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## Relationship Between the Socio-Educational Context and the Cognitive Performance Based on the WISC-IV Index Scores

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### Abstract

Background: National and international studies attach special importance to the shared social and educational environment as an explanatory variable for intellectual performance in psychometric tests. Objective: To analyse the relationship between maternal education, number of books available at home, school starting age and extracurricular activities -as variables to measure socioeconomic, educational and environmental level- with WISC-IV level cognitive production. Method: A survey was implemented to 154 children, aged 6 to 12, who attend public schools<sup>2</sup> in the city of San Luis (Argentina). This sociodemographic survey was designed ad hoc and was implemented together with the Argentine version of the Wechsler Intelligence Scale for Children. ANOVA and Student's t-Tests were used to analyse the differences between the variables proposed from the data obtained and WISC-IV. Results: Associations were found between mothers' educational level and their children's Verbal Comprehension Production, Perceptual Reasoning, Working

<sup>1</sup> CONICET stands for *Consejo Nacional de Investigaciones Científicas y Técnicas* (National Scientific and Technical Research Council), and it is the main organization in charge of the promotion of Science and Technology in Argentina.

<sup>2</sup> Public schools are part of the free public education and commonly include kindergarten, primary and secondary schools.

Memory and total IQ. In addition, significant differences were found between number of books available at home, school starting age, extracurricular activities and some WISC-IV index scores. Conclusion: the need to acknowledge the socio-environmental factors to develop a proper interpretation of the test production is ratified. In this context, an extended and integrated diagnostic device is proposed as a means to capture the complex scheme that emerges from the combination of capacities consolidated thanks to the stimulation provided by the environment and the development of specific abilities less influenced by environmental factors.

**Keywords:** intellectual capacity - WISC -IV – childhood – socio-educational context

## Introduction

Latest generation conceptual matrices show that genetic programming requires environmental stimulation to complete the task started by the genome. When meeting others, neuronal circuits from the brain hemispheres evolve with the specificities that are then turned into the integration areas self-representation, the world around, constitutive systems of different cognitive abilities; as a consequence, ways of being and behaving with the animate and inanimate world are outlined (Gallese, 2011; Kandel, Schwartz y Jessell, 2001; Lecannelier, 2006; Sadurní, 2011).

From this perspective, human development, and particularly the evolution of cognitive functions is shaped as an open and complex organization, in an interplay with permanence and changes that accompany the evolutionary path, immersed in a specific time and contextual space, and influenced by them. Every intellectual potentiality and difficulty is developed in the crosslinking with the cultural and family environments. Recent studies give special importance to the shared environment, to parents' education, and mainly to the mother's, as some possible variables to account for children's intellectual development and school performance. (Labin, Brenlla y Taborda, 2015; Fuica, Lira, Alvarado, Araneda, Lillo, Miranda, Tenorio y Perez-Salas, 2014; Brenlla y Taborda, 2013). To disregard the fact already mentioned is detrimental both to interpret the results obtained in psychometric tests and to advance health promotion programs (Fletcher-Janzen, 2010; Flanagan y Kaufman, 2006).

From this perspective, the research study in course focusses on the study of the potential influences of the stimulation received from the sociocultural environment in the interplay of crystallized and fluid abilities to solve the items in the Argentine version of the fourth edition of the Wechsler Intelligence Scale for Children (WISC-IV).

The author of the test defined intelligence as the individual's global capacity to behave with intention, think rationally and act in an effective way with his surroundings. The

scale's fourth version takes into account the advances in psychometry, neurosciences and the "Hierarchy Theory of Intelligence" (CHC), developed from the proposals by Cattell, Horn and Carroll, in an attempt to introduce the differentiated evaluation of crystallized abilities –explored from the Verbal Comprehension Index–, of fluid reasoning processes –analysed from the Processing Speed, Working Memory and Perceptual Reasoning Index scores–; at the same time the test measures global intelligence in an accurate way. In Argentina, there are very few current bibliographic reports on the cognitive domains based on this psychometric instrument. There are studies developed only in Buenos Aires –both in Capital Federal and the surrounding areas (conurbano bonaerense). Consequently, it is worth expanding and replicating these studies in the rest of the country. The main purpose is to provide valid evidences for the analysis based on the test in different socio-educational contexts, following the guidelines provided by the International Test Commission in relation to the responsible use of psychological instruments.

## **Method**

### Participants

The sample was made up of 154 children, aged 6 to 12, and divided in groups according to their ages. The group had 89 boys and 65 girls, all of whom attend public schools in the city of San Luis (Argentina). Children and parents accepted to participate willingly; they were chosen using a purposive sampling method.

### Instruments

I) Survey: it was designed ad hoc with the aim of exploring the maternal academic antecedents, children's previous school experiences, number of books available at home and the children's extracurricular activities. All the variables mentioned were taken as proxy indicators to measure socio-educational stimulation.

II) The Argentine version of the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV) (Taborda, Barbenza y Brenlla, 2011). This instrument is administered individually and evaluates subject's global intelligence (FSIQ) through composite scores: Verbal Comprehension (VCI), Perceptual Reasoning (PRI), Working Memory (WMI) and Processing Speed (PSI).

### Design and procedure

Once the educational institutions gave permission to carry out the study, parents and children were informed about the methodology of work. Those who decided to participate signed an informed consent. After that, the socio-demographic survey was administered to mothers and the complete version of WISC-IV was administered to children in two meetings. Then, the protocols were scored blind by two professionals.

A descriptive design was implemented together with a quantitative methodology. From the results obtained, tests for normality of distribution tests and variance

homogeneity were applied, so as to ensure the proper use of normality tests in the variance analysis (ANOVA) and Student's t-test. In order to know if the variable maternal educational level has significant effects, the group was divided into three groups. The first group was made up of children whose mothers had incomplete primary or secondary schooling (less than 12 years of education). The second group was made by subjects whose mothers had 12 years of education, which means they have finished secondary school. The third group was made up of children whose mothers have been to University or to a tertiary level institution (more than 12 years of education). The variable books at home was computerized into two groups; group 1: 1-25 books and group 2: more than 26 books. The variable extracurricular activities was also taken into account. In relation to the variable school starting age, the first group was formed by children who started maternal education at the age of 1, 2 or 3; while in the second group children started school at the age of 4 or 5.

## Results

Variance analysis showed significant differences between maternal educational level and the VIC measures [F (2;149) = 14.92; p = .000]; PRI [F (2;149)= 7.88; p = .001]; WMI [F (2; 149)= 11.30; p = .000]; and FSIQ [F (2; 149)= 14.33; p = .000] but not for PSI [F (2; 149)= 1.74; p = .169]. Post hoc tests reveal that there are differences between the group of children whose mothers have a lower educational level and the groups of children whose mothers have 12 or more years of education. The association between number of books at home and WISC-IV scores has a significant impact on mean scores PRI [t (2.32)= .007; p=.021], WMI [t (2.23)= .152; p=.027], and FSIQ [t (2.36)= .529; p=.020]. Similarly, the analysis of differences in WISC-IV mean scores in relation to the beginning of early childhood education showed differences in the groups studied only in FSIQ [group 1: M= 97.50, SD = 11.39; group 2: M = 92.69, DE = 12.62; t (2.1)=.503; p= .034]. In relation to WISC-IV differences according to extracurricular activities, significant differences were recorded for the VCI measures [extracurricular activities: M= 94.53, SD =12.17; subjects that do not do any extracurricular activities: M =89.19, SD =12.28; t (2.50)=.686; p= .013]; WMI [subjects that do extracurricular activities: M= 100.10, SD = 11.80; subjects that do not do any extracurricular activities: M = 93.79, SD = 13.63; t (.2.96)=.042; p=.004], PSI [subjects that do extracurricular activities: M= 102.07, SD = 12.28; subjects that do not do any extracurricular activities: M= 97.09, SD = 12.90; t (2.37) =.693 ; p= .019] and FSIQ [subjects that do extracurricular activities: M= 96.97, SD = 11.06; subjects that do not do extracurricular activities: M = 91.21, SD = 13.45; t (2.79) = .729; p= .006].

## Discussion

The purpose of this article is to analyse the differences in the performance of children in tasks that imply the use of crystallized and fluid abilities, according to the socio-educational conditions.

The results obtained show associations between maternal education level and their children's VCI, PRI, WMI and FSIQ. In this sense, significant differences were found between number of books at home and indexes VC, PR and FSIQ; significant differences were also found between most indexes and extracurricular activities. Differences were significant for FSIQ in relation to school starting age. These differences clearly blur in the other domains evaluated.

The data obtained show the impact of environmental variables in the consolidation of crystallized abilities and in the cognitive processes that imply the use of fluid reasoning domains such as attention, concentration, ability to maintain in the conscience information that is activity and can render results. Environmental variables also exert an influence on concept formation and recognition, perception of pattern relationships and understanding implications. On the other hand, in the processing speed tests that imply abilities to combine visual stimuli, non-related patterns or partially hidden patterns, production is homogeneous in the groups studied; so, it can be said that these activities depend very little on environmental stimuli. (Flanagan, 1998).

As a consequence, access to artistic, sports and cultural extracurricular activities and to a bigger number of verbal, perceptual and scientific stimuli provided by mothers with large academic training correlates with unequal access to socio-educational opportunities in the future. In this sense, there is evidence of the limitations to consolidate crystallized and fluid abilities reflected in the cultural transmission from generation to generation. What has been outlined above is congruent with several updated research studies that evidence the existence of a mutual codetermination between subjectivity, environment, sociohistorical context, genetic vulnerability and brain development (Rebollo, Carriquiry, Christophersen, y Rodríguez, 2010; Kandel, 2007).

From the perspective outlined above, the use of psychometric instruments is understood as a testing method that should be complemented with cross-sectional studies: qualitative interpretation, clinical analysis of results and study of recurrences throughout the whole clinical diagnosis and/or educational process. Therefore, the use of an extended and integrated diagnostic device is proposed, a device that takes into account the complexities and the relevance of psychological evaluation for a person's life. Extended diagnosis is the implementation of test-retest techniques so as to evaluate the symptoms evolution –after six months or a whole year of treatment, depending on the disturbance observed at the beginning– before delivering categorical diagnoses (Brenlla y Taborda, 2013).

In this sense, it is advisable to have a test taker that understands the child and the group he/she belongs to and the socio environmental factors surrounding him/her to develop a broader interpretation of the production registered in the WISC-IV. At the same time, the results show the importance of outlining public policies to bridge the current sociocultural gap through the design of specific stimulation programmes.

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