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Executive Disorder: Educational Strategies To Rethink New Educational Challenges

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Abstract: The study, of a theoretical-exploratory nature, has the intent, in compliance with today's educational panorama, to provide reflections on the definition of *Executive Disorder* in accordance with what is present in the literature. These disorders can therefore manifest themselves and affect various areas of development, specifically, dyspraxia and dysgraphia are of attention as they are disorders of a praxis-motor nature which affect daily and scholastic activities. The objective is therefore to raise the teaching staff's awareness of the early recognition of disorders that fall within this macro-area of educational needs, both thanks to specific screening tools and the use of new technologies to support teaching, to arrive at timely planning of appropriate educational intervention measures, taking into account the central role of corporeity.

Keywords: executive disorder; dysgraphia; dyspraxia; evaluation; new strategies;

1. Introduction

This work aims to offer a perspective on the evaluation and intervention methodologies to be developed in the teaching and educational field in children who encounter difficulties in executive functions and who require the development and effectiveness of motor coordination.

The coordination of any movement involves the adaptation of the strength and duration of the contractions of the agonist and synergistic muscles and the consequent regulation of the simultaneous and subsequent contractions, as well as the corresponding relaxation of the muscles and the permanent correction of the precision of the movement through the play of balance regulating reflexes.

Gross motor or fine motor coordination therefore not only require the integrity of the neurophysiological system and a progressive regulation between different muscle groups, but also an integrated processing of sensory information coming from the surrounding environment, so as to be able to modulate the movements in based on the environmental demands themselves. In summary, the characteristics of a coordinated motor action (a praxis) reside in the intentionality, the spatio-temporal organization of the movement, the sequence of motor acts and the calibration on the environmental coordinates (Bernstein, 1067).

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Scientific literature highlights how motor coordination disorders are not just movement disorders: motor coordination difficulties, which can already be seen in preschool age, are often associated with cognitive difficulties and specific learning disorders such as dysgraphia. These comorbidities complicate a situation that further hinders the learning process, an aspect that could lead to many complications in adolescence, including psychological ones with consequences for self-esteem and self-efficacy (Bandura, 1996).

Praxia, understood as the ability to carry out intentional voluntary motor movements (Sabbadini, 2005) is the expression of a cognitive function characterized by a specific mental representation that contains visual, tactile, proprioceptive and lexical-semantic information necessary for the motor acts assigned to one same purpose can be produced correctly. Developmental dyspraxia therefore describes children with difficulty in representing, planning and carrying out consecutive motor acts, designated and aimed at a specific purpose and objective.

This disorder is evident in the production of significant intentional actions but also in non-significant intentional actions which however require multisensory integration. For these reasons, the educational challenges of our time are constantly evolving and in order to be addressed they require pedagogical itineraries, which, at this time, appear to still not be fully explored. Pedagogy is therefore called to realism and to grasp limits and potential, following the open path of the digital revolution as a function of educational responsibility.

2. Executive Disorder

The new educational challenges require us to plan and reformulate evaluation and planning, which leads us to search for alternative operational proposals, in which it is important to recognize the need to enhance the body, and this is why a timely reorganization of knowledge is needed, to enhance what is the compendium of professional skills in order to make educational interventions more functional. The work aims to raise reflections on the concept of Executive Disorder, in relation to the complex scenario in which the teaching staff is called to operate.

The disorder of executive functions is found in poor executive speed and in spatio-temporal difficulties (Crispiani, 2006) and can be found in cases of dyslexia, dysgraphia, dyscalculia, dyspraxia, motor and spatio-temporal disorders and neurodevelopment .

The Executive Disorder dichotomy places disorders that concern executive functions in a single category, referring to a set of processes responsible for the planning and coordination of manifest behaviors, which include organization, attention, memory, coordination in a general sense as well as regulation of emotions and situational adaptation. These disorders tend to affect various areas of development, compromising both daily and scholastic activities (Crispiani, 2006).

Faced with this dichotomous expression, the risk is to lead to what is a generalization to the possible functional diagnoses whether it is a specific learning disorder or a neuro-developmental disorder. Specifically, the work here pays attention in this context to the disorders of Dyspraxia and Dysgraphia (DSM-5, 2013. pp. 66-74), as disorders of a praxis-motor nature.

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2.1. Dyspraxia and Dysgraphia

Dyspraxia is classified as a «specific developmental disorder of motor function» (F 82 - WHO, 2022), and is generally included in the definition of DCD (Developmental Coordination Disorder) Developmental Coordination Disorder (DSM-V, American Psychiatric Association, 2013). Specific learning disorder recognized by Italian Law no. 170 of 2010, and article no. 1 quotes verbatim «For the purposes of this law, dysgraphia means a specific writing disorder that manifests itself in difficulty in graphic creation». Dyspraxia specifically is configured as a developmental disorder of motor coordination whose diagnostic criteria include a marked difficulty and a possible delay in motor development, understood as the inability to represent oneself in space, to plan and voluntarily execute consecutive motor acts. If, however, we consider writing first and foremost from a praxeological aspect, it appears as a complex skill that involves synergistic neurological, motor and cognitive processes (Berninger et al., 2006). Practical difficulties, understood as the planning and execution of intentional motor acts aimed at a purpose, are not only highlighted in the use of the upper limbs, but can also involve other body areas (gaze dyspraxia, verbal dyspraxia) or specific intentional motor acts (clothing dyspraxia, drawing dyspraxia, writing dyspraxia, constructive dyspraxia, walking dyspraxia) (Sabbadini & Sabbadini, 2013). In fact, dysgraphia is configured as a form of dyspraxia declined as a specific learning disorder characterized by a clear and important difficulty in the reproduction of alphabetical and numerical signs, the outline of which appears uncertain, irregular in shape and size (Russo et al., 2012).

In this sense, however, there is also implicit a difficulty in carrying out motor projects both in grapho-motor terms and in sequential terms (Crispiani, 2006). There are several studies that highlight the comorbidity often present between dysgraphia and dyspraxia, placing the subjects in what could be defined as dyspraxic syndrome, confirming that bad handwriting underlies a serious problem that involves both the motor components (including prehension), but also the perceptive ones (space management) and psychomotor ones (eye-motor coordination) (Sabbadini, et al., 2018). A functional evaluation is therefore necessary that takes into account both sequentiality (hands and fingers) and oculomotor skills and static and dynamic coordination, without excluding graphic-constructive skills, orofacial movements, symbolic gestures and graph ability. -motor.

3. Evaluative Suggestions

3.1. Domain-specific psychomotor assessment tools

Writing as a practice has always represented a fundamental and complex skill that involves cognitive, perceptive and coordination aspects of children. In recent decades, following the influence and use of technologies, there has been a change in educational systems which has led to changes in both the teaching and assessment of writing. Recent studies regarding bibliometrics and methods of evaluating the graphonometric status of children have highlighted that writing remains a key tool for the growth and learning process, as well as for the identification of cognitive problems.

For early intervention, graphonometric assessment tools appear to be a valid means of detecting difficulties or disorders in learning to write (Aleman, et al., 2023).

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The proposal is the possible introduction into teaching practices of specific evaluation tools such as the BHK scale, for the evaluation of grapho-motor skills in developmental age (Di Brina & Rossini, 2021), Italian adaptation from the Dutch original by E. Hamstrabletz , J. De Bie and B.P.L.M. Den brinker), specific for the evaluation of the graphic trait for primary school children. For developmental dyspraxia we find the APCM-2 Protocol, specific for the evaluation of Practical Abilities and Motor Coordination (Sabbadini, 2018), which within it also has an observation area for graphic ability as praxis.

The APCM-2 protocol is in fact a psychomotor assessment tool at the service of the clinician who evaluates the motor and practical skills of children aged 2 to 8 years of age. The test was designed as a screening tool and as a neuropsychologically based observation model of the various aspects of development, which aims to identify subjects with certain motor/practical disorders early, and to act as the basis for adequate interventions. (Sabbadini, 2018).

The aforementioned tests are both used in the neuropsychological area for the diagnosis of developmental disorders and any comorbidities.

It is of fundamental importance to seek alternative operational proposals and evaluation solutions to propose timely and personalized practical interventions, as well as to raise the teaching staff's awareness of the knowledge and use of diversified and valid evaluation tools, consistent with the actual needs of the learners.

3.2. Motion capture technologies and digital software

In the current context and in the clinical field, we have the possibility of being able to take advantage of technologies that would allow the possibility of carrying out objective and detailed assessments on multiple levels with respect to executive-motor disorders.

Depending on the type, these new technologies find application in different fields: in the diagnosis of neuromotor diseases, in the analysis of writing variability, as well as in the forensic analysis of documents.

For example, motion capture systems are recognized in the evaluation and management of neuromotor diseases, and are applied for various therapeutic and performance evaluation purposes, in particular: gait analysis, diagnosis of neuromotor diseases, evaluation of motor coordination and to investigate movement patterns in sports together with the athlete's performance analysis.

Digital software allows you to record the writing process in digital format, to evaluate hand-eye coordination and identify any difficulties in visual processing while writing. However, already known motion capture systems can be used to monitor body movements during the act of writing, and these systems use sensors to record three-dimensional movements, consequently they can offer a detailed perspective on hand-eye coordination and other aspects of motor control, as they allow you to precisely record body movements during specific activities, such as walking, running or performing manual tasks. This detailed analysis can reveal any irregularities in motor patterns associated with dyspraxia.

The three-dimensional visualization of the movements captured by motion capture can provide immediate visual feedback for both the professional and the analyzed subject. This can be useful to increase the individual's awareness of their movements and aid in the correction of those same performances.

Data collected through motion capture can be used to develop individualized intervention programs that target the specific motor challenges found in the individual with dyspraxia, also because motion capture provides in-depth biomechanical analysis, allowing parameters such as joint angles, length of steps.

Motion capture could be used as part of a broader, multidisciplinary approach to the management of dyspraxia and the kinematic evaluation of graphic gesture (Vastola et. al, 2013). These contributions would allow us to distinguish reversible difficulties from real disorders, lay the conditions (even if non-clinical) to start an evaluation process by drawing up educational interventions with the competent figures that take individual needs into account. To teaching planning, which is therefore of an inclusive nature, an in-depth and total knowledge regarding the potential and possible deficiencies with respect to specific executive functions is therefore preparatory, in order to stem a generalization of the problems and to identify the specific needs in relation to the specificity of the disorder.

Alongside such systems are specialized software programs designed to analyze and evaluate digital writing and to provide quantitative metrics on writing speed, surface pressure, and other aspects. Masquerade®, for example, is an example of software already used in forensic activities and in the analysis of writing variability in ancient manuscripts (Parziale et al., 2016). It also offers the possibility of analyzing handwriting and making diagnoses of neuromotor diseases, analyzing their morphological and dynamic characteristics, also in the teaching field (Piccinno et al., 2021).

3.3. New approaches and new scenarios

As described in the literature, computerized assessment of developmental dysgraphia appears to be an increasingly used method. It is based on online writing processing, in which a child writes on a digital tablet. Recent studies aimed to explore how the quantitative analysis of online writing recorded via a tablet display/screen could support the assessment of developmental dysgraphia. Several studies presented at the recent International Graphonomics Conference presented different approaches to the study of learning and writing education and confirm that although complex, the evaluation of developmental dysgraphia via tablet is promising (Mekyska et al., 2023).

An exploratory study was recently conducted with the aim of analyzing eye movements during a copy-writing task using eye-tracking glasses. The test was subjected to a group of children who present not only dysgraphia but also developmental coordination disorder and to a control group. It was noted that children with comorbid disorders spent less time looking at what they were writing, making shorter and more numerous fixations than children in the control group. This suggests that distinctive oculomotor strategies are present during copying activities in these children (Lambert et al., 2023). a study of an intelligent pen-based tutoring system for anatomy courses in higher education, known as IntuiSketch.

This system is able to analyze students' drawings with respect to a problem defined by the teacher and generate corrective feedback. This tool bases its methodology on the two-dimensional CD-CMG grammar (Context Driven Constraint Multiset Grammar) capable of modeling the structure of the document. The tutoring system is based on constraint modeling, which allows to define the knowledge of the domain and the problem and to analyze the students' production with respect to the constraints that must be satisfied to solve the problem (Barchouch, et al., 2023). Another

recent research aimed to qualitatively evaluate children's writing based on visual-structural criteria with the aim of supporting teachers and identifying children with writing difficulties. The test, conducted on children aged between 3 and 11 years, involved a complete data set of written words followed by a comparison between the judgment of human experts with a graph-based analysis, both compared to classification and clustering. This highlighted the potential of graph-based methods for writing assessment (Scius-Bertrand, et al., 2023).

In recent years, scientific research, through Crowdsourcing, has used new methods of information collection. In fact, there are various platforms used to carry out specific tasks, among which we remember Copilotr@ce, which is a platform created for the analysis of graphomotor gestures. These methodologies should be explored and studied to be used to serve educational assessment practices, to facilitate the analysis and evaluation processes (Gaëte, et al., 2023).

4. Conclusions

This study aimed to provide reflections on possible research horizons that have already been partly explored, with the intention of underlining the possibility of using cutting-edge tools in teaching, therefore also used in the clinical and neuropsychiatric field. The instruments mentioned above appear theoretically well founded and all appear to have good psychometric capabilities. Here, useful trajectories have been provided to focus on and explore teaching situations with special educational needs. The importance of these considerations lies in the fact that there are not many standardized tools for the detection of symptoms of dyspraxia and dysgraphia by teachers. This can be particularly problematic given the extreme importance of early diagnosis of such executive disorders. In fact, there is numerous empirical evidence that indicates how these executive difficulties, in addition to motor problems, lead to numerous other problems and that they negatively affect activities both in school and in everyday activities. In addition, very often the condition of DCD or/and dyspraxia is associated with depression and anxiety (Missiuna et al., 2014), thus producing a significant reduction in the "quality" of life of these children.

Regarding the reflections considered here, the literature underlines the importance of drawing up an early diagnosis and a timely rehabilitation program based on a multidisciplinary intervention, in which teaching and the pedagogical sector must be part.

Everything must be aimed at the acquisition and integration of the different affected skills, considered as different aspects of a single disorder and not as dissociated disorders, in such a way as to guarantee adequate functional development in the different evolutionary phases. We know how disorders affecting executive processes are associated with and affect cognitive development, determining an increasingly deficient transition to the subsequent levels of maturation of this system. Often, in young children, motor and/or coordination difficulties represent the most relevant and tend to be considered as isolated data, today we know from the most recent theories that linguistic and cognitive abilities emerge in parallel with psychomotor development and in particular in relation to gestural abilities and the ability to produce intentional actions, therefore it becomes fundamental that the motor-practical aspects do not are neglected.

The practical difficulties, in fact, although initially less evident, condition and compromise the global development of the child, often defining problems in

space-time organization and fine motor skills and consequently influencing graphic development, causing further difficulties in the field of school.

Furthermore, practical difficulties influence simple daily life activities in which motor coordination is required, from sports to autonomy (for example in dressing) and for a child they frequently represent a source of feelings of inadequacy and frustration in comparison with peers, sometimes resulting in emotional and behavioral disorders, isolation and low self-esteem. Taking into account the embodied paradigm, and according to the well-known principle that cognitive processes are directly influenced by sensorimotor operations, it is appropriate to propose other ways of achieving knowledge, especially in conditions of cognitive-processual difficulty (Wilson, 2002)

A psychomotor evaluation and a possible integrated and simultaneous intervention will therefore be equally essential in such a way as to intervene early on each area of development involved and in evaluating the individual subject it will be possible to propose activities that involve an interactive approach and aim at strengthening some specific sectors such as , symbolic skills (schemes of action with the object, symbolic play in sequence) and representation as a mental image, the progression from a single gesture with a hand to the creation of a sequence, up to arrive at the representative gesture of an object. Other activities to propose are those of a graphic-expressive type, which involve the execution and perception of sequential linguistic and non-linguistic tasks (sequential rhythms and sequential stories).

It would be useful to carry out perceptual-motor games that allow the child to develop adequate body knowledge and the ability to use it in the most appropriate way, as well as acquiring confidence in his own abilities and self-confidence. Therefore, the importance of a holistic approach to the child emerges that takes into account his needs, the inclusion of the family and environmental influences in the planning of value paths that have the body as centrality.

According to the well-known paradigm of *embodied cognition*, one of the scientific approaches that most influences the field of education, it is possible to appeal to innovative teaching methodologies. The body, in fact, between perception and action, becomes a mediator for the learning process. In the literature, the importance of the body in cognitive and linguistic processes is often underlined, since it is in the perceptive and physical interactions of the human body with the world that knowledge can take place (Barsalou, 2008;). The latter passes through bodily experience in a close relationship between mental functions and interactions between the body and the environment that surrounds it (Chemero 2009; Sibilio 2012; Fedeli 2014). From this perspective, the digital environment presents itself as a connector of multiple expressive modes, each in dynamic interaction with the others, for the production of new artefacts. It can be said that the possibility of using multiple languages and putting them online, thanks to digitalisation, promotes better understanding, memorisation and processing of information, and therefore of learning and the processes linked to it.

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