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Parental Skills and Academic Competences in School Children: The Mediator Role of Executive Functions

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Abstract

The role of parenting in the development of children's learning constitutes, at present, part of the discussion in the psychoeducational field. Although parental competences (PC) and executive functions (EF) have been investigated by psychology and neuropsychology, their relationship with academic competences remains to be fully studied. The aim of this investigation was to analyze the effect of PC perceived by parents on behavioral EF and performance-based measures of reading and mathematical competences in children. We worked with 131 school children of both sexes, between 9 and 11 years old, and their respective parents. Multivariate Analysis of Variance (MANOVA) and structural equation model (SEM) were used. The results indicate that parental skills from the parents' perspective have a significant effect on EF, reading, and mathematical skills. However, the best fit model indicates that EFs mediate the relationship between parenting skills and reading and math skills.

Keywords: parental skills, executive functions, academic competences, learning, children.

Competencias Parentales y Competencias Académicas en Niños Escolarizados: El Rol Mediador de las Funciones Ejecutivas

Resumen

El rol parental en el desarrollo del aprendizaje de los niños constituye, en el presente, una parte de la discusión en el campo psicoeducativo. Aunque las competencias parentales (CP) y las funciones ejecutivas (FE) han sido investigadas por la psicología y la neuropsicología, su relación con las competencias académicas permanece abierta para ser estudiada a profundidad. El objetivo de esta investigación es analizar el efecto de los CP percibidas por los padres en FE comportamentales y las mediciones basadas en el desempeño de las competencias lectoras y matemáticas en niños. Trabajamos con 131 niños y niñas escolarizados, entre 9 y 11 años, y sus padres. Se hizo uso del Análisis Multivariado de Variancia (MANOVA) y Modelos de Ecuaciones Estructurales (SEM). Los resultados indican que las competencias parentales desde la perspectiva de los padres poseen un efecto significativo en las FE, la lectura y las habilidades matemáticas. De forma que los modelos mejor ajustados indican que las FE median la relación entre las competencias parentales, lectoras y matemáticas.

Palabras clave: habilidades parentales, funciones ejecutivas, competencias académicas, aprendizaje, niños.

Introduction

THE INTEREST in the relationships between parents and children in psychology has always been present and it is a topic closely related to the theories of human development (Vargas-Rubilar & Richaud, 2018). In recent decades, parenting has emerged as a defined construct which refers to the activities of care, education, and promotion of socialization, developed by fathers, mothers or caregivers towards their children (Bayot & Hernández, 2008; Bornstein & Bornstein, 2014; Sanders & Turner, 2018). One of the most recently analyzed aspects of parenting is parenting competences (Azar, Vargas-Rubilar, & Arán-Filippetti, 2018; Rodrigo, Máiquez, Martín, & Rodríguez, 2015; Vargas-Rubilar, Lemos, & Richaud, 2020). Parental competences refer to the emotional, social, and cognitive abilities of parents or caregivers to care for, protect, educate, and socialize their children (Barudy & Dantagnan, 2010; De Cock, Henrichs, Klimstra, Maas, Vreeswijk, Meeus, & van Bakel, 2017). Authors have also defined parental competences as the self-perceived ability of parents to face the educational task of their children in a satisfactory and effective way (Bayot & Hernández, 2008).

Earlier research has shown that the specific parental practices favor the development of children's cognitive skills (see, for a review, Vargas-Rubilar & Arán-Filippetti, 2014) and in particular that of executive functions (EF). EF are considered higher-order cognitive processes that enable self-regulation by formulating goals, organizing plans to achieve them, and executing the plan effectively (Lezak, 1995). Overall, the dimensions into which executive skills are grouped are: (a) working memory (WM), defined as the ability to keep information in the mind where it can be manipulated; (b) cognitive flexibility, comprising creative thinking and flexible adjustments in the face of changes; and (c) inhibition (Miyake, Friedman, Emerson, Witzki, Howerter, & Wager, 2000). Several studies agree that EFs require time to reach their full potential, which is explained by the slow maturation of the prefrontal cortex (PFC) (Diamond, 2002). However, the genetic information for the structural and functional changes of the PFC is not enough to guarantee the development of EFs (Arán-Filippetti, 2011; González, 2013). EFs receive, in turn, a differential effect of the particular condition on the child's development, such as the parenting culture, parenting styles, learning modalities, among others, as well as schooling, especially the specific teaching-learning processes (Thorell, Lindqvist, Bergman Nutley, Bohlin, & Klingberg, 2009; Wenzel & Gunnar, 2013). Studies in this line have indicated that children with secure attachment have an advantage over insecure, ambivalent, and disorganized ones, in various developmental domains such as language, metacognitive functioning, cognitive flexibility, ability to express internal states and understanding of negative emotions in others (González, 2013). González (2013) also reports that stressful experiences in the child's early interactions (e.g., abandonment, abuse, etc.) can cause permanent damage to the orbitofrontal cortex, impacting on regulation and social adjustment behaviors, associated with future behavioral and psychic problems. As regards particularly to the effect of parental competences on EF, some recent studies showed significant associations between most of the dimensions of parental abilities and specific domains of EF of children in the Chilean population (Bernal-Ruiz, Rodríguez-Vera, González-Campos, & Torres-Alvarez, 2018; Bernal-Ruiz, Ortega, & Rodríguez-Vera, 2020).

Parental skills, executive functions, and academic competences

Current paradigms in the educational field promote education by competences with the purpose of developing in students their ability to overcome in a comprehensive way, from a know-how to do, the challenges that arise by the accelerated changes of the new century (National Education Law No. 26.206, chapter II, art. 11; Provincial Education Law No. 9870, art. 4). For De Miguel (2006), competences are a potential of behaviors adapted to a situation, an aspect entrenched in the student's personality that can explain and/

or predict their performance, and are linked to underlying characteristics such as motives, self-concept, knowledge, skills, etc. Competences will be conditioned or shaped both by the context in which their knowledge, skills, values, etc. are developed, as well as by the study situations and the students' track of experiences inside and outside school (Moya & Luengo, 2011).

Regarding the concept of *reading competence* (RC), Jiménez Pérez (2014) states that it encompasses reading comprehension, which is an abstract fact that depends on the individual ability of each subject, while RC is the ability of human beings to use their reading comprehension in a useful way in the society around them. In this way, the ability is closely linked to intellectual or emotional capacities, or the individual's psychological profile, while competence refers to a pragmatic variable, social intelligence, and socialization. On the other hand, *mathematical competences* (MC) entail the ability to use numbers, perform basic operations, use symbols and forms of communication of mathematical reasoning, to interpret and solve problems of daily life and work (Education Law Provincial No. 9870, art. 4). D'Amore, Díaz and Fandiño (2008) argue that MC are complex and dynamic. Complex, since it implies two interacting and inseparable components: use (of an exogenous nature) and domain (of an endogenous nature), in the cognitive, interpretative, and creative elaboration of mathematical knowledge in which different contents are linked and related. Dynamic, because it encompasses not only mathematical knowledge, but also metacognitive, affective, motivational, and volitional factors, being in most cases the result of diverse and interconnected knowledge. In this sense, it implies use, mastery, and availability.

Neurosciences have made significant contributions to brain functioning and the cognitive processes for learning (Dehaene, 2016; Mogollón, 2010). Likewise, other studies (Lipina & Segretín, 2015; Posner & Rothbart, 2018) have pointed out the importance of family environment, particularly the role of parents in the development of motivation to read and the acquisition of the its preconditions (i.e., development of motor skills, cognitive processes, oral language skills or abilities, and phonological awareness). Related studies also state that the competences put into play by those who fulfill parental functions have a relevant impact on the development and maturation of brain functions, as well as on the possibilities of learning, particularly school learning (Cervigni, Stelzer, Mazzoni, & Álvarez, 2012; Basuela, 2014; Fernández, 1987; Paín, 1975; Posner & Rothbart, 2018). Consistently, Mero, Pico, Rodríguez, and Bello (2015) indicated that the causes of low academic performance are very diverse, and that family variables that may be associated with other pedagogical and/or personal characteristics of the student stand out.

Research in cognitive neuroscience has also related the academic performance of students with the cognitive and affective resources placed by them in the classroom environment. Studies in this line have indicated the existence of a link between the students' EF and their performance obtained in calculation, reading, and writing activities (Blair, 2013; Evans & Rosenbaum, 2008; Geary, Hoard, Byrd-Craven, Nugent, & Numtee, 2007). In the academic area of mathematics, studies such as those by Arán-Filippetti and Richaud (2017) have shown that WM would be involved in numerical production and mental calculation, while cognitive flexibility would be selectively associated with solving arithmetic problems. Consistently, Risso et al. (2015) and Veleiro and Thorell (2012) have shown the predictive role of WM on mathematical performance. Research conducted with elementary school students also suggests that WM and attention control play a key role in supporting emerging literacy and mathematical calculation and problem solving (Passolunghi, Vercelloni, & Schadee, 2006). Likewise, several investigations have shown the relationship between EF and RC. Among these, Arán-Filippetti and López (2016) found that WM and spontaneous cognitive flexibility (i.e., verbal fluency) would be the main executive processes that would explain, in part, individual performance

variations in reading comprehension tasks. Also, Cruz and Tomasini (2005) reported the impact of self-regulation processes on reading comprehension. Previous study results have also shown that during EC tasks children create a purpose, think, review their plan, supervise it, and motivate themselves to execute it (Reyes, Barreyro, & Injoque-Ricle, 2015).

Overall, the competences displayed by those who fulfill parental functions have a relevant impact on the development and maturation of brain functions (Posner & Rothbart, 2018), as well as on the possibilities of learning —particularly school learning— (Barudy, 2010; Basuela, 2014; Fernández, 1987; Fernández, 2002; Paín, 1975; Vargas-Rubilar & Arán-Filippetti, 2014). However, scientific research regarding the relationship between parental competences, EF and academic competences in school-age children is scarce in the Latin American population and practically nonexistent in the Argentine population. Although some research has examined the role of parenting on children's cognitive development, there are few studies about parenting skills in processes related to learning in school-age that analyze the effect of mediating variables. Thus, this research aimed at analyzing the effect of parental skills on academic competences in school-age children, examining the mediating role of EF. Based on the aforementioned objectives, the following hypotheses were proposed:

H1. Parental competences perceived by parents have a positive and significant effect on children's EF.

H2. Parental skills perceived by parents have a positive and significant effect on children's academic competencies.

H3. EFS mediate the relationship between parental skills and academic competences.

Method

Participants

We worked with a sample of 131 children of both sexes (63 girls = 48.1% and 68 boys = 51.9%), between 9 and 11 years old (M = 9.84; SD = 0.71) from public schools and their respective parents (110 women = 83.96% and 21 men = 16.04%; Mage = 36.68; SD = 7.05), citizens of Córdoba, Argentina. The criterion of inclusion was that children were not repeaters and did not have a clinical, neurological, or psychiatric history.

Instruments

Perceived Parental Competence Scale (ECPP-p; Bayot & Hernández, 2008. Argentine adaptation by Azar, Vargas-Rubilar, & Arán Filippetti, 2018). The Argentine version of the ECPP-p is composed of 22 items that assess four dimensions: school involvement, dedication and orientation, shared leisure, and assumption of the role of father or mother. The instrument has four response options. Its psychometric functioning was adequate in the Argentine population (Azar et al., 2018). The analysis of the discriminative power of the items showed that the 22 items are discriminative; they obtained a score = p <.001. The reliability of the total scale from the aspect of internal consistency was highly satisfactory (α = .83). That of the dimensions ranged between low and high values (.45 to .73). The construct validity study reported a good fit with four factors: school involvement, dedication and orientation (integrating the factors personal dedication and advice and orientation of the original scale), shared leisure, and assumption of the role of father or mother (Azar et al., 2018).

Childhood Executive Functioning Inventory (CHEXI; Thorell & Nyberg, 2008). It assesses EF in children aged 4 to 12 years from the perspective of parents and/or teachers. This questionnaire has 24 items and presents five response options. It includes four subscales: working memory, planning, inhibition, and regulation. By means of EFA techniques, a two-factor solution have been found (i.e., working memory and inhibition in Swedish speaking children; Thorell & Nyberg, 2008). Both dimensions show acceptable levels of internal

consistency (Cronbach's α =.89 for WM and = .85 for inhibition) and adequate reliability (Thorell, Veleiro, Siu, & Mohammadi, 2013). A recent study also demonstrated that the CHEXI inventory is a reliable measure to assess EF in Argentinean Spanish-speaking children (Gutiérrez, Arán Filippetti, & Lemos, 2021). Regarding the parent form, the reliability measured through ω McDonald was adequate for both factors (WM ω = .86; IN ω = .84) and the total scale (ω = .92; Gutierrez et al., 2021).

EVALUA batteries (García Vidal, González Manjón, García Ortiz, & García Pérez, 2013). The EVALUA battery allows detecting school learning difficulties. It assesses general skills related to essential elements of the level of development in school age (cognitive, personal, and social), and specific skills related to dimensions of the school learning process (Reading, Writing, Mathematics, work and study habits, and academic orientation). The battery consists of two sub-batteries, EVAMAT and EVALEC. The EVAMAT 4 and 5 and EVALEC 4 and 5 batteries of the adaptation were applied (García Vidal, González, García Ortiz, & García Pérez, 2013).

EVALEC version 2.0 of the EVALUA battery (García Vidal et al., 2013). This instrument is a set of tests aimed to assess basic RC. Battery and test studies report a high level of reliability between .93 (Evalec-8) and .98 (Evalec-7). The EVALEC 4 and EVALEC 5 batteries are structured in two large blocks: reading efficiency and processes directly related to reading comprehension. The studies of the batteries and the EVALEC 4 and 5 tests report a high level of reliability, being α = 0.94 and α = 0.94 respectively (García Vidal et al., 2013). The inter-test correlation is all significant at 0.01 (bilateral). In both batteries (EVALEC-4 and EVALEC 5) and with the batteries as a whole, a high inter-test correlation of most tests stands out. This indicates a high level of homogeneity (García Vidal et al., 2013).

EVAMAT version 2.0 of the EVALUA battery (EVAMAT-4: García Vidal, García Ortiz, & González, 2013; EVAMAT-5: García Vidal et al., 2013). This instrument is designed to assess the development of mathematical skills, and it includes the following tests: (a) numbering tests; (b) calculus tests: children's knowledge and mastery of operations and procedures to solve them; (c) geometry tests (not applied); (d) evidence of treatment of the information and chance; (e) problem-solving tests that assess skills involved in solving problem situations of a quantitative nature related to all of the above. Battery studies and EVAMAT 4 and 5 tests report a high level of battery reliability, α = .97 and α = .95, respectively (García Vidal et al., 2013). In all cases, the inter-test correlation is high, with a correlation coefficient greater than .50. In the case of EVAMAT 4, all the correlations are significant at 0.01 bilateral in both cases. A high inter-test correlation was found for most of the tests with each other, and with the batteries as a whole, which indicates a high level of homogeneity (García Vidal et al., 2013).

Data collection

To collect data from parents, they were contacted by their children's school, where they were introduced to the research objectives in a meeting organized by teachers. Then, they received the protocols, informed consents, and a note that explained the objectives and relevance of the study, as well as the ethical precautions. The evaluation of the children was carried out in groups during the usual class time.

Data analysis

Multivariate Analysis of Variance (MANOVA) was used to analyze differences regarding EF and performance on objective tests that assess children's mathematical and reading competence, according to parental skills from the parents' perspective. For said data analysis, the statistical software SPSS version 23 was used. To test different structural equation models, the AMOS version 16 was used (Arbuckle, 2007). The fit of the models was estimated using the χ^2 test and the following Fit indices: CFI (Comparative Fit Index) and NFI (Normed Fit Index). In

addition, the mean square error of approximation (RMSEA) was calculated for each model.

Ethical considerations

Actions carried out within the framework of this work considered the international ethical mandates for research with human beings (i.e., Council for International Organizations of Medical Sciences [CIOMS], World Health Organization [WHO] & Pan American Health Organization [PAHO], 2016) and the statements of the Interamerican Society of Psychology (ISP, 2019) on ethical behavior (American Psychological Association [APA], 2010; Colegio Colombiano de Psicólogos, 2009). The students participated anonymously and voluntarily, and the parents were asked to sign the informed consent to apply the instruments. No incentives of any kind were given in exchange for participation. The information collected was treated confidentially and was not accessible to anyone outside of the investigation.

Results

Effect of parental competences on EFS

Shared Leisure. An overall significant effect of this dimension on EF was found, Hotelling's $F(8, 246) = 2.635$, $p = .009$, $\eta p^2 = .79$. The Eta squared value above 0.06 indicates a medium effect. Univariate analysis indicated that there are significant differences in the four EF subscales, i.e., WM, $F(2, 127) = 5.85$, $p = .004$, $\eta p^2 = .84$; planning, $F(2, 127) = 4.09$, $p = .019$, $\eta p^2 = .61$; regulation, $F(2, 127) = 10.01$, $p < .001$, $\eta p^2 = .13$; and inhibition, $F(2, 127) = 4.86$, $p = .009$, $\eta p^2 = .71$ (Table 1). Significant differences were found between the groups with low and high levels of this PC regarding WM, planning, regulation, and inhibition. A significant difference was also found between the groups with low and medium levels of shared leisure in WM, regulation, and inhibition (Table 1).

Table 1
Descriptive statistics for the recategorized PCP-P dimensions and EFS

		Low		Medium		High		Statistics			
	FE	M1	SD	M2	SD	M3	SD	F	p		η_p^2
									M1-M2	M1-M3	M2-M3	
Implication School	1	21.18	6.30	19.62	5.41	20.41	7.31	0.42	0.690	0.765	0.996	0.01
	2	9.26	3.00	8.92	2.89	9.21	3.59	0.70	0.465	0.844	0.854	0.00
	3	14.47	4.10	13.74	4.39	13.74	4.42	0.14	0.861	0.996	0.922	0,00
	4	16.63	4.93	16.49	4.60	15.74	4.91	0.47	0.691	0.706	1.000	0.00
Dedication and Orientation	1	21.69	6.32	19.73	6.00	19.60	6.57	1.62	0.295	0.282	0.995	0.02
	2	9.59	2.93	8.78	3.04	8.89	3.47	0.95	0.422	0.550	0.988	0.01
	3	15.09	4.07	13.24	3.56	13.43	5.01	2.79	0.089	0.166	0.980	0.04
	4	17.39	5.35	15.66	3.96	15.57	4.65	2.18	0.089	0.166	0.997	0.03
Shared Leisure	1	22.91	6.87	19.67	5.91	18.61	5.27	5.85	0.042	0.007	0.727	0.84
	2	10.13	3.01	8.87	3.00	8.29	3.15	4.09	0.120	0.018	0.661	0.61
	3	16.15	4.29	13.20	3.63	12.58	4.02	10.01	0.002	0.000	0.780	0.13
	4	18.07	5.23	15.61	4.33	15.18	4.32	4.86	0.045	0.022	0.918	0.71
Assumption of the Father's or mother's role	1	20.86	6.44	22.31	5.86	18.32	6.07	3.97	0.550	0.150	0.025	0.59
	2	9.46	2.97	9.83	3.02	8.05	3.20	3.59	0.852	0.095	0.050	0.54
	3	14.63	3.92	15.46	4.16	11.92	4.12	7.95	0.638	0.007	0.001	1.11
	4	16.77	5.11	17.23	4.59	14.92	4.32	2.53	0.905	0.182	0.121	0.38

Note: 1 = Working Memory; 2 = Planning; 3 = Regulation; 4 = Inhibition.

Assumption of the Role of Father or Mother. An overall significant effect of this PC on EF was found, Hotelling's $F(8, 246) = 2.10$, $p = 0.036$, $\eta p^2 = 0.06$. Univariate analysis indicated that there are significant differences regarding WM, $F(2, 127) = 3.97$, $p = .021$, $\eta p^2 = .59$; planning, $F(2, 127) = 3.59$, $p = 0.030$, $\eta p^2 = .54$; and regulation, $F(2, 127) = 7.95$, $p = .001$, $\eta p^2 = 1.11$. No significant difference was observed regarding inhibition, $F(2, 127) = 2.53$, $p = .083$, $\eta p^2 = 0.38$. Significant differences were found in the EF of WM, planning and regulation between the groups with medium and high levels of this parental competence. A significant difference in regulation was also found between the groups with low and high levels of parental competence (Table 1).

No overall significant effect for the school involvement dimension (Hotelling's $F(8, 246) = .493$, $p = .860$, $\eta p^2 = .016$) and for the dedication and orientation dimension (Hotelling's $F(8, 246) = .839$, $p = .569$, $\eta p^2 = .027$) on EF was found.

Effect of Parental Skills on Reading Skills (RS)

Shared Leisure. No overall significant effect was found for this dimension on RS, Hotelling's $F(12, 238) = 1.619$, $p = .087$, $\eta p^2 = .075$. However, the univariate analysis indicated that there are significant differences in terms of phonological access, $F(2, 125) = 3.658$, $p = .029$, $\eta p^2 = .055$, global comprehension, $F(2, 125) = 5.792$, $p = .004$, $\eta p^2 = 0.085$, and in the total of CL $F(2, 125) = 3.776$, $p = .026$, $\eta p^2 = 0.057$, but not in terms of visual access, $F(2, 125) = 2.522$, $p = 0.084$, $\eta p^2 = 0.039$, reading accuracy $F(2, 125) = 0.075$, $p = .928$, $\eta p^2 = .00$, and literal comprehension $F(2, 125) = 1.114$, $p = .331$, $\eta p^2 = .018$. Significant differences were observed between children with low and high levels of shared leisure in phonological access, between low and medium and medium and high levels in global comprehension, and between medium and high levels in the total reading competence (Table 2).

Table 2
Descriptive statistics for the different recategorized dimensions of PCP-P and RC

		Low		Medium		High		Statistics				
	RC	M1	SD	M2	SD	M3	SD	F	p			η_p^2
									M1-M2	M1-M3	M2-M3	
Implication School	1	38.25	16.43	38.57	19.96	41.01	19.66	0.26	0.996	0.768	0.842	0.00
	2	23.15	9.91	26.44	11.44	23.32	11.23	1.19	0.317	0,997	0.441	0.01
	3	16.91	6.63	16.56	6.93	18.92	4.87	1.48	0.962	0.308	0.260	0.02
	4	40.28	13.51	39.84	13.56	38.13	13.62	0.27	0.987	0.746	0.857	0.00
	5	23.17	10.37	24.05	9.60	23.72	10.90	0.08	0.914	0.968	0.990	0.00
	6	141.78	43.39	145.36	45.23	145.12	46.73	0.09	0.924	0.937	1.000	0.00
Dedication and Orientation	1	36.78	17.58	40.73	19.34	40.65	18.19	0.70	0.560	0.598	1.000	0.01
	2	22.06	11.26	25.56	10.71	25.70	9.69	1.73	0.265	0.264	0.998	0.02
	3	16.50	6.57	16.85	6.39	19.18	5.65	2.10	0.961	0.126	0.249	0.03
	4	38.55	14.64	40.10	13.88	40.55	11.25	0.27	0.850	0.777	0.988	0.00
	5	22.11	10.04	24.76	10.90	24.41	9.71	0.92	0.435	0.559	0.988	0.01
	6	136.02	45.16	147.91	48.37	150.52	37.88	1.38	0.410	0.295	0.965	0.02
Shared Leisure	1	38.45	19.34	35.36	15.35	44.22	19.39	2.52	0.697	0.318	0.071	0.03
	2	21.63	11.88	23.57	10.04	27.81	9.29	3.65	0.656	0.023	0.165	0.05
	3	17.07	6.59	17.41	6.08	17.60	6.46	0.07	0.965	0.925	0.990	0.00
	4	38.37	13.83	38.49	14.16	42.32	12.10	1.11	0.999	0.381	0.403	0.01
	5	21.94	10.85	21.36	8.76	28.12	9.87	5.79	0.957	0.014	0.006	0.08
	6	137.47	48.99	136.20	40.58	159,97	39.98	3.77	0.989	0.054	0.039	0.05

		Low		Medium		High		Statistics			
	RC	M1	SD	M2	SD	M3	SD	F	p		η_p^2
									M1-M2	M1-M3	M2-M3	
Assumption of the Father's or mother´s role	1	38.52	15.66	37.44	19.78	41.39	20.49	0.46	0.960	0.739	0.629	0.00
	2	24.13	10.55	21.43	11.07	26.67	10,36	2.21	0.470	0.497	0.093	0.03
	3	16.08	6.61	18.89	4.59	17.75	7.04	2.25	0.101	0.419	0.720	0.03
	4	39.71	13.15	34.90	13.93	43.71	12.42	4.08	0.214	0.323	0.014	0.06
	5	22.19	8.83	21.54	10.34	27.45	11.18	4.11	0.951	0.037	0.034	0.06
	6	140.57	39.99	134.21	46.68	156.99	46.70	2.69	0.782	0.183	0.073	0.04

Note: 1 = Visual Access; 2 = Phonological Access; 3 = Reading Accuracy; 4 = Literal Comprehension; 5 = Global Comprehension; 6 = total Reading Competence. The mean difference is significant at level 0.05.

Assumption of the Role of Father or Mother. A significant general effect of this dimension was found: Hotelling's $F(12, 238) = 1.862$, $p = 0.040$, $\eta p^2 = 0.086$. Univariate analysis indicated that there are significant differences regarding literal comprehension $F(2, 125) = 4.080$, $p = 0.019$, $\eta p^2 = 0.061$ and global comprehension $F(2, 125) = 4.110$, $p = 0.019$, $\eta p^2 = 0.062$. In all cases, the Eta squared value indicated a medium effect. There were no significant differences regarding visual access $F(2, 125) = 0.467$, $p = 0.628$, $\eta p^2 = 0.007$, phonological access $F(2, 125) = 2.211$, $p = 0.114$, $\eta p^2 = 0.034$, reading accuracy $F(2, 125) = 2.254$, $p = 0.109$, $\eta p^2 = 0.035$, and in the total of RC, $F(2, 125) = 2.695$, $p = 0.071$, $\eta p^2 = 0.041$. Significant differences were observed between low and high and medium and high levels of this PC regarding global comprehension, and between medium and high levels of literal comprehension (Table 2).

No overall significant effect was found for school implication, Hotelling's $F(12, 238) = 0.011$, $p = 0.439$, $\eta p^2 = 0.049$ and for dedication and orientation Hotelling's $F(12, 238) = 0.843$, $p = 0.606$, $\eta p^2 = 0.041$.

Effect of parental competences on mathematical competences.

Dedication and Orientation. No overall significant effect was found: Hotelling's $F(8, 248) = 1.399$, $p = 0.198$, $\eta p^2 = 0.043$. However, univariate analyses indicated there were significant differences in numbering ($F(2, 128) = 4.050$, $p = 0.020$, $\eta p^2 = 0.060$) between children with low and high levels and between children with medium and high levels of this PC (Table 3).

No overall significant effect on MC or its different dimension were found for the school involvement dimension, Hotelling's $F(8, 248) = 0.227$, $p = 0.986$, $\eta p^2 = 0.007$; the shared leisure dimension, Hotelling's $F(8, 248) = 0.893$, $p = 0.523$, $\eta p^2 = 0.028$; and the assumption of the role of father or mother dimension, Hotelling's $F(8, 248) = 1.457$, $p = 0.174$, $\eta p^2 = 0.045$.

Table 3
Descriptive statistics for the different recategorized dimensions of PCP-P and MC.

		Low		Medium		High		Statistics			
		M1	SD	M2	SD	M3	SD	F	p		η_p^2
									M1-M2	M1-M3	M2-M3	
Implication School	1	27.69	9.95	27.66	9.89	29.03	10.47	0.22	1.000	0.813	0.829	0.00
	2	28.63	7.47	27.85	9.25	28.44	10.35	0.09	0.904	0.995	0.956	0.00
	3	29.49	8.78	27.52	7.71	28.77	9.74	0.60	0.518	0.922	0.813	0.00
	4	20.91	13.72	20.66	14.13	21.79	14.82	0.06	0.996	0.955	0.937	0.00
	5	106.74	29.60	103.69	29.75	108.04	34.25	0.20	0.882	0.979	0.819	0.00

		Low		Medium		High		Statistics				
		M1	*SD*	*M2*	*SD*	*M3*	*SD*	*F*	*p*			η_p^2
									M1-M2	M1-M3	M2-M3	
Dedication and Orientation	1	26.92	10.17	26.11	10.15	32.02	8.65	4.05	0.916	0.045	0.026	0.06
	2	28.25	7.22	27.60	9.79	29.34	9.85	0.36	0.933	0.836	0.670	0.00
	3	28.93	8.69	27.95	8.72	29.22	8.93	0.23	0.851	0.987	0.804	0.00
	4	19.32	14.11	22.47	15.43	22.14	12.16	0.72	0.525	0.625	0.994	0.01
	5	103.44	29.61	104.16	34.07	112.73	28.08	1.10	0.993	0.344	0.447	0.01
Shared Leisure	1	26.76	10.89	27.64	9.83	30.05	9.01	1.18	0.906	0.293	0.511	0.01
	2	26.58	7.88	27.87	7.83	31.05	10.35	2.87	0.754	0.052	0.215	0.04
	3	28.59	8.38	28.24	9.60	29.41	8.10	0.19	0.980	0.903	0.813	0.00
	4	18.47	13.65	20.91	12.32	24.38	16.02	1.86	0.677	0.134	0.492	0.02
	5	100.42	28.52	104.67	29.78	114.91	33.19	2.45	0.778	0.079	0.274	0.03
Assumption of the Father's or mother´s role	1	27.88	9.15	25.66	12.05	30.51	8.73	2.22	0.547	0.416	0.093	0.03
	2	29.17	8.35	26.19	8.68	29.13	9.35	1.49	0.249	1.000	0.322	0.02
	3	27.97	9.03	27.98	7.53	30.48	9.21	1.12	1.000	0.355	0.435	0.01
	4	19.42	11.83	20.68	15.05	23.89	15.92	1.18	0.907	0.283	0.587	0.01
	5	104.45	28.15	100.52	31.39	114.02	32.94	1.96	0.818	0.294	0.142	0.03

Note: 1 = Numbering; 2 = Calculation; 3 = Information and Chance; 4 = Problem Solving; 5 = total Mathematical Competence. The mean difference is significant at level 0.05.

Structural equation models

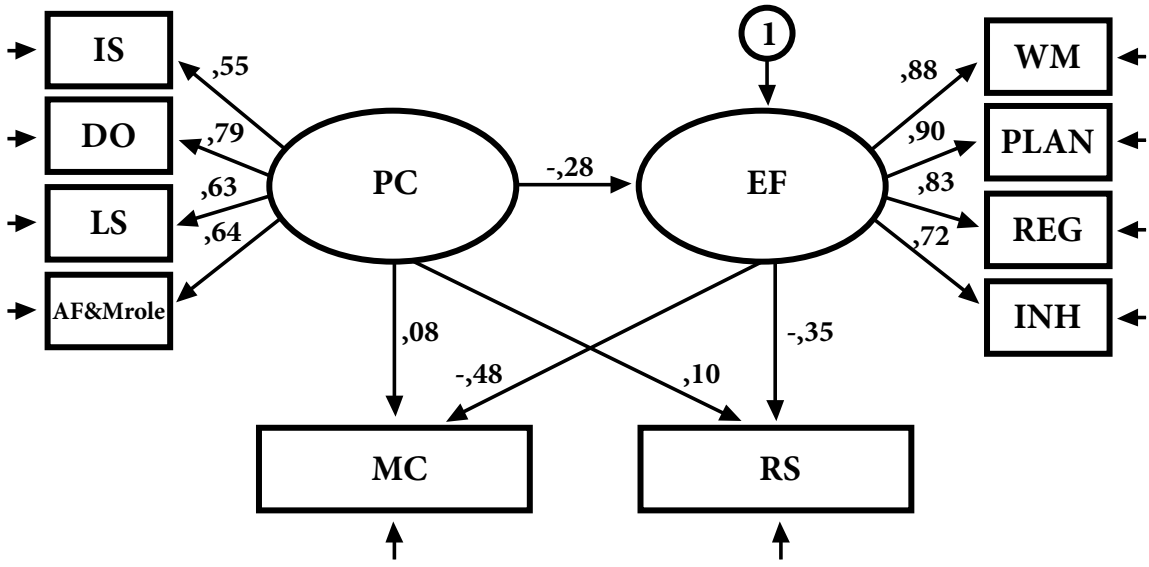
Finally, different models were tested to examine the relationship between parenting skills, EFs, and academic skills. First, the effect of PCs on EFs was examined. This model showed a good fit to the empirical data, indicating that PC predicts EF from the parents' perspective (-.28, p = .010). Model 2 (M2), which analyzes the contribution of PCs to academic competences, showed that PCs predict both Mathematical Competences (MC) (.25, p = .016) and Reading Skills (RS) (.23, p = .026). However, the model did not show a satisfactory fit to the data. In Model 3, we analyze the relationship between FE and academic competences. This model showed a good fit to the empirical data, indicating that EF predicts both MC (-.50, p <.001) and RS (-.38, p <.001). Finally, Model 4 (M4), that analyzes the direct effects of PCs on EFs and indirect effects on academic competences through EFs, showed the best fit to the data (see Table 4 and Figure 1). These results suggest that PCs have a direct effect on EF and indirect effects on academic competencies through EF.

Table 4
Model Fit Indices

Model	χ^2	df	*p*	χ^2/df	NFI	CFI	RMSEA
Model 1	28.508	19	.074	1.50	.94	.98	.063
Model 2	35.134	9	.000	3.90	.77	.81	.151
Model 3	15.332	8	.053	1.92	.96	.98	.085
Model 4	31.987	31	.417	1.03	.94	1.00	.016

Note: M1 = contribution of parenting skills to EF; M2 = contribution of parenting skills to reading and math skills; M3 = contribution of EF to reading and math skills; M4 = direct effects of PC on EF and indirect effects of PC on academic skills through EF.

Figure 1. Direct effects of parental competences on EF and indirect effects on academic competences through EF.



Discussion

This work aimed to analyze the effect of parental skills on academic competences in school-age children and to examine the mediating role of EF in the relationship between parental skills and academic competences. In the first place, it found a significant effect of parental competences on EF, with a marked discrepancy between children with a higher degree of parental competences and those who presented lesser competences. Particularly, we observed that the shared leisure dimension (i.e., perception of the commitment of parents to collaborate with their children so that they learn to know and integrate into the environment and the time of quality shared) and the assumption of the role of father or mother dimension (i.e., perception of adaptation to parental function after the birth of children), had a positive impact on children's EF behavior. Our findings suggest that higher self-perceived parental competences favor children's EF.

These results also agree with earlier research that indicates that parental support, the establishment of limits, and an adequate parental sensitivity and positive control are linked to a greater WM capacity, planning, inhibition, monitoring, attentional shift, and emotional control and self-regulation (Arcos & Flores, 2017). Likewise, a recent study found that protective and formative parental competences were related to a greater EF in children (Bernal-Ruiz et al., 2020). In particular, the authors found that knowledge, attitudes, and everyday parenting practices that organize the exploration and learning environment (i.e., formative competencies) predict planning, problem-solving, and executive fluency in children (Bernal Ruiz et al., 2020). Consistently, González (2013) found that situations of abandonment and abuse (i.e., indicators of low parental competences) could cause permanent damage to the orbitofrontal cortex, affecting the behaviors of regulation and social adjustment. Consequently, we could confirm hypothesis 1 of the study: that parental competences perceived by parents have a positive and significant effect on children's EF.

Regarding the effect of parental skills on academic competences, this study found a significant effect of the shared leisure dimension on phonological access, global comprehension, and total RC, and in the dimension assumption of

the father's or mother's role on RC, especially on literal comprehension and global comprehension. Similarly, Guarneros and Vega (2014) observed that exposure to a diverse vocabulary is among the factors that favor the development of oral language in preschool children. According to their research, the use of different and new words by parents and teachers prompts children to include more vocabulary into their conversations. Lipina and Segretin (2015) and Posner and Rothbart (2018) also highlight the importance of the role of parents, both for the acquisition of the prerequisites of reading and reading motivation.

Considering the theoretical background and the results of this study, one could argue that the above-mentioned parental dimensions refer to a dialogic interaction between parents and children, hence their positive impact on the linguistic competence of children. According to Weiss (2014), positive relationships between parents and children and the involvement of parents in their children's school activities have a positive effect on their school performance. Regarding the effect of PC perceived by parents on MC, our results showed that the dedication and orientation dimension significantly affects numbering tests. Thus, it is possible that parents who are dedicated to clarifying doubts and guiding the resolution of problems favor their children's ability to apply knowledge of numbers, measurements, and magnitudes. The results agree with those of Epstein (2013), who found that the perceptions that mothers and fathers have about their children's mathematical abilities relate to the academic results that they have in Mathematics. In this line, Bucci, Brumariu, Diaconu-Gherasim, and Hunter (2021) found that maternal parenting skills (i.e., maternal achievement-oriented control and maternal monitoring) and maternal teaching strategies relate to children's academic competence in middle childhood. Particularly, the authors found that mothers who use less achievement-oriented control have children with higher academic competence. However, no incidence of parental competencies was found on the other MC skills related to calculating and solving problems. Therefore, we could partially confirm hypothesis 2 of the study: that parental competences have a positive effect on the academic competences of children.

Finally, when examining the relationship among variables by means of structural equation model techniques, we observed that parental competences predict EF (i.e., Model 1) and that EFS predict academic competences (i.e., Model 3). However, M2, that analyzes the relationship between parental competences and academic skills, did not show a satisfactory fit to the empirical data. Based on these findings, a fourth model (M4) was tested to examine the mediating role of EFS in the relationship between parenting skills and academic competences. The results show that EFS play a mediating role between PC and both academic competences, and suggest that PCS influence the development of EFS (Vargas-Rubilar & Arán-Filippetti, 2014), which in turn promote the acquisition of academic skills (Pérez & Beltrán, 2014). The mediating role of EFS was also revealed by Bernal Ruiz et al. (2018), who found that certain PCS affect the ability of children to regulate their behavior (which implies the use of EF) and these would be related to optimal performance in mathematics and language. Similarly, Bernal Ruiz et al. (2018) showed that children whose parents showed greater protective, reflective, and formative skills, had more developed EF, as well as better performance in mathematics and language.

The relationship between EF and academic skills has also been demonstrated in studies that assess EF through laboratory tasks. Indeed, Arán-Filippetti and López (2016) found that WM and spontaneous cognitive flexibility (i.e., verbal fluency) would be the main executive processes that explain, in part, individual performance variations in reading comprehension tasks. Likewise, Cruz and Tomasini (2005), when analyzing the impact of self-regulation processes on reading comprehension, found that during this task the children create a purpose, think, review their plan, supervise it, and motivate themselves to execute

it. Stelzer and Cervigni (2011) also highlighted the existence of a link between certain executive processes and performance in different curricular domains. Therefore, our findings offer additional support to the hypothesis that executive processes play a central role in learning, even when they are assessed at the behavioral level from the parents' perspective. Based on these results, we can confirm hypothesis 3: that EFs mediate the relationship between parental skills and academic competences.

In summary, our results indicate that appropriating literacy and math abilities requires a set of affective resources, which are closely related to parenting skills, as well as cognitive resources, among which EFs stand out (see Blair & Razza, 2007; Geary et al., 2007; Roselli et al., 2008). Earlier studies (Basuela, 2014; Cervigni et al., 2012; Fernández, 1987; Paín, 1975; Posner & Rothbart, 2018) have also shown that the competences of those who perform parental functions have a significant impact on the development and maturation of brain functions, as well as on learning possibilities, especially at school age.

Conclusions

This study shows that some dimensions of parental competences are positively related to: (a) EFs in general and/or with some of them in particular, and (b) the total RC and/or some of its abilities. Besides, some of them are related to different aspects of MC. Finally, we found that EFs play a mediating role in the relationship between parental skills and academic competences.

These results have theoretical, clinical, and psychoeducational implications. Theoretical, since they provide empirical data regarding the relevance of PCs for the development of EF and for academic task performance, as well as concerning the impact of EF on RS and MC. Clinical, because our results bring forwards the importance of early detection and approach to families in order to strengthen EFs and perform differential diagnoses. Finally, they constitute the basis for proposing interventions in parental strengthening programs during childhood.

Other studies have suggested that EF ratings assessed by parents and teachers are important predictors of the development of academic competencies at school age (Risso et al., 2015). Taking this into consideration, our study is limited, on the one hand, by not having the results of performance-based measures of EF. These indicators would have provided greater richness and objectivity to the investigation. Hence, further studies would benefit from analyzing the joint contribution of the EF from both perspectives (cognitive vs. behavioral) on children's academic task performance to examine which measure has a higher predictive level. On the other hand, parental competences were only assessed from the parent's perspective. In this regard, future studies would benefit from analyzing the relationship among variables by also evaluating the parental competences perceived by children, given that earlier research has emphasized that children's perceptions or interpretations of parental attitudes and behaviors have an important impact on their psychosocial development (Richaud, Lemos, & Mesurado, 2011; Vargas-Rubilar et al., 2020). Finally, another limitation is related to the geographical representativeness of the sample, since the study only included children from Argentina with a typical development. This hinders the generalizability of the results to children from other Spanish-speaking countries or to samples with atypical development.

In summary, our results show the impact of PC on different structural dimensions of the learner and the link between EF and the academic skills of reading and calculation. Considering that EFs involve a series of skills that allow "doing" with what has been learned, they constitute an essential factor for meaningful learning. The results also visualize the centrality of PC on children's EF and in their ability to regulate their behavior to learn.

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