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The Benefits of Chess for the Intellectual and Social-Emotional Enrichment in Schoolchildren

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This paper examines the benefits of regularly playing chess for the intellectual and social-emotional enrichment of a group of 170 schoolchildren from 6-16 years old. It is based on a quasi-experimental design, where the independent variable was the extracurricular activity of chess ($n = 170$) versus extracurricular activities of soccer or basketball ($n = 60$). The dependent variable was intellectual and socio-affective competence, which was measured by an IQ test (WISC-R), a self-report test (TAMAI) and a hetero-report questionnaire (teacher-tutor's criterion) applied at the beginning and the end of the academic year. In contrast to the comparison group, it was found that chess improves cognitive abilities, coping and problem-solving capacity, and even socioaffective development of children and adolescents who practice it. The results are modulated, particularly in the area socioaffective, by the personal profile of students who choose practice this activity.

Keywords: chess, intellectual enrichment, emotional development, social development, schoolchildren.

Se analiza los beneficios de la práctica regular del ajedrez en el enriquecimiento intelectual y socioafectivo de un grupo de 170 escolares de 6 a 16 años. Se trabaja sobre un diseño cuasi-experimental, donde la variable independiente es la actividad extraescolar de ajedrez ($N = 170$) versus las actividades extraescolares de fútbol o baloncesto ($N = 60$), y la variable dependiente la competencia cognitiva y socio-afectiva evaluada mediante pruebas de rendimiento (WISC-R), auto-evaluación (TAMAI) y hetero-evaluación (criterio del profesorado-tutor), aplicadas al iniciar y al finalizar el curso académico. Al contrastar con el grupo de comparación, se evidencia que el ajedrez mejora las capacidades cognitivas, moldea la capacidad de afrontamiento y resolución de problemas e, incluso, influye en el desarrollo sociopersonal de los niños y adolescentes que lo practican. Si bien los resultados se ven modulados, especialmente en el ámbito sociopersonal, por el perfil personal del alumnado que opta por la práctica de esta actividad.

Palabras clave: : ajedrez, competencia cognitiva, educación socio-afectiva, escolares.

The goal of this study is to empirically analyze whether playing chess produces benefits in cognitive competence, coping and problem-solving capacity, personal adjustment, and in children's and adolescents' academic and social adjustment.

There are currently many studies and experiences, both sports and educational, which address the topic of chess. However, among the empirical-based studies, most of them focus on the analysis of the intellectual domain (Charness, 1998; Charness, Tuffiash, & Krampe, 2005).

Pioneer studies (Groot, 1946, 1965) related the mental processes used by chess players to the mental processes carried out by an investigator to solve a problem. They concluded that the scientific method is similar to the schema used by a chess player to analyze the position and the movement of the chessmen: analysis and investigation, calculation, assessment, selection, and decision.

Other works, such as those of Krogus (1972), indicate that intellectual processes such as attention, memory, concentration, creativity, and reasoning, among others, are stimulated and fostered by practicing this discipline. The authors conclude that this is due to the fact that playing chess requires rigorous thinking, which must be combined with great mental agility for it to be effective.

But if we reflect on the chess player's profile, we see that intellectual abilities alone do not guarantee success in this discipline (Kelly, 1985). In addition to cognitive competences, chess players require the participation of socioaffective competences. However, there are few empirical studies of the participation of these socioaffective competences.

In the same vein are the noteworthy works of Hernández and Rodríguez (2006), which show how more successful chess players use more realistic, positive, and pondered ways of appraising and facing reality (cognitive-affective molds). In contrast, less successful chess players tend to use more evasive, fantastic, defensive, and inefficient molds.

In another investigation (Ruiz, 2006; Ruiz & Luciano, 2009), it was reported that a chess player's performance can be maximized by means of a psychological intervention model, the therapy of acceptance and commitment. According to this study, the efficacy of the strategies of acceptance increase chess performance by decreasing experiential avoidance, in a context that merges diverse cognitive skills and strategies.

More along the lines of the goal of the present work, Machargo, García, Ramos, and Luján (2002) analyzed the efficacy of a program based on chess rules to improve the cognitive capacities, personality traits, and self-concept of Primary Education students. Their results are inconclusive because they only found differences in some characteristics, but not in others. But, strangely enough, the differences were more remarkable in the personality traits, leading the authors of the work to formulate the following question: Does this mean that chess is more closely linked to personality traits than to cognitive capacities?

According to Bilalic, McLeod, and Gobet (2007), if chess has this status in psychology, it is surprising that so little is known about the (personality of) the people who perform this activity, and still less about the children who decide to take up chess as a hobby. The results obtained by these authors indicate that children who are less sensitive to others, more prone to arguing, and less concerned about avoiding conflict (Agreeableness), who have more energy (Energy/extraversion) and are more open to new experiences (Intellect/openness) are more apt to be attracted to the game of chess. According to these authors, these results may be explained by taking into account the competitive and aggressive aspect of chess. Chess is a game of constant conflicts in which each player tries to overwhelm and exasperate the other. This aggressive component may also be one of the reasons for the gender differences in the participation rates, in favor of the males.

Other works that deserve attention are the diverse didactic proposals about teaching and learning this discipline in the classroom (García, 1998, 2001; Ferguson, 1995), even for students with special educational needs (Pallarés, 2004). In the same vein, but focused on teaching chess, Bruin, Rikers, and Schmidt (2007) provide effective guidelines to stimulate the learning processes in novel chess players.

With the present study, we shall attempt to validate the statement repeated by the great chess masters and experts: chess helps to develop intellectual thinking, improving all the skills and capacities that are related to intelligence. But also—and this could be the most novel contribution of this work—that if young boys, girls, and adolescents play chess regularly and more or less systematically (in this case, as a complementary school activity), in addition to promoting their cognitive competences, it will promote their socioaffective competences, especially those more closely associated with the academic sphere, and with coping and problem-solving competences.

The following hypotheses were formulated:

Chess will increase the cognitive competences of the children and adolescents who play it.

These improvements will be especially obvious in tasks that require the capacities of attention, concentration, memory, planning and foresight, as these capacities are considered to be particularly activated when playing chess.

Likewise, we expect this improvement in the cognitive competence to transfer to the academic sphere, reflected in increased academic interest and effort, as well as a better relationship and higher satisfaction with the teachers.

In the personal and social spheres, in contrast, no remarkable results are expected, because the comparison group (which practices soccer or basketball) is also expected to show improvements both in personal adjustment (satisfaction and self-confidence) and, especially, in social adjustment (sociability and respect for people and the rules), as these are team activities.

Method

Participants

The sample was extracted from eight schools of the Isle of Tenerife (five Primary schools, and three Secondary schools) that offer chess as an extracurricular activity in the afternoon. Ages ranged between 6 and 16 years. The experimental group comprised all the boys and girls from these schools who chose chess as the extracurricular activity, a total of 170 people. To form the comparison group, we randomly chose 60 students, classmates of the former students, who chose to play soccer or basketball as their extracurricular activity.

Instruments

Wechsler Intelligence Scale for Children, WISC-R. The WISC-R (Wechsler, 1974) is an updated and revised version of the 1949 scale (WISC). Like the WISC, it is made up of 12 subtests, 6 for the Verbal Scale and 6 for the Performance Scale. Given their relevance for the goals of the investigation, we selected the following tests: (a) Verbal Scale: Information; Similarities; Arithmetic; and Digit Span. (b) Performance Scale: Picture Completion; Block Design; Object Assembly; Coding; and Mazes.

Test Autoevaluativo Multifactorial de Adaptación Infantil [in English, Multifactor Self-Assessment Test of Child Adjustment] (*TAMAI*). The TAMAI (Hernández, 1983) includes 175 statements that assess Personal, Social, Family, and School Maladjustment, and Parents' Educating Attitudes. The factor structure is the result of analyzing the data provided by administering the test to 1200 male students of Secondary Education and High School, using correspondence factor analysis, and grouping the factors into clusters by automatic classification. The index reliability, obtained by the split halves method and the Spearman-Brown correction, is .87. In this study, the following factors and subfactors were taken into account:

Personal Maladjustment: Personal Dissatisfaction, Cogniaffection, Somatization, Depression-self-punishment.

School Maladjustment: Hypo-effort, Hypomotivation, Aversion to the Teacher, Indiscipline.

Social Maladjustment: Social Aggressiveness, Dysnomia, Social Restriction.

Record to be filled in by the tutor-teacher. This was designed ad hoc for this investigation, taking as reference the adjustment factors of the self-assessment test (Hernández, 1983), to which were added the steps for coping and problem solving (Hernández & Aciego de Mendoza, 1990). The teacher-tutor had to estimate the student's level in the following aspects:

Personal Adjustment

Expresses self-satisfaction and satisfaction with reality
Expresses self-confidence, self-assuredness, and tranquility
Appears to be a healthy person with no bodily troubles
Expresses attitudes of joy and self-esteem

Coping and Problem Solving

Identifies the problem (reads the heading carefully before trying to solve the problem)
Takes time to think about possible alternatives (Thinks about alternatives)
Mentally tests the most appropriate alternative, before acting by trial and error (Assesses the alternatives)
Usually executes the solution confidently (Confident performance)
After finishing a problem, the student reviews, assesses, and follows up consistently (Review)

Academic Adjustment

Is satisfied with the teacher and the way the teacher explains, and with the teacher's treatment of the students
Is satisfied with the school
Enjoys studying
Behaves well in class

Social Adjustment

Is peaceful and understanding towards others
Is aware of the rules and regulations, and respects them
Is quite sociable, relating to others without problems
An example of the teachers' record is presented below:

Expresses dissatisfaction about self and about reality	1 2 3 4 5	Expresses self-satisfaction and satisfaction with reality
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Design

The design employed was quasi-experimental with a treatment group (the extracurricular activity was chess) and a comparison group (the extracurricular activity was soccer or basketball).

The dependent variable analyzed was cognitive and socioaffective competence, assessed by means of the performance scales (WISC-R), self-assessment (TAMAI) and hetero-assessment (teacher-tutor's criterion), applied at the start (pretest) and at the end (posttest) of the academic course.

Procedure

During the month of October, the students completed the TAMAI and the WISC-R, and the teachers filled in the record for each student.

Table 1

Mean Scores and Standard Deviations of the Chess and Soccer/Basketball Groups in Cognitive Competence and Contrasts of Means

		Chess (<i>n</i> = 170)		C1	Soccer/Basketball (<i>n</i> = 60)		C2	C3
		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>		
Information	pre	13.56	5.02	***	11.28	5.74		**
	post	16.15	5.44		11.93	5.50		
Similarities	pre	12.93	4.86	***	12.28	4.29	*	
	post	14.82	5.05		12.93	4.39		*
Arithmetic	pre	12.51	2.05		12.28	1.90	*	
	post	13.02	2.15		12.51	2.02		
Digit Span	pre	10.43	4.43	***	9.70	4.58	*	
	post	12.87	4.39		10.21	4.25		*
Picture Completion	pre	16.22	4.19	***	15.18	4.05	***	
	post	18.71	4.00		16.81	5.00		
Block Design	pre	22.71	11.40	***	22.41	11.64		
	post	25.91	10.92		22.83	11.78		*
Object Assembly	pre	22.76	5.93	***	20.65	5.77		*
	post	25.00	4.88		21.13	5.44		*
Coding	pre	43.77	12.78	***	44.95	12.95	*	
	post	49.29	14.01		46.46	13.09		
Mazes	pre	20.07	5.92		18.25	6.61	*	*
	post	22.24	5.56		18.88	6.53		*

C1: pre-post contrast with Sidak correction of the chess group

C2: pre-post contrast with Sidak correction of the Soccer/Basketball group

C3: ANCOVA Chess vs. Soccer/Basketball at posttest with statistical control of pretest.

Significance (two-tailed): * $p < .05$. ** $p < .01$. *** $p < .001$.

Throughout the academic course, the students attended the extracurricular activities of chess, soccer, or basketball, at the same school and in the afternoon.

At the end of the course, the instruments were administered again in order to appraise the changes produced.

Data Analysis

To analyze whether there were significant posttest group changes, univariate analysis of covariance was conducted with the pretest measures as the covariate. The analyses of within-group pre-posttest differences were carried out by means of a group pre-posttest ANOVA, in which the multiple pairwise comparisons of the interaction adjusted the level of Type I error, following Sidak's correction. In both tests, the application assumptions were verified. The statistical analyses were performed using the SPSS 15.0 statistical package.

Results

Contrast of Means in Cognitive Competence

Table 1 shows that the pre-posttest contrasts of performance in cognitive competence (WISC-R) of the students who play chess as their extracurricular activity during the academic course show significant increases ($p < .001$) in Information, $t(169) = -1.70$, $p < .001$, Similarities, $t(169) = -10.18$, $p < .001$, Digit Span, $t(169) = -16.67$, $p < .001$, Picture Completion, $t(169) = -11.05$, $p < .001$, Block Design, $t(169) = -5.93$, $p < .001$, Object Assembly, $t(169) = -6.43$, $p < .001$, and Coding, $t(169) = -14.07$, $p < .001$.

The students who played soccer or basketball as their extracurricular activity also experienced significant increases ($p < .05$) in five out of the eight tests: Similarities, $t(59) = -2.07$, $p < .05$, Arithmetic, $t(59) = -2.33$, $p < .05$, Digit Span, $t(59) = -2.11$, $p < .05$, Coding, $t(59) = -2.29$, $p < .05$.

.05, and Mazes, $t(59) = -2.16, p < .05$. And very significant ($p < .001$) in Picture Completion, $t(59) = -4.30, p < .001$.

The comparison of the chess group versus the soccer/basketball group in the dependent variables through analysis of covariance showed that, at the end of the academic course, the chess group achieved significantly better performance in: Similarities, $F(1, 226) = 6.59, p < .05$, Digit Span, $F(1, 226) = 11.76, p < .05$, Block Design,

$F(1, 226) = 10.61, p < .05$, Object Assembly, $F(1, 226) = 28.78, p < .05$, and Mazes, $F(1, 226) = 10.76, p < .05$. No differences were found in Information, Arithmetic, Picture Completion, and Coding.

Lastly, as the students who freely chose one of the extracurricular activities were not totally comparable in cognitive competence, we performed a pretest study. Specifically, the results show that the students who chose

Table 2

Mean Scores and Standard Deviations of the Chess and Soccer/Basketball Groups in Socioaffective Competence (Self-Rating) and Contrasts of Means

		Chess (n = 170)		C1	Soccer/Basketball (n = 60)		C2	C3
		M	SD		M	SD		
PERSONAL MALADJUSTMENT	pre	7.50	4.54		8.33	4.26		
	post	5.80	3.73		8.36	4.25		
Personal dissatisfaction	pre	1.09	1.95		1.35	2.52		
	post	.86	1.54		1.73	2.60		
Cogniaffection	pre	1.68	1.41		1.73	1.28	*	
	post	1.50	1.38		1.48	1.08		
Somatization	pre	1.94	1.84	***	2.25	1.94		
	post	1.46	1.48		2.38	2.02		
Depression-Self-punishment	pre	2.93	2.13	**	3.23	2.30	*	
	post	2.01	1.66		2.80	2.03		
SCHOOL MALADJUSTMENT	pre	6.84	6.05		9.68	7.68		**
	post	5.57	5.30		9.50	7.07		*
Hypo-effort	pre	1.53	2.11		2.43	2.45		**
	post	1.38	1.96		2.45	2.31		
Hypomotivation	pre	3.08	2.54	**	3.95	3.39		
	post	2.51	2.29		3.75	3.38		
Aversion to teacher	pre	1.11	1.54		1.88	1.90		**
	post	.90	1.25		1.86	1.85		
Indiscipline	pre	1.07	1.63		1.38	1.99		
	post	.81	1.50		1.35	1.78		
SOCIAL MALADJUSTMENT	pre	8.52	4.49		9.38	4.63	*	
	post	6.92	4.05		8.68	4.38		
Social Aggressiveness	pre	.92	1.47		1.48	1.64		**
	post	.91	1.35		1.31	1.39		
Dysnomia	pre	4.57	3.02	**	5.40	6.21		
	post	3.95	2.78		4.48	3.05		
Social Restriction	pre	3.00	2.23	**	3.20	2.08		
	post	2.19	1.75		2.85	2.06		

C1: pre-post contrast with Sidak correction of the chess group

C2: pre-post contrast with Sidak correction of the Soccer/Basketball group

C3: ANCOVA Chess vs. Soccer/Basketball at posttest with statistical control of pretest.

Significance (two-tailed): * $p < .05$. ** $p < .01$. *** $p < .001$.

playing chess had a higher cognitive performance in: Information, $t(228) = 2.90, p < .01$ —a difference that disappeared at posttest—Object Assembly, $t(228) = 2.39, p < .05$; and Mazes, $t(228) = 1.61, p < .05$ —the latter two differences increased at posttest.

Contrast of Means in Socioaffective Competence

Table 2 shows that the pre-posttest contrasts of self-assessment in socioaffective competence (TAMAI) carried out by the students who played chess as their extracurricular activity during the academic course displayed improvements in the Personal sphere, in the reduction of Somatization, $t(169) = 5.47, p < .001$, and of the feelings of self-contempt, punishment, sadness and worries (Depression-self-punishment), $t(169) = 8.4, p < .01$. In the School sphere, in the reduction of lack of interest in studying (Hypomotivation), $t(169) = 5.49, p < .01$. And in the Social sphere, in the reduction of conflict with the rules (Dysnomia), $t(169) = 2.55, p = .01$, and Social Restriction, $t(169) = 7.06, p < .01$.

In contrast, the group of students that chose soccer or basketball as their extracurricular activity only displayed improvements in: the reduction of feelings of contraction and fear (Cogniaffection), $t(59) = 2.04, p < .05$, and in the feelings of self-contempt, punishment, sadness and worries (Depression-self-punishment), $t(59) = 2.35, p = .05$, and in the reduction of Social Maladjustment, $t(59) = 2.02, p < .05$.

In the contrasts of the chess group versus the soccer/basket group, the analyses of covariance conducted at the end of the academic course showed that the chess group, according to self-perceived criteria, enjoyed much more satisfactory levels of Academic Adjustment, $F(1, 226) = 7.34, p < .05$, than the group that chose soccer or basketball as the extracurricular activity. For the rest of the variables of Personal Adjustment and Social Adjustment, there were no significant differences between the chess group and the soccer/basketball group at posttest, after controlling for the pretest effects.

As with the intelligence variables, because the students who freely chose one of the extracurricular activities were not completely comparable in self-perceived socioaffective competence, we conducted a study of pretest group differences. The results show that the students who chose soccer or basketball displayed more conflict in the School sphere, when compared to those who played chess, $t(228) = 2.90, p < .01$. This is reflected in the dedication to learning (Hypo-effort), $t(228) = -2.70, p < .01$, higher Aversion to the teacher, $t(228) = -3.01, p < .01$, and even higher Social Aggressiveness, $t(228) = -2.41, p < .01$.

Contrast of means in Socioaffective Competence and Coping, according to the teachers' criterion

Table 3 shows the contrasts of the teacher-tutors' criterion of the students' socioaffective competence and

coping at the beginning (pretest) and at the end (posttest) of the academic course: the teachers observed that the students who played chess had progressed significantly in all the dimensions assessed: Self-satisfaction, $t(149) = -2.69, p < .01$; Self-confidence and Self-assurance, $t(149) = -7.67, p < .001$; Healthy, $t(149) = -6.26, p < .001$; Joyful, $t(149) = -9.03, p < .001$; Identifies the problem, $t(149) = -12.57, p < .001$; Thinks of alternatives, $t(149) = -15.68, p < .001$; Assesses alternatives, $t(149) = -12.54, p < .001$; Confident Performance, $t(149) = -11.01, p < .001$; Review, $t(149) = -10.19, p < .001$; Satisfaction with the teacher, $t(149) = -2.30, p < .05$; Satisfaction with the school, $t(149) = -6.31, p < .001$; Enjoys studying, $t(149) = -6.66, p < .001$; Good behavior, $t(149) = -4.80, p < .001$; Peaceful attitudes, $t(149) = -4.51, p < .001$; Respects the rules, $t(149) = -6.53, p < .001$; and Broad Sociability, $t(149) = -4.67, p < .001$.

In contrast, in the group of students who chose soccer or basketball, the same tutor-teachers only detected improvements in the way they coped with and solved problems, but not in the personal, academic, or social spheres. The tutor-teachers considered that the students who decided to play soccer or basketball had improved in the identification of problems, $t(49) = -2.07, p < .01$, and in executing the solution, $t(49) = -2.80, p < .01$, at the end of the course.

In the contrasts of the chess group versus the soccer/basketball group, according to the teacher-tutors' criterion, the position of the chess group was much more satisfactory in the Personal and Academic spheres, and in the way they coped with and solved problems at the end of the academic course. According to the tutor-teachers, the students of the chess group, in contrast to the soccer/basketball group, were more notable in the following aspects: they expressed higher self-satisfaction and satisfaction with reality, $F(1, 196) = 29.98, p < .01$; were more self-confident, self-assured, and tranquil, $F(1, 196) = 14.52, p < .01$; happier and with more self-esteem, $F(1, 196) = 38.70, p < .01$; they identified problems better, $F(1, 196) = 40.03, p < .01$; they thought about alternatives, $F(1, 196) = 12.96, p < .01$; they mentally verified the most appropriate alternative, $F(1, 196) = 17.80, p < .01$; they executed the solution better, $F(1, 196) = 5.06, p < .05$; they were more satisfied with the teacher and the way he/she explained, $F(1, 196) = 4.39, p < .05$; they were more satisfied with the school, $F(1, 196) = 22.96, p < .01$; and they enjoyed studying more, $F(1, 196) = 40.35, p < .01$. In contrast, no differences were detected in their behavior in class or in their relation with others or with the rules.

Lastly, we compared the groups at pretest, finding that the students who chose to play chess tended to identify with their tutor-teacher, in contrast to the soccer/basketball group; the former students were more satisfied with the teacher and the way he/she explained, $t(228) = 2.71, p < .01$; more satisfied with the school and the academic

Table 3

Mean Scores and Standard Deviations of the Chess and Soccer/Basketball Groups in Socioaffective Competence and Coping (Teachers' Rating) and Contrasts of Means

		Chess (<i>n</i> = 150)		C1	Soccer/Basketball (<i>n</i> = 50)		C2	C3
		<i>M</i>	<i>SD</i>		<i>M</i>	<i>SD</i>		
PERSONAL								
Self-satisfied	pre	3.63	.81	**	3.28	.75		
	post	4.06	.59		3.30	.73		**
Self-confident and self-assured	pre	3.82	.90	***	3.60	.83		
	post	4.13	.71		3.64	.77		**
Healthy	pre	3.88	1.00	***	3.82	.96		
	post	4.20	.70		3.84	.88		
Happy	pre	3.79	.85	***	3.28	.90		**
	post	4.16	.64		3.38	.92		**
COPING								
Identifies the problem	pre	3.20	1.10	***	2.98	.86	**	
	post	3.96	.72		3.20	.92		**
Thinks of alternatives	pre	3.20	1.10	***	2.98	.86		
	post	3.88	.80		3.14	.72		**
Assesses the alternatives	pre	3.24	.95	***	3.10	.73		
	post	3.90	.75		3.22	.70		**
Confident performance	pre	3.19	.96	***	3.08	.82	**	
	post	3.76	.78		3.34	.79		*
Review	pre	3.26	1.08	***	3.26	.89		
	post	3.78	.85		3.38	.83		
SCHOOL								
Satisfaction with teacher	pre	4.00	.69	*	3.70	.70		**
	post	4.06	.65		3.66	.68		*
Satisfaction with school	pre	3.78	.94	***	3.36	.96		**
	post	4.02	.75		3.36	.94		**
Enjoys studying	pre	3.56	1.11	***	2.94	1.21		**
	post	3.86	.84		3.02	1.16		**
Good behavior	pre	3.96	1.20	***	4.00	1.16		
	post	4.19	.84		4.02	.97		
SOCIAL								
Peaceful and understanding attitudes	pre	3.92	1.11	***	4.06	1.01		
	post	4.09	.89		4.04	.92		
Respect for the rules	pre	3.89	1.17	***	3.94	1.03		
	post	4.21	.84		3.98	.86		
Expansive sociability	pre	4.06	.91	***	4.14	.72		
	post	4.24	.72		4.10	.73		

C1: pre-post contrast with Sidak correction of the chess group

C2: pre-post contrast with Sidak correction of the Soccer/Basketball group

C3: ANCOVA Chess vs. Soccer/Basketball at posttest with statistical control of pretest.

Significance (two-tailed): **p* < .05. ***p* < .01. ****p* < .001.

situation in general, $t(228) = 2.70, p < .01$; enjoyed studying more, $t(228) = 3.374, p < .01$; and even displayed more happiness and self-esteem, $t(228) = 3.61, p < .01$.

Discussion and Conclusions

The goal of this work was to assess the beneficial effects of the continued practice of chess on a sample of adolescents in the improvement of cognitive and socioaffective aspects, as there is scant empirical evidence of the latter in the literature (Kelly, 1985; Machargo et al., 2002). Our data show an improvement in the cognitive competences of the group that played chess regularly (Charness, 1998; Charness et al., 2005; Groot, 1946, 1965; Krogus, 1972). Likewise, data analysis revealed that certain socioaffective variables showed a significant improvement in the chess group, both in the teachers' rating and, to a lesser extent, in the students' self-appraisals. Lastly, the pre-posttest comparisons showed that these improvements occurred both at the within-group and the between-group levels. The chess group showed improvements in a larger number of subtests.

In the cognitive dimension, the students who played chess improved significantly, in comparison to the soccer/basketball group, in the following tests: Similarities, Digits, Block Design, Object Assembly, and Mazes. Likewise, according to the pre-posttest measures within this group, we found a significant global improvement in almost all the cognitive competences measured, except for Arithmetic and Mazes. Therefore, the value of chess as a tool to be introduced in the classroom to stimulate cognitive competences and skills is confirmed (Groot, 1946; 1965; Krogus, 1972). The continued practice of an extracurricular activity such as chess improves general cognitive capacity aspects such as the capacity for verbal abstraction, attention, resistance to distraction, perceptive organization, analysis, synthesis, visuomotor coordination, speed, planning, and foresight. Thus, playing chess contrasts with other programs of intellectual enrichment, because it requires appraising alternatives and making decisions instantly, providing immediate feedback of the soundness of the decision. It is a game that simultaneously activates diverse intellectual skills to design the strategy that will lead to victory. A strategy that, in turn, will have to be revised depending on the opponent's responses.

In the socioaffective dimension, when we compare students who play chess with students who play soccer/basketball, we find that, according to teachers' ratings, the former improve significantly in the variables of Academic Adjustment, Personal Adjustment, and Coping Capacity. The teachers perceive the students as being more satisfied with the school and with the teacher, enjoying studying more, being more self-satisfied, more self-confident and self-assured, and lastly, having a greater coping and problem-solving capacity. Taking into account the pre-posttest

comparison, the chess group was observed to have improved significantly in the same socioaffective dimensions, including the social dimension. However, these data contrast with the chess group students' self-ratings, in which they only perceived improvement in the Academic Adjustment variables when compared to the soccer/basketball group. In this case, the students who played chess scored lower on the scale of Personal Maladjustment than the students who played soccer/basketball. This apparent lack of agreement between the teachers' ratings and the students' self-appraisal of the socioaffective measures was revealed in the teachers' firm statements at the end of the course. They declared that they observed these students to be more focused on the task, more receptive to corrections, rules, and work routines, with an attitude of not giving up when encountering difficulties, being more constant and persistent. In contrast to the firmness of these teachers' statements, the students did not seem to be very aware of these important changes.

An important fact derived from the study, and which was not contemplated in the hypotheses, is that the choice of an activity like chess, versus other more expansive ones such as soccer or basketball, is not capricious. Those who chose chess were the students who were best adapted to school. Whereas those who chose a more expansive and less academic activity like soccer or basketball do not seem to have such a good relationship with school aspects. Comparatively, the former performed better in the tests of Information, Object Assembly, and Mazes. They self-rated themselves as having a better attitude towards learning, higher satisfaction with the teachers, and even less conflicts with people. And the teachers corroborated this, describing the chess players as students who enjoy studying, act satisfied with the school and the teachers, and even display more happiness and self-esteem. If these results are compared with those obtained by Bilalic et al. (2007), although the variables are not completely comparable, there is some parallelism in the attitude of being more open to new experiences (Intellect/openness) and perhaps also in displaying more energy (Energy/extraversion), but not in being less sensitive towards others, more prone to arguing, and less concerned about avoiding conflicts (Agreeableness).

To sum up, we conclude that the results of the investigation show chess to be a valuable educational tool. After one year of regularly practicing this activity, the students improve their performance in tests that require the cognitive skills of attention and resistance to distraction, perceptive organization, speed, planning, and foresight. Their teachers consider them to be better personally adjusted, more satisfied with the school, they enjoy studying and have better coping and problem-solving strategies. They also self-rate themselves as people with better school adjustment. It is also shown that choosing an activity like chess, versus other more expansive activities such as soccer or basketball, reveals a differential profile between these students, with the former characterized mainly as being better adapted to school.

An interesting topic for future research could be to compare the effect of different training methods of chess, for example, “board-focused” versus methods concerned with providing a more integral formation. This could shed some light on why training in chess produces these benefits, and whatever is occurring in the socioaffective sphere is particularly interesting. It would also be interesting to analyze, in children and youngsters with adjustment problems at school, the results obtained if they were encouraged to play chess continually and more or less systematically.

To conclude, this work provides new and contrasted evidence about the value of chess as an educational tool. Chess not only improves cognitive capacities, it also influences sociopersonal development and molds the coping and problem-solving capacity in the children and adolescents who play chess. With the data provided by this work, one could conclude that chess is not reaching a collective for which it could be particularly beneficial, as it is predominantly chosen by those who are already well adapted to school. Doubtless, an important challenge is to motivate maladapted students to practice a game that requires them to remain seated and to have a high level of concentration, and which can, nonetheless, become thrilling. More psychoeducational research and didactic innovation is needed to bring this effective educational tool closer to potential beneficiaries.

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