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BAPNE Method, Developmental Dyslexia and Inclusive Education: Cognitive, Socio-Emotional and Psychomotor Stimulation in Secondary School. A Practical Resource for Education within a Cross Curriculum

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Abstract

The strong link between phonological awareness and musical rhythm is widely explored in scientific literature. Interventions based on rhythm are proved to be fundamental for reading and writing skills in dyslexic students. Recent studies highlight the close relation between executive functions and learning circumstances within the school context. Learning is a high cognitive function and involves the socio-emotional processes, the motivational aspects related to reward, self-efficacy, self-esteem, empathy and also the acquisition of values. This study is focused on (1) phonological awareness and musical rhythm in developmental dyslexia; (2) current research on learning environment, executive functions and brain development during adolescence; (3) a practical proposal of inclusive education through body percussion activities – BAPNE Method for cognitive, socio-emotional and psychomotor stimulation within the context of the secondary school classes.

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1. Introduction

The cultural achievement of reading is among the most important and complex to be acquired (Moritz, Yampolsky, Papadelis, Thomson, & Wolf, 2013; Wolf, 2007). The specific reading disorder or developmental dyslexia represents one of the most widespread and explored developmental disorders in children and adolescents. They show unexpected difficulties in reading tasks if compared with their cognitive skills, age, intelligence and level of education (Shaywitz & Shaywitz, 2003). These difficulties persist also in the young adult reader and in the lifelong period. Dyslexia

significantly interferes with the literacy skills development and therefore with school learning as well as with everyday life activities requiring reading skills (Miles, 2008; Riddick, Sterling, Farmer, & Morgan, 1999).

Dyslexia appears heterogeneously and many other impairments are often associated to reading difficulties, as attention, working memory, motor coordination, laterality and auditory information processing.

In Italy Barbiero and colleagues have conducted a pilot research that was started in 2008 on children from 8 to 10 years of age in the Italian region Friuli Venezia Giulia in order to evaluate the prevalence of this disorder in the non-selected school population (Barbiero et al., 2012). The study results have shown the variance between the percentage of children who already had the diagnosis (1%) and the prevalence of dyslexia measured after the study (3.1% - 3.2%). In the primary school, therefore, 2 kids out of 3 are not diagnosed their disorder.

A late diagnosis or a diagnosis not revealed for a long time often affects a person self-esteem and it can lead to negative outcomes during the following adolescent period not just at a clinical level, but also at a cognitive, emotional, social, cultural and educational level (Alexander-Passe, 2006; Nicolson & Fawcett, 2008; Wolf, 2007).

In Italy the legislation about dyslexia within school context is recent (Nuove norme, 2010). Among the purposes of the document also appears in the article 2 “ridurre i disagi relazionali ed emozionali [to lower discomforts in relationships and emotional sphere]” (Nuove norme, 2010, art. 2, §c) and “favorire (...) percorsi didattici riabilitativi [to foster (...) teaching rehabilitation paths]” (Nuove norme, 2010, art. 2, §f).

Early interventions in developmental dyslexia are optimal. However it is possible to conduct interventions focused on developmental dyslexia during adolescence thanks to neurosciences about the ways the brain is activated for reading tasks (Blakemore & Frith, 2005; Fawcett & Nicolson, 2007; Wolf, 2007).

1.1. Phonological awareness and musical rhythm.

Several authors identify the phonological deficit as the main disorder that is responsible for reading difficulties in developmental dyslexia in the majority of dyslexic people. A wide literature and many empirical data confirm the close link between rhythmic skills and phonological awareness. The latter includes perception, discrimination, analysis, representation and manipulation of linguistic sounds. The correlation between phonological awareness and rhythmic skills has been explored in different ages of development, starting from infancy (Anvari, Trainor, Woodside, & Levy, 2002; Moritz et al., 2013) and with children and adolescents with or without developmental dyslexia (Bonacina, Cancer, Lanzi, Lorusso, & Antonietti, 2015; Huss, Verney, Fosker, Mead, & Goswami, 2011). Recent researches provide data on the improvement of reading skills through rhythmic training (Schön & Tillmann, 2015). The development of linguistic and phonological awareness are essential for further development of reading (Wolf, 2007).

In order to improve linguistic skills Patel (2011) suggests, within a neurobiological perspective, a musical training by the OPERA hypothesis. It is possible to obtain improvements of the linguistic reading skills taking advantage of brain plasticity via the activation of a musical training that complies with OPERA hypothesis criteria (Overlap, Precision, Emotion, Repetition, Attention).

Within the recent research on children from 8 to 11 years with a diagnoses of dyslexia conducted by Flaunacco and colleagues (Flaunacco et al., 2014) a strict link between musical rhythmical reproduction, phonological awareness and reading skills has been confirmed. In particular the correlations between tapping tasks and language, and between rise time and text reading tasks. It was also highlighted the link existing between temporal auditory processing and verbal short-term memory.

BAPNE Method, created by Romero-Naranjo, is a method for cognitive, socio-emotional and psychomotor stimulation through teaching of body percussion. The activities are based on contributions coming from disciplines as Biomechanics, Anatomy, Psychology, Neuroscience and Ethnomusicology (BAPNE). The body percussion is associated to the word that is thought, spoken, recited, sung and united through the prosodic stress to the movements. Initially prosodic accents of words and musical accents coincide in order to synchronize correctly all the movements; the movements of limbs are then executed independently and each of them is linked to the prosodic accents of words. The purpose is to create independence of lower limbs from the upper ones and to create also independence from speaking. Coordination exercises, based upon both biomechanical and neuroscientific principles are proposed through several ways of psychomotor learning: imitation/repetition, inverse or opposite reaction, variable circular coordination

and real-time signaling. These ways can develop crucial learning aspects, as working memory, attention, planning and laterality.

In BAPNE the activity is conducted in group and in an inclusive way; it is based on the framework of Howard Gardner's multiple intelligences theory (Gardner, 1983) in order to involve all the brain lobes, to activate specific neural synapsis and stimulate the brain through the rhythm realized by body percussion. Each exercise, through body percussion teaching, is focused on the development of each of the multiple intelligences. Vestibular, cutaneous and proprioceptive systems are stimulated. In BAPNE all the intelligences are used and stimulated: linguistic, musical, logical-mathematical, spatial, bodily-kinesthetic, naturalist, intrapersonal and interpersonal (Romero-Naranjo & Castillo-Martínez, 2011).

2. Method

Learning is a high cognitive function and involves the socio-emotional processes, the motivational aspects related to reward, self-efficacy, self-esteem, empathy and also the acquisition of values. Dyslexic children tend to perceive themselves through a lens of low self-efficacy and low self-esteem; this can be the cause of negative and frustrating situations during their educational path, as choices of a lower level compared to their real potential, with a clear social impact.

Current researches on learning environment, executive functions and brain development during adolescence are examined.

This research propose to adopt BAPNE Method in secondary school class context within a cross curriculum that is specifically designed in order to jointly develop all processes involved and needed in learning.

2.1. Learning environment

Everyday teaching and learning context continuously expose students to social events and actions strictly correlated to metacognitive and emotional functions (Ardila & Ostrosky-Solís, 2008, p. 6). Each success at school strengthens the perception to be able to achieve goals and the consciousness of self-efficacy and self-esteem contributes modelling the students identity. Executive functions facilitate learning and influence school success.

The recent study conducted by Moral-Bofill and colleagues (Moral-Bofill, Romero-Naranjo, Albiar-Aliaga, & Cid-Lamas, 2015) displays the way the activities based upon BAPNE Method develop a socio-emotional learning (SEL). This happens simultaneously with a development of the cognitive aspects and it affects positively the learning environment. Activities are proposed always in group with suitable choice for the spatial classroom setting. BAPNE favourite group setting is circle, since this layout creates a positive learning environment (Alonso-Sanz & Romero-Naranjo, 2015; Alonso-Sanz & Trives-Martínez, 2013). To realize all together the same rhythm creates a sense of belonging to a community and creates positive, prosocial effects in people taking part to it as well as it improve group cohesion (Repp & Su, 2013; Trainor & Cirelli, 2015).

According to BAPNE Method purposes and to the neuroscientific justification of each activity, group setting may vary and take several basic positions: circle, two concentric circles, semicircle, quartet, sestet, octet, couple, double row disposition with or without lateral or frontal movement, crossing, mirroring. This last position, for example, is thought to be fundamental for a typology of very specific exercises in which the alternation hand/foot and right/left must be clearly understood by students in order to develop laterality. Exercises on laterality may reveal cognitive problems as dyslexia. The correlation between dyslexia, attention and laterality is widely explored in BAPNE, that suggests a specific methodology of stimulation depending on different types of laterality: somesthetic or somatosensorial, percussive, revolving, and spatial (Romero-Naranjo, 2012). Each of them rely on neurological principles.

2.2. Executive Functions and brain development during adolescence

Executive functions represent a largely investigated topic by neuroscientific studies within the last decade. Nonetheless the concept of Executive Functions is still waiting for a formal definition and the researchers assume

divergent positions on this topic (Jurado & Rosselli, 2007). Contemporary studies generally associate the term executive functions to a variety of cognitive processes, as inhibitory control, planning, working memory, cognitive flexibility among others. These cognitive processes enable individuals to plan behaviors, to implement projects, to achieve planned goals.

Some studies propose the hypothesis of a distinction between “cool” cognitive aspects and “hot” affective aspects instead of a general domain (Hongwanishkul, Happaney, Lee, & Zelazo, 2005). In their study Ardila and Ostrosky-Solís (2008) suggest the existence of two different skills, strictly correlated, and mediated by pre-frontal areas that are partially different: (1) metacognitive, as problem solving, planning, inhibition, development and implementation of strategies and working memory, associated to dorsolateral pre-frontal areas; (2) emotional, as coordination of cognition and emotion, both associated to orbitofrontal and medial areas of frontal lobes.

Recent studies bring to light the narrow correlation between executive functions and circumstances of learning in school context; executive functions are a “hot scholarly topic” (Moran & Gardner, 2008, p. 34) in contemporary educational context. Moran e Gardner explore executive functions both from a development and a multiple intelligences perspective. They understand executive functions as rising from intrapersonal intelligence. This intelligence is related to affections and personal emotions. This intelligence is regulated by the frontal lobes. In these brain structures the sensory information, to which posterior cortical areas contribute, is integrated with the information of motivational and emotional functions coming from limbic systems.

In an educational perspective, BAPNE Method explains in great detail to the teacher how to sequence activities, what is the neuroscientific justification standing behind each of them, and how to articulate them in a concrete way in the classroom in order to develop each of the multiple intelligences, taking in consideration Howard Gardner theory (Romero-Naranjo & Castillo-Martínez, 2011).

Currently emerging researches on children, adolescents and adults with developmental dyslexia point to explore tasks involving executive functions (Brosnan et al., 2002; Gooch, Snowling, & Hulme, 2011; Kapoula et al., 2010; Lima, Salgado Azoni, & Ciasca, 2013; Reiter, Tucha, & Lange, 2005; Varvara, Varuzza, Sorrentino, Vicari, & Menghini, 2014; Wang & Yang, 2015). Executive functions role in reading skills of children and adolescents with developmental dyslexia has been investigated by Varvara and colleagues (Varvara et al., 2014). The study highlights low scores in categorical and phonological fluency, in spoonerism, in visual-spatial and auditory attention, in visual and verbal short-term memory and in verbal working memory.

Empirical researches so far with dyslexic students converge to underline impairments in cognitive inhibition skills (Brosnan et al., 2002; Gooch et al., 2011; Kapoula et al., 2010; Lima et al., 2013; Varvara et al., 2014; Wang & Yang, 2015).

BAPNE has designed activities with a neuroscientific justification in order to stimulate different processes of attention. From a neuropsychological point of view, attention is a function that, according to the type of task, can be focused, selective, alternating, divided, sustained. These processes are essential in a teaching context. Several studies explore the connection between body percussion – BAPNE Method and attention (Jauset Berrocal, Tripovic, & Romero-Naranjo, 2014; Pons-Terrés, Romero-Naranjo, Romero-Naranjo, Crespo-Colmino, & Liendo-Cárdenas, 2014; Romero-Naranjo, 2015; Trives-Martínez et al., 2014), in teaching context also with dyslexic students (Crespo-Colmino, Pons-Terrés, Romero-Naranjo, Romero-Naranjo, & Liendo-Cárdenas, 2014; Crespo-Colmino & Romero-Naranjo, 2014). In these studies are concretely explained some of the activities to be implemented in educational context and to propose to the class group as a whole. By using BAPNE Method concrete tools the teacher can implement these activities to develop attention, memory (short-term, long-term, declarative, procedural, muscular, auditory, visual, nominal, rhythmic, analytical, emotional), as well as inhibitory processes and independence of movements from speaking.

3. Discussion

3.1. BAPNE Method

From a point of view related to phonological development, the acquisition of phonologic awareness is facilitated, in the very early years, by a literate domestic environment. Verbal poverty is not only related to a situation in which a

5-years-old child has heard 32 million of fewer words but it is also related to a situation in which there is a lower level of deduction, prevision and comprehension about what other people feel (Wolf, 2007).

In early childhood rhythmic skills play an important role for the further development of reading (Anvari et al., 2002; Moritz et al., 2013). Interventions focused on rhythm have proved to be essential to improve reading and writing skills in children. Recently the study conducted by Carretero-Martínez and colleague (Carretero-Martínez & Romero-Naranjo, 2015) underlines the importance of development and stimulation of the fine psychomotor skills through the activities run in the class with BAPNE Method to develop ocular-manual coordination, corporal self-consciousness, laterality, writing skills and executive functions. Exercises have been especially thought to develop the fine psychomotor skills, as classified by Romero-Naranjo: crossing, rotation, manual dissociation, alternating, pressure, precision and symbolic.

Throughout primary school period rhythm plays a central role not just for a prediction of reading difficulties of developmental dyslexia (Flaugnacco et al., 2014; Huss et al., 2011), but also to implement interventions to improve phonological awareness and reading skills (Flaugnacco et al., 2015).

BAPNE Method suggests interventions with class group through body percussion teaching. In the study conducted by Crespo-Colmino and colleagues it is analyzed the development of attention in dyslexic students through the teaching of body percussion – BAPNE Method in an inclusive context and a class group setting (Crespo-Colmino et al., 2014; Crespo-Colmino & Romero-Naranjo, 2014).

In secondary school adolescents are given mainly accommodation methods than remediation (Shaywitz & Shaywitz, 2003). However, in students with dyslexia, rhythm-centred activities can improve the skills involved in brain development processes in adolescence. Within a scientific theoretic framework Flaugnacco and colleagues (Flaugnacco et al., 2014) highlight the criteria of a musical intervention on developmental dyslexia. This criteria are clearly explained by researchers in 4 recommendations: “to use a group setting rather than an individual setting (...), to use a fully active setting with music making and active musical games (...), to focus on rhythm rather than on pitch accuracy (...), to keep variety high” (Flaugnacco et al., 2014, p. 12).

BAPNE is not a musical method. BAPNE Method can be used in teaching context to reinforce attention, memory and body movements independence, but it also can be used as a resource within a therapeutic context (Parkinson, Alzheimer). BAPNE can be used at every age, from infancy to adult and old age. It can be used both with students with or without dyslexia, ADHD, cognitive deficits. Exercises for each of these types of groups are specifically thought and carried out. BAPNE is focused on a rhythm that is proposed in an active form through movement jointly with word and singing. Only when movement is united to the practical activity of singing it is produced a cognitive stimulation. If movement is realized on a musical base, movement involves just the emotional aspect but not the cognitive one.

The aim of this study is to offer a concrete contribution for students with developmental dyslexia through an intervention that activates all brain areas and lobes on: cognitive processes, attentive processes (focused, selective, alternating, divided, sustained), rhythmic and muscular memory, fine motor skills, gross motor skills and socio-emotional aspects. Learning is a high cognitive function. To enhance executive functions means to benefit all learning processes within each subject field.

Many scientific publications on BAPNE Method describe some of the many activities and some of the strategies used to prepare materials and learning setting. In this type of exercises are combined several stimulations leading to cognitive processes with a different sensory origin. Each sequence lasts no more than three minutes. Latest studies on cerebellum show its involvement in new tasks. When tasks becomes routine, cerebellum level of attention drops. There are empirical data highlighting cerebellum participatory role on motor processes of coordination, muscular tone, balance, posture control, rhythm regulation, strength and precision in movements and in defense mechanisms. Latest neurosciences on cerebellum explore, with not unanimous agreements, its role on several high level cognitive processes (attention, language, visual skills, learning, declarative and procedural memory, executive functions) and emotional modulation (Tirapu-Ustárriz, Luna-Lario, Iglesias-Fernández, & Hernández-Goñi, 2011).

Ethnomusicology contributes to exploring how body moves within different cultures. BAPNE classified all of the body percussion possible uses, meanings, functions in eight variants.

For body percussion – BAPNE Method a clear, precise structuring is required. A BAPNE Method work session is carried out for at least 15 minutes at a time at the end of the class.

Evaluation is an essential process in learning. Romero-Naranjo published a study in which he explains in great detail the specific evaluation criteria that must be applied in BAPNE Method body percussion teaching (Romero-Naranjo, 2013). The author proposes practical criteria to realize the evaluation in class group. Main indicators of the evaluation list are: psychomotor coordination, cognitive aspects, learning of values, development of the multiple intelligences. Indicators are also articulated in sub-indicators and give the teacher a package of clear evaluation tools to apply BAPNE Method in a practical teaching context.

During adolescence, the period between childhood and adult age and in which physical, psychological and social development take place (Ernst, Pine, & Hardin, 2006), the executive functions keep on developing (Crone, 2009). Recent studies have underlined the structural and functional re-organization during adolescence in brain regions involved both in high cognitive functions, as the capacity to take decisions and the cognitive control, and in social and emotional behavior (Blakemore & Choudhury, 2006; Yurgelun-Todd, 2007). The neurobiological growth process affects the brain regions involved in attentive processes, in gratification circuit and in the evaluation of reward, in the inhibitory response and in behavior aiming to a purpose: therefore secondary school age appears to be a key period within the learning issue.

4. Conclusions

Throughout this study we can assume the validity of the incorporation of the BAPNE Method in secondary school cross curriculum in order to develop the executive functions in students with specific reading disorder. The studies highlights that developmental dyslexia affects not only reading, but children and adolescents with dyslexia also present weaknesses in several executive functions. In learning context this must be considered.

The cerebral stimulation applied through the teaching of body percussion - BAPNE Method simultaneously enables several cerebral areas to activate and to improve attentive processes and learning. Furthermore, BAPNE activities, based on neurosciences principles, enable to develop all the intelligences, even the less stimulated ones in school context.

In this study we propose an intervention on developmental dyslexia in adolescence using the BAPNE Method in school context. This intervention uses a multidisciplinary approach to work simultaneously on all the processes involved on learning and it takes advantage of the currently available neuroscientific knowledge on a brain focused on reading tasks.

We suggest to explore this issue through additional researches and quantitative and qualitative evaluations.

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