

Evaluation of selective attention in 9- to-11-year-old children

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Abstract- The study proposes an analysis of selective attention in a population of students between 9 and 11 years old, for the evaluation process the stroop test has been used, the proposed activity is important for their learning process because they are training and neurological development; The study proposes a population of 135 students from various educational units of the Ambato canton, Ecuador; obtaining results: 127 (94%) students had a positive score equivalent to “Normal attention”, said students have adequately inhibited the automatic response found in the reagent; and on the other hand, 8 (6%) students obtain negative evaluations, which means that they have “attention deficit” due to different factors specific to each one that will be analyzed later.

Keywords: *Selective attention, Stroop, treatment*

Resumen- El estudio plantea un análisis de atención selectiva en una población de estudiantes entre 9 y 11 años, para el proceso de evaluación se ha utilizado prueba stroop, la actividad propuesta es importante para su proceso de aprendizaje debido que están formación y desarrollo neurológico; el estudio plantea una población de 135 educandos de varias unidades educativas del cantón Ambato, Ecuador; obteniendo resultados: 127 (94%) estudiantes puntaje positivo equivalente a “Atención normal”, dichos estudiantes han inhibido adecuadamente la respuesta automática que se encuentra en el reactivo; y por otra parte 8 (6%) estudiantes obtienen evaluaciones negativas lo que significa que poseen “déficit de atención” por diferentes factores específicos de cada uno que se analizarán posteriormente.

Palabras clave: *Atención selectiva, Stroop, tratamiento*

1. INTRODUCTION

Attention has been studied from different approaches over time, it is important to highlight that from the scientific perspective of clinical psychology and neuropsychology attention is the process that is part of the higher cognitive functions of human beings (Chen, Herrera, & Hwang, 2018).

It has not managed to homogenize its various definitions; it is about a process that is activated instantaneously in all human beings before the large number of stimuli to which we are permanently exposed (Huang, Wang, Chen, & Wei, 2019).

The attentional process is evidenced by limiting or filtering the amount of information we receive and allowing only the stimulus or stimuli that are most relevant through the sense

organs to enter the central nervous system (Marotta, Caballero, Lupiáñez, & Arrows, 2018).

It is directly related to the executive functions located at the level of the prefrontal cortex of the frontal lobe. Within the higher cognitive functions, several of them can be cited such as memory, thinking, attention, among others. Attention is considered as a complex process where the human being interacts with the environment obtaining stimuli, it can be of different types, among these we can refer to selective attention whose characteristics stand out in placing attention on outstanding (external) stimuli preventing other less notable stimuli from generating distractors (Motesa, y otros, 2018).

Evolutionary theories and cognitive functions evolve according to the age of the individual so that as the years go by, higher functions such as attention and its types improve notably (Guillamón, García, & Martínez, 2021).

Higher cognitive processes are different depending on the study carried out, it cannot be guaranteed that the evaluation is generalized, at school ages it can be shown that the attentional processes are diverse, children between 9 and 11 years old present attentional processes that in some cases have different types of affectation typical of their age, taking into account that this stage is full of stimuli, it is taken as a "training process" that benefits the different types of attention to perfection (Carpio, 2020).

Selective attention has immersed characteristics of inhibitory control and processing speed, these particularities are stimulative, i.e. they can be trained over time so that their function shows significant improvements. Inhibition and processing speed are only two of the important cognitive mechanisms at play in human cognitive activities (Introzzi, Aydmune, Zamora, & Vernucci, 2019).

If the perspective of the clinical psychopathology framework is considered then the attention and the higher functions can undergo alterations throughout life. Most affectations are evidenced precisely at school age since it is this stage of life where the human being brings into play his

attentional skills to be able to abstract external information that allows him to acquire new knowledge (Wray, y otros, 2017).

A large part of children's attentional problems is related to the learning processes to which they are subjected within the school system (Lagos, Pizarro, & Fuentes, 2019).

When focusing the theory on the brain, it is necessary to emphasize that it is conceived as an integral structure since it brings as a whole, its different cortexes and various divisions participate in each of the processes that the system performs, although it is also true that according to the function that is performed, some areas will take more prominence than others.

Within the neuropsychological bases of attention, it should be noted that this higher function and its different types rely on the functioning of several important brain structures such as the ascending reticular activating system, also known as ARAS, this system is defined in an elementary way, the most basic level to initiate the attentional process, seeing it from the perspective that to be able to pay attention to a stimulus requires that our whole system be ready to perceive. Tone and wakefulness, which are indispensable aspects in the higher cognitive processes, including attention, allow the system - the body - to maintain a state of alertness, which causes it to be receptive to stimulation and preparation, thus allowing it to provide a correct response (Portellano, 2019).

The reticular formation, located in the brain stem, has connections with most of the regions of the cortex and is responsible for maintaining the level of alertness.

The superior colliculi located in the midbrain participate in the changes of attentional stimuli related to visual stimuli, the superior colliculi favor the focus of attention to new places or objects by controlling eye movements responsible for bringing peripheral stimuli to the visual area.

The basal ganglia are a formation of subcortical nuclei surrounding the thalamus, the most prominent is the caudate followed by the putamen and the globus pallidus located between the thalamus and the insula. Their function is motor, they are activated in selection, perception, and responses.

The pulvinar nucleus of the thalamus receives almost all sensory stimuli entering the system, from which they are forwarded to different parts of the brain.

The cingulate cortex integrates all this information with emotion and helps to select an appropriate response (Ardila, 2020).

Due to these important contributions of different researches and the lack of studies aimed purely at children's evidence, it was proposed to analyze selective attention in infants between 9 and 11 years old by evaluating the speed of processing and inhibition to performance in a task. For this purpose, a Stroop test was administered to evaluate the ability to classify information from the environment and to react selectively to it.

2. CONTEXT

The research is necessary because there are limited scientific works on this subject, even more so when an excellent number of attention evaluations are handled through the Stroop test, considering that the data obtained from the study population are in the school stage where learning problems stand out and are generally linked to this type of difficulties.

Finally, by identifying the attentional alterations of the students, based on the use of the psychological instrument, it will be possible to diagnose therapeutic processes that reinforce the deficiencies found in 9-to-11-year-old students.

3. DESCRIPTION

3.1. Design and population

In this study, 135 students of nine, ten, and eleven years old participated. The sample was not calculated and therefore the test was applied to the entire population. The participants belonged to several schools in Ambato, Ecuador. The test was applied during the first partial of the second semester of the school year 2020.

The following inclusion criteria were considered: (i) voluntary participation in the study; (ii) belong to the population group of 9 to 11 years old; (iii) area of operation - in Ambato; and (iv) students should not present special needs.

3.2. Data collection instrument

The color and word Stroop test, CITAR, was used; the evaluation of the test was done individually, the duration time took approximately 300 seconds for each student; the evaluation contains three sheets of A4 paper size, each of them containing 100 items distributed with five columns of 20 items each.

The slides are presented as follows: (i) Words (P), consisting of the words RED, GREEN and BLUE randomly ordered; all words were printed in black ink. It is not allowed to print two repeated words in the same column. (ii) Colors (C), consisting of four X's "XXXX" printed in blue, green, red. It is not allowed to print the same color twice in the same column and the printing order is different from the first sheet; (iii) Word-Color (PC) which contains words from the first sheet in the colors of the second sheet. The color and the word must not coincide in any case with the color of the ink; therefore, the student must only mention the color of the ink.

With the results obtained, we must apply scales to compare the equivalence; however, in this case, we obtain the raw result.

3.3. Individual evaluation

Once the evaluator has verified the availability of the necessary resources for the application of the test, the following instructions should be taken into consideration: (i) to present the P, C, and PC sheets to the evaluated student; (ii) the sheets are presented in front of the evaluated student on a flat surface; (iii) the evaluated student may not turn the sheet more than 45° to the right or left, likewise he/she is not allowed to lift or separate the sheet from the surface where it was placed; (iv) the third page must be located in the same position as the second page; and, (v) covering any sheet is not allowed.

3.4. Punctuation T

Once the individual evaluation process was completed, we proceeded to perform the T-score, which consists of the following steps:

(a) P: It is the result of the correct number of words read on the first sheet; C: is the result of the correct number of items named on the second color sheet; and, PC is the result of items correctly named on the third sheet. The errors made do not score.

(b) For our study population (students from 9 to 11 years old) the raw score is considered, that is, the number of correct answers reads and named.

(c) Then we proceed to calculate PC' (estimated PC) according to the following formula:

$$PC' = \frac{P * C}{P + C}$$

(d) Then the Interference is calculated by applying the following equation:

$$Interference = PC - PC'$$

(e) The interference value will serve to make a relationship with the scales and find the T-Score, the transformation scales are found in Table 1.

Table 1. Stroop test scales

P	C	PC	Interference	Puntuation T
168	125	75	30	80
164	122	73	28	78
160	119	71	26	76
156	116	69	24	74
152	113	67	22	72
148	110	65	20	70
144	107	63	18	68
140	104	61	16	66
136	101	59	14	64
132	98	57	12	62
128	95	55	10	60
124	92	53	8	58
120	89	51	6	56
116	86	49	4	54
112	83	47	2	52
108	80	45	0	50
104	77	43	-2	48
100	74	41	-4	46
96	71	39	-6	44
92	68	37	-8	42
88	65	35	-10	40
84	62	33	-12	38
80	59	31	-14	36
76	56	29	-16	34
72	53	27	-18	32
68	50	25	-20	30
64	47	23	-22	28
60	44	21	-24	26
56	41	19	-26	24
52	38	17	-28	22
48	35	15	-30	20

3.5. Consolidation and analysis of information

Finally, once the evaluation of 135 students had been carried out, and the values of P, C, PA had been obtained, the information was consolidated in an Excel spreadsheet to obtain the values of PA', Interference and T-score. Subsequently, the

free software RStudio was used to rule out errors in the values obtained.

3.6. Ethical Aspects

Informed consent was applied individually to the parents or representatives of each student. During the socialization, the purpose of the study, the safe and confidential handling of the data, as well as the use for academic purposes were made known.

4. RESULTS

Once the Stroop color and word test have been applied, the following results are obtained: (i) interference and (ii) T-score.

4.1 Interference results

The interference evaluation according to this test recommends that values lower than "0" are equivalent to "Attention deficit" and higher than "1" are equivalent to "Normal attention"; however, due to the experience in clinical cases in students from 9 to 11 years of age, it was considered that the evaluation of "Interference lower than 10" will be cases for individual analysis and intervention.

Therefore, once the test was applied, the results obtained in the study population are in the range from -14 to 18; the negative evaluations, considering the proposed range, indicate that in the children evolutionary development there is not the same level of selectivity, because they have difficulty in interfering stimuli, they are exposed to certain external stimuli, which is equivalent to "Attention deficit" as shown in Figure 1.

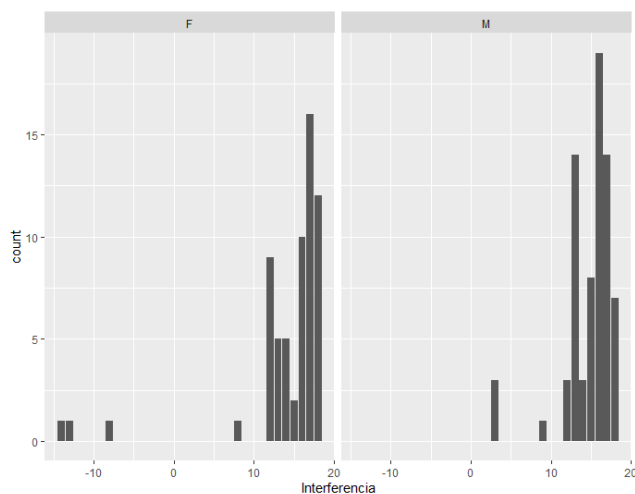


Figure 1: Interference result, via RStudio

4.1 T-score results

Once the interference values were obtained, the scale indicated in Table 1 was applied, and values ranging from 36 to 68 were obtained.

Therefore, 127 students (94%) with a positive score equivalent to "Normal attention" have adequately inhibited the automatic response found in the reagent; on the other hand, the negative evaluations have been considered from the raw value of the interference less than or equal to (interference = 10) resulting in 8 students (6%) presenting a negative score, which indicates that they have presumably inadequately inhibited the responses, equivalent to an "Attention deficit".

If the score is positive, the individual has adequately inhibited the automatic response and, if negative, presumably has inadequately inhibited (always considering that the general population ranges approximately between -10 and 10).

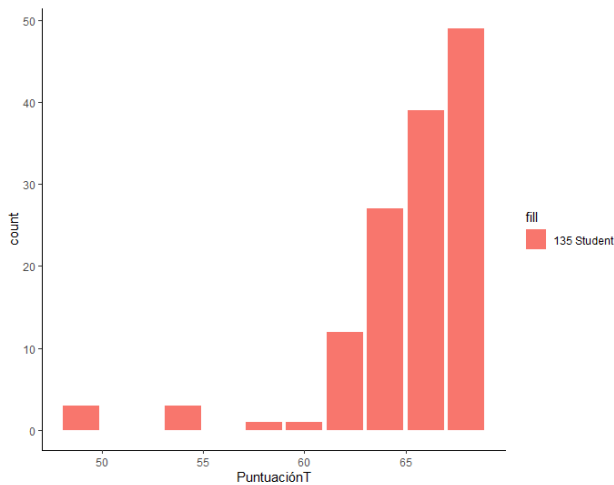


Figure 2: T-Score Results in RStudio

In addition, as a final result, Figure 3 shows a comparison between the interference and T score.

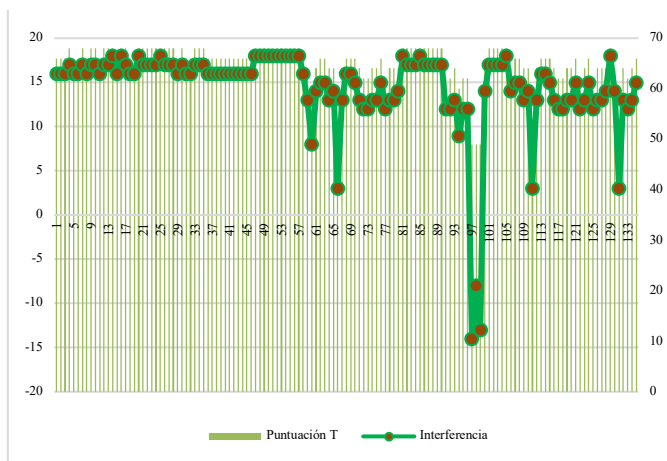


Figure 3: Interference score vs. T-score

5. CONCLUSIONS

From the population of 135 students between 9 and 11 years old, who participated in the project, the following evaluations have been obtained: 99% of the evaluated students obtained positive scores; however, based on the clinical experience of brain development, this percentage obtained should be analyzed by expanding the level of negative interference score so that 94% of positive scores have been obtained which is equivalent to 127 students with a positive score equivalent to "Normal Attention" which means that they have adequately inhibited the automatic response found in the reagent.

The negative evaluations have been considered from the raw value of interference less than or equal to (interference = 10) resulting in 8 students presenting a negative score, which indicates that presumably, they have inhibited worse than what would have been expected at the moment of obtaining the scores of the evaluation and it has an equivalence of "Attention deficit" for different factors that later on will be analyzed.

The development of executive functions in general and selective attention, in particular, is irregular among children of the same age group. This is of particular importance when planning educational programs and dealing with the learning difficulties that students may encounter when confronted with educational content.

It can be seen that children between 9 and 11 years old who were subjected to the evaluation of the instrument show different results, some below the norm, which allows us to show that there are some possible shortcomings in selective attention since they have not yet She is mature enough to be able to ignore distracting stimuli.

The initial scores of the children evaluated have standard levels, according to figure 3, and interferences begin to be noticed from the middle of the illustration, so it can be concluded that the children who finished the application first did so correctly denoting that their inhibitory control process and processing speed are in accordance with their age and therefore their evolutionary stage

Children who are from the middle of figure 3, show a greater amount of interferences and their resolution time of the test was longer, which is why it is evident that their selective attention process has not yet managed to specify their processes of inhibitory control and processing speed does not mean that they are wrong, but rather that these processes are possibly a little "delayed" with respect to their age and evolutionary stage.

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