascimento, and Resende (2004) and Toniolo (2007) state that DCD occurs in children between 6 and 12 years of age and is characterised by developmental delays in motor skills or difficulties in movement coordination, based on chronological age and intelligence.

Toniolo *et al.* (2009) claim that the specialised literature indicates that at least 50% of students with learning difficulties concomitantly exhibit a motor condition developmental disorder and that, given the presence of learning difficulties – as is the case with ADHD – there is a greater probability that the praxic and gnosis functions are altered, compromising dexterity and the performance of daily activities.

Toniolo *et al.* (2009) continue by confirming that there are still few studies on DCD in Brazil, which makes it possible for school children who

exhibit motor disorders associated with ADHD to go underdiagnosed, thus leading to the inadequate development of psychoeducational intervention programs for this population.

Okuda *et al.* (2011) assert that in the last few years, studies have found that students with ADHD exhibit brain dysfunctions, in particular in the frontal lobes (frontal-striatal-cerebellar circuit), which can cause changes in cognitive mechanisms, such as sustained attention, executive functions, motor inhibition deficits, and psychomotor agitation, thus undermining the learning process.

Bolfer (2009) corroborates these findings, adding that the changes in some brain areas and their associated circuits determine that, in addition to the cardinal symptoms (hyperactivity, impulsivity, and attention deficit), more complex mental functions, called Executive Functions (EFs), are also impaired.

Defined as a "series of mental processes involving planning, selection, response inhibition, perception, attention, working memory (WM), among others" (BOLFER, 2009, p. 36). EFs allow the individual to perceive environmental stimuli, respond appropriately, change direction flexibly, anticipate future objects, consider consequences, and respond in an integrated way, using all these abilities to achieve a final objective.

Under the domino effect, the learning disorder, as a corollary to ADHD, impairs the attention and working memory (WM) functions, which are responsible for practical-productive performance by enabling the development of successful action strategies. As a consequence, these functions simultaneously stimulate the EFs to absorb this impairment, compromising the performance of other behavioural domains, notably those related to motor skills (PEREIRA; ARAÚJO AND MATTOS, 2005).

Considering Developmental Coordination Disorder (DCD) and the impairment of Executive Functions (EFs) as essential elements and therefore detailed in the teaching-learning process in general, one may see how the diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) would result in barriers to the holistic development of children.

This turbulent context, aggravated *pari passu* by the lack, by the impossibility, or by the nonexistence of a program of systematic intervention in the field of sports, such as learning to swim, negatively affects the development of children who exhibit difficulties with movement coordination, stumbling, bumping into

objects while walking, the propensity to drop objects, and consequently difficulties with functional tasks such as buttoning, using scissors, handling coins and pencils, and writing, among others (ROTTA, OHLWEILER AND RIESGO, 2006; TONIOLO *et al.*, 2009; MAGALHÃES *et al.*, 2004; RODHE; MATTOS, 2003).

Identifying the intersections between physical education and developmental psychology in an interdisciplinary perspective, therefore, becomes an essential challenge for joining the action of cognition (and the cognitive processes within it), establishing the interactions between them both. It is necessary to clarify how a constructed practical (corporeal) knowledge can become an identifying instrument of a normative (epistemological) knowledge, noting the identifying attributes of the transformation.

Piaget (1977) considers actions as the raw materials of all intellectual-perceptual adaptations; without action, there is no thought, and action is the instrument by which the organism interacts with the environment.

By recognising the gnosiologic status granted to motricity (Piaget, 1973) and considering it a privileged mediator of the subject when acting on objects that it proposes to know, it is necessary to begin to create spaces for the construction of new knowledge in the epistemological field of physical education in the face of a new didactic-pedagogical requirement brought about by ADHD in everyday teaching.

Despite being an author still removed from the theoretical framework for training physical education teachers, especially those dedicated to teaching children to swim, Piaget offers clues so that one can ascertain the gradual transformation, the change of state, or the condition of a mental structure in children with ADHD as the effect of an experience.

Due to the express inextricability of action and cognition, as Oro (1999) well demonstrated, this study assesses the interrelationship between the motor dynamic and the development of intelligence, the latter understood as "superior forms of organization or equilibrium of cognitive structurings" Battro (1978, p. 138) in the context of EFs, with emphasis on the structuring of space by students with ADHD.

Piaget (1937) claims that the construction of the notion of space, when evolving from the practical or experimental plane in the sensorimotor period to the representational plane in the preoperational period, allows the child to be coherent and understand the universe not only by means of his or her direct



participation but, now, in a much more complex framework, which consists of reflecting mentally and coordinating internally his or her possible actions.

The exercises provided by the representation of the spatial notion performed by the child with ADHD can make him or her capable of establishing paths to be followed, taking into account the presence of obstacles. In other words, he or she is now able to create detours and move safely without tripping or bumping into objects, thus demonstrating autonomous mobility (PEREIRA, ARAÚJO E MATTOS, 2005).

Corroborating this finding, Bolfer (2009) asserts that an efficient executive function plays an important role in the control of behaviours, thoughts, and working memory (WM). WM is the ability to keep in mind an event that just occurred or recall long-term information and use this representational knowledge to inhibit inappropriate thoughts or actions and plan future and effective actions.

One of the major impairments of ADHD, as Bolfer (2009) notes, is related to response inhibition, which is included in EFs and needs adequate WM capacity to be executed. This type of difficulty can be observed daily in the responses given before the end of questions or in being able to remain focused in the presence of an important external stimulus. Both the failure of inhibitory control and unsustained attention cause cognitive impairment because the reception of information is disorganised and unsustained. Therefore, failures occur in the storage and stocking of information.

Stimulated by the practice of an activity that mobilises the entire sensory-perceptual and motor apparatus of the practitioner, such as swimming Bonacelli (2004); Brito (2005); Orival (1998); Velasco (1994), the construction of the notion of space, associated with the combined mental functions of attention and WM (planning and organisation), can allow for self-control and, thus, become one of the conditioning factors of the development of successful action strategies in the teaching-learning process for the child with ADHD.

After participating in an experimental program to learn to swim, it seems possible, from a comparative discussion based on graphic representation (drawing), to note the existing interdependence between nature and the evolution of the spatial structures underlying motor performance and the relationships and interactions of these in the teaching-learning processes manifested by children with ADHD.

As a "form of representation" in the sense conceived by the Swiss maître-à-penser Jean Piaget, drawing corresponds to that which was learnt, internalised, and underwent a process of optimising equilibration with respect to its new accommodative structures.

Valente (2001) stresses that drawing is not a plastic or an artistic manifestation but an element that is able to graphically represent an internalised set and thus an operation, in Piaget's sense, of new experiences; from its analysis, it is possible to assess or even to analyse the transformation of these experiences (assimilation) into meaningful learning for the child.

Given the above, this study aims to investigate the cognitive appropriation of the notions of space in children with ADHD who are learning to swim, seeking to generate thinking about notions of space and the construction of meaningful elementary topological spatial relations: neighbourhood (far/near), separation (together/apart), succession or order (before/middle/after), inclusion, circumscription, or envelopment (inside/outside), and the continuity of lines and surfaces (BONON, 1987).

Piaget and Inhelder (1993) assert that the construction of space by a child, in addition to topological notions, also encompasses projective and Euclidean notions. However, the authors show that children, in their cognitive development during the preoperational period, can only logically structure topological spatial notions.

Furthermore, they state that certain projective notions can appear early in this same period, although it is clear that both the projective and Euclidean notions truly begin to strengthen themselves only at around 7 years of age.

In assuming the conclusions of Piaget and Inhelder (1993) as a prerogative, namely, that the topological notions are already formed at the age investigated and, in terms of the acquisition of spatial relations, that there is a predominance of topological relations over projective and Euclidean ones, and given the executive dysfunction in ADHD that promotes various cognitive behavioural changes associated with the impairment of its already reported component processes, imposing a series of problems in everyday life and characterising what Assef (2005) called dysexecutive syndrome, this option was arbitrarily made.

METHODS

This study was approved by the Research Ethics Committee of the Centre for Human and Natural Sciences of the Federal University of Espírito Santo (Centro de Ciências Humanas e Naturais da Universidade Federal do Espírito Santo - CCHN/UFES), Vitória, the state of Espírito Santo (ES), under report number 419.711.

Prior to the beginning of the assessments, the parents or guardians of the selected participants signed an informed consent form, authorising their participation in the study.

The following procedures were used to conduct this study:

a) The graphic production of a drawing produced by the children in two separate sessions: before and after he or she experienced learning to swim, each child in a separate room was asked to make a drawing (D1) on an A4-sized sheet of paper with a box of 24 coloured pencils based on the following clinical question: "What is swimming ... What would you do to swim?"

At the end of the experiment and in an identical situation, each child was asked to make a new drawing (D2) based on the following clinical question: "How far can you swim?"

b) The application of an Experimental Program for Learning to Swim: the program applied consisted of one (1) unique stage, distributed in five units that, combined, made up a total of 21 swimming lessons.

Each of the program's swimming lessons included four pre-determined strategies in a pedagogical order that went from easiest to most complex.

For each unit, a Final Performance Criterion described in an Observation Sheet of Performance in Learning to Swim was established. At the end of each set of lessons that composed a unit, the student was supposed to be able to perform the proposed behaviour as a parameter to evaluate, when attained, the learning of all the activities included in the strategies of each class.

The pool used was of increasing depth, with 0.70 m of depth at its shallowest end and 1.40 meters in the deepest part used for lessons. Thus, the degree of difficulty imposed by each strategy used could be varied based on depth.

Finally, each lesson had a pre-established duration of 50 minutes. The lessons were administered in the morning twice per week.

PARTICIPANTS

A single group of three children, all of the male gender and in the age range of 7 to 9 years old with the interdisciplinary diagnosis of Attention Deficit Hyperactivity Disorder (ADHD) of the combined type participated in this study. The interdisciplinary diagnosis of ADHD was made by a public hospital in Grande Vitória. To ensure the homogeneity of the group, due to the possibility of the children having had experience in the water, the condition of not knowing how to swim was imposed as a selection criterion. At the time of the experiment, the 3 participants, Alberto, Bruno, and Cristiano, had the following ages, respectively: 7 years, 8 months; 8 years, 2 months; and 8 years, 10 months. The names used in this study are fictitious.

RESULTS

Appropriating the cognitive and communicative function of drawing expressed by the reconstructions in the mental plane of that which is structured in the plane of actions, the following results are centred on observations and comparative analyses of the drawings (D1 and D2), considering: the construction of the elementary topological spatial relations proposed by Piaget; Alexandroff (2010), in which recognises the existence of phases, periods when a system of representation made by subjects in the process of the appropriation of the drawings are common; the observation of the ground basis in the drawings, treated by Lowenfeld and Brittain (1977) as element that amplifies the spatial representation is enough as a pillar to sustain the figurations, as well as indications that whoever draws is evolving in the sense of drawing with perspective.

In light of this perspective, in comparing the drawings D1 and D2 by Alberto and Bruno, a situation of transition between the Ordered Scribbling and Preschematic stages, as Piaget states Alexandroff (2010), is identified in the D1 of both. The remnants of the Ordered Scribbling stage, which lasts until the age of four, are observed in the movements that are drawn with longitudinal and circular strokes as well as in the human figure, which still appears in imaginary form, and an interest in forms begins to emerge.



In D2, in the Preschematic stage, the discovery of the relationship between drawing, thought, and reality occurs. This stage is part of the second half of the preoperational stage, which starts at the age of four and typically lasts until the age of seven. In this stage, as Luquet (1969) states, the child does not draw the object that he or she sees but rather the one that he or she knows. In doing so, the child uses varied processes, such as discontinuity, folding-out, transparency, planning, and changing viewpoints.

In this sense, the drawings D1 and D2 by Alberto and Bruno show, for example, discontinuity (as opposed to the continuity of lines and surfaces), which is characterised by the drawings being scattered in air, without the support of a line on the ground.

In comparing Cristiano's drawings, a transition is observed because the first drawing (D1) is included in the Preschematic stage, whereas the second drawing (D2) shows the types of strokes indicative of the Schematic stage.

The Schematic stage, according to Piaget Alexandroff (2010), is part of the concrete operational stage (7 to 10 years) but typically goes until approximately nine years of age. Within the representative schemes, the construction of different forms for each category of object is begun. In this stage, two great achievements occur: the use of baselines and the discovery of the relation with the object. There is already a defined concept of the human figure; however, deviations may arise, such as exaggeration, negligence, omission, or change of symbol. Two phenomena also appear, transparency and folding-out.

With the discontinuous and negligent forms used to draw the human figure, the Preschematic stage jumps out in the first drawing (D1), suggesting a change in viewpoints.

In turn, Schematism is clearly evident in the second drawing (D2), with the drawing of the pool in a rectangular shape that includes starting blocks and lanes and with a clear attempt at symmetrical alignment between the outer edges and the lanes.

Moreover, in the pool, some human figures are drawn that are distributed in the lanes at almost-equidistant spaces. Because of the view used, in which the human figures are over the water, they convey the feeling of swimming.

Regarding the elementary topological spatial relations, in Alberto's D1, one notices, when analysing the human figure (which represents Alberto swimming in the crawl style, thus, in a "belly-down" – prone position), the absence of the relation of separation; thus, the relation of neighbourhood is compromised. The two neighbour elements, the arms, can be interpenetrated and are clustered together in a single mass.

Similarly, the "swimmer's" legs are not identified because they are obscured by a disproportional trunk. By drawing only the feet as pairs of isolated elements, the representation of the relation of succession or spatial order is also compromised. Given that swimming is a methodical activity of coordination between the arms, legs, and breathing, it is still possible to note the compromise of the representation of the topological relation of spatial order applied to all the elements, in this case, the arms and the legs. Signs of alignment between them are not observed. Concerning the relation of inclusion, there is no evidence in the drawing, given that there is no surface line.

Nevertheless, in the following drawing (D2), one sees an advancement in the relations of neighbourhood, separation, and succession or spatial order drawn in the human figure. The spatial notion of inclusion already appears, as demonstrated by the projection of part of the body as submerged and part as not submerged, as if it is swimming. The surface line is still non-existent, but there are signs of projective and Euclidean notions, as shown by the ripple of the water, which indicates the existence of continuous movement through the establishment of curves/angles of this element, the water.

Already in Bruno's first drawing (D1), the answer to the clinical question "What is swimming?" occurs through the representation of the human figure, drawn as if it were swimming, containing the face, eyes, mouth, hair, arms, and legs. The body is represented by a longitudinal stroke with origin in a circle (the head), the arms by a unique transversal stroke, and the legs by oblique strokes that originate at the end of the "body" (longitudinal stroke).

There is, therefore, the absence of the relation of separation, which compromises the relation of neighbourhood. In only two of the three human figures drawn, three fingers are superimposed over the arms, without the existence of hands, which demonstrates the absence of the relation of spatial succession or order established

between elements that are simultaneously nearby and separated because they are distributed one after the other. Analogously, the feet are lacking, and there is no nose on the face. Finally, the long hair extends on the sides but does not extend down, which reveals a lack of inclusion, circumscription, and/or envelopment relations.

In Bruno's second drawing (D2), when answering the clinical question "How far can you swim?", he draw a long stretch of rippling water that contains a figure that represents him swimming, appearing only at the right edge of the A4-sized paper, in "portrait" view. This shows, therefore, not only the settlement of the spatial relations of neighbourhood, separation, and order or succession but also signs of projective and Euclidean notions, as demonstrated by the ripple of the water, in a similar situation to Alberto's.

One also observes the appearance of a baseline delimiting the bottom (floor) of the pool as one of the constituent elements of the most advanced spatial topological notion, i.e., the harbinger of the Schematic stage.

Still, with respect to elementary topological spatial relations, in Cristiano's first drawing (D1), there are eight human figures randomly distributed within a pool, with arms and legs drawn with winding and curvilinear forms, suggesting "movement" and therefore more greatly resembling the act of swimming. The mouth and nose are positioned on the face in such a way as to indicate that the head is turned to the water surface, suggesting swimming in the crawl style. The drawing also reproduces a pool that contains an access ladder, the diving board, and the lanes and starting blocks. Taken as a whole, it suggests it belongs to the projective stage of spatial construction. Thus, the main notional elements that comprise the elementary topological spatial relations are fully established and/or structured.

Finally, Cristiano's second drawing (D2) shows a pool in a bi-dimensional view, with the same human figure in two separate frames: in the first, floating upright and thus showing a total control of the body over the water and, in the second, swimming in the crawl style. The drawing makes explicit the phenomena of transparency and folding-out because, in both frames described, the constituent parts of the human figure can be observed both in the water and out of it.

Unlike a topological drawing, the representation of projective relations implies a coordination of the viewpoints of the elements represented from a unique perspective: that of who sees them or experiences (draws) them. This explains Cristiano's second drawing (D2), with its mixtures of viewpoints and "folding-out", that is, the pool (figurative physical form) that surrounds the water is "folded-out" on the plane.

DISCUSSION

The comparative analysis of the drawings as a system of representation (D1 and D2) indicates a structural leap in the cognitive functions of the children studied. After partaking in a swimming experimental program, Alberto and Bruno transition from perceptual structuring, characteristic of the Ordered Scribbling stage, which is grounded in the possibility of direct contact with the object to be known, characteristic of the sensorimotor period (D1), to representative structuring, equivalent to the Preschematic stage, which is grounded in the image as a concrete internalised symbol of the preoperational period (D2). Cristiano already evolved from the Preschematic stage to the Schematic stage, established by two major achievements: the use of a baseline and the discovery of the relation with objects. Still, the transparency and the folding-out in his second drawing (D2) denote ways of drawing that are typical of the projective stage.

According to Piaget and Inhelder (1993), the drawing corresponds to the reproduction of an imagistic abstraction of the object in its figural and symbolic aspect, from sensorimotor exploratory actions. The drawing is formed by the joining of movements, anticipations, reconstructions, and comparisons specific to the perceptive activity, in which imitation and movement appear interconnected. Thus, the drawing is a form of semiotic function halfway between symbolic play and mental image, with which it shares the effort of internalised imitation of reality (DA SILVA, 2005).

The role of representation through drawing, among the other possible representations, is of great importance in learning and in the development of thinking among children with ADHD. It is after the sensorimotor period that a fundamental cognitive function emerges: the semiotic or symbolic function that, according to



Piaget and Inhelder (1993), comprises the ability to represent something, attributing to it a meaning, by means of a different signifier specific to that representation, in this case, swimming.

In the sensorimotor period, however, these meanings cannot be considered representative because the signifier is still not differentiated from its meaning. In other words, the signifier cannot be determined as a symbol or a sign but rather as an indication. The semiotic function only emerges when the child can make an evocative representation of an absent object or a past event, thus involving the construction of different signifiers.

This study showed that the children with ADHD expressed through their drawings a symbolic construction, relative to the topological notions that originate from the senses and their perception, concretising an action with meaning and signifiers.

The children, in the situations analysed here, revealed the construction and understanding of topological notions; through drawing, it was observed that they made several attempts/hypotheses in seeking to coordinate their internalised image with the representations of actions.

According to Piaget and Inhelder (1993), the child, when drawing, already has a representation of the object and of spatial relations intrinsic to the object. Thus, the child is capable of reconstructing and constructing displacements that he or she has not seen, which is explained only by a combination of mental images that lead to the organisation of action. The distortions in the drawings of children with ADHD show that they still fail to establish all the spatial relations associated with the activities of swimming.

Moreover, Piaget (1978) claims that the act of drawing is an accommodative process precisely because, by drawing with distortions, the child becomes aware of these distortions and begins to make the necessary adjustments to achieve the most accurate representation possible of the spatial relations originating from his or her motor experiences inherent to his or her actions.

In the construction of representative space, psychogenetic studies show (Valente, 2001; Padilha, 2009; Alexandroff, 2010) that the child understands and uses, first, topological properties

with the interaction between assimilation schemes and properties of objects. The spatial perceptions are the ones that establish the construction of representative relations, bringing out the construction of imagery, because mental representations are generated from perceived proprioceptive information that is extracted from the active body in the water.

CONCLUSION

Considering that the preoperational period represents an advance over sensorimotor intelligence and, analogously, the operational period represents an advance over its predecessor, this study actions of the participants suggest that the structural leap in cognitive function after the experience of learning to swim by the children with ADHD, it's possible in the drawings made before and after the experiment by Alberto, Bruno, and Cristiano.

Because of the age of the children analysed here, the primitive strokes used in the drawings, as Okuda *et al.* (2011) state, may be due to a visual-spatial perception deficit related to the executive dysfunction that affects the quality of the altered writing, known as unintelligible writing or dysgraphia (written expression disorder). These manifestations in the children with ADHD who exhibit visual-motor integration deficits may be due to attentional changes, the executive function, perceptive organisation, synchronisation, delayed maturation of coordination, and constructive dyspraxia.

Regarding Developmental Coordination Disorder (DCD), Toniolo *et al.* (2009), based on the results of a study among school children from 6 to 12 years old with ADHD but without this disorder, state that deficits in the motor coordination of students with ADHD may not be characteristic of the disorder but instead may be characteristic of the DCD associated with ADHD.

Therefore, a child with ADHD is not uncoordinated because of the disorder but rather is susceptible to having it. Admitting DCD as a comorbidity and based on the promising results of this study, we advocate the importance of practicing an activity that mobilises the sensory-perceptual and motor apparatus of the practitioner, such as swimming, for children with ADHD.

From the initial experiment using the clinical method, operationalised by graphic representation (drawing), it is important to highlight the need to study the process of the construction of drawing together with the verbal statements that were given to us by the individuals. During the drawing of D1 and D2, on being questioned, the child described *pari passu* all that he drew, reporting details that resulted in representations of more elaborate spatial relations compared to those demonstrated by his ability of exteriorisation through drawing.

Finally, in spite of the whole set of difficulties that permeate the teaching-learning process of children with ADHD, as reported in this study, the cardinal symptoms, hyperactivity and impulsivity, that characterise the disorder were instead an extremely positive pedagogical element in the adaptation stage to the water proposed in the research. Considering that all the lessons, developed as a motivating strategy, contained tasks with challenges to be overcome, students with (hyperactive/impulsive) ADHD did not “think” to perform them, ignoring fear, dread, or their own fear of not knowing how to swim. Thus, by completing the task with full dexterity and fearlessness, they encouraged other students without ADHD, more fearful and reflective at first, who, when they found out that there was no “risk” in the task/activity, accomplished it without a second thought.

It may be stated, from the pedagogical perspective that permeates teaching-learning, that the hyperactivity/impulsivity of ADHD is a positive factor in the process.

Moreover taking into account the small sample size used in the study, the generalisation of these results, for now, should not be done. The continuation of this line of research is recommended with the use of sample groups with a larger number of participants.

This study allowed for reflection on the need for greater investment in studies that bring together physical education and developmental psychology in an interdisciplinary manner because the lack of knowledge of comorbid conditions in children with ADHD, in this case, DCD, may increase the chances of sterile interventionist measures.

Furthermore, developmental psychology epistemologically describes in a unique way the expected actions for individuals, creating conditions for the construction of observation and evaluation protocols that may be very useful for research conducted on swimming and other activities related to physical education.

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