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# OUTLINES - CRITICAL PRACTICE STUDIES

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• Vol. 21, No. 1 • 2020 • (49-68) •  
[www.outlines.dk](http://www.outlines.dk)

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## Compensation of intellectual disability in a relational dialogue on Down Syndrome

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### Abstract

*The historical-cultural theory of Intellectual Disability (ID) overcompensation / compensation is referenced in several studies, but little empirical evidence is presented to corroborate its thesis. In this work, current studies on Down syndrome (DS), the most studied worldwide neurobiological occurrence of ID, were analyzed establishing a dialogue with compensation theorization. Apart from contributing to an up-to-date understanding of DS, the study points to similarities between different scientific traditions, allowing discussion of methodologies, data interpretation, language comprehension, as well as the impact of studies for school inclusion and the development of ID / DS people. It is concluded that the theorization in question is pertinent to developmental studies, dialogues with other perspectives and that its progress depends on investigations directed towards the affective motivators / emotions of the person with ID / DS by means of more dynamic systems perspectives and interpretative methodologies.*

**Keywords:** Down syndrome, compensation, behavioral profile, Intellectual Disabilities  
Development

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The compensation / overcompensation theorization (Adler, 1967) of Vygotsky's Defectology approach introduces the idea that people with Intellectual Disabilities (ID), even those with severe conditions, could reach the same social goals as those with Typical Development (TD) (Akhutina & Pylaeva, 2012; Dainez, 2013; Dainez, Monteiro, Freitas & Cisotto, 2011; Dainez & Smolka, 2014; Kozulin & Gindis, 2007; Vygotsky, 1997). This process is oriented "by the search for full social validity or self-esteem or acceptance" (Vygotsky, 1929; 1997, p.20), where the needs of collective life demand a psychic reorganization involving the whole personality for the creation of alternative routes for development (Dainez & Smolka, 2014; Gindis, 1995; Kozulin & Gindis, 2007; Souza & Barbato, 2019; Vygotsky, 1929; 1997).

In other impairments, feelings of worthlessness would be the primary factor for compensation (Adler, 1967; Vigotsky, 1997), hence Braille, sign language and prosthetics exemplify this process. People with ID, however, due to problems of psychic field-change, which affect psychological functions related to abstraction, generalization and imagination, often display high self-esteem as a trait (Barbato-Bloch, 1997; Lewin, 1945; Vygotsky, 1997), hampering an awareness of the negative associations of ID (Vygotsky, 1997). ID triggers volitional disorders with collateral damage in the development of concrete thinking, reduction in motor intelligence, attention and memory. In practice, people with ID could present little resistance to unfavorable situations, proneness to exhaustion, absence of anomaly awareness, often diagnosed as high esteem, cognitive inflexibility, exemplified by fixation in set activities (Lewin, 1945; Vigotsky, 1997). Physical characteristics such as short stature, thoracic and muscle strength capacity would also be observed (Lewin, 1945; Vigotsky, 1997).

In this approach, there is the understanding that ID traces results from the juncture of primary defect - biological, organic - with a secondary type related to distortions due to social deprivations, acquired in social interactions. Thus, the compensation / overcompensation process would depend on phylogenetics, but more precisely on the kind of cultural development through mediations provided by the other that could lead to disability correction or aggravation (Akhutina & Pylaeva, 2012; Beyer, 1996; Borges & Kittel, 2002; Bottcher, 2012; Dainez, 2013; Feuerstein et al., 2012, 2003; Kozulin & Gindis, 2007).

Mediation is understood as a self-regulating process, occurring in the appropriation of goods and the use of cultural, symbolic and material tools, leading to consciousness transformation through social interactions (Bodrova & Leong, 2007; Pino, 2001; Vygotsky, 1934, 1978, 1997; Wertsch, 2007). This process is displayed through communication / language in different types of human interaction, such as speech, activities, experiences, contemplation, or any situation that generates meanings and allows the person to develop different modes of thought and / or behaviors (Luria, 1990; Vygotsky & Luria, 1934, Wertsch, 2007). It normally takes place in explicit and implicit mode (Wertsch, 2007), where the former refers to interventions previously organized to change the behavior / conduct of the person, such as teaching and remedial practice, while the latter refers to events with considerable developmental impact, which occur in human relations during communication, related to real life problems solutions . Due to its unpredictable nature and outcomes, implicit mediation, being highly affective / emotive (Wertsch, 2007), demands constant processes of adaptation, and can have a significant influence on development. Both processes transpire

in a dynamic, complex and simultaneous way, since even artificially introduced signs can take on a different meaning in the course of human interaction, understood here as co-action (Wertsch, 2007).

In ID, the compensatory process would be channeled through mediations via participation in a social collectivity of TD people, since it is driven by social demands, or requirements of daily life. We would add access to pedagogical practices designed to mitigate ID, with efforts to develop cultural processes of abstract thinking, logical memory, voluntary attention and goal-directed behavior (Akhutina & Phylaeva, 2012; Kozulin & Gindis, 2007; Vygotsky, 1997). In organizing compensatory strategies, it would be imperative to observe development-oriented forces rather than deficits (Akhutina & Phylaeva, 2012; Kozulin & Gindis, 2007; Vygotsky, 1997). Moreover, real life affective motivators are needed to engage with the compensatory process, allowing the person to psychologically regroup in overcoming difficulties that he / she may experience whilst acquiring mediating cultural tools. The emotive factors are crucial since compensation is oriented by the search for social esteem / value regulating emotion and will. According to Vygotsky (1997) it is impossible to view from anything other than an affective standpoint.

Compensation would depend on exchanges between psychological functions, understood as Elementary (EPF) biologically embedded, and the superior culturally acquired set (SPF), (Bodrova & Leong, 2007; Luria, 1990, 1991; Vygotsky, 1997; Tosta, 2012). Human intellect is viewed as an entire system that establishes exchanges between their different functions where not all are affected equally by ID (Akhutina & Pylaeva, 2012; Hazin, Leitão, Garcia, Lemos & Gomes, 2010; Vygotsky, 1997; Vygotsky & Luria, 1930). These exchanges could result in alternative and creative psychological tools to achieve a goal, such as a person who has memory problems and who uses external symbols to remember. Different from direct primary defect-related interventions focusing on EPF, the efficacy of compensation depends on interventions based on high culturally developed mental processes. While the development of EPF would be hampered, in Vygotsky's view, the correction by SPF would be unlimited (Kozulin & Gindis, 2007; Vygotsky, 1997).

This theorization is innovative since it introduces the idea of the reversibility of ID through cultural factors. Before that, ID was historically understood to be an incurable, biological anomaly, located in the brain (Gould, 2014; Kozulin & Gindis, 2007; Vygotsky, 1997) with no differentiation between organic and cultural processes. However, the theorization now unites these factors, adding that ID correction depends on pedagogical practices and social interactions oriented by the affective motivators of daily life.

The compensation / overcompensation thesis has been cited in several studies which emphasize the importance of schooling and inclusion for ID people's development (Dainez, 2013; Dainez & Smolka, 2014; Dias & Oliveira, 2013; Leite & Monteiro, 2008; Rossato & Leonardo, 2011). However, scant empirical evidence is presented to corroborate its developmental function through concepts such as exchange between HPF and EPF functions, strengths and weaknesses of the anomaly, affective motivators and inclusion, through participation in typical social collectivities. Exceptions relate to studies which develop interventive pedagogical methods (Alony & Kozulin, 2007; Feuerstein, Feuerstein, Feuerstein, 2003; Akhutina & Pylaeva, 2012; Kozulin et al., 2010), understood as processes

of explicit mediation, (Wertsch, 2007), but lacking data relevant to the typical social collectivity.

Nowadays, most publications on ID development come from cognitive traditions, so it would be important to know how far current findings could reinforce the compensation / overcompensation theorization. According to previous literature, it has been argued that environmental or organic problems can cause ID. Additionally, there is a tendency among researchers to study syndromes separately, according to case variables (Jarrold, Nadel, & Vicari, 2008; Vianello & Lanfranchi, 2009). In order to access recent advances in the literature and review if it dialogues with compensation theorization, current inquiries on the most studied worldwide neurobiological occurrence of ID, which is Down Syndrome (DS), were reviewed (Bennet, Holmes, & Buckley, 2013; Buckley, Bird, Sacks & Archer, 2006; Daunhauer & Fidler, 2012; Daunhauer et al., 2014; Fidler, Most, & Philofsky, 2008; Jarrold et al., 2008; Lee et al., 2011; Martin, Klusek, Estigarribia, & Roberts, 2009; Roberts & Richmond, 2015; Skotko, Levine, & Goldstein, 2011; Vianello & Lanfranchi, 2009, 2011; Wright, Lewis, & Collins, 2006). The studies selected present empirical data and literature reviews about how DS has been understood in different realms of development, such as language, memory, schooling, methodologies etc. Studies were selected from the Brazilian organization known as CAPES, (Council for Quality and Development in Higher Education) and from Google Scholar through searches for Down syndrome, development, and compensation. Results produced sixty-five publications of which thirteen were selected for analysis. Selective criteria required that items were less than fifteen years old, by researchers showing significant presence in high impact journals. The studies were critically examined, with emphasis on the compensation thesis and principles of historical-cultural psychology (Kozulin & Gindis, 2007; Vygotsky, 1934, 1978, 1984, 1997, 2001; Vygotsky & Luria, 1930; Wertsch, 2007). This work establishes a dialogue between different scientific traditions in the validation of studies that refer to the compensation / overcompensation concept (Vygotsky, 1929, 1997), showing the need to studies developed by means of more dynamic systems perspective and interpretative methodologies (Overton, Molenaar & Lerner, 2015).

## **Findings of the literature review**

In this section, it will be presented aspects of the literature review considered important from the standpoint of the compensation's theorization. Taking into account that in order to compensate it is necessary to understand what needs to be overcome, we focused on the DS general understanding, early development and in the behavioral phenotype or neuropsychological profile on DS, identified by patterns of strengths and weakness. Also, some research related to school learning, study contributions to remediation of ID as scientifically claims for advance in research and methodology.

### **General understanding on Down syndrome and early development**

DS, also known as trisomy-21 is the most-widely studied and most frequent genetic occurrence of ID (Bennett et al., 2013; Daunhauer & Fidler, 2012; Fidler et al., 2008; Jarrold et al., 2008; Lee et al., 2011; Martin et al., 2009; Roberts & Richmond, 2015; Vianello & Lanfranchi, 2009; Wright et al., 2006), occurring in 98% of cases with an extra copy of chromosome 21 (Martin et al., 2009 ; Roberts & Richmond, 2015). In rare cases, it can occur by translocation, when part of chromosome 21 attaches to another, or by

mosaicism, when some cells include its copy. DS is common in all ethnicities and social classes, with an average occurrence of one child in 700 births. The only etiological claim is related to maternal advanced age. In cognitive development, about 80% of cases present moderate ID, despite the occurrence of severe or normal average IQ (Fidler et al., 2008; Martin et al., 2009).

From the 26th week of gestation, up to the age of two and a half months, infants with DS have typical brain morphology, with normal density in the dendrites and in the length of the pyramidal neurons in the prefrontal cortex. After this period, there are progressive differences of diminution of these components. At six months, infants present abnormal brain activity in response to auditory stimuli in cognitive tasks (Roberts & Richmond, 2015). Cognitive development appears to be normal until two years of age, decreasing after this period, possibly due to delays in the level of cerebral myelination (Roberts & Richmond, 2015; Fidler et al., 2008). Roberts and Richmond (2015) suggest that children with DS at pre-school do not have the same delays in memory and learning.

### **The behavioral phenotype or neuropsychological profile on DS**

Studies suggest that DS can be identified through a behavioral phenotype or a neuropsychological profile that is characterized by patterns of relative "strengths and weaknesses" (Martin et al., 2009, p. 14) regarding Executive Functions (EF) (Bennett et al., 2013; Daunhauer & Fidler, 2012; Daunhauer et al., 2014; Martin et al., 2009; Fidler et al., 2008; Jarrold et al., 2008; Lee et al., 2011; Vianello & Lanfranchi, 2009; 2011; Wright et al., 2006). EF are processes of continuous development that involve the necessary skills to control and regulate thoughts, emotions and actions, comprised within the competences of 1) Working Memory (WM), closely related to functional intelligence; 2) Inhibition, or the inhibitory response related to self-control and; 3) Cognitive Flexibility (CF), which is related to creative thinking, the possibility of understanding by different perspectives and rapid adaptation to changes (Diamond, 2013). EF development interferes with human performance in learning, health care, and social interaction (Knap & Morton, 2013; Lee et al., 2011; Roberts & Richmond, 2015). The profile is based on comparative tests between people with DS and those with Typical Development (TD), with compatible Mental Age (MA) (Fidler et al., 2008). There is the understanding that, if not, the outcome would result in lower performance, (Roberts & Richmond, 2015) since the DS cohort presented deficits in all EF when compared with TD peers of the same chronological age (Daunhauer et al., 2014; Bennett et al., 2013; Lee et al., 2011).

### **Weakness in DS**

Previous studies have claimed that one of the main weaknesses in DS is related to poor performance in WM skills (Bennett et al., 2013; Daunhauer et al., 2014; Fidler et al., 2008; Jarrold et al., 2008; Lee et al., 2011; Martin et al., 2009; Vianello & Lanfranchi, 2009) in Verbal Short Term Memory (VSTM) tasks (Bennett et al., ; Daunhauer et al., 2014; Fidler et al., 2008; Jarrold et al., 2008; Lee et al., 2011; Martin et al., 2009; Vianello & Lanfranchi, 2009). WM, or Short Term Memory (STM), is defined by remembering, maintaining, and manipulating information from Short-Term Memory (STM) during complex activities and has a key role in learning, problem solving, planning, and behavior organization (Aben, Stapert, & Blokland, 2012; Cowan, 2008; Jarrold et al., 2008; Bennet et al., 2013). Studies suggest that WM assessment encompasses STM, due to the nature of the tasks for this purpose, which are more complex, requiring STM components in the resolution process (Aben et al., 2012; Bennet et al., 2013). Difficulties in representing or reconstructing verbal

information requiring VSTM is present even in activities that do not require listening or speaking (Jarrold et al., 2008). VSTM may have a major role in language acquisition, especially in grammar and vocabulary development (Jarrold et al., 2008) as it relates to reading skills (Lee et al., 2011). Daily living skills studies (Lee et al., 2011; Daunhauer et al., 2014), involving EF as Inhibition, Cognitive Flexibility point to deficits in verbal memory from an early age, affecting planning and organizing everyday activities. Neuropsychology studies suggest that problems with VSTM and deficits such as CF, WM and Inhibition are related to dysfunction in brain functioning and anatomy in (the prefrontal cortex region (Daunhauer et al., 2014; Knap & Morton, 2013; Jarrold et al., 2008; Lee et al., 2011; Roberts & Richmond, 2015). In addition, people with DS show impairment in Long-Term Memory (LTM), which can be divided into Explicit (ELTM) and Implicit (ILTM). ILTM refers to non-conscious learning / knowledge that can be observed, such “as riding a bicycle” (Jarrold et al., 2008, p.68), while ELTM refers to “memories of conscious facts and events” (Jarrold et al., 2008, p.68; Roberts & Richmond, 2015). Due to difficulties related to Verbal Short Term Memory (VSTM), people with DS present large deficits in relation to the Spatial Long Term Memory (SLTM; Daunhauer et al., 2014; Jarrold et al., 2008; Roberts & Richmond, 2015), especially in tests that evaluate VSTM, as well as difficulties in memorizing physical characteristics of objects (Martin et al., 2009). The LTM difficulties may be related to dysfunctions in the hippocampus (Jonas & Lisman, 2014), where neuro-imaging shows a reduced volume of this region (Jarrold et al., 2008; Roberts & Richmond, 2015). Studies suggest that learning delay may be due to these difficulties, which makes it one of the most researched topics (Aben et al., 2012; Cowen, 2008; Jarrold et al., 2008; Bennet et al., 2013).

Morphological dysfunctions may contribute to an atypical development regarding communication, language, and speech (Buckley et al., 2006; Martin et al., 2009). Approximately two-thirds of children with DS may have conductive hearing loss and / or hearing loss due to Otitis Media (OME). Its incidence has been attributed to dysfunctions in the cranial anatomy and occurs in at least 96% of children with DS. Hearing loss is related to difficulties in grammatical comprehension of morphemes and vocabularies, phonological memory, language comprehension, reading, and the late development of expressive language (Martin et al., 2009). Language in experimental studies is usually understood (Martin et al., 2009) as behavior encompassing areas of syntax, morphology, semantics, pragmatics, and phonology (Martin et al., 2009). Other non-verbal skills such as shared attention, gestures, and imitation play an important role in language development, but are generally considered to be within the sphere of general communication (Klusek, 2017, personal communication). In the pre-verbal phase, children with DS aged 18 to 48 months produced fewer verbal requests for objects than the ones with TD (Martin et al., 2009). Frequency of non-verbal requests for objects or for repetition of events may be associated with delays in expressive oral language development. Due to differences in structures and oral functions, people with DS exhibit phonological difficulties from the pre-verbal stage, suppressing more sounds than TD, producing little intelligibility. These difficulties may be related to speech aphasia, dysarthria, and voice quality, noting that people with DS may have a smaller oral cavity, relatively longer tongue, and a broad and highly curved palate (Martin et al., 2009). In the facial structure there is evidence of additional or poorly differentiated muscles and divergences in the distribution of nerves that may affect speech difficulties and coordination of the articulators (Martin, et al., 2009; Fidler et al., 2008). There is some consensus about difficulties in expressive vocabulary (Martin et al., 2009),

which taken together with the previously mentioned literature, contributes to difficulties in problem-solving that involves other areas of EF (Lee et al., 2011; Daunhauer et al., 2014). Deficiencies in syntactic language skills, both in expressive and receptive domains, are observable from infancy to adulthood (Martin et al., 2009). There are complications in understanding grammatical morphology, such as prepositions and morphemes, and syntactic aspects, such as direct object, indirect object, and the passive voice. On the pragmatic level, studies point to complications in initiating a conversation, topic elaboration, and some linguistic aspects of narratives, with difficulties in orally reproducing stories (Martin et al., 2009). However, in this respect, there are differing views, where researchers attest to forces and other deficits (Fiddler et al., 2008; Martin et al., 2009; Roberts & Richmond, 2015).

Studies suggest that there is a bi-directional relationship between language and literacy, which is understood as the ability to extract meanings from words. However, there is little knowledge about it regarding DS. Difficulties in VSTM may affect language acquisition, communication and literacy processes (Bennett et al., 2013; Jarrold et al., 2008; Martin et al., 2009; Vianello & Lanfranchi, 2009). Yet there is evidence that VSTM deficits cannot be explained by hearing loss or speech problems. Impairment in phonological memory skills may be associated with weakened language comprehension, reduced forms of pronunciation, and reading difficulties. Due to difficulties with phonological memory, people with DS have problems in acquiring reading and writing, especially for complex literary skills. Nonetheless, studies have focused on initial literacy skills, such as phonological recognition and simple word decoding. In the phase between fifty to seventy years of age, people with DS may present dementia, compromising aspects of language, and communication (Martin et al., 2009).

### **Strengths in DS**

Along with difficulties, people with DS can also present strengths (Martin et al., 2009) in some aspects of EF, language, and communication showing performance compatible or superior to that of people of TD, but of the same Mental Age (MA) (Bennett et al., 2013; Daunhauer & Fidler, 2012; Jarrold et al., 2008; Martin et al. 2009; Lee et al., 2011; Vianello & Lanfranchi, 2009; 2011).

Although greater deficiencies are observed in activities that require STVM, individuals with DS often demonstrate better performance in Visio Space Short Term Memory (VSSTM) and/or Spatial Visio Processing (SVP) (Bennett et al., 2013; Daunhauer & Fidler, 2012; Jarrold et al., 2008; Martin et al., 2009; Lee et al., 2011; Vianello & Lanfranchi, 2009) and perception (Martin et al., 2009). Insofar as ELTM is compromised, the same does not occur with ILTM (Jarrold et al., 2008; Roberts & Richmond, 2015). DS participants also show more preserved Spatial Visual Memory learning for Spatial position and Motion (Martin et al., 2009; Jarrold et al., 2008; Roberts & Richmond, 2015), which should be taken into account in amnesia studies and interventive programs (Jarrold et al., 2008).

In pre-verbal language, children with DS present the same frequency of pointing gestures in order to pick up or show objects as those with TD (Martin et al., 2009). In addition, children with DS show imitative representation skills, through gestures and symbols (Wright et al., 2006), understood as a pre-linguistic ability that can predict late language skills (Martin et al., 2009). Contrary to past studies that point to areas of weaknesses (Martin

et al., 2009), some agree that vocabulary, which relates to the ability to recognize words, rather than phonemes, is one area of strength, to the detriment of syntactic abilities (Jarrold et al., 2008). Due to vocabulary skills, the difficulties related to VLTm are not linked to short-term phonological representation or deficiencies of what was heard (Jarrold et al., 2008; Martin et al., 2009). Pragmatically understood as the social use of language, there is still some disagreement among researchers (Fidler et al., 2008; Jarrold et al., 2008; Martin et al., 2009; Vianello & Lanfranchi, 2009; 2011). Some scientists suggest that it is an area of difficulty, especially in some aspects of referential communication (Fidler et al., 2008; Jarrold et al., 2008), whereas others claim the contrary (Vianello & Lanfranchi, 2009; 2011). Strengths include the use of a variety of communicative functions, such as the ability to keep up with a subject, responses to qualification requests, and the ability to retell stories when visual media are used (Martin et al., 2009). There is consensus however that individuals with DS present better performance in receptive language, related to understanding (Daunhauer & Fidler, 2012; Fidler et al., 2008; Lee et al., 2011).

Studies indicate a better performance in core social relatedness skills (Daunhauer & Fidler, 2012; Fidler et al., 2008; Martin et al., 2009), which require interpersonal relations and subjective exchanges, being recognized as forces in the behavioral profile, as long as they do not present evidence(s) of autism (Daunhauer & Fidler, 2012; Fidler et al., 2008; Martin et al., 2009). Imitative skills (Fidler et al., 2008; Martin et al., 2009), more advanced in early childhood (Wright et al., 2006) may play an important role. These abilities, recognized as early non-verbal skills, may explain why children with DS at pre-school age have more playful initiatives, accounting for ease in interpersonal relations. Studies describe people with DS as "engaging, affectionate, communicative, enthusiastic, happy and sociable, more pronounced than TD" (Fidler et al., 2008, p.38). On social development, Skotko et al., (2011) claim that children with DS establish friendships and pro-social behaviors, such as patience, group participation activities, and flexibility. Adolescents and older students demonstrate social competence, considering the quality and frequency of their participation, forming friendships and gaining awareness of how to work and have fun alone and with others. Self-concept studies suggest that people with DS present high self-esteem, describing themselves as happy with their own lives, with positive opinions of their appearance and DS. They also show that people with DS are aware of their ability to make friendships and have feelings of love for friends and family, except in cases where individuals live in isolation (Skotko et al., 2011).

According to Lee et al. (2011) EFs relate to each other, but the processes can distinguish between those most associated with affective issues, named as EF hot, and processes primarily cognitively mediated, such as EF cool. People with DS have higher deficits in the domain of cool executive functions than in hot ones (Daunhauer et al., 2014; Lee et al., 2011). The hot EFs are related to the cerebral development of the ventromedial prefrontal cortex, while cool EFs are linked to the dorsolateral pre-frontal cortex. The marked performance of people with DS in hot EF may be associated with a normal amygdala anatomy, which is a brain structure hypothetically related to emotion regulation. The behavioral phenotype has been proven by studies in neuropsychology, which argue that patterns of strengths and weaknesses can be associated with dysfunctions or preservation of the brain's parts structure (Jarrold et al., 2008). However, there are innumerable variables such as the maturation time of the cerebral structure, the relationship between pre-frontal cortex development, EF and life experiences; evaluation of behaviors such as Inhibition and



Cognitive Flexibility (CF). Moreover, neuro-imaging studies are not able to determine if the differences in brain activity patterns are related to participants age or to different ways of performing the proposed test activity (Knap & Morton, 2013).

### **School learning and education**

Individuals with DS can become literate, if exposed to appropriate instruction and materials. Word identification skills would be linked to VSSTM, supporting the acquisition of reading and writing. However, it is recommended that interventions should focus on improving phonological awareness to acquire better these skills (Martin et al., 2009). Another aspect related to EF improvement is the type of schooling (Buckley et al., 2006; Vianello & Lanfranchi, 2009; 2011).

Comparative studies (Buckley et al., 2006) among people enrolled in special and / or inclusive schools show that the mainstream group presents greater development gains in relation to speech, language, academic benefits in reading, writing, numeracy and social development, related to coping potential and age-appropriate social behavior. Inclusion in mainstream schools makes it possible to align communicative skills with practical and social skills, focusing on the development of reading and writing, as well as supporting speech development. Researchers claim, “it is not possible to provide a maximally effective learning environment in a special education. Children with DS need to learn with their non-disabled peers with the necessary individual support to make this successful” (Buckley et al., p.61). On the other hand, social inclusion, by daily contact with typically developing students, did not improve socially independent skills, social contacts, pleasure activities, and community inclusion, meaning that it did not result in deep affective relationships, such as best friends or dating, so may contribute to a more dependent and isolated life. The opposite happened with those who had access to other groups of disabled people, with a more independent, fuller and social life of their own, due to deeper relationships. Thus, it is important that parents and teachers promote and encourage friendships with disabled peers, including outside school. Vianello and Lanfranchi (2009; 2011) point out that, after participating in school inclusion. their research participants presented better linguistic performance in pragmatic aspects and other EF, evaluated above average in adaptive abilities in comparison with those from other countries. The researchers report that some participants did not receive either private education or participate in adaptive training, indicating that gains were due to school inclusion (Vianello & Lanfranchi, 2011). The authors name the difference as a surplus effect, referring to an increase in IQ in people with DS (Vianello & Lanfranchi, 2009; 2011).

### **Contributions and methodological claims for advances**

Research on the behavioral phenotype of DS has contributed to intervention design in order to provide better development conditions (Bennett et al., 2013; Fidler et al., 2008; Martin et al., 2009). For example, Fidler et al., (2008) point out that self-confidence in interpersonal relationships can be used by teachers to motivate students with DS. Difficulties with verbal memory and facilities with spatial visio memory can guide teacher’s pedagogical work to support verbal information in images. Similarly, interventions should focus on the development of syntactic arrangement in language in order to improve expressiveness (Martin et al., 2009). The study’s findings contributed to technological interventional programs such as computerized activities in Visio Spatial Memory for substantial and lasting gains in skills such as verbal and behavioral memory (Bennett et al., 2013).

Despite the innovations, researchers agree that the behavior of people with DS cannot be explained by simple patterns of strengths and weaknesses, drawing attention to the need for the production or development of dynamic perspectives that link aspects of social and cognitive development (Fidler et al., 2008; Roberts & Richmond, 2015). In this manner, contextual theories have been developed (Fidler et al., 2008), such as the Indirect Effect on Genetic Disorders (IEGD), where phenotypic characteristics impact upon the behavior of children as well as upon those who are part of the surrounding environment, such as family and peers. It also attempts to expand the behavioral phenotype by processes of self-organization, from dynamics between cognitive and social components. Evidence indicates that people with DS have poor persistence in more challenging cognitive tasks and overconfidence in interpersonal relationships. It can be argued that a process of self-orientation may cause these characteristics where such people, when faced with difficulties related to functional intelligence, use social skills to avoid tasks. This personality style, with little motivation to perform cognitive tasks and overconfidence in social strategies, may be the result of one or two deficiencies in primary issues, biologically derived from trisomy, to dysfunctions in brain development. The convergence of these relational aspects generates epiphenomena's, perceived as secondary characteristics of the phenotype (Fidler et al., 2008).

Despite this, much of the knowledge about DS is based on static human functioning perspectives, which allow access to actions in detached fields and over a specific period of time. There is a lack of studies that focus on processes of change that take into account the interaction between biological and cultural factors in development (Filder et al., 2008). Advances from laboratory reports into descriptions of EF in daily skills are necessary, such as planning and inhibition, essential for DS people to exist in society, with more possibilities of empowerment (Lee et al., 2011). Furthermore, most studies are carried out upon children with the justification of clarifying the nature of the deficiencies and the functions affected, for the planning of subsequent intervention methods (Bennett et al., 2013; Daunhauer & Fidler, 2012; Jarrold et al., 2008; Lee et al., 2011; Vianello & Lanfranchi, 2009; 2011). This suggests a need for studies on these functions in DS youths and adults (Roberts & Richmond, 2015). Longitudinal studies would be alternatives to further understand the development of EF (Filder et al., 2008; Lee et al., 2011; Roberts & Richmond, 2015) and its dynamics from childhood to adulthood.

## Discussion

From the above, it is possible to build a dialogue between compensation theorization and current studies. The analyses contributed to validating some of the main claims, and also furthered consideration(s) about possible advances in DI / DS developmental studies, showing the need for more dynamic systems perspectives (Vygotsky, 1997; Overton et al., 2015), although only one (Lee et al., 2011) refers to culturalist studies (Bodrova & Leong, 2007).

### Similarities in understanding and methodologies

The research methodology is the same as that adopted by Vygotsky (1997) in his defectology inquiries. In addition, there is a distinction between ID cases for biological and cultural / environmental issues. Cognitive difficulties in DS that begin at the age of two, corroborate studies in the argument that this period comprises the genesis of the interaction between thought and language (Barbato-Block, 1997; Vygotsky, 1934; 1978; 2001). Accordingly, the differences are due to difficulties in the dynamic of imaginative development processes, which are more related to EF- oriented cognitive flexibility (Barbato-Block, 1997). The emphasis given to the behavioral phenotype of DS, characterized by patterns of relative "strengths and weaknesses" is understood to be an important advance, since it corroborates the compensation claim that ID does not affect all the psychological functions with the same intensity, allowing exchanges between HPF and EPF. Also, it dialogues with Vygotsky (1997) and Luria (1961) claims that human intellect makes up a unique interconnected system where not all functions are affected equally by ID, with the possibility of overcompensation through exchanges between functions. It relates to the wider view of EFs (Bennet et al., 2013; Knap & Morton, 2013; Jarrold et al., 2008) and how intervention training methods designed to improve some EF's, end up correcting others.

By attesting that school inclusion promotes speech, language, and literacy to a greater extent than education in special schools, the studies suggest that opportunities for implicit mediation (Wertsch, 2007) may favor the development of DS individuals. These positive results corroborate some of the key aspects of compensatory development, namely, participation in typical social collectivities, such as mainstream schools, abstract learning, and possible affective motivators elicited by co-existence with non-disabled cultures, (Bennett et al., 2013; Buckley et al., 2006; Lee et al., 2011; Vianello & Lanfranchi, 2009; 2011). Inclusive environments may place DS students in Proximal Development Zones of implicit mediation, even if the joint practices are not so intentionally collaborative from non-disabled peers. It may allow processes of language adaptation, thought imitation, deduction, and other forms of cultural practice acquisition (Vygotsky, 1997). Studies indicate that some people with ID prefer to study in traditional education, despite discriminatory situations, as they understand these spaces as potential sites for learning that in turn facilitate professionalization and independence (Souza & Almeida, 2013; Veltrone & Mendes, 2011; 2009). These meanings, along with the access to the Basic Education curriculum and interactions with typical peers, may trigger affective motivators, where some can aim for the same cultural goals of the typical group, aspiring to valued social positions, enabled by schooling.

**Possible contributions**

As shown above, there are similarities between the studies' conclusions and compensation theorization. However, it is possible to make some observations that may favor advances in ID / DS developmental studies.

From a socio-cultural perspective, the current interventions in DS favor more the development of EPF, concerning the primary defect, focusing on environmental perception and stimulation, with few opportunities to observe and promote forms of implicit mediation, with real life affective motivators. In the review, there is reference to the attempt to expand the behavioral phenotype by processes of self-organization that in part relates to the disontogenesis. However, the interpretation that DS people may use their social skills as way of avoiding more challenging cognitive tasks, suggests a focus on deficit expansion, rather than as a benefit for development. The tendency to avoid more difficult tasks has been observed since the studies of Lewin (1945), yet this result can be related to methodologies that do not allow the access of this EF in real life activities (Harré, 2012; Souza, 2019; Vygotsky, 1997). Social skills more related to emotions can be imperative for facing cognitive challenges, such as reading, writing, and language. Moreover, well established interpersonal relationships normally require the development of EF aspects, such as Inhibition and Cognitive Flexibility, which are crucial to an independent and fuller life in society, with regards to compensation. In other words, interpersonal relationships are responsible for long standing emotive processes that can redirect people's motivations (Lazarus, 2006a; 2006b; Moors et al., 2013). In practical life, these characteristics may have another function, not of deficit, but development promotion even in more cognitive challenges. For example, take a person with DS that may perceive a mainstream school as a means to achieve their personal goals. Cognitive Inflexibility, which hampers ID awareness (Lewin, 1945; Vygotsky, 1997) and is associated with fixation in activities, like stubbornness, may orient actions towards an engagement in learning and to softening negative feelings from possible prejudice or stigma. Allied to social relatedness skills, these peculiarities may allow individuals to keep on attending inclusive spaces and benefiting from them. According to Vygotsky, (1997, p. 286) "Life naturally determines consciousness". In this manner, it would be interesting to investigate if people with DS avoid cognitive tasks when they are related to their personal motivations.

An important finding was related to the positive interpretation that people with DS who participate in mainstream schools have friendships with disabled peers, in order to develop deeper bonds (Buckley et al., 2006). Some qualitative studies interpret this as a negative aspect of inclusion. In this sense, researchers should focus on the extent to which interpersonal relationships with disabled peers have negative or positive impact on the developmental process, especially related to school learning.

As to the proposal for a more dynamic investigative approach to DS / ID, narratives in discursive and analytical procedure are seen as a methodological alternative (Harré, 2012). It allows explanations of motivations for engagement or refusal to perform this or that action that can be associated with EF.

Principally, however, it is important an expansion of the language concept. Researchers of this review agree, "Words and sentences are the foundation for mental development. We think reason and remember by making use of spoken language, even in silence and in our minds" (Buckley et al., 2006, p.7). Likewise, gestures used by people during an interaction

are always situated within contexts and within a linguistic system in a given culture. Even pre-verbal private speech is not disconnected, since it is associated with problem solving and therefore thought (Vygotsky & Luria, 1934; Luria, 1961). The consideration of what would be expressive language in a laboratory or in a real conversation, equivalent to the social use of language (Bakhtin, 2012), may be an important variable in the debate on pragmatic aspects identified in those studies. Pragmatic studies consider gestures and other communicative forms as language, or as materializations of socio-communicative usages of language in interaction.

The studies were not found to mention the main claim of compensation that people with ID would achieve the same cultural development goals / results as those with TD. However, we suggest that this phenomenon has been occurring, possibly due to the greater possibilities of inclusive schooling allied to special education. Nowadays, people with DS, adults and youth, are occupying and achieving social positions that would have been unthinkable a few decades ago, since they demand skills in cool EF. It is important for researchers in these cases to focus on the role of emotive processes in goal-oriented actions (Lazarus, 2006a; Moors et al, 2013; Scherer, 2005, Valsiner, 2005; Vygotsky, 1997). It would be interesting to understand if the same weakness were to be observed in real life events, especially in individuals who take part in typical social collectivities such as school or work.

## **Final considerations**

Compensation theorization dialogues with empirical research in both neurology and experimental psychology. For further advances, implicit mediation studies are suggested, in real life / natural situations, especially with individuals who have access to inclusive environments. Narratives focused on explanations of experience and action are a methodological alternative, as long they consider in particular the interpretations of ID / DS participants, those who may evince compensation for a full and independent life, and carrying out activities that require EF normally impaired by ID. In this sense, the possibility of empirical indicators on ID compensation can be glimpsed, which envisage the affective motivators in the social interactions of real life.

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