# Inclusion and New Technology for Students with Learning Disorders and Attention Deficit with Hiperativity Disorder

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**Abstract**
The purpose of this paper is to analyze possible correspondences between new technologies and inclusive practices for students with difficulties. This perspective allows authors to describe the use of Technology as a possible component of plurals educative settings, able to draw every actor involved on a variety of resources. The targeted use of technologies, intended as a potential, can allow the development and the improvement of inclusive dynamics within the educative field. Specifically this paper presents the technological resources which have enabled the inclusion of students with learning disorders, dyslexia and attention deficit hyperactivity disorders, in the Brazilian scenario.

**Keywords:** inclusion, new technology, learning disorders, attention deficit with hyperactivity disorders.

## Use of Technology: General Considerations

The use of technology as an instrument in the processes of evaluation and educational intervention has aroused a growing interest and provided initiatives

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involving the development and use of computer programs, software adaptation, application structuring and the composition of new instruments that provide a differentiated educational performance, with individualized characteristics towards the work with students who present learning disorders, dyslexia and attention deficit hyperactivity disorder.

Among the several benefits that the use of technology provides, one of the main refers to the possibility of the student with attention and learning disorders be able of using the resources interactively, benefiting from a series of stimuli which can emphasize from visual perception through the use of images, drawings and animations, to the perception and processing of auditory information, through the use of environmental or speech sounds, and the integration with stimuli of different spectrum, such as auditory-visual programs, as described by Capellini, Oliveira and Pinheiro (2011), Pinheiro and Capellini (2010), Germano and Capellini (2011).

## Technology, Programs and Information Environment for student with learning disorders, dyslexia and attention deficit hyperactivity disorder

The use of technology, specifically the use of programs or information environment that use computers to integrate texts, graphics, images, videos and audio, should be considered as a strong trend towards the digital world in which our students are immersed (Shih and Alessi, 2004), since they are part of the students' daily life, being thus an excellent resource to keep patients motivated in therapy or to maintain their attention during the evaluation process.

The motivation factor, according to the studies by Ellis (2008), and Griffith (2008), is very important for learning. Studies by Kamberi (2013), and Park (2013), have demonstrated that the incorporation of technologies, such as the use of computers in the learning process, represents a highly motivational factor for the development of academic abilities.

Currently, the existence of mobile technology can provide complete tools and services to access any audio and video material available. The 4G technology allows speed and mobility of broadband Internet access, providing its use even in establishments which do not have internet, but this form of access has been briefly explored by the Brazilian educators. According to Abachi and Muhammad (2014) the use of these services can facilitate access to programs and have a direct impact on the ways of interaction and learning.

However, in order to use the technological resources which help the inclusion of student with learning disorders, dyslexia, and attention deficit hyperactivity disorders, a careful analysis of the stimuli and its various presentation forms in the softwares, applications or programs which comprise

activities as reading, writing and predictive skills for literacy, considering: complexity of the terms used, quality of stimuli (auditory, visual), amount of items, linguistic aspects (manipulation of different unit sizes, such as: words, syllables, phonemes, segments of rhyme or alliteration) and the specific cognitive operations required by the different types of activities (Casalis & Colé, 2009; Germano, 2011; Silva, 2013; Pinheiro, 2014).

In Brazil the educational technology used for these students to develop reading and writing skills involves software with phonemic, syllabic and supra-phonemic activities (rhyme and alliteration), which aim to develop skills related to phonological processing concerning reading and textual comprehension (speed of access to the lexicon, naming and phonological awareness). The activities present in these softwares and even in the applications, include activities with the syllabic structure of the word (analysis and synthesis); syllable identification; identification of phonemes; syllable comparison; phoneme comparison; syllabic recombination (segmentation and manipulation) and identification of sounds and syllables by rhyme and alliteration. This combination of strategies is described by several authors, including Broom and Doctor (1995), Capellini (2001), Ygual-Fernández and Cervera-Mérida (2001), Etchepareborda (2003), Capellini, Tonelotto and Ciasca (2004), O'connor, Fulmer, Harty and Bell (2005), Paolucci and Ávila (2009) and Silva (2013).

However, the technology employed in the educational realm does not follow the advance and rapid development of the use of technology in the clinical scope. In this regard, it is highlighted the use of neurofeedback, which is a field of specialty within biofeedback, which is dedicated to the formation and control about the electrochemical processes in the human brain (Lavaque, 2003; Evans & Abarbanel, 1999). It aims to acquire self-control over certain patterns of activities in the brain, deriving self-regulation strategies and implementation of these 5 self-regulation skills in daily life (Gevensleben, *et al*., 2010).

The practice of neurofeedback is understood nowadays, as a direct training of the brain function, which allows the brain to be stimulated and to function more efficiently. It is a gradual learning process in which we can observe and control cerebral functioning in different cognitive-linguistic activities. Thus, brain activity can be observed through the Electroencephalogram (EEG), to follow the self-regulation which allows the Central Nervous System to perform better tasks involving attention, reading and writing (Hamadicharef *et al*., 2009; Breteler, Arns, Peters & Verhoeven, 2010; Nazari, Mosanezhad, Hashemi and Jahan, 2012; Cerquera, Arns, Buitrago, Gutierrez and Freund, 2012).

In spite of being a relatively old technique, neurofeedback has only been diffused in the last ten years among researchers and in the clinic of attention and learning disorders, consequently, the increasing number of publications of its application in ADHD and dyslexia. This is due to several factors, such as:

1) Technological evolution: change of equipment from analog to digital model; 2) Evolution of computing: increasing the storage capacity of large amounts of data and improving graphical interfaces; 3) Expansion of availability: equipment of greater reliability and lower costs. This allowed field exploration outside large technology centers, thus, with more accessible and portable equipment, many clinicians arranged to explore the possibilities, as many researchers had facilitated access to technology.

In addition, there are technologies that help the analysis of writing, more precisely the analysis of manual writing that aims to estimate the parameters for each movement performed in the writing motor act, such as Neuroscript MovAlyzeR, which is a software that performs the writing image processing, recording different segments such as pause, pen inclination, acceleration, letter continuity, descending movements, speed, pressure and gripping of the pen used and supplied, and each movement is defined by spatial and dynamic characteristics.

Devices and types of technology have increased dramatically in recent years, bringing computer systems that verify dynamic signatures, providing biometric data through tablets and pen signing, or even fingerprintings.

In addition to Movalyzer, another software used for handwriting analysis is denominated as Ductus, which, it is a software tool designed to analyze and aid the comprehension of the underlying processes of handwriting, as a device based on scanning and providing online information about the calligraphy, consisting of two distinct modules which operate independently. It can be suitable for student and patients who present changes in handwriting, offering a range of kinematic information, such as speed, duration, fluency and pauses, that are directly linked to the domain of the movement (Guinet & Kandel, 2010).

Handwriting consists on a common tool for communication among human beings, which it involves cognitive and motor skills (Carmona-Duarte, Ferrar, Parziale & Marcelli, 2017). According to Stevenson and Just (2014), for the student to have accuracy when recording letter forms, he/she will need fine motor skills, visual perception, perceptual-motor-visual integration, maturity and integration of cognition. In other words, the use of manual writing requires visual mnemonic representations of each letter, the recognition of the traces that make up each letter, and the ability to reproduce these traces in a respectful order and direction (Schickedanz, 1999).

In general, studies on the evaluation of manual writing are based on the final static product which can be analytically or globally analyzed (Hamstra-Beltz & Blote, 1993), e.g. the tests, scales and/or protocols used, make a descriptive analysis of the written product and do not make a qualitative analysis of the performance throughout the writing process (Rosenblum, Weiss, and Parush, 2003). The research points out (Rosenblum, Weiss, and Parush,

2003) that evaluating the readability of the written product through its static characteristics, as example: spacing between letters and words, letter formation, degree of inclination, among others, can be limiting.

Thinking about a deeper understanding of writing development, computerized studies are being developed, since it is possible to measure different variables, such as temporal, kinematic and kinetic (Lam, Au, Leung, & Li-Tsang, 2011). The technology invested to evaluate the handwriting process consists basically of a tablet (digital table), a special pen and a computer, which together they allow the recording of "x" and "y" coordinates of the pen on paper. The recordings allow the investigation of spatial and temporal characteristics in real time and the sensors located in the pen allow to record the pressure used by the writer during the writing activity (Rosenblum, Weiss & Parush, 2003; Falk, Tam, Schellnus & Chau, 2011).

Although computerized handwriting assessments are faster, more accurate, more sensitive and more reliable than subjective analyzes, it should be noted that equipment and software are considerably more expensive than traditional calligraphy evaluation tests/scales. Contrary to what might seem, computerized assessments are not employed to replace clinical evaluation, but rather to supplement providing data that goes beyond what is observable to the human eye. The more specific aspects of handwriting are evaluated, the better the decisions regarding referrals, diagnoses and interventions.

It is important to understand that, when we use technology with student who have or do not have learning disorders, this is not enough for Brazilian schools to introduce computer education under the pretext of modernity into their school curriculum by investing in computer rooms, that students attend once a week, accompanied by a monitor or, at best, a trainee from a higher education course connected to the area, proficient in computing technical teaching. Thus, instead of guiding these students to learn how to use this new technological apparatus in favor of meaningful learning and universal access to knowledge, students are conditioned to the use of the newest computational technologies, in decontextualized classes, without any link with the other disciplines and without any pedagogical conception, as described by Valente and Freire (2001).

## Final Considerations

Brazil still presents challenges for the real and effective use of technology in the classroom, and one of them consists on the definition of a clear objective on the use of such a tool that can offer to students with and without attention and learning disorders a new environment and a type of student-educator relation different from those characteristic of traditional teaching, since, in a context in

which the tool used to favor learning, is a computer (counting on software to aid in activities), application or tablet, the interest in learning may increase.

The use of the multimedia resources, such as, programs or information environment which use computers or tablets to integrate texts, graphics, images, videos and audio, represent a strong tendency towards the digital world in which our students are immersed, as well as an excellent resource to keep student with attention and learning disorders motivated to learn.

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