ARTÍCULO ORIGINAL

The Role Of Inhibitory Control In The Ability To Solve Problems Of University Students

El Rol Del Control Inhibitorio en la Habilidad Para Resolver Problemas de Estudiantes Universitarios

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Abstract

The aim of the present study was to analyze the role of inhibitory control in the ability to solve problems of university students. The sample consisted of 90 young people with typical development (M_{age}= 20.58, SD= 1.27), 39 females (43.33%) and 51 males (56.7%). The Stroop and the Anillas' Test tasks were applied as instruments. As results, it was found a directly proportional and predictive relationship between inhibitory control and problem-solving of university students (correlation between: r= .34 and .47, p= <.01; prediction: r2= .14, F(1,88)= 13.88, p= <.01). It concludes by reflecting on the contribution of conscious control to solve problems faced by the university student on a day-to-day basis in an efficient way and invites future research in order to train inhibitory control.

Keywords: Executive Functions, Inhibitory Control, Monitoring, Planning, Problem-solving.

Resumen

El objetivo de esta investigación fue analizar el rol del control inhibitorio en la habilidad para resolver problemas de estudiantes universitarios. La muestra estuvo conformada por 90 jóvenes con desarrollo típico (M_{edad}= 20.58, DE= 1.27), 39 mujeres (43.33%) y 51 hombres (56.7%). Se aplicaron dos tareas neuropsicológicas experimentales: test de Stroop y el test de Anillas. En los resultados se encontró una relación directamente proporcional entre el control inhibitorio y la habilidad para resolver problemas de los estudiantes universitarios (correlación: r= .34 and .47, p= <.01; predicción: r2= .14, F(1,88)= 13.88, p = <.01). Se concluye la investigación resaltando la relevancia del control consciente de la conducta en el proceso de resolución de un problema y dejando en evidencia la necesidad de continuar aportando evidencia empírica en favor de esta línea de investigación.

Palabras clave: Funciones ejecutivas, control inhibitorio, monitorización, planificación, resolución de problemas.

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Introduction

Executive Functions (EF) are located mainly in the prefrontal areas of the brain, even when these maintain connections with multiple zones that could make an interconnection with cortical and subcortical areas,[1] thanks to myelination processes, which are in charge of a better functioning of the afferent and efferent structures for the connection with cortical and subcortical regions.[2]

Theorists as Stelzer, Cervigni and Martino,[3] have associated the EF with the prefrontal cortex's activity and the anterior cingulate cortex, among another zones. Nigg & Casey[4] affirm that neural connections where EF are located, are composed by three circuits, the frontal-striatum, in charge of suppressing responses capacity in order to attend adequately to a specific stimulus, the use of working memory and planning. In second place, the frontal-limbic circuit, in

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charge of emotional control, motivation and impulsivity, and the frontal-cerebellum circuit, which is related to the motor activity coordination and time organizing.

In this sense, pre-frontal cortex represents excellence as the integration zone, since it is the one that receives and sends information from the variety of sensorial systems and motors from the brain.[5] Frontal lobes are cerebral structures of recent development and evolution in the human brain, its perfectionism in primates is related to the need of a control and coordination of the cerebral most complex network of cognitive and behavioral processes in a person.[6,7]

Within this evolutive and hierarchical process, executive functions (EF) are the mental abilities most developed in the activity of frontal lobe, where are highlighted processes of superior order such as programming, interpretation of action scenarios, decision making, acquisition and use of attribution system to decode another´s intentions, behavioral autoregulation, precise selection of behaviors, flexibility in cognitive work, inhibitory control of automatic answers among other functions that fulfill an important role in the solution of problems and in the conscious control of mental and behavioral activity.[8,9]

The Inhibitory Tripartite Model,[11] distinguishes three inhibitory processes: behavioral inhibition, cognitive inhibition and perceptual inhibition. The main function of the behavioral inhibition consists in suppressing predominant responses. Meanwhile, this process contributes to the behavioral control, the other two inhibitory processes, cognitive and perceptual inhibition, are applied to the cognition, because those intervene actively regulating either the activation or the inhibition of thoughts and representations.

Cognitive inhibition is the responsible of decreasing the activation level of the mental predominant representations, intrusive thoughts or irrelevant information of the working memory.[11] In general lines, this term makes reference to a control process that intervene decreasing the accessibility of those memories representations' which are irrelevant and which generate interference over the ones that are considered important to the accomplishment of actual goals.[12] As the last one, perceptual inhibition is the mechanism that allows focalizing the attention on the stimuli, attenuating the interference linked to other stimuli present in the environment. This inhibitory control's role is fundamental on selective attention, according to some authors, its principal role is attenuating the effect of interference of external distractors in a context of stimuli competition.[12,13]

There is an especial interest in the research line of EF to show some lights in order to understand conscious regulation processes in a variety of contexts where a human being develops, such as the context of superior education, where the principal character is the university student, who must play EF keys such as inhibitory control to be successful in academic activity, as well as regulating his behavior in order to learn.[14]

Inhibitory control, also known as conscious impulse control or response inhibition, refers to an EF which allows conscious control of automatic and semi-automatic behavior,[7] its development starts in early age, in consonance with the development of prefrontal cortex, this explains why a children of 8 years old is capable of choosing among a variety of options which imply a level of competition among them, and like this to decide for a procedure that will fit the best to solve a problem, ending it when a human being is in process or end of academic university activities, around to the age of 25.[15-18]

Inhibitory control allows consciously focusing on attention, behavior, and emotions towards a specific objective through the formulation of intentions, corrections, and behavioral evaluation.[19] Also, inhibitory control allows the possibility to inhibit distractors such as thoughts, feelings or actions that could decrease attention focussing on an actual task,[18] demonstrating a significant impact to the ability of problem-solving, because, auto control ability is directly influenced by cognitive and motor processes that are implicated at the moment to solve them. A person faces this situation daily in a variety of contexts where he or she develops. In this study, the interest is placed at a university context.[20]

The resolution of a problem is understood as a pattern of answers given by a subject towards the solution of a specific situation,[21] the analysis of this variable is key to the comprehension of human psychic processes, because it involves a variety of components, making possible understanding individual psychological functionality.[22,23] A problem appears when a person faces a determined situation and experiences tension, which demands satisfaction as a response, due to a discrepancy between the actual situation and another considered as better one. In order to do it, the person activates a series of high-level cognitive mechanisms aiming to find a solution to the task and, to eliminate or at least decrease the tension experienced.[23,24]

When a person faces a problem, a conscious reflection process in order to choose the best option for solving this situation is needed, as well as the activation of high-level functions, such as automatic impulse control, planning, monitoring, and verification, those have a predominant role, because, thanks to them, a person will be able to control a possible answer that will not be reflective, instead will be impulsive, and, at the end, will make a mistake, not accomplishing a resolution. Therefore, when executive functions are working right, a person would be able to solve a problem efficiently.[25,26]

In educative contexts, EF in general, and inhibitory control specifically would be related to different type of academic areas, where it is required to solve a problem. Recent studies have demonstrated that there is a direct and positive relationship between executive functions and academic performance, as well as the improvement in mental

flexibility, when a cognitive intervention in executive functions in students with diverse qualities and characteristics and in different formatives stages has been applied.[27,28]

Late researches have demonstrated that there are students who are characterized by being impulsive, presenting difficulties in organizing information, problem-solving, and an inadequate level of development of executive functions for their age and scholar level, which influences in their academic performance, so, the effect of inhibitory control on cognitive development would be essential to improve the ability to perform abstract analysis, and to solve problems of any type.

Based on previous research, it is necessary to contribute with empiric evidence in favor of mental superior abilities comprehension as executive functions are, and its role in the ability of problem-solving in contexts that demand a conscious behavioral control, as it is the university level. In this sense, the aim of this research was to analyze the influence of inhibitory control in the ability of problem-solving at the university level, in order to accomplish it, there was proposed a correlational study through the execution of experimental tasks to assess the two mentioned variables.

Research Hypotheses

H1. Difficulties in inhibitory control of automatic actions impact negatively in the time that a university student needs to solve a problem, increasing the time of resolution.

H2. Difficulties in the inhibitory control of automatic responses, impact negatively by increasing the number of tries that a university student needs to solve a problem successfully.

Method

Sample

The sample for this study was composed of 90 participants between 18 and 24 years old, (M_{age}= 20.58, SD=1.27). Referring to gender, 39 were female (43.3%) and 51 male (56.7%) participants; according to academic level, every participant had a superior degree. According to socio-economic status, participants belonged to average and higher-average level.

Research Design

The design of this research is quantitative, correlational, and cross-sectional. Not experimental stages considered.

Instruments

For this research, it was necessary the use of two instruments. The first one was the STROOP Color and Word Test. The execution of this test consisted of presenting three tables, the first table showed some words in black ink, and participants were asked to read them aloud; the second table showed words written in different colors, participants were asked to read them, and which were congruent with the color they were written; and, in the third table, written words presented were incongruent with the color they were written, for example, a written word was BLUE, but it was colored in red ink, and participants were asked to identify aloud the color of the words instead of reading them. Inhibiting like this, the tendency to read the word, controlling the automatic response33. Stroop Color and Word Test was used as a measurement of inhibitory control, based on quantification of the errors produced, which allowed assessing difficulties on inhibitory control in a person.[34]

The second instrument used was Anilla´s Test, it was used as an indicator of problem-solving assessment, which involves higher-level mental abilities such as capacity of planning, working memory, mental flexibility and monitoring that represent essential components of EF.[10,35] This test was composed of 15 tasks of increasing difficulty, where participants had to reproduce different models presented in plates by moving rings, one to one, of different colors and sizes, which are located in a table with three poles. From this test, it was possible to obtain the participant's number of applied movements and the time in seconds that took to each one to solve the presented task.[36]

Procedure

The present study started with the approval of the Ethical Research Committee of a local Ecuador´s University. Throughout the process of this study, standards of research in human beings were followed, such as volunteering participation, signing an informed consent document, confidentiality of collected information, anonymous participation, protection of participants' physical and psychical integrity; accomplishing like this, with the ethical compromises of scientific research and assuring basic principles of autonomy, beneficence and not malice and the principle of justice. Tests were applied individually and in a distraction-free place. Once, the Stroop Test and Anilla's Test were qualified, the next step consisted on building a database, then, statistical analyses took place.

Data Analyses Plan

Statistical analyses were applied as follows: (a) descriptive, central tendency, and dispersion measurements were used to characterize sample and to describe data findings; (b) Chi-square was used to analyze the relationship among nominal variables; (c) Pearson´s correlation technique was used to analyze direct and inversely proportional relationship; (d) to accomplish predictive analyses lineal regression was used; and, (e) to compare means, T-test was used. The level of significance used was less than .01. These analyses were executed in the statistical package for social studies SPSS version 25.

Results

In the Stroop Color and Word Test, it was found a minimum of 0 errors and a maximum of 17 (M=2.72, SD=2.90). In the Anillas' Test the minimum time in seconds was 141 and a maximum of 453 (M=213.97, SD=58.69); and, the minimum of movements was 134, while the maximum was 224 (M=168.84, SD=20.42). In table 1, the correlation existent among tested variables is presented.

Table 1. Correlation between variables tested with the Stroop, and Anillas' Test.

	TMST	TSRT	TMRT
TEST	1	.37*	.34*
TSAT	.37*	1	.47*
TMAT	.34*	.47*	1

Note: TEST (total errors Stroop Test), TSAN (total seconds Anillas´ Test) TMAN (total of movements Anillas´ Test). *p = < .01

After these analyses, it was calculated the prediction of inhibitory control over the time that took the resolution of a problem; it was found that errors of inhibitory control predict 14% (r^2= .14, $F_{(1,88)}$= 13.88, p= < .001) of variance of the time that the participants took in solving any proposed problem in the Anillas' Test. The equation of prediction in this relationship would be expressed as following: Y = B0 + (B1 * X), where Y = 193.65 + (7.46 * * errors in the Stroop Test). In this equation must be considered that, X value corresponds to independent variable, it means, the number of errors that a participant could make in the Stroop Test; to get a better idea of the presented analysis it is important to take into account the following, when there were 5 errors in the Stroop Test, the time that a participant would take to solve the Anillas´ Test would be 230.95 seconds. In figure 1 is presented the dispersion diagram of the analyzed relationship.

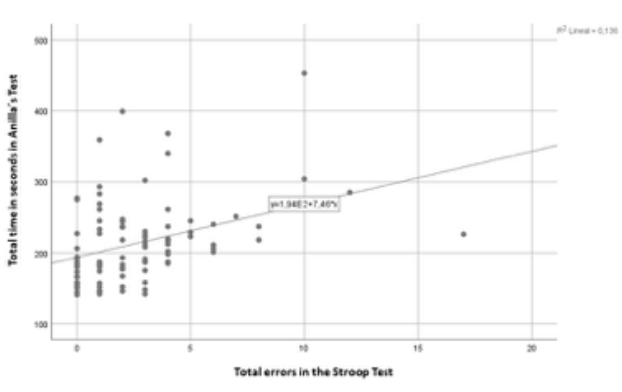

Figure 1. Dispersion diagram of the relationship between errors in the Stroop Test and time in Anillas' Test.

Referring to the prediction of inhibitory control over the number of movements to accomplish successfully the task from the Anillas' Test, it was found that, this variable explains 12% of the variance of what is needed to solve a problem (r^2 = .12, $F_{(1,88)}$= 11.76, p = < .001). The predictor equation of analyzed relationship showed that Y = 162.27 + (2.42 * errors in the Stroop). In this equation, are projected as data, for example, when a participant presents 3 errors in the Stroop Test, the number of movements to solve the 15 tasks of the Anillas' Test would be 169.53 movements. In figure 2, the dispersion diagram that shows the relationship among errors in the Stroop Test and the number of movements in the Anillas´ Test tasks is presented.

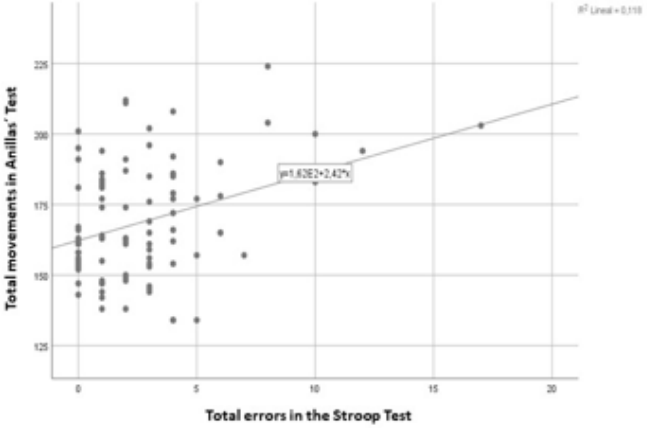

Figure 1. Dispersion diagram of the relationship between errors in the Stroop Test and time in Anillas' Test.

There was conducted a comparison of means, considering as a factor of clustering participants' gender, as result there was not significant differences in the total errors in the Stroop Test $t_{(88)}$= -.66, p= .51, total of seconds in Anillas' Test $t_{(88)}$= -.01, p= .99, and, the total of movements in the Anillas' Test $t_{(88)}$= .43, p= .67. Also, there was analyzed the association among variables and the participants' age, there was not found either significant statistic results in the total mistakes $x^2_{(90)}$= 50.93, p= .91, total of time in seconds $x^2_{(90)}$= 366.28, p= .73, and, the total movements $x^2_{(90)}$= 333.98, p= .34.

Discussion

In this work, the results of a study that had the objective to analyze inhibitory control, one of the variables that are considered as a determinant to solve any type of problems in higher education. As a hypothesis, there was announced that difficulties in inhibitory control would negatively impact on the time that a person would need to solve a problem, and in the number of executed tries to solve it.

Based on the first hypothesis, results are contributions as empiric evidence in favor of the affirmation announced, where was found that inhibitory control predicts significantly part of the variance of the implication of the time for problem-solving. This association would make sense because problem-solving is a complex activity and uses two systems: experiential and logical. Results found that university students who have the capacity of

executing their inhibitory control would solve problems from the logic system; therefore, tasks would be solved in less time and efficiently. While, in the case of university students who do not execute their inhibitory control to solve problems, would make it impulsively, generating struggles to solve a task, the need of more time and obtaining negative academic results.[21,23]

According to hypothesis two, results contribute as empiric evidence where inhibitory control predicts a percentage of the variance that implies to solve a problem. These results would occur because when a university student is not executing inhibitory control difficulties in behavior regulation would be produced, presenting a try - error behavior until the success of solving the tasks that are in front of him or her, which is the opposite to a regulated and reflexive behavior in favor to the resolution of a problem.[30,31,32]

It is important to highlight that the adequate inhibitory control functionality will influence on the working capacity of metacognitive abilities such as planning, monitoring and verifying, requiring reflection and the domain of automatic responses.[26] In this sense, at the moment that a university student is facing a problem, if he or she has been capable of inhibiting the tendency to act impulsively, avoiding giving an automatic response, would allow a response based on a reflexive process, analyzing every possible option, understanding the consequences and choosing the best alternative to accomplish the goal proposed at first, and, as the last point, would be capable of verify the obtained results of his or her learning process.[25]

Previous research had reported that inhibitory control is fundamental in the problem-solving processes, this fact, invites to continue with the investigation in this line, because, with training processes of this EF, in the variety of scholar contexts and considering specifically the university student, would be possible to propose improvement methods of autoregulation abilities, where individuals will be involved and successfully finish any activity.[29]

As future research, it is of great interest to realize an inhibitory control training process, because, as a projection from the statistical obtained data in this study in favor of optimizing the time that a university student needs to solve a problem, if there is an improvement in this EF could be beneficial in around 41.63 seconds and 20.26 movements within the process of solving tasks, according to this, it is possible to hypothesize that, training inhibitory control would be beneficial for the process of resolution of tasks, being more efficiently and decreasing the number of tries.

Finally, as a limitation of this research the sample used was very homogenous and bounded, participants belonged to a university from a Latin American city, although, is important to mention that Quito is a metropolis with similar characteristics to other cities from the region, because of it, the results found in this study give lights to the comprehension of the role of inhibitory control in the resolution of tasks of university students in many other similar contexts to Quito-Ecuador.

References

1. Bernal, F. & Rodríguez, M. (2014). Estimulación temprana de las funciones ejecutivas en escolares, una revisión actualizada. Revista de Orientación Educacional, 28(53), 15-24.
2. González Osornio, M. G., & Ostrosky, F. (2012). Estructura de las funciones ejecutivas en la edad preescolar. Acta de investigación psicológica, 2(1), 509-520.
3. Stelzer, F., Cervigni, M. A., & Martino, P. (2010). Bases neurales del desarrollo de las funciones ejecutivas durante la infancia y adolescencia. Una revisión. Revista Chilena de Neuropsicología, 5(3), 176-184.
4. Nigg, J.T., & Casey, B.J. (2005). An integrative theory of attention-deficit/hyperactivity disorder based on the cognitive and affective neurosciences. Development and psychopathology, 17(3), 785-806.
5. Delgado-Mejias, I., & Etchepareborda, M. (2013). Trastornos de las funciones ejecutivas. Diagnóstico y tratamiento. Revista de Neurología, 57, 95-103.
6. Flores, J. (2008). Neuropsicología de Lóbulos Frontales, Funciones Ejecutivas y Conducta Humana. Neuropsicología, Neuropsiquiatría y Neurociencias, 2(1), 47-58.
7. Ramos, C., & Pérez-Salas, C. (2015). Relación entre el modelo hibrido de las funciones ejecutivas y el trastorno por déficit de atención con hiperactividad. Psicología desde el Caribe, 32(2), 299-314.
8. Medina, A., Moreno, M., Lillo, R., & Guija, J. (2017). Los trastornos del control de los impulsos y la psicopatias: Psiquiatría y Ley. Córdoba-Argentina: Fundación Española de Psiquiatría y Salud Mental.
9. Núñez, J. (2012). Revisión teórica de las funciones ejecutivas. Lumen, 14, 1-10.
10. Portellano , J., Díez , A., Melero , H., & García, U. (2007). El test de las anillas (TA), un nuevo instrumento para la evaluación de las Funciones Ejecutivas. Mapfre Medicina, 18(1), 54-63.
11. Diamond, A. (2013) Executive Functions. Annual Review of Psychology, 64, 135-168.
12. Anderson, M., & Bjork, R. (1994). Mechanisms of inhibition in long-term memory: A new taxonomy. In D. Dagenbach & T. Carr (Eds.), Inhibitory processes in attention, memory, and language. New York: Academic Press.
13. Eriksen, B. A., & Eriksen, C. W. (1974). Effects of noise letters upon the identification of a target letter in a nonsearch task. Perception & Psychophysics, 16, 143-149.
14. Ramos-Galarza, C. (2018). Secuelas neuropsicológicas en el daño cerebral adquirido: análisis de casos. Quito-Ecuador: Universidad Tecnológica Indoamérica.

15. Flores-Lázaro, J., Castillo-Preciado, R., & Jiménez-Miramonte, N. (2014). Desarrollo de funciones ejecutivas, de la niñez a la juventud. Anales de psicología, 30(2), 463-473.
16. Mauricio C., Stelzer F., Mazzoni, C., Álvarez, M.Á. (2012). Desarrollo de las funciones ejecutivas en niños preescolares. Una revisión de su vínculo con el temperamento y el modo de crianza. Revista Pensando Psicología, 8(15), 128-139
17. Rosselli, M., Matute, E., & Ardila, A. (2012). Neuropsicología del desarrollo infantil. México DF: El Manual Moderno.
18. Santa-Cruz, C., & Rosas, R. (2017). Mapping of Executive Functions/Cartografía de las Funciones Ejecutivas. Estudios de Psicología, 38(2), 284-310.
19. Herreras, E. B. (2010). Función ejecutiva y desarrollo en la etapa preescolar. Boletín de pediatría, 50(214), 272-276.
20. Rojas-Barahona, C. (2017). Funciones ejecutivas y educación. Comprendiendo habilidades claves para el aprendizaje. Santiago de Chile: Ediciones UC.
21. Bados, A., & García, E. (2014). Resolución de problemas. Evaluación y Tratamiento Psicológico. Universidad de Barcelona, 1–34. Retrieved from http://diposit.ub.edu/dspace/bitstream/2445/54764/1/Resolución problemas.pdf
22. Álvarez, J. (1981). La resolución de problemas en psicología. Revista Latinoamericana de Psicología, 13(2), 247–266.
23. Sánchez, Y. (2007). La solución de problemas como un campo de concurrencia de distintas teorías en Psicología. Revista Colombiana de Psicología, 16, 147–162.
24. Kelly, G. (2001). Psicología de los constructos personales. (Paidós, Ed.). Barcelona.
25. Bados, A., & Garcia, E. (2011). Habilidades Terapéuticas. Barcelona: Universidad de Barcelona. Retrieved from http://diposit.ub.edu/dspace/bitstream/2445/18382/1/Habilidades terapéuticas.pdf
26. Sáiz-Manzanares, M. C., & Pérez-Pérez, M. I. (2016). Autorregulación y mejora del autoconocimiento en resolución de problemas. Psicología desde El Caribe, 33(1), 14–30. doi: 10.14482/psdc.33.1.8076
27. Reyes Cerillo, S., Barreyro, J. P., & Injoque-Ricle, I. (2015). El rol de la Función Ejecutiva en el Rendimiento Académico en niños de 9 años. Revista Neuropsicología Latinoamericana, 7(2), 42–47. doi: 10.5579/rnl.2015.0229
28. Ríos-Gallardo, Á. M., González, A., Toledo, D., Bermeo, M.A., Bonilla-Santos, J., Vallejo, L. (2016). Efectividad de una intervención cognitiva en funciones ejecutivas para mejorar flexibilidad mental en niños con trastorno por déficit de atención e hiperactividad. R.F.S Revista Facultad de Salud, 1, 16–22. doi: 10.25054/rfs.v8i1.1328
29. Cascante Ramírez, J., Campos Céspedes, J., Cantero Acosta, R., Hernández Herrera, N., Rodríguez Ugalde, E., & Campos Badilla, M. A. (2016). Desarrollo de un módulo para fortalecer funciones ejecutivas en un grupo de estudiantes universitarios. Innovaciones Educativas, 17(23), 63. doi: 10.22458/ie.v17i23.1371
30. Cassotti, M., Agogué, M., Camarda, A., Houdé, O., & Borst, G. (2016). Inhibitory control as a core process of creative problem solving and idea generation from childhood to adulthood. New Directions for Child and Adolescent Development, 151, 61–72. doi: 10.1002/cad.20153
31. Gómez, G., García, J., Olavarrieta, S., & Rodríguez, E. (2004). Valoración de la capacidad de obrar: el control de los impulsos. Investigación en Salud, 6(1), 35-42.
32. Iglesias, M., Gutiérrez , N., Loew, S., & Rodríguez , C. (2015). Hábitos y técnicas de estudio en adolescentes con trastorno por déficit de atención con o sin hiperactividad. European Journal of Education and Psychology, 9 (1), 29-37. doi: 10.1016/j.ejeps.2015.07.002
33. Golden, C. (2010). STROOP Test de Colores y Palabras. Madrid: TEA Ediciones.
34. Rodríguez, L., Pulido, N., & Pineda, C. (2016). Propiedades psicométricas del Stroop, test de colores y palabras en población colombiana no patológica. Universitas Psychologica, 15(2), 255-272.
35. León-Carrión, J., & Barroso-Martín, J. (2001). La torre de Hanoi/Sevilla: una prueba para evaluar las funciones ejecutivas, la capacidad para resolver problemas y los recursos cognitivos. Revista Española de Neuropsicología, 3(4), 63-72.
36. Portellano , J., & Martinez, R. (2011). Test de la ANILLAS para la evaluación de las Funciones Ejecutivas. Madrid : TEA Ediciones

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