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Executive function assessment in children with ASD through ENFEN: Guidance for teachers

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Abstract

During the recent years there are an increasing number of children diagnosed with Autism Spectrum Disorder (ASD) in the schools. Some studies have shown that IQ is a good indicator of their social behaviour, but it cannot give a total explanation. Other researches considered executive functions have an important role both in the social and cognitive deficits in children diagnosed with ASD. Ten children with ASD were assessed through ENFEN and WISC-IV at three schools into a competitive research (I+D+i 2010:19478). The aim is to evaluate the performance of ENFEN as a tool to determine these executive functions (planning, inhibition response, working memory and mental flexibility) more related to the diagnosis with ASD. The results suggest children with ASD show lower performance in executive function, mainly planning and mental flexibility. Besides, a relation between ENFEN, IQ and ADI-R exists whereby children with fewer difficulties in ENFEN performance get a higher IQ and simultaneously lower scores on the ADI-R. Some educational strategies for children with ASD were suggested in order to improve their executive functions in the classroom.

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Keywods: ASD, executive function, IQ, ENFEN, educational strategies

1. Introduction

During the last decade there has been an increasing number of students diagnosed with Autism Spectrum Disorder (ASD) which, according to the DSM-V, is a qualitative disorder of social communication and interaction, including behavioural alterations, which hinders social inclusion and participation of students in the daily activities within the school context (Zingerevich & LaVesser, 2009).

Moreover, 70% of people diagnosed with ASD show signs of being intellectually challenged (Fombonne, 2003 Volkmar & Pauls 2003 Bertrand, Mars, Boyle Bove, Yeargin-Allsopp & Deco, 2001 Chakrabarti & Fombonne , 2005), while others have an intellectual capacity that is above average (Miller & Ozonoff, 2000).

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Studies show that the Intelligence Quotient (IQ) is a predictor of social behaviour but it does not go all the way to fully explaining it. Volkmar & Pauls (2003) conclude that the intellectual level and communicative skills of people with ASD should be considered the best predictors of behaviour during people's lives. Other studies show that executive functions also play an important role in the social and cognitive deficits in children diagnosed with ASD (De Bruin, Verherij & Ferdinand, 2006 Ghaziuddin and Mountain-Kimchi, 2004, Happe, Booth, Charlton & Hughes , 2006 Kenworthy, Yerys, Anthony & Wallace, 2008 Semrud-Clikeman, Walkowiak, Wilkinson & Butcher, 2010, among others) as well as behavioural and emotional control (Anderson, Northam, Hendy & Wrennall, 2001).

The executive function is a general concept that refers to mental processes that enable physical, cognitive and emotional self-control (Denckla, 1996 Lezak, 1995, Pennington and Ozonoff, 1996), which is required to maintain effective behaviour directed at an objective (Welsh and Pennington, 1988 Donders, 2002 Nyden, Gillber, Hjelmquist & Heiman, 1999). Most studies of neuropsychological executive functions carried out on people diagnosed with ASD suggest that they have difficulties in controlling response inhibition and a slowing of information processing (Bishop and Norbury, 2005 Fernandez-Duque, Baird & Posner, 2000, Schmitz, Blonde, Daly, Smith, Williams & Murphy, 2006, among others).

Finally, Zingerevich & LaVesser (2009) suggest that due to the increase of students diagnosed with ASD, teachers in schools should include systematic strategies such as: how to plan actions to achieve goals, the adoption of measures in accordance with these plans, accuracy control and the modification of actions as needed.

In this competitive research paper on *Improvement in the educational response through good inclusive practice in schools* (I+D+i 2010:19478), we hope to assess whether the ENFEN (Portellano, Martinez-Arias and Zumarraga, 2009), a neuropsychological assessment battery of executive functions, will enable us to outline those functions more closely related to an ASD diagnosis and, therefore, give us a series of guidelines for teachers to improve the executive functions of students diagnosed with ASD within the school context.

2. Method

2.1. Participants

Twenty students from three primary schools, aged between 6 and 12 years old, participated in our study. Students who had multi-diagnostic problems and whose IQ was below 45 or had serious problems of language or behaviour were excluded. Finally, the representative sample consists of 10 students diagnosed with ASD according to the ADI-R (Le Couteur, Lord & Rutter, 2006). All of them were in regular classroom with support personal or special educational classroom.

Table 1: Students diagnosed with ASD according to the ADI-R; A) Reciprocal social interactions B) Language and communication C) Repetitive and stereotyped restricted behaviour and interests.

	ADI-R (subfactors)			
Subject	**ADI-R A**	**ADI-R B**	**ADI-R C**	**Diagnosis**
1 – Male	26	12	5	Autism
2 – Male	17	9	1	PDD-NOS
3 – Male	26	14	5	Autism
4 – Male	17	5	4	PDD-NOS
5 – Male	15	5	7	Asperger
6 – Male	10	15	8	Autism
7 – Male	16	8	10	PDD-NOS
8 – Male	13	8	5	Asperger
9 – Female	22	15	5	Autism
10 – Female	13	10	1	PDD-NOS

2.2. Instruments

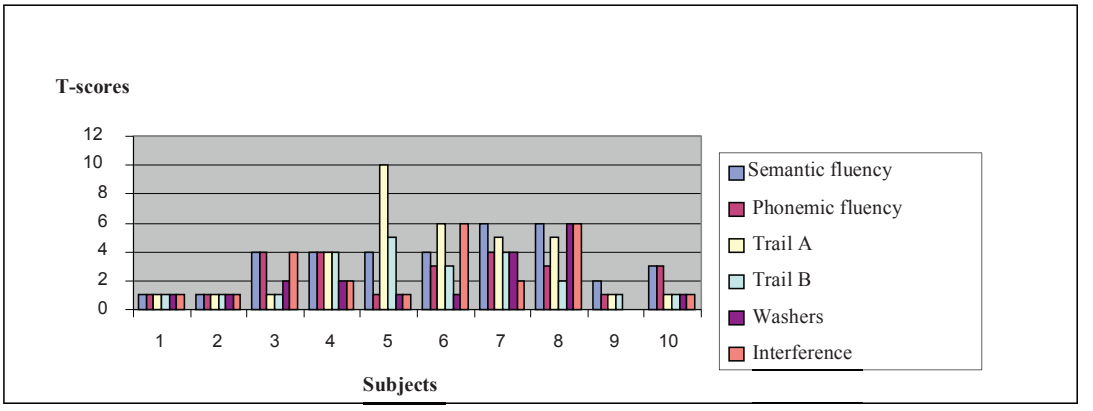
All participants in the study were assessed through ENFEN and WISC-IV (Weschler, 2005). The WISC-IV is an intelligence test that gives information on the intellectual abilities of children, both on a general level (total IQ) as well as in terms of verbal comprehension, perceptual reasoning, working memory and information processing speed. It consists of 15 tests, 10 compulsory and 5 optional, which were given to the subjects of the sample within the school context in order to know their IQ.

ENFEN, on the other hand, is a new battery of tests used to evaluate the overall development of maturity in boys between 6 and 12 years of age stemming from the study of executive functions. The battery consists of four tests: verbal fluency, trails, washers and resistance to interference which assess mental flexibility, working memory, planning and response inhibition, respectively.

Finally, ADI-R is a clinical interview which allows a thorough evaluation of individuals with ASD. It relies mainly on behaviour rarely found in those without ASD. The interviewer explores four areas or sub-factors: A) reciprocal social interactions B) language and communication C) restricted, repetitive and stereotyped patterns of behaviour and interests D) alterations in development that are evident at or earlier than 36 months through questions asked of the parent or caregiver. This last area has not been taken account in this paper.

3. Results

Figure 1 presents the scores obtained by the subjects in ENFEN. We can see that students who obtain higher scores in this battery of tests are subjects 4, 5, 6, 7 and 8. However, there are differences between them: subjects 4, 5 and 7 have more difficulties in the planning of tasks and inhibition of stimuli, while subjects 6 and 8 have more difficulties in working memory. Furthermore, subjects 1, 2 and 9 obtain the lowest scores across the board on all items, while subjects 3 and 10 improve in the test of mental flexibility.



Graphic 1: ENFEN: T-scores

Of these students, subjects 2, 5, 6, 7 and 8 are located within the highest total IQ and, apart from subject 2, they are the same as those that obtain the lowest scores on the ADI-R (reciprocal social interactions sub-factor). Students who get the lowest scores on the ADI-R (language and communication sub-factor) are subjects 4, 5, 7 and 8. Subjects 2, 4 and 10 obtain the lowest scores on the ADI-R (restricted, repetitive and stereotyped patterns of behaviour and interests).

Taula 2: IQ dels subjectes de la mostra

Subject	1	2	3	4	5	6	7	8	9	10
IQ	62	87	75	71	81	100	117	122	49	70

4. Conclusions

The results show that students with less difficulty in ENFEN obtain a higher IQ and, in time, lower scores on the ADI-R (reciprocal, social interactions sub-factor as well as language and communication sub-factor but not the restricted, repetitive and stereotyped patterns of behaviour and interests sub-factor). We must keep in mind that the reciprocal social interactions sub-factor and the communication language sub-factor can be related to mental rigidity and with the lack of planning those students with ASD show. This can also be related to the difficulties students with ASD have with respect to response inhibition to a particular stimulus. Nor can we find a strong relationship between the presence of repetitive behaviours and executive functions (Joseph & Tager-Flusberg, 2004).

However, this claim is not met in 100% of cases due, in part, to the heterogeneity of the sample in terms of age, IQ, the diagnosis and sub-factors of the sample, as well as the skills developed (Martos-Perez and Paula Perez, 2011). It is important to note that in order to properly assess executive functions, the age of the subject must be taken into consideration. For example, subject 2 of the sample is a 7 year-old student who repeated kindergarden due to his/her low development in the skills proper of his/her age; when he/she did the tests, it was just after starting primary school. Therefore, the evolution of this subject needs to be analysed.

Moreover, the subjects of this study show a variability in the executive functions evaluated showing more difficulties in mental flexibility and response inhibition, in accordance with the conclusions of the theoretical review conducted by Sanders et al (2008). However, this study also found lower responses in planning and work memory.

At the same time, although lower scores on executive functions in those students with a lower IQ were found, we would need to go deeper into the relationship that can be established between intellectual disability and executive functions (Rodriguez Jimenez, Lopez Risco, Rubio García and Gómez Jiménez, 2011).

As we have seen in our study, all executive functions evaluated need to be improved. Following is a presentation of some proposals to incorporate into the curriculum of primary education through various activities.

With respect to mental flexibility, it is recommended to make lists of words that begin with the letter to work on (S, C, A ...) or make lists of words containing these letters. It is also possible to work from drawings classified according to the letter they begin with or according to the letters they contain or by making word associations according to semantic categories.

In terms of work memory, it is necessary for students to perform mental arithmetic exercises, incorporating the time factor while carrying out the task and observing if it takes less time to make the calculation. It is also possible to give exercises a specific numerical series or symbols at a given time interval.

In order to improve planning it is recommended that subjects do puzzles, play tangram or chess.

Finally, in order to work the skills of response inhibition, we must eliminate distracting elements of the subjects' environment; work in a neutral environment without anything that might distract them such as toys or noise in order to focus their attention.

Given the results of this study, we conclude that, although the ENFEN can be a good tool for assessing executive functions in children with ASD, other tests are needed on executive functions to check the consistency of the results, bearing in mind that the sample needs to be enlarged and its heterogeneity reduced.

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