Recibido: 19 Feb., 2023 | **Aceptado:** 27 Mar., 2023 | **Publicado:** 18 Abr., 2023

RESEARCH ARTICLE

Implications of empathy in executive functions of students with school coexistence problems

Implicaciones de la empatía en funciones ejecutivas de estudiantes con problemáticas de convivencia escolar

Implicações da empatia nas funções executivas dos estudantes com problemas de coexistência escolar

DOI: https://doi.org/10.21803/penamer.16.31.607

Alexander Alonso Ospina Ospina
https://orcid.org/0000-0003-4732-6481
Doctor en Psicología con orientación en Neurociencias cognitivas aplicadas. Docente, Fundación Universitaria Católica del Norte, Medellín, Colombia. aospinaa@ucn.edu.co

Danicza Martínez Morales
https://orcid.org/0000-0002-8809-283X
Magister en Neuropsicología, Neuropsicóloga clínica, Fundación Instituto Neurológico de Colombia, Medellín, Colombia. danicza.martinez@neurologico.org.co

Abstract

Introduction: executive functions are the set of cognitive skills necessary to control and self-regulate behavior, and empathy is the ability to emotionally understand what others feel. Both variables interact with each other to regulate aggressive behaviors, thus low levels of empathy and poor performance in executive functions have been associated with different difficulties in school coexistence, including bullying. **Objective:** this study examined the role of empathy and executive functions in a population of students between 12-17 years old, belonging to a private educational institution in the municipality of Bello, Antioquia. **Methodology:** the research was descriptive and cross-sectional in scope. Questionnaires on school coexistence, prosocial behavior, and instruments to assess executive functions such as the TMT part B, the Stroop and the Wisconsin Card Sorting Test were applied. **Results:** it was evidenced that there is an association between low empathy and deficiencies in the performance of executive functions, and a relationship between adequate levels of empathy and good performance in executive functions, in the sample of students evaluated. **Conclusions:** a high level of empathy in prosocial students is related to better executive processing in selective attention, conflict resolution, and inhibitory control.

Keywords: Peer violence; School coexistence; Empathy; Executive functions.

Resumen

Introducción: las funciones ejecutivas son el conjunto de habilidades cognitivas necesarias para controlar y autorregular la conducta, y la empatía es la capacidad de comprender emocionalmente lo que sienten los demás. Ambas variables interactúan entre sí para regular las conductas agresivas, por ello los bajos niveles de empatía y un deficiente desempeño en las funciones ejecutivas se han asociado a diferentes dificultades de convivencia escolar, entre ellas el bullying. **Objetivo:** este estudio examinó el papel que desempeña la empatía y las funciones ejecutivas en una población de estudiantes entre 12-17 años, pertenecientes a una institución educativa privada del municipio de Bello, Antioquia. **Metodología:** la investigación tuvo una orientación de alcance descriptivo, transversal. Se aplicaron cuestionarios de convivencia escolar, conducta prosocial, e instrumentos para valorar las funciones ejecutivas como el TMT parte B, el Stroop y el Test de Clasificación de tarjetas de Wisconsin. **Resultados:** se evidenció que existe una asociación entre la baja empatía y deficiencias en el desempeño de las funciones ejecutivas, y una relación entre los niveles adecuados de empatía y un buen desempeño en las funciones ejecutivas, en la muestra de estudiantes evaluados. **Conclusiones:** un nivel alto de empatía en los estudiantes prosociales se relaciona con un mejor proceso ejecutivo en la atención selectiva, la resolución de conflictos, y el control inhibitorio.

Palabras clave: Violencia entre iguales; Convivencia Escolar; Empatía; Funciones ejecutivas.

¿Cómo citar este artículo?
Ospina, A. y Martínez, D. (2023). Implicaciones de la empatía en funciones ejecutivas de estudiantes con problemáticas de convivencia escolar. *Pensamiento Americano, e#*:607. *16*(31), 1-15. DOI: https://doi.org/10.21803/penamer.16.31.607

RESEARCH ARTICLE

Resumo

Introdução: Baixos níveis de empatia e fraco desempenho em funções executivas têm sido associados a diferentes dificuldades na coexistência escolar, incluindo o bullying. Objectivo: Este estudo examinou o papel da empatia e das funções executivas numa população de estudantes com idades compreendidas entre os 12 e os 17 anos, pertencentes a uma instituição educacional privada no município de Bello, Antioquia. **Metodologia:** A investigação foi descritiva e transversal no seu âmbito. Foram aplicados questionários sobre coexistência escolar, comportamento prosocial, e instrumentos para avaliar funções executivas como o TMT parte B, o Stroop e o Wisconsin Card Sorting Test. **Resultados:** Verificou-se que existe uma associação entre baixa empatia e deficiências no desempenho de funções executivas, e uma relação entre baixa empatia e deficiências no desempenho de funções executivas. e uma relação entre níveis adequados de empatia e um bom desempenho em funções executivas, na amostra de funções, na amostra de estudantes avaliados. **Conclusões:** um elevado nível de empatia nos estudantes prosociais está relacionado com um melhor processamento executivo na atenção selectiva, resolução de conflitos e controlo inibitório.

Palavras-chave: Violência entre pares, Coexistência escolar, Empatia, Funções executivas.

Introducción

One of the main problems faced by educational institutions, both in Colombia and worldwide, according to Pinilla Gómez et al. (2012), is the phenomenon of peer violence or bullying. For more than a decade Colombia has been facing a rather delicate situation of school violence and bullying in the classroom, the media frequently report situations in which students and teachers are victims of aggressions of different kinds by members of the same institution (Romero, 2012; Castiblanco Hernández and González-Santos, 2020).

To understand the phenomenon of school violence it is essential to know what traits characterize aggressive students, which implies studying variables that are related to violence, allowing to clarify the causes that originate it, and seek to intervene in this problem. In this sense, the objective of this study was to examine whether the performance of executive functions can explain peer violence, using a descriptive, cross-sectional, non-experimental methodology. From this context, the question arises: What is the relationship between the empathy coefficient and executive functions in adolescent aggressors, victims of school violence and prosocial students? In the first instance, the article develops the context in which the research phenomenon occurs, and subsequently, in a second section, it analyzes the implications of empathy in the executive functions of students with school coexistence problems, and concludes with a discussion of the main findings of the study.

Although it is not a new phenomenon, much importance has been given to the issue of bullying in research due to the negative consequences it generates, affecting the mental health and behavior of schoolchildren, as explained by Turanovic & Siennick (2022), due to symptoms related to depression and anxiety, low self-esteem, poor school performance, physical injuries, risk of self-harm and suicide, which put health at risk, and alteration of healthy school coexistence. Therefore, Holguín-Álvarez et al. (2020) point out that the problems of aggressiveness in the school environment is one of the main concerns of principals and teachers in Latin American schools.

A study by the Pan American Health Organization (2006) showed that in most Latin American countries violence in schools is on the rise, with an enormous human, economic and social cost. This reality jeopardizes the democratic foundations of a society, its collective life and the quality of harmonious coexistence. In another study (Valencia Aguirre et al., 2021), citing a report by the Organization for Economic Cooperation and Development (OECD) that estimated that 18.8 million students had suffered school bullying at some time in their lives (Unesco, 2017), they point out the importance of seeking pedagogical strategies to prevent violence in the school environment. Cano-Echeverri and Vargas Gonzáles (2018) express that bullying occurs "In different spaces whose differentiation is relevant to understand its modalities and also the responsibilities for its prevention and control. Such spaces can be intra-school, external to the school and even social networks" (p.60).

This research focused on the description of the problems of school coexistence, observed in a sample of students of an educational institution that has not been alien to the problems of bullying, as it has been observed behaviors of verbal and physical violence in students, both in classrooms and in different areas of the school, at recess, sports, at the entrances and exits of the institution. Observing this reality, it was considered necessary to investigate variables that may be at the basis of school violence, such as low levels of empathy and difficulties in the performance of executive functions (EF), in order to seek intervention strategies. According to Martorell et al. (2009), violence or aggressiveness among schoolchildren is a highly topical issue at the social level, since educational institutions, together with the family, are fundamental spaces in which

children and adolescents are formed.

Cano-Echeverri and Vargas Gonzáles (2018) describe as basic actors of bullying the victim or assaulted, the victimizer or aggressor and the observers. García-Piña and Posadas-Pedraza (2018), consider that the adjectives aggressor and victim can stigmatize or label those involved in these behaviors. These authors rather propose in relation to the "aggressor term" taking the verb aggresir, to allow the person to become aware if he/she has been assaulted and to take responsibility for his/her behavior, and to see the behaviors of aggression as a transitory state from which it is possible to get out, and for this an adequate intervention is necessary. Victims can also overcome the stigma by understanding that they have been assaulted, and that they cannot remain in this position. In this research, by using the classic terms aggressor and victim, it is not intended to label this population, but to use a way of naming the study groups.

The study of empathy has been of vital importance, since it allows understanding empathy as a component of emotional regulation with respect to aggressive behaviors and at the same time facilitating prosocial behaviors (Moya et al., 2010). Empathy refers to the ability to put oneself in the other person's place, to understand his or her emotional states. According to Baron-Cohen (2012) "empathy occurs when we suspend our single focus of attention centered exclusively on our own mind, and instead adopt a dual focus of attention that also focuses on the mind of the other" (p. 27).

Zavaleta Herrera et al. (2022) point out that executive functions (EF) are necessary to adapt adequately to different contexts of daily life, such as education, family, work, and facilitate learning, adaptability, planning and completion of tasks, internalization of values, regulation of social behaviors of students, allowing them to develop ethical behaviors. Delgado Reyes et al. (2022) also relate executive functions to cognitive flexibility, which "refers to the ability to vary a response pattern or style and adapt according to environmental feedback" (p. 117). This shows the relationship between Executive Function and Empathy, processes that integrate cognitive and emotional aspects, and that failures in these processes can manifest in antisocial behaviors. In this sense, Tamayo et al. (2018) highlight that the "Executive Functions (EF) allow the control of cognitive, affective and behavioral activity, and are influenced by multiple factors such as the sociocultural, academic and family environment" (p.1).

The study of executive functions, with the rise of neurosciences, has allowed understanding that a good performance of executive functions as a factor that can have a modulating role "in the development of citizenship skills that help individuals to better adapt optimally to a society where decision making should be oriented to achieve a common good" (Pino & Urrego, 2013, p.9).

Metodology

Design

A quantitative analytical empirical study was carried out with a descriptive, cross-sectional, non-experimental scope.

Participants

The research involved 88 adolescents in an age range of 12-17 years (57.9% males, 42.1% females), students of a private educational institution, grades 7 - 10, with an average age for females of 14.49 (standard

deviation SD = 1.44) and for males of 14.61 (SD = 1.34).

Ethical considerations

The directors and ethics committee of the Educational Institution granted permission to conduct the research, taking into account Resolution 008430 of 1993 of the Ministry of Health, the international ethical guidelines of the Declaration of Helsinki for research on Human Beings, and Law 1090 of 2006 - Deontological and Bioethical Code of the Psychologist. Within the ethical considerations, an informed consent form was developed for the parents of the students who participated in the research, which complies with the necessary ethical precepts. All parents signed the consent form and informed assents of the students. The research data, title and objectives were specified, the instrument was described in detail, voluntary participation was requested, and it was specified that the study does not involve any type of physical or mental harm. It was also clarified that the information would be kept confidential, and the possibility of not accepting or withdrawing from the study at any time. In addition, it was specified that the information would be used only for academic purposes.

Procedure

In the first phase, participants were selected for the convenience of the researcher. Three groups of students were chosen, consisting of 31 students with problems of aggressive behavior, 29 victims, and 28 prosocial students. For the selection of the groups, the reports provided by the school coordination, according to the students' school coexistence diaries, were taken into account, which was key in the classification criteria. The total population was 88 participants, who were interviewed about the process of their participation in the research. All parents signed the consent form and informed assent of the students. In the second phase, psychological interviews were conducted and it was ruled out that they had a neurological or psychiatric diagnosis. The school coexistence questionnaire of Martínez (2014) and the prosocial behavior questionnaire of Rey (2003) were applied. In the third phase, the instruments to assess variables related to Executive Functions were applied. In the fourth phase, the data collection and data analysis were carried out, which were analyzed with the SPSS Version 20.0 statistic, seeking descriptive and correlational analysis, between the variables empathy and executive functions. In the fifth phase, each participant received a report with the analysis and recommendations suggested from the results.

Instruments

For the assessment of executive functions and empathy coefficient, the following measurement instruments were used:

Empathy Quotient (EQ)

The Empathy Quotient (EQ) is an instrument to examine deficits in Social Cognition at the psychological level (Baron-Cohen & Wheelwright, 2004 cited in Politis et al., 2008). This questionnaire allows to assess empathy levels in four categories: low (0-32), average (33-52), above average (53-63), and very high (64-80).

Trail Making Test B

This test was developed by Reitan and Wolfson in 1993 within the Healstein Reitan neuropsychological battery (Puerta et al., 2019). This instrument has two versions, one A related to attentional processes, and a part B related to executive functions. Pineda (2000) explains that the TMT B, also called the path-opening test, serves to observe self-regulation, sustained attention control and the ability to flexibly switch from one execution to another.

Wisconsin Card Sorting Test (WCST)

This test was initially created by D.A Grand and E.A. Berg, and allows assessing the capacity for abstraction, flexibility of thought and the ability to reverse a response according to context feedback (Vallejo-Reyes, 2019).

STROOP Word, Color and Color / Word Test

The STROOP test, a test of colors and words, is characterized by its sensitivity to neurological difficulties. The test is used to evaluate executive functions, such as attention, cognitive flexibility, inhibition of automatic responses (Rodríguez, Pulido & Pineda Roa, 2016). Its scope of application is from 7 to 80 years of age, individual in nature. The STROOP test consists of 3 sheets, each of which contains 100 items distributed in five columns of 20 items each.

Results

For data analysis, descriptive statistics were used according to the type of variable involved (nominal, ordinal, discrete or continuous) and assumptions of normality were verified using Kolmogorov-Smirnov and Shapiro Wilks tests. The 3-group comparison of means test (one-factor ANOVA) was used to compare groups of students with respect to the different quantitative variables. In this specific case, the Bonferroni correction was used with a p-value rejection for the null hypothesis of 0.01. All data were analyzed using SPSS (Statistical Package for the Social Sciences v. 20).

Regarding the empathy coefficient, the aggressor students presented the lowest mean (M = 34.68; SD 101), followed by the victim students (M = 36.93; SD7 231), and the prosocial students obtained a mean of (M = 53.68; SD 10.37). Regarding the comparisons of the results of the tests measuring executive functions, the following results were obtained. In the TMT part B test, the pro-social students had a lower mean in execution time (M = 62.21; SD = 19.259), followed by the aggressors (M =167.65; SD = 54.315), and the victims had a higher mean in execution time (M =172.17; SD = 44.232).

In Wisconsin, the highest means were for offenders on the variables attempts (M = 122.45 ; SD = 11.369), errors (M = 37.68; SD = 12.838), perseverative errors (M = 12.87; SD = 6.898), and nonperseverative errors (M = 24.16; SD = 7.929), followed by victims, who had the following means, on attempts (M = 115.14 ; SD = 15.540), errors (M = 30.24; SD = 11.357), perseverative errors (M = 10.00; SD = 11.357) and non-perseverative errors (M = 19.45; SD = 7.008); and the prosocial with the lowest means, in attempts (M = 104.29; SD = 17.707), errors (M = 24.39; SD = 9.158), perseverative errors (M = 8.00; SD = 5.813) and non-perseverative errors (M = 14.57; SD = 4.229). On the other hand, in the variables conceptual responses (M = 77.39; SD = 10.528) and categories (M = 5.61; SD = 629), the highest mean was obtained by prosocials, followed by victims, who obtained in the variables conceptual responses (M = 76.90 ; SD = 6.405), and categories (M = 5.31; SD = ,850), and finally the aggressors, who obtained a lower mean in conceptual

responses (M = 72.84; SD = 12.620), and categories (M = 4.48; SD = 1.235).

Comparison for the aggressor, victim and prosocial groups.

To establish the differences between aggressor, victim and prosocial groups, a one-factor ANOVA corrected with the Bonferroni statistic with a significance value of $p < 0.01$ was performed.

In the running time variable of the TMT part B test the relationship in running time was (F = 61.384; gl = 2; p = 0.000). The result explains that the difference lies in the fact that the prosocial group took less time to perform the task compared to the victims and aggressors. The mean time in seconds of the prosocials was (M = 62.21; SD = 19.269), that of the aggressors was (M = 167.65; SD = 54.315) and that of the victims was (M = 172.17; SD = 44.232). These results allow inferring that low levels of empathy are related to a lower performance in executive functions (EF) in aggressor students, victims of school violence and provide evidence that there is a positive relationship between the variable empathy and a better performance in executive functions, in the sample of prosocial students evaluated.

Regarding the Stroop test, in the statistical results of the test, differences were found in the STROOP variables among the three groups (see Table 1). In the STROOP_PC (F = 17.685; gl = 2; p = 0.000) and STROOP PC_Calculus (F = 15.246; gl = 2; p = 0.000) variables, a p value = 0.000 was found, which allows inferring that there is a relationship between empathy levels and FE performance. Aggressive students, who obtained a mean PC score of (M = 36.6594; SD = 10.334), and victims a mean PC score of (M = 37.1379; SD = 8.433), taking into account that lower scores are related to difficulties in the performance of the EFs. In prosocial students, a mean PC score of (M = 51.8571; SD = 10.672), higher than the other two groups, is evident.

Thus, in the variable STROOP_Word (F = 6.901; gl = 2; p = 0.002), the prosocial group obtained the highest mean (M = 96.43; SD = 6.752), with respect to the mean of the victims (M = 86.55; SD = 13.002), and of the aggressors (M = 88.42; SD = 11.099). In the STROOP_Color variable (F = 15.882; gl = 2; p = 0.000) the mean of the prosocial group was also higher (M = 76.43; SD = 8.062), differing significantly from the victims (M = 61.03; SD = 10.792) and aggressors (M = 63.32; SD = 13.556). These results provide evidence that there is a positive relationship between the variable empathy and performance in executive functions.

The last set of analyses of this type was performed by comparing the values of the three groups with respect to WCST performance (see Table 2). The ANOVA test showed differences in Attempts (F = 10.874; gl = 2; p = 0.000) indicating that prosocials needed fewer attempts on average (M = 104.29; SD = 17.707) to complete the test, compared to aggressors (M = 122.45; SD = 11.369), who in turn had no significant differences with victims (M = 115.14; SD = 15.540). In Errors (F = 10.295; gl = 2; p = 0.000) differences were also found between the groups, as well as in Perseverative Errors (F = 5.510; gl = 2; p = 0.006) and in Non-perseverative Errors (F = 15.363; gl = 2; p = 0.000). The pattern of differences is similar in these three variables: the prosocial group differed from the aggressors by obtaining fewer errors of all types. Between prosocial and victims, as well as between victims and aggressors, no significant differences were found. Finally, in the number of categories (F = 11.224; gl = 2; p = 0.000) the difference found is the reverse of the previous ones: the aggressor group obtained significantly fewer categories than the other two groups.

Tabla 1.

Anova de un factor con prueba post-hoc

Variable dependiente	(I) rol	(J) rol	Diferencia de medias (I-J)	Error típico	Sig.
Stroop palabra	Agresor	Víctima	1.868	2.754	1.000
		Prosocial	-8.009	2.779	.015
	Víctima	Agresor	-1.868	2.754	1.000
		Prosocial	-9.877*	2.824	.002
	Prosocial	Agresor	8.009	2.779	.015
		Víctima	9.877*	2.824	.002
Stroop Color	Agresor	Víctima	2.288	2.875	1.000
		Prosocial	-13.106*	2.902	.000
	Víctima	Agresor	-2.288	2.875	1.000
		Prosocial	-15.394*	2.949	.000
	Prosocial	Agresor	13.106*	2.902	.000
		Víctima	15.394*	2.949	.000
Stroop palabra-Color	Agresor	Víctima	3.02336	2.54840	.716
		Prosocial	-11.69585*	2.57180	.000
	Víctima	Agresor	-3.02336	2.54840	.716
		Prosocial	-14.71921*	2.61355	.000
	Prosocial	Agresor	11.69585*	2.57180	.000
		Víctima	14.71921*	2.61355	.000

Fuente: Elaboración propia.

In this variable, victims and prosocials did not differ. This shows a pattern of differences in Executive Functions depending on the group to which one belongs: the prosocial group has a significantly higher performance in EF in the variables measured by the WCST, which shows that there is a positive relationship between empathy levels and EF in prosocial students, while in aggressive students, victims of school violence, there is a negative relationship, the lower the empathy, the greater the difficulties in EF.

Discusion

The findings described in the analysis of the results are presented below to provide explanations for the variables studied and, of course, a scholarly discussion of the research on empathy and executive functions.

Regarding the tests used to describe the relationship between empathy and executive functions, the execution time with the TMT B was assessed. In the aggressor students the execution time in the TMTB, the mean was (M = 167.65; SD = 54.315), and for the victims it was (M = 172.17; SD = 44.232), which shows that both groups are close to the time limit value of 180 seconds, which is the duration that indicates a deficit in execution time. In this sense, Puerta et al., (2019), explain that the TMT part B evaluates complex attention, and cognitive flexibility, which at the same time allows observing self-regulation, and the ability to flexibly switch from one execution to another. From this perspective, it is understood that executive

Tabla 2.

Anova de un factor con prueba post-hoc

Variable dependiente	(I) rol	(J) rol	Diferencia de medias (I-J)	Error típico	Sig.
Wisconsin Intentos	Agresor	Víctima	7.314	3.873	.187
		Prosocial	18.166*	3.909	.000
	Víctima	Agresor	-7.314	3.873	.187
		Prosocial	10.852	3.972	.023
	Prosocial	Agresor	-18.166*	3.909	.000
		Víctima	-10.852	3.972	.023
Wisconsin Aciertos	Agresor	Víctima	-3.606	2.325	.374
		Prosocial	-.710	2.346	1.000
	Víctima	Agresor	3.606	2.325	.374
		Prosocial	2.897	2.384	.683
	Prosocial	Agresor	.710	2.346	1.000
		Víctima	-2.897	2.384	.683
Wisconsin Errores totales	Agresor	Víctima	7.436	2.915	.038
		Prosocial	13.285*	2.942	.000
	Víctima	Agresor	-7.436	2.915	.038
		Prosocial	5.849	2.989	.161
	Prosocial	Agresor	-13.285*	2.942	.000
		Víctima	-5.849	2.989	.161
Wisconsin Errores perseverativos	Agresor	Víctima	2.871	1.467	.161
		Prosocial	4.871*	1.480	.004
	Víctima	Agresor	-2.871	1.467	.161
		Prosocial	2.000	1.504	.562
	Prosocial	Agresor	-4.871*	1.480	.004
		Víctima	-2.000	1.504	.562
Wisconsin Errores no perseverativos	Agresor	Víctima	4.713	1.715	.022
		Prosocial	9.590*	1.730	.000
	Víctima	Agresor	-4.713	1.715	.022
		Prosocial	4.877	1.758	.020
	Prosocial	Agresor	-9.590*	1.730	.000
		Víctima	-4.877	1.758	.020
Wisconsin respuestas conceptuales	Agresor	Víctima	-4.058	2.646	.387
		Prosocial	-4.554	2.671	.275
	Víctima	Agresor	4.058	2.646	.387
		Prosocial	-.496	2.714	1.000
	Prosocial	Agresor	4.554	2.671	.275
		Víctima	.496	2.714	1.000
Wisconsin categorías	Agresor	Víctima	.826*	.245	.003
		Prosocial	1.123*	.248	.000
	Víctima	Agresor	.826*	245	.003
		Prosocial	.297	.252	.724
	Prosocial	Agresor	1.123*	.248	.000
		Víctima	.297	.252	.724

Fuente: Elaboración propia.

functions are related to emotional self-regulation, and according to the TMT part B, difficulties in inhibitory control are observed in aggressor and victim students. Decety and Sommerville (2003) also argue that empathy requires inhibitory mechanisms, processes mediated by the prefontal cortex.

As for the prosocial students in the TMT part B test, they obtained a mean of (M = 62.21; SD = 19.269), whose duration shows that they have a good level of execution. This explains, that these young people have greater ability to plan their activities, greater mental flexibility, success in achieving task accomplishment, better emotional regulation, good coping skills, and excellent social skills, corroborating that an adequate performance in this test evidences a good executive component, and greater capacity in efficient problem solving (Londoño et al., 2019).

The low results of the PC variable in aggressors and victims may indicate, according to Aran Filippetti and Lopez (2017) deficiencies in an adequate functioning of the prefrontal circuits in these students, which could generate problems ranging from poor time organization to difficulties in the regulation of emotional response. These difficulties can affect the ability to make rational social decisions, with drastic personality changes, even when cognitive functions, are normal (Blake et al., 1995; Ishikawa & Raine, 2002; Raine, et al., 2000; Volavka, 1999, as cited in Trujillo et al., 2007). This explains that the main symptoms observed in most of the aggressor students with respect to executive functions are related to decision making, cognitive flexibility, and above all in the management of basic emotions, which is evidenced in the difficulties in controlling aggressiveness, and attitudes of insults, annoying comments, and difficulty in internalizing norms. From the above it is inferred that executive functions in aggressors are related to bullying behaviors.

It is interesting to emphasize what Fernández-Daza (2016) expresses, that young people who suffer school violence generally lack coping and conflict resolution skills, as they find it difficult to cope with the bullying situation, experience difficulty in the use of cognitive resources, experience emotional disturbance, loss of balance. In this sense, Kellij et al. (2022) point out that victimized students focus their attention on negative social cues from bullies, creating difficulties in their relationship with other students who could help them. Therefore, it is important to work with these students on coping strategies that allow them to be more assertive and seek social support, so that they can get out of the victim situation..

In the perseverative errors according to the WCST test, the mean of the aggressors was the highest (M = 12.87; SD = 6.898) which indicates some degree of deficiency, as explained by Ochoa and Cruz (2007), the higher the perseverative errors, the lower the cognitive flexibility. Victims and prosocials obtained a mean that indicates a range of normality, the fewer the errors the better the performance in cognitive flexibility. Also in non-perseverative errors, the mean in aggressors was the highest (M = 24.16; SD = 7.929) and in victims the mean was (M = 19.45; SD = 7.008), and in prosocials it was M = 14.57; SD = 4.229). The fewer the errors, the better the executive functioning.

Finally, the number of categories, whose p value = 0.000, shows that there is a statistically significant relationship, since the aggressor group obtained significantly fewer categories than the other two groups. The aggressors have a mean of (M = 4.48; SD = 1.235) with respect to the victims who have a mean of (M = 5.31; SD = .850) and the prosocial ones of (M = 5.61; SD = .629), which indicates that in this variable, the lower the score, the lower the degree of dysfunction. The closer to score 6 in the category number, the better the executive functioning. In this category, victim and prosocial did not differ significantly.

The low performance in the WCST test of the aggressors confirms what Ochoa & Cruz (2007) explain,

citing Ozonoff (1995), that levels of social awareness are necessary to perform correctly in tests of executive functions (EF) such as the WCST, since there is a high relationship between skills of a social nature and executive functions. This explains why aggressive students have greater difficulty in achieving a good performance in executive functions involving social behaviors. In this sense, it corroborates what some studies show, as pointed out by Cano-Echeverri and Vargas Gonzáles (2018) "that aggressors, are characterized by having social difficulties as they tend to be impulsive, with low frustration tolerance, difficulty in complying with rules, low school performance and minimal self-critical ability" (p. 62).

The three tests applied to assess executive functions allow us to evaluate the functioning of the prefrontal lobes, and the cognitive and affective processes of empathy and personality. In this sense, it is possible to argue that executive functions, as general control processes, can also modulate affective and emotional aspects. As well as the cognitive aspects of empathy, mainly related to higher order cognitive processes such as cognitive flexibility (Filippetti et al., 2012).

In line with this hypothesis, Shamay-Tsoory et al (2009) suggested that cognitive empathy (CE) would depend on executive functions mediated by the dorsolateral prefrontal cortex and affective empathy (AE), on the other hand, would depend mainly on affective processes such as emotional recognition. The low performance in tests measuring executive functions by aggressive students may indicate that there is a fronto-limbic deficit or lesion (either of neurological or psychiatric origin), which would explain characteristics of emotional dyscontrol, behavioral disinhibition, affective lability, in addition to problems in the regulation of aggression (Blanco & Vera De La Puente 2013).

Damasio (2010) explains that, in the emotional domain, executive processes confer coherence to affective behavior and modulate emotions and attitudes towards objects in the external world. This explains the fact that the higher the empathy coefficient, the better the performance in executive functions, as in the case of prosocial students, who performed well on the TMT part B, the STROOP, and the WCST. In this sense, it is understood that executive processes confer a feeling of unity to the personality, in addition to what has been called "emotional intelligence" (Goleman, 1995). This ability would involve both affective and cognitive understanding of mental states and those of other people (theory of mind) and has been referred to in various ways, such as metarepresentational abilities or, more briefly, metacognition (Blanco & Vera De La Puente 2013, citing Flavell, 1977 and Karmiloff-Smith, 1992).

Conclusions

The research found that there is a relationship between low empathy and deficiencies in the performance of executive functions, as in the case of aggressors and victims, who are more likely to have altered the dorsolateral circuit, which is related to cognitive activities such as working memory, selective attention, concept formation or cognitive flexibility. Therefore, it is important to propose new studies in which other more sensitive instruments can be applied to assess these executive functions.

Similarly, it is concluded that the good level of empathy in prosocial students is related to a better executive control process, such as selective attention, conflict resolution, and inhibitory control. This is also manifested in the behaviors of these students, as people who have a good management of their emotions.

It is expected that this research will have implications from the point of view of neuroeducational intervention in bullying problems observed in educational institutions, through interventions aimed at promoting empathy and improvement of executive functions related to inhibitory control, planning, cognitive flexibility and decision making, thus allowing the development of social cognition in adolescents, which favors satisfactory relationships with their environment.

Finally, the need to generate interventions other than pencil and paper, which may be aimed at promoting empathy and improvement of executive functions, from a social cognition approach, thus promoting prosociality in students with school coexistence problems, is highlighted. Therefore, it is recommended to innovate in the creation of rehabilitation programs that involve cognitive and behavioral therapeutic techniques and the advantages of virtual reality technology and computerized training software that allow stimulating cognitive, emotional and motivational aspects, in addition to using platforms such as NeuronUP or Cognift that allow customizing activities for neurorehabilitation intervention. It is also recommended to work on real-life ecological exercises that involve social interaction with others, and from there work with the theory of mind.

Conflicts of Interest:

The article presents no conflicts of interest.

References

Arán Filippetti, V. & López, M. B. (2017). Estructura Latente de las Funciones Ejecutivas en Adolescentes: Invarianza Factorial a través del Sexo. *Avances En Psicología Latinoamericana, 35*(3), 615-629. https://doi.org/10.12804/revistas.urosario.edu.co/apl/a.4724

Baron-Cohen, S. (2012). *Empatía, nueva teoría de la crueldad Cero.* Alianza.

Blanco-Menéndez, R. & Vera de la Puente, E. (2013). Un marco teórico de las funciones ejecutivas desde la neurociencia cognitiva. *Eikasia Revistadefilosofía.org. Marzo, 48,* 199-215. https://docplayer.es/1244744-Un-marco-teorico-de-las-funciones-ejecutivas-desde-la-neurociencia-cognitiva.html

Cano-Echeverri, M. M. & Vargas Gonzáles, J. E. (2018). Actores del acoso escolar. *Revista Médica de Risaralda. 24* (1), 61-63. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0122-06672018000100011

Castiblanco Hernández, L. & González-Santos, B. (2020). Bullying y estilos de afrontamiento en víctimas de una institución educativa, Colombia. *Indagare,* (8). https://doi.org/10.35707/indagare/804

Damasio, A. (2010). *El error de Descartes.* Buenos Aires. Drakontos Bolsillo.

Decety, J. & Sommerville, J. (2003). Shared representations between self and others: A social cognitive neuroscience view. *Trends in Cognitive Science. 7*(12), 527–533. https://sci-hub.se/10.1016/j.tics.2003.10.004

Delgado Reyes, A. C., Arismendy Restrepo, M., Sánchez López, J. V., y Aguirre Aldana, L. (mayo-agosto, 2022). Funcionamiento ejecutivo en un grupo de preescolares de una institución educativa privada de la ciudad de Cali (Colombia): un estudio descriptivo. *Revista Virtual Universidad Católica del Norte,* (66), 99-129. https://www.doi.org/10.35575/rvucn.n66a5

Fernández-Daza, M. (2016). Neuropsicología del Acoso Escolar: Función Mediadora del Comportamiento prosocial. *Revista Mexicana de Neurociencia.* 17(6), 106-119 https://www.researchgate.net/publication/323523738_Neuropsicologia_del_Acoso_Escolar_Funcion_Mediadora_del_Comportamiento_Prosocial

Filippetti, V. A., López, M. B. & Richaud, M. C. (2012). Aproximación Neuropsicológica al Constructo de Empatía: Aspectos Cognitivos y Neuroanatómicos. *Cuadernos de neuropsicología. 6*(1), 63-83. http://pepsic.bvsalud.org/scielo.php?pid=S0718-41232012000100006&script=sci_abstract&tlng=es

García-Piña, C. A. & Posadas-Pedraza, S. (2018). Acoso escolar: de lo tradicional a un enfoque integral. *Acta Pediátrica México. 39*(2), 190-201. https://doi.org/10.18233/apm39no2pp190-2011579

Goleman, D. (1995) *Inteligencia Emocional.* Editorial Kairós

Holguín-Álvarez, J., Ledesma-Pérez, F., Montañez-Huancaya, A. & Cruz-Montero, J. (2020). Aggressive school communities: Transformation of coexistence through artivist education methods. *Problems of Education in the 21century. 78*(4), 554. https://files.eric.ed.gov/fulltext/EJ1265647.pdf

Kellij, S., Lodder, G.M.A., Van den Bedem., Güroglu, B. & Veenstra, R. (2022). The Social Cognitions of Victims of Bullying: A Systematic Review. [La cognición social de víctimas de Bullying]. *Adolescent Research Review. 7,* 287–334. https://doi.org/10.1007/s40894-022-00183-8

Londoño, L. P., Becerra-García, J.A., Arias Castro C.C. & Martínez-Bustos, P. S. (2019). Funciones ejecutivas en escolares de 7 a 14 años de edad con bajo rendimiento académico de una institución educativa. *Revista Encuentros. 17*(02). http://dx.doi.org/10.15665/encuent.v17i02.2037

Martínez Rojas, J. (2014). *El manual de convivencia y prevención de la violencia escolar. Diagnóstico, estrategias y recomendaciones.* Magisterio.

Martorell, C., González, R., Rasal, P. & Estellés, R. (2009).

Convivencia e inteligencia emocional en niños en edad escolar. *European Journal of Education and Psychology. 2*(1), 9-78. https://doi.org/10.30552/ejep.v2i1.18

Moya, L. A., Herrero, N. & Bernal, C. (2010). Bases neuronales de la empatía. *Revista de Neurología. 50*(2), 89-100. https://doi.org/10.33588/rn.5002.2009111

Ochoa A, S. & Cruz Panesso, I. (2007). Wisconsin Card Sorting Test en el estudio del déficit de atención con hiperactividad, trastornos psiquiátricos, autismo y vejez. *Universitas Psychologica. 6*(3), 637-648. http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S1657-92672007000300015&lng=pt&tlng=es.

Organización Panamericana de la Salud. (2006). Estado del arte de los programas de prevención de la violencia en ámbitos escolares. https://iris.paho.org/handle/10665.2/2732

Pineda, D. (2000). La función ejecutiva y sus trastornos. *Revista de Neurología 30*(8), 764 - 768. https://doi.org/10.33588/rn.3008.99646

Pinilla Gómez, E., Orozco Vargas, L.C., Camargo Figuera, F.A., Berrío, J.A. & Medina Moreno, L.X. (2012). Violencia escolar en adolescentes escolarizados: validación del diagnóstico de enfermería 'riesgo de violencia dirigida a otros. *Revista Hacia la Promoción de la Salud. 7*(1), 45-58. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0121-75772012000100004

Pino Melgarejo, M. M. & Urrego Betancur, Y. (2013). La importancia de las funciones ejecutivas para el desarrollo de las competencias ciudadanas en el contexto educativo. *Cultura, Educación y Sociedad. 4*(1), 9-20. https://revistascientificas.cuc.edu.co/culturaeducacionysociedad/article/view/969

Politis, D., Moyano, P. & Calodolce. (2008). *Cociente de empatía y percepción emocional en la variante frontal de demencia frontotemporal.* XV Jornadas de Investigación y Cuarto Encuentro de Investigadores en Psicología del Mercosur. Facultad de Psicología - Universidad de Buenos Aires, Buenos Aires. https://www.aacademica.org/000-032/131

Puerta Lopera, I. C., Dussán Lubert, C., Montoya Londoño, D.M. & Landínez Martínez, D. (2019). Estandarización de pruebas neuropsicológicas para la evaluación de la atención en estudiantes universitarios. *CES Psicología. 12* (1), 17-31. https://doi.org/10.21615/cesp.12.1.2

Rey, C. (2003). La medición de la empatía en preadolescentes y adolescentes varones: adaptación y validación de una escala. *Revista Latinoamericana de Psicología. 35*(2), 185-194. http://www.redalyc.org/pdf/805/80535206.pdf

Rodríguez Barreto, L.C., Pulido, N. & Pineda Roa, C. A. (2016). Propiedades psicométricas del Stroop, test de colores y palabras en población colombiana no patológica. *Universitas Psychologica, 15*(2), 255–272. https://doi.org/10.11144/Javeriana.upsy15-2.ppst

Romero Serrano, D. R. (2012). *Representaciones sociales de la violencia escolar entre pares, en estudiantes de tres instituciones educativas públicas, de Bogotá, Chía y Sopó, Cundinamarca.* (Trabajo de grado maestría, Universidad Nacional). https://repositorio.unal.edu.co/handle/unal/10827

Shamay-Tsoory, S. G., Aharon-Peretz, J. & Perry, D. (2009). Two systems for empathy: a double dissociation between emotional and cognitive empathy in inferior frontal gyrus versus ventromedial prefrontal lesions. *Brain: a journal of neurology, 132*(3), 617–627. https://doi.org/10.1093/brain/awn279

Tamayo Topera, D. A., Merchán Morales, V., Hernández Calle, J. A., Ramírez Brand, S. M. & Gallo Restrepo, N. E. (2018). Nivel de desarrollo de las funciones ejecutivas en estudiantes adolescentes de los colegios públicos de Envigado-Colombia. *CES Psicología. 11*(2), 21-36. https://doi.org/10.21615/cesp.11.2.3

Trujillo, N., Pineda, D. & Puerta, I. (2007). Alteraciones cognitivas en adolescentes infractores con trastorno disocial de diversos niveles de gravedad. *Revista Psicología Conductual. 15* (2), 297-319. https://www.researchgate.net/publication/228369610_Alteraciones_cognitivas_en_adolescentes_infractores_con_trastorno_disocial_de_diversos_niveles_de_gravedad

Turanovic, J.J & Siennick, S.E (2022). The Causes and Consequences of School Violence: A Review. U.S Department of Justice. *National Institute of Justice*. https://www.ojp.gov/pdffiles1/nij/302346.pdf

United Nations Educational, Scientific and Cultural Organization UNESCO (2017). *According to the data offered by PISA 2015, bullying is one of the biggest concerns in schools*. [Según los datos que ofrece PISA 2015, el bullying es una de las mayores preocupaciones en las escuelas]. https://es.unesco.org/news/segun-datos-ofrecidos-pisa-2015-acoso-escolar-es-mayores-preocupaciones-escuelas

Valencia Aguirre, A. C., Prieto Quezada, M. T. & Carrillo Navarro, J. C. (2021). Peaceful coexistence at school as an imperative of current education: proposals and perspectives. *Sincronía*. (79). http://sincronia.cucsh.udg.mx/pdf/79_eng/628_645_2021_eng.pdf

Vallejo-Reyes, F. (2009. Evaluación de la Función Ejecutiva en Usuarios con Dependencia de Pasta Base de Cocaína Mediante una Batería Neuropsicológica. Psykhe. 28(1), 1-17. https://dx.doi.org/10.7764/psykhe.28.1.1111

Zavaleta-Herrera, T. I., Reynoso-Alcántara, V., Sanchez-Lopez, J., Mejía-Castillo, A. de J., Vergara-Lope-Tristán, S. & Poumian-del-Puerto, M. A. (2022). La Autopercepción de las funciones ejecutivas como predictoras de las habilidades sociales en estudiantes universitarios. *Revista ConCiencia EPG, 7*(1), 23 - 42. https://doi.org/10.32654/ConCienciaEPG/Eds.especial-2

2023, Vol. 16(31) 1-15. ©The Author(s)
Reprints and permission: www.americana.edu.co
http://publicaciones.americana.edu.co/index.php/pensamientoamericano/index