

Using chess instruction to foster self-control in student-athletes not specializing in chess

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Abstract

This study examines the psychological aspects of chess training and its impact on cognitive abilities, tactical thinking, and time management among student-athletes. It explores how incorporating chess instruction into university curricula can enhance cognitive functions such as memory, problem-solving, and executive functioning. A 15-week chess training program was performed at the Uzbek State University of Physical Education and Sports with the participation of 26 student-athletes. The research employed the Consensual Qualitative Research (CQR) method, using structured interviews, cognitive reflection tasks, and think-aloud protocols. Statistical analysis using SPSS revealed significant improvements in tactical thinking and personal time management, underscoring the cognitive benefits of chess training. Additionally, the study investigates the effects of chess education on decision-making under pressure, self-discipline, and strategic adaptability.

Keywords: Chess training, cognitive abilities, executive functions, tactical thinking, time management, decision-making, problem-solving, memory enhancement, strategic adaptability, self-discipline, cognitive reflection, educational methodologies.

Introduction

Psychological factors play an important role in achieving success in both chess and athletic performance. Cognitive skills such as goal setting, relaxation techniques, and internal dialogue are commonly used by cognitive psychology specialists to improve chess performance, intellectual functioning, and knowledge retention in chess education (Glynn et al., 2013; Vealey, 1994; Weinberg & Williams, 2014). Incorporating chess instruction into educational curricula—particularly in sports psychology and cognitive science—provides student-athletes with opportunities to develop psychological strategies that improve analytical thinking. These cognitive competencies also support professional effectiveness in high-stakes fields, including law enforcement, the military, and emergency response (Adler et al., 2015; Anton et al., 2017; Page et al., 2016).

Empirical research demonstrates that chess training promotes the development of working memory, executive functions, and problem-solving skills—key components of academic and professional success (Burgoyne et al., 2016; Sala & Gobet, 2017). A systematic review by Sala, Gobet, Trinchero, and Ventura (2020) further confirmed that chess education significantly improved students' mathematical and reading abilities, indicating that its cognitive benefits extend beyond strategic gameplay. Additionally, neuroimaging studies show that engaging in chess strengthens connectivity between the prefrontal cortex and parietal regions—areas associated with complex reasoning and decision-making (Atherton et al., 2003). These findings highlight the potential of chess training as a cognitive enhancement tool applicable across various domains.

Research on the effectiveness of chess courses continues to advance contemporary understanding in the fields of chess training and performance psychology. These studies contribute considerably to educational sciences, athlete preparation methodologies, and sports pedagogy. Numerous large-scale studies and meta-analyses have confirmed the value of chess education, showing moderate to significant positive effects not only on athletic performance but also on intellectual development (Meyers et al., 1996; Thelwell & Greenlees, 2003; Weinberg & Comar, 1994). However, while traditional approaches—such as team training and individual consultations—have been widely studied, the integration of chess instruction into formal educational settings, particularly in university curricula, has received comparatively limited scientific attention. This research gap underscores the need to explore the specific potential of chess courses in academic settings, promoting both intellectual growth and chess-related development.

Comprehensive chess course methodologies incorporate techniques that support holistic and individualized training. A variety of implementation strategies are used, with sports psychology specialists using a broad spectrum of pedagogical approaches (Aoyagi et al., 2017; Poczwadowski et al., 2004). Poczwadowski and colleagues (2004) categorized psychological preparation methods for chess players into five primary models: (a) psychological skill development schemes, (b) consultative support models, (c) medical approaches, (d) interdisciplinary cognitive science strategies, and (e) supervisory interaction models with integrative

components. Owing to the wide range of these methodologies, assessing their specific impact on chess performance remains an ongoing challenge (Holliday et al., 2008). Contemporary research highlights the necessity of refining experimental methodologies to validate the effectiveness of these interventions and to further examine their influence on cognitive functions and strategic thinking (Barker et al., 2020; Von Guenther et al., 2010).

Performing this research presents a complex challenge that requires a multifaceted approach to examining life circumstances and accounting for diverse situational characteristics. Some situations can be classified as "simple," while others are more "complex." The latter category includes critical turning points (Folkman & Lazarus, 1984), traumatic events (Kubany et al., 2000; Herman, 1992), personal hardships (Linley & Joseph, 2004), negative life experiences (Taylor, 1991), stressful episodes (Cohen et al., 2019; Monroe, 2008), and extreme circumstances (Sagi-Schwartz, 2008; Zinchenko et al., 2023). Each of these situations possesses distinct features that shape individual perception and response.

To understand the psychological meaning of the term "turning point," it is essential to examine subjective situational perception as it arises in the consciousness of a student-chess player. This perception involves a "cognitive interpretation" of circumstances and their significance. Along with it, an "evaluative attitude" develops, encompassing personal perceptions and associated elements. These elements are experienced or recognized by the individual in connection with a specific event, object, person, or phenomenon (Khalyan, 2023). This ability is associated with "mental faculties," enabling individuals to analyze, understand, and regulate their cognitive processes, as well as interpret and adapt to the strategic behavior of others (Mayer & Salovey, 1993; Goleman, 2005). The cognitive component is crucial in chess because it directly influences the effectiveness of strategic decision-making under competitive conditions (Chebykin et al., 2024). The interaction between cognitive and emotional evaluation shapes situational perception, prompting chess students to categorize situations as simple or complex and to choose tactics accordingly.

The situational context encompasses social norms developed through both learning and competitive experiences, which in turn influence individual behavior. Numerous studies have explored cognitive abilities and adaptation strategies in educational settings, particularly in relation to the cognitive development of children, adolescents, and young adults (Downey et al., 2010; Grant et al., 2014). This research also extends to professional contexts (Dolev & Leshem, 2016), chess expertise (Mayer & Fletcher, 2007; Khalyan, 2023a, 2023b; Popovich et al., 2021a, 2023b), psychophysiological states (Tak & Patlamazoglu, 2019), family dynamics (Laki et al., 2021), work-study balance (Ganesh & Ganesh, 2022; Mauno et al., 2012), interpersonal relationships (Ruetti & Pirotti, 2024), and the interaction between cognitive abilities and psychological well-being (Schutte et al., 2002).

Analyzing these aspects is essential for the intellectual development of chess students (Dolev & Leshem, 2016). Through reflection on their experiences (Grant et al., 2014), students learn to overcome mental and emotional challenges that affect their psychological well-being. Chess practice plays a key role in this process because it engages the psychophysiological components of thinking and decision-making (Cretu, 2021; Kozin, 2022, 2023). However, current scientific literature lacks sufficient empirical data on the cognitive capacities of chess students and the factors influencing their choice of adaptation strategies under intellectual stress. Investigating how mental faculties affect behavioral responses in competitive settings remains crucial for advancing sports psychology and cognitive science.

Methodological framework and philosophical paradigm

This study examines how student chess players interpret their training experiences designed to enhance cognitive skills within the context of their academic journey and chess practice. The research uses Consensual Qualitative Research (CQR; Hill et al., 2021) to enable an in-depth analysis of their thought processes and psychological patterns.

From an ontological standpoint, this study adopts a relativist perspective, recognizing that the subjective experiences of student chess players are dynamic and shaped by their academic and competitive contexts (Hill et al., 2021). This view aligns with contemporary cognitive psychology, which highlights the interaction between cognitive development, situational factors, and skill acquisition (Clark, 2016). Empirical evidence further supports that chess training promotes neuroplasticity and cognitive flexibility, underscoring the continuous evolution of expertise (Sala & Gobet, 2017).

Epistemologically, CQR is grounded in constructivist and post-positivist concepts. These frameworks propose that knowledge is co-constructed through active interaction between researchers and participants. This paradigm acknowledges cognition as self-organizing, where individuals build understanding based on their personal experiences (Hill et al., 2021). Social constructivism complements this view by emphasizing that knowledge arises from social interactions and collective learning processes (Savin-Baden & Howell-Major, 2013). This perspective is particularly relevant to chess research, where expertise develops through pattern recognition, iterative learning, and heuristic refinement (Chase & Simon, 1973; Gobet & Charness, 2006).

This study is guided by a pragmatic perspective that links knowledge construction with the cognitive experiences of student chess players. Drawing on the work of Peirce (Burch, 2022) and James (Goodman, 2022), pragmatism offers a flexible framework for examining cognitive adaptation in dynamic learning environments.

Chess training supports the development of key cognitive functions such as strategic reasoning, analytical thinking, focused attention, and memory retention. Research demonstrates that these cognitive skills transfer effectively to academic and professional domains, highlighting the value of a pragmatic approach to research (Giacobbi et al., 2005; Ericsson, 2006).

Moreover, research on metacognition and self-regulation demonstrates that chess players develop sophisticated cognitive monitoring strategies, enhancing decision-making and analytical accuracy (Flavell, 1979; Veenman et al., 2006). Pragmatism supports methodological flexibility, enabling a balanced integration of qualitative and quantitative approaches to investigate the cognitive processes underlying chess expertise (Creswell & Clark, 2011).

Understanding is thus viewed as a continuous, interactive process between the researcher and student chess players, emphasizing the importance of individual cognitive experiences and unique information-processing strategies. Owing to the complexity of mental skill development in chess, this study uses cognitive task analysis (CTA) to examine how players organize and refine their thought patterns during both training and competition (Schraagen et al., 2000).

In the CQR framework, the researcher serves as an impartial interpreter, aiming to uncover participants' perspectives rather than collaboratively constructing meaning (Hill et al., 2021). Although the interview protocol was structured, its conversational style facilitated deeper exploration of the cognitive strategies used by student chess players in both academic and competitive contexts.

To ensure methodological rigor, triangulation was applied by integrating multiple data sources, including structured interviews, cognitive reflection tasks, and think-aloud protocols (Ericsson & Simon, 1993). These methods collectively offer a comprehensive understanding of the cognitive schemas underlying chess expertise, providing a detailed evaluation of how mental training impacts performance and learning trajectories.

By combining theoretical perspectives from constructivism, post-positivism, and pragmatism, this study establishes a solid foundation for examining the psychological and cognitive aspects of chess training. The findings add to the growing body of research on the development of expertise, cognitive skill acquisition, and their wider implications for education, sports psychology, and the field of strategic decision-making.

Participants

With the support of the management of the Uzbek State University of Physical Education and Sports, a practical qualitative case study was performed involving student athletes who completed a 15-week university chess training course. The group consisted of 26 student athletes—13 men and 13 women—with an average age of 21 years. A detailed description of the participants is provided in Table 1. The course instructor planned, organized, coordinated, and supervised the entire teaching process during the course. At the time of the study, the instructor was a FIDE(International Chess Federation) master with 8 years of teaching experience and several published scientific papers. Additionally, the instructor held a PhD, was a management teacher, and held the candidate master of sports rank in chess. The course was delivered by this instructor over three separate cycles, with the control test for this study administered during the final (third) cycle.

Table 1. Participant demographics

Participant ID	Age	Gender	Ethnicity	Education level	Sport
1	21	M	Asian	High school	Tennis
2	20	M	Asian	High school	Tennis
3	21	M	Asian	High school	Tennis
4	22	M	Asian	High school	Tennis
5	23	M	Asian	High school	Ice hockey
6	21	M	Asian	High school	Ice hockey
7	22	M	Asian	High school	Ice hockey
8	21	M	Asian	High school	Boxing
9	20	M	Asian	High school	Boxing
10	20	M	Asian	High school	Boxing
11	21	M	Asian	High school	Rowing
12	20	M	Asian	High school	Rowing
13	21	M	Asian	High school	Rowing
14	21	F	Asian	High school	Swimming
15	21	F	Asian	High school	Tennis
16	22	F	Asian	High school	Tennis
17	21	F	Asian	High school	Tennis
18	21	F	Asian	High school	Gymnastics
19	21	F	Asian	High school	Gymnastics
20	20	F	Asian	High school	Gymnastics
21	21	F	Asian	High school	Gymnastics
22	22	F	Asian	High school	Gymnastics
23	21	F	Asian	High school	Gymnastics
24	21	F	Asian	High school	Gymnastics
25	21	F	Asian	High school	Gymnastics
26	21	F	Asian	High school	Gymnastics

The course was developed based on more than three decades of applied experience in educational technology and curriculum design. Both the content and teaching methods were shaped equally by current research, student feedback, teacher training, and academic best practices. The current instructor's approach draws on extensive experience in sports, coaching, academic teaching, and educational consulting. As an independent researcher and certified chess specialist, the instructor has over seventeen years of experience consulting with athletes, teams, and coaches. The course was delivered twice a week, with each session lasting 90 min. This structure aimed to balance traditional lecture-based instruction with case studies, simulation games, and interactive learning components. The weekly chess course was structured around three components: (1) sports education, which introduced the fundamentals of chess through lectures; (2) seminar classes, featuring active discussions and the use of current teaching technologies; and (3) practical sessions, focused on problem-solving and hands-on exercises. Throughout all three stages, student-athletes were given practical assignments alongside theoretical content. This design allowed them to immediately apply their knowledge in both sports and academic contexts, allowing for real-time practice. The instructor emphasized an individualized approach, providing additional assignments to student-athletes when further reinforcement of the material was needed. Each week, the psychological and educational portion of the course often began with practical classes, which prompted reflection and discussion based on the assigned readings. The course content was then delivered using various effective teaching methods such as supplementary videos and athlete case examples (Coumbe-Lilley & Shipherd, 2020). The chess course was designed to last 15 weeks, with every two-week period focused on the development and improvement of specific cognitive skills alongside chess education. The curriculum of this course was carefully designed to achieve an optimal balance between analytical theory and strategic application, enabling students to immediately apply the cognitive skills they acquire in both competitive and academic contexts. In the initial phase of learning, students are introduced to fundamental concepts such as setting tactical objectives, developing positional thinking, and managing attention, thereby establishing a strong foundation for intellectual training.

As the course advances, it addresses more complex elements of chess mastery, including visualizing game scenarios, managing tournament pressure, and adapting to unexpected moves. Each weekly lesson is tailored to develop key cognitive skills aligned with the practical demands of chess players. Designed to last 15 weeks, the course dedicates each week to a specific aspect of chess thinking. It is structured to seamlessly integrate theoretical knowledge with practical strategy application, enabling students to effectively apply what they learn in real-game situations. The initial weeks emphasize basic concepts such as game planning, error analysis, and concentration development, establishing a strong base for continued improvement.

As students advance, they master sophisticated techniques such as combination play, emotional regulation during matches, and building mental resilience in high-pressure situations. Each lesson is designed to balance the development of intellectual skills with the practical demands of chess players, allowing them to confidently apply their knowledge both during play and in the analytical review of games.

Throughout the course, students actively engaged in analytical discussions, maintained systematic chess diaries, and participated in practical exercises such as game scenario simulations, analysis of internal dialogue during play, and concentration techniques. These methods contributed to the in-depth development of strategic thinking and self-reflection. By the end of the course, participants had created individualized programs for enhancing their chess skills, which they presented as part of their final projects. The final weeks focused on the long-term integration of strategic methods into daily practice, preparing students to effectively apply their knowledge both at the chessboard and in intellectual activities beyond the game. The main goals of the course were as follows: (a) mastering essential cognitive strategies for successful play and applying them in other areas of life; (b) completing practical tasks designed to enhance analytical and tactical skills; (c) developing a personalized plan to integrate chess strategies for improving playing efficiency and intellectual growth. The course incorporated several mandatory assessment components, which were carefully structured to promote student engagement, knowledge retention, and practical application of concepts (Coumbe-Lilley & Shipherd, 2020). Key assessments included active participation in class and group discussions, a variety of practical assignments and game analyses, open-ended quizzes followed by class discussions, and a comprehensive final project. A detailed analysis of individual content units is beyond the scope of this paper. However, a structural overview of the course is presented in the flow chart (Table 2), which outlines the sequence of topics covered during the 15-week period.

Table 2. Participant demographics

	Lecture	Cognitive component	Seminar	Practical elements of self-development	Practical lesson
1	History of the origin of chess. Initial arrangement of chess pieces.	Sports self-development. Strengthening physical and mental health	Understanding the value of chess pieces. King's movement and piece capturing	Developing discipline and determination. Building self-confidence. Improving communication skills	Rook movement and capturing techniques
2	Chess notation	Procrastination and	Bishop movement	Perfectionism and	Bishop movement

		motivation		and capturing techniques	academic procrastination	and capturing techniques
3	Chess notation	Individual timing	activity	Queen movement and capturing techniques	Result analysis and individual activity timing	Queen movement and capturing techniques
4	Pawn movement and capturing techniques	Personal management	time	Pawn movement and promotion	Eisenhower Matrix and avoiding multitasking	Pawn movement and capturing techniques
5	Attack and defense strategies in chess	Goal setting and prioritization tools		Methods of attacking the king	Study and reinforcement of basic breathing exercises	Checkmate and castling techniques
6	Checkmate with pieces	Planning tools		Drawn situations	Study and reinforcement of basic breathing exercises	Stalemate situations
7	Checkmate with queen and rook vs. king	Work organization tools		Checkmate with two rooks vs. king	Study and reinforcement of basic neurogymnastics	Queen checkmate vs. king
8	Checkmate with a rook vs. king	Work coordination tools		Checkmate with two bishops vs. king	Study and reinforcement of basic neurogymnastics	Checkmate with two bishops vs. king
9	Checkmate with a bishop and a knight vs. a lone king	Work control tools		Checkmate with a bishop and a knight vs. a lone king	Self-monitoring of pre-start state	Checkmate with a bishop and a knight vs. a lone king
10	Parts of the game of chess	Work coordination tools		Tactics for starting the game	Self-monitoring of pre-start state	Tactics for starting the game
11	Tactical techniques in chess and training games	Analysis and comprehension of new material (reading speed, attention, and understanding)		Piece sacrifice and training games	Recovery strategies during the post-competition transition period	"Impossible move" training games
12	Open attack in chess	Current planning		Open check in chess	Teamwork in the information environment	Tactical move "distraction of a piece"
13	Tactical move of "destruction defense"	Tactical planning		Endgame: types of endgame	Presentation and review of individual projects	Endgame: types of endgame
14	Pawn endgames	Strategic planning in sports		Pawn endgames	Course reflections on growth and final analysis activities	Pawn endgames
15	Knight endgames	Strategic planning in sports		Rook endgames	Group discussion of main findings	Endgame: types and strategies

Organizing the interview process

An interview was performed with each course participant, with prior consent obtained from all individuals involved. Confidentiality of the information collected was strictly maintained during the data collection and interview process. The interviews took place in two stages—at 2 weeks and at 15 weeks. For ethical reasons, participation was voluntary and did not affect course grades. The interviews were recorded using Zoom video conferencing (Zoom Video Communications, Inc., 2021) and transcribed with Otter transcription software (Otter.ai, 2021). Both the course instructor and an interview specialist performed the interviews; they were the course leaders. It was important to assess the development of self-control skills, personal time management, regulation of pre-start mental states, as well as knowledge and abilities in the theory and practice of openings, middlegame, and endgame. Of course, full mastery of the chess course in 15 weeks is not feasible. However, the course stimulates cognitive skills and fosters analytical thinking, which improves students' ability to effectively solve the problems presented. The interview structure included several targeted questions: (1) What do you like most and least about your sport? (2) Was the chess course beneficial for you? (3) How valuable are self-development skills in both your sport and daily life? (4) What challenges did you face while studying the course? (5) Have your communication skills improved as a result of completing the program?

The interviews lasted an average of 30 min. To empirically assess the assimilation of new chess knowledge, competitions were organized following the Swiss system. In this format, players with equal points are paired, and from the second round onward, winners compete against winners and losers compete against losers. This order is maintained until the end of the tournament.

Results

The pedagogical study ensured the principle of objectivity. The interview expert had no vested interest in the study's outcomes. A key advantage of involving the interview expert was their support in performing analysis using mathematical statistics. Given human nature, the presence of a human factor—particularly between the

teacher and student-athletes—was possible. Interviews were recorded via Zoom meetings. The course leaders analyzed and discussed the participants' responses. Additionally, a specialist in mathematical statistics was involved to ensure thorough data collection, processing, and storage. All questions and answers were documented in transcript form.

The researcher analyzed the data using descriptive thematic analysis, coding the interview transcripts to develop categories. The steps of the thematic analysis were as follows.

The study used the SPSS 25.0 software package. Calculations included intra-group and inter-group arithmetic means, as well as standard deviations and measurement values. Data analysis was performed using the T-test and one-way ANOVA. The one-way ANOVA tested for statistically significant differences between the means of independent groups. The Scheffe test was applied to identify which groups differed significantly. Based on the F-distribution, the Scheffe test performed all possible pairwise comparisons between the pooled means. The number of pooled means corresponded to the number of procedures, and the results from both interviews were analyzed.

The first interview took place during the second week of the course. The student-athletes came from various sports backgrounds and generally had little to no experience playing chess. Only a few had some familiarity with the basic principles of the game, the rules, and how the pieces move.

Table 3. Mean and standard deviation scores of chess assimilation levels among student-athletes at the beginning of the course

Item	Sex	Statistic	Std. error
The level of chess assimilation	M (n=13)	Mean	2.31
		Median	2.00
		Variance	0.231
		Standard deviation	0.480
	F (n=13)	Mean	2.62
		Median	3.00
		Variance	0.423
		Standard deviation	0.650
	Total (n=26)	Mean	2.46
		Median	2.50
		Variance	0.338
		Standard deviation	0.582

$p \leq 0.05$

As shown in Table 3, at the start of training, the average chess mastery score was $\bar{X} = 2.31$ for men and $\bar{X} = 2.62$ for women. Chess mastery was evaluated using a nominal scale where 2 corresponds to "poor," 3 to "satisfactory," 4 to "good," and 5 to "excellent." These results indicate that the student-athletes' interest in studying chess is driven by a genuine interest.

This study used the SPSS version 25.0 software package for data analysis. The analysis involved calculating in-group and between-group means, standard deviations, and measurements using the U-test and one-way ANOVA. Three statistical tests were applied: one-way ANOVA, T-test, and Scheffe test. The one-way ANOVA and Scheffe tests were used in combination, while T-tests were performed for each subdimension to identify significant differences between groups, such as gender (male and female) and levels of chess mastery. The one-way ANOVA assessed statistically significant differences between the means of independent groups. The Scheffe test identified which groups exhibited significant differences in their means. Based on the F-distribution, this test is applied to all possible pairwise comparisons of means corresponding to the number of procedures (i). Additionally, the Scheffe test is used to estimate confidence intervals for means and to perform multiple comparisons.

At the end of the course, during the 15th week of training, a final interview was performed. The results revealed changes in several key areas: tactical thinking, emotional state management, personal time management, communication skills, learning ability, and self-analysis capacity.

Table 4. Descriptives for the results of the test on the level of assimilation of chess in student-athletes studying in the chess course at the end of the course

	N	Mean	Standard deviation	Std. error	Minimum	Maximum
2.0	3	9.667	1.5275	0.8819	8.0	11.0
3.0	9	13.222	0.9718	0.3239	12.0	15.0
4.0	6	17.667	0.5164	0.2108	17.0	18.0
5.0	8	19.375	0.5175	0.1830	19.0	20.0
Total	26	15.731	3.5277	0.6918	8.0	20.0

$p \leq 0.05$

Table 4 presents the descriptive statistics for the chess mastery test results. At the end of the course, 3 student-athletes were rated at level 2 ("poor"), 9 at level 3 ("satisfactory"), 6 at level 4 ("good"), and 8 at level 5 ("excellent").

Table 5. Results of ANOVA for the test of tactical thinking ability in student-athletes studying chess at the end of the course

	Sum of squares	df	Mean square	F	Sig.
Between groups	295.684	3	98.561	140.523	0.000
Within groups	15.430	22	0.701		
Total	311.115	25			

$p \leq 0.05$

Table 5 shows that Fisher's F statistic is $F = 140.523$ with a significance level of $\text{Sig} = 0.000$. The variance between groups is considerably larger than the variance within groups. This indicates that the measurement of tactical thinking ability among student-athletes reveals distinct group clusters and significant differences between these groups.

Table 6. Multiple comparisons for the dependent variable: Scheffé test on the tactical thinking abilities of student-athletes studying chess at the end of the course

(I) Level of chess mastery	(J) Chess mastery level	Mean difference (MD)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
2.0	3.0	-3.5556*	0.5583	0.000	-5.244	-1.867
	4.0	-8.0000*	0.5922	0.000	-9.791	-6.209
	5.0	-9.7083*	0.5670	0.000	-11.423	-7.994
3.0	2.0	3.5556*	0.5583	0.000	1.867	5.244
	4.0	-4.4444*	0.4414	0.000	-5.779	-3.109
	5.0	-6.1528*	0.4069	0.000	-7.384	-4.922
4.0	2.0	8.0000*	0.5922	0.000	6.209	9.791
	3.0	4.4444*	0.4414	0.000	3.109	5.779
	5.0	-1.7083*	0.4523	0.011	-3.076	-0.340
5.0	2.0	9.7083*	0.5670	0.000	7.994	11.423
	3.0	6.1528*	0.4069	0.000	4.922	7.384
	4.0	1.7083*	0.4523	0.011	0.340	3.076

* The mean difference is significant at the 0.05 level.

The data in Table 6 illustrate the relationship between the level of chess assimilation and the factor scores from the assessment of tactical thinking ability. Statistically significant differences between groups—marked with an asterisk (*)—are shown for students rated at levels 2 ("poor"), 3 ("satisfactory"), 4 ("good"), and 5 ("excellent") in chess mastery. This demonstrates that as students progressed in mastering chess strategies and tactics, their tactical thinking abilities improved. In teaching chess, the primary focus was on developing gameplay skills, with the cognitive component serving as an intermediate link to reinforce chess knowledge. As a result, the students' performance after completing the course demonstrates positive dynamics.

Table 7. Ranks for tactical thinking ability in student-athletes studying chess at the beginning (Group 1) and end (Group 2) of the course

	Group	N	Mean rank	Sum of ranks
Tactical thinking ability	1.00	26	17.42	453.00
	2.00	26	35.58	925.00
	Total	52		

Table 7 shows that the average rank for student-athletes in the chess course was $M_r = 17.42$ at the beginning (Group 1) and $M_r = 35.58$ at the end of the course (Group 2).

Table 8. Mann–Whitney test for tactical thinking ability in student-athletes studying chess at the beginning (Group 1) and end (Group 2) of the course

Test statistics	
Tactical thinking ability	
Mann–Whitney U	102.000
Wilcoxon W	453.000
Z	-4.366
Asymp. Sig. (2-tailed)	0.000

a. Grouping variable: Group

Table 8 clearly presents the results of the Mann–Whitney test comparing tactical thinking ability in student-athletes at the beginning of the course (Group 1) and at the end of the course (Group 2). The significance

level is Asymp. Sig. = 0.000, indicating a statistically significant difference. This demonstrates a positive change in the tactical thinking ability of the student-athletes.

Table 9. Ranks for the ability to manage personal time among student-athletes studying in a chess course at the beginning (Group 1) and end (Group 2) of the course

	Group	N	Mean rank	Sum of ranks
Ability to manage personal time	1.00	26	17.98	467.50
	2.00	26	35.02	910.50
	Total	52		

Table 7 shows that the average rank for student-athletes in the chess course was $M_r = 17.98$ at the beginning (Group 1) and $M_r = 35.02$ at the end of the course (Group 2).

Table 10. Mann–Whitney test for the ability to manage personal time in student-athletes studying chess at the beginning (Group 1) and end (Group 2) of the course

Test statistics	
	Ability to manage personal time
Mann–Whitney U	116.500
Wilcoxon W	467.500
Z	-4.086
Asymp. Sig. (2-tailed)	0.000
a. Grouping variable: Group	

Table 10 clearly shows the results of the Mann–Whitney test comparing personal time management ability among student-athletes at the beginning of the course (Group 1) and at its conclusion (Group 2). The significance level is Asymp. Sig. = 0.000, indicating a statistically significant difference. This reflects a positive improvement in the student-athletes' ability to manage personal time.

Table 11. ANOVA results for the ability to manage personal time in student-athletes studying chess at the end of the course

	Sum of squares	df	Mean square	F	Sig.
Between groups	174.125	3	58.042	18.813	0.000
Within groups	67.875	22	3.085		
Total	242.000	25			

$p \leq 0.05$

Table 11 shows that Fisher's F statistic is $F = 18.813$ with a significance level of $\text{Sig} = 0.000$. The variance between groups is substantially greater than the variance within groups. This indicates that the results measuring personal time management ability among student-athletes reveal distinct group clusters and significant differences between these groups.

Table 12. Multiple comparisons using the Scheffe test for the dependent variable: ability to manage personal time in student-athletes studying chess at the end of the course

(I) Level of chess mastery	(J) Chess mastery level	Mean difference (MD)	Std. error	Sig.	95% Confidence interval	
					Lower bound	Upper bound
2.0	3.0	-4.3333*	1.1710	0.012	-7.875	-0.792
	4.0	-7.3333*	1.2420	0.000	-11.090	-3.577
	5.0	-8.0417*	1.1891	0.000	-11.638	-4.445
3.0	2.0	4.3333*	1.1710	0.012	0.792	7.875
	4.0	-3.0000*	0.9257	0.033	-5.800	-0.200
	5.0	-3.7083*	0.8535	0.003	-6.290	-1.127
4.0	2.0	7.3333*	1.2420	0.000	3.577	11.090
	3.0	3.0000*	0.9257	0.033	0.200	5.800
	5.0	-0.7083	0.9486	0.905	-3.577	2.161
5.0	2.0	8.0417*	1.1891	0.000	4.445	11.638
	3.0	3.7083*	0.8535	0.003	1.127	6.290
	4.0	0.7083	0.9486	0.905	-2.161	3.577

* The mean difference is significant at the 0.05 level.

The data in Table 12 show the relationship between the level of chess assimilation and the factor scores from the personal time management ability. Statistically significant differences, marked with an asterisk (*), are shown for groups of students rated as 2 ("poor"), 3 ("satisfactory"), 4 ("good"), and 5 ("excellent") in chess mastery. This demonstrates that as students mastered chess strategy and tactics, their personal time management skills also improved. Overall, the students' results after completing the course reflect positive progress.

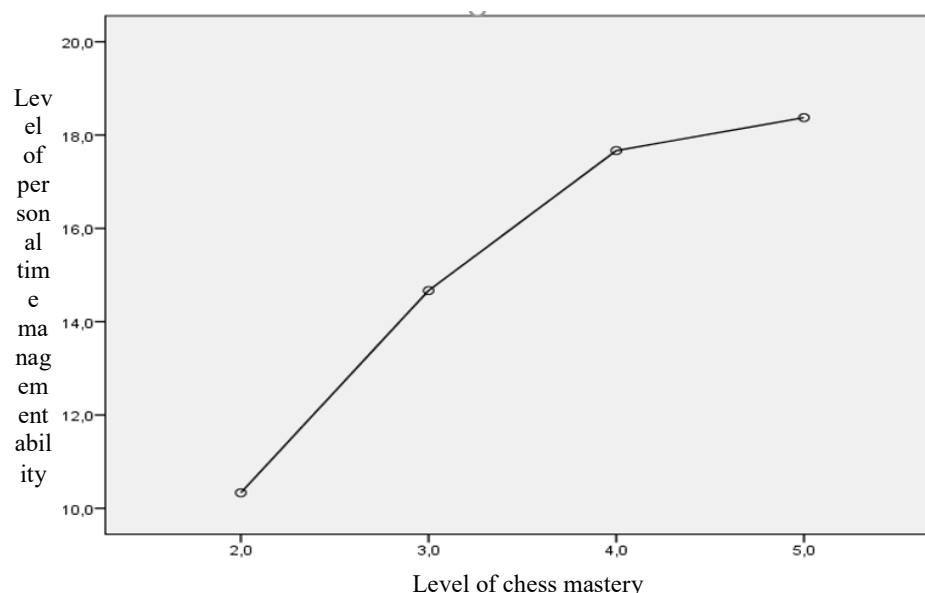


Figure 1. Graph showing the relationship between personal time management ability and chess mastery level among student-athletes enrolled in a chess course at the end of the course

A direct relationship exists between the level of personal time management skills and the level of chess mastery among student-athletes at the end of the course. Consequently, the students' results after completing the course demonstrate positive progress (Fig. 1)

Discussion

The study results show that the level of chess acquisition among student-athletes improved during the course, as confirmed by the data in Tables 3, 4, 6, 7, 8, 10, and 12. At the beginning of the course, the average chess acquisition score was slightly higher for women ($X = 2.62$) than for men ($X = 2.31$), highlighting the need for chess training given the initially low skill levels of the student-athletes. These findings align with existing research demonstrating that chess improves cognitive abilities such as memory, concentration, and strategic thinking (Sala & Gobet, 2016). Moreover, scientific studies (Burgoyne et al., 2016) confirm that chess training positively influences academic performance and the development of cognitive functions in students.

Data analysis was performed using SPSS version 25.0 and included calculations of within-group and between-group means, standard deviations, as well as the application of the U-test and one-way ANOVA. Additionally, the T-test and Scheffe test were used to identify statistically significant differences among groups.

By the end of the course, positive progress in chess assimilation levels was evident. While three student-athletes remained at the "poor" level (2), the others showed improvement: nine reached "satisfactory" (3), six achieved "good" (4), and eight attained "excellent" (5). These statistically significant differences in chess assimilation levels are supported by the analysis shown in Table 6.

Comparison of data from the initial and final stages of the course, using the Mann–Whitney test, reveals a significant improvement in the tactical thinking ability of student-athletes ($As = 0.000$). The average rank increased from $Mr = 17.98$ to $Mr = 35.02$, confirming the course's effectiveness in improving tactical skills. These findings align with scientific evidence linking chess training to the development of cognitive abilities such as logical reasoning, strategic planning, and consequence prediction (Bart, 2014; Burgoyne et al., 2016). Additionally, research indicates that chess training improves executive brain functions, including cognitive flexibility and working memory (Sala & Gobet, 2017).

Additionally, statistically significant improvements were observed in personal time management skills ($As = 0.000$), indicating that students improved their self-organization and effective time management abilities. However, no statistically significant changes were found in emotional state management or communication skills. This may be because the training primarily focused on developing chess-related skills rather than addressing social or emotional aspects.

The data obtained confirm the positive impact of the chess course on the development of tactical thinking and personal time management skills in student-athletes. Future research could focus on exploring additional factors affecting the development of communication skills and emotional state management, as well as improving teaching methods to achieve a more comprehensive development of students.

Conclusions

This study confirmed the significant impact of chess training on the cognitive abilities of student-athletes. Notably, statistically significant improvements were observed in tactical thinking and personal time management, underscoring chess's role in enhancing strategic analysis and self-organization. These findings align with previous research demonstrating that chess training improves executive brain functions and promotes the development of analytical thinking (Sala & Gobet, 2017; Burgoyne et al., 2016).

Psychological factors play a crucial role in success both in chess and sports performance. The development of cognitive skills such as goal setting, relaxation, and self-talk is actively used by cognitive psychologists to improve chess performance and intellectual functioning (Glynn et al., 2013; Vealey, 1994; Weinberg & Williams, 2014). Incorporating chess into educational programs—particularly in sport psychology and cognitive sciences—offers students valuable opportunities to refine psychological strategies that improve their analytical thinking. These skills also improve professional effectiveness in critical fields such as the military, law enforcement, and emergency response (Adler et al., 2015; Anton et al., 2017; Page et al., 2016).

The study's findings improve our understanding of chess's role in both academic and professional development. Systematic reviews consistently demonstrate that chess training positively influences not only athletic performance but also cognitive functioning (Meyers et al., 1996; Thelwell & Greenlees, 2003; Weinberg & Comar, 1994). However, current research has yet to adequately address the integration of chess courses into university curricula, underscoring the need for further investigation in this field.

Contemporary chess training methods incorporate various approaches that provide personalized learning. Analysis of these strategies reveals that the most effective models combine cognitive training, consultative techniques, and medical as well as interdisciplinary methods (Poczwardowski et al., 2004). Research further confirms that cognitive training in chess instruction improves executive brain functions, including cognitive flexibility, working memory, and multitasking abilities (Sala & Gobet, 2017; Bart, 2014). Moreover, interdisciplinary approaches that integrate elements of sport psychology and cognitive science have proven effective in improving students' chess abilities and overall intellectual fitness (Burgoyne et al., 2016). Future research should focus on evaluating the efficacy of these methods and developing innovative tools to further advance students' chess and cognitive skills (Barker et al., 2020; Von Guenther et al., 2010).

Thus, the study's findings underscore the need for further research into chess education, its effects on cognitive development, and its integration into educational and professional programs.

Conflict of Interest

The authors declare no conflict of interest in this study.

Ethical consideration

This research adhered to ethical standards and received approval to involve all respondents as participants.

References

- Adler, A. B., Bliese, P. D., McGurk, D., Hoge, C. W., & Castro, C. A. (2009). Battlemind debriefing and battlemind training as early interventions with soldiers returning from Iraq: Randomization by platoon. *Journal of Consulting and Clinical Psychology*, 77(5), 928–940.
- Anton, R., & Vidal, C. (2017). The influence of psychological skills training programs on the performance of soccer players. *Journal of Human Sport and Exercise*, 12(1), 32–44.
- Aoyagi, M. W., Poczwardowski, A., Statler, T., & Shapiro, J. L. (2017). The roots of sport and performance psychology: A synthesis of cultural praxis and science. *Journal of Sport Psychology in Action*, 8(2), 106–116.
- Atherton, M., Zhuang, J., Bart, W. M., Hu, X., & He, S. (2003). Functional MRI reveals cortical regions active in mental rotation and intelligence. *Brain Research Cognitive Brain Research*, 16(1), 73–81.
- Barker, J. B., Mellalieu, S. D., McCarthy, P. J., Jones, M. V., & Moran, A. (2020). *Single-case research methods in sport and exercise psychology*. Routledge.
- Burgoyne, A. P., Sala, G., Gobet, F., Macnamara, B. N., Campitelli, G., & Hambrick, D. Z. (2016). The relationship between cognitive ability and chess skill: A comprehensive meta-analysis. *Intelligence*, 59, 72–83.
- Chebykin, S. V., Orlov, M. V., & Petrova, A. D. (2024). Cognitive control in strategic decision-making: A case study of competitive chess players. *Journal of Cognitive Sciences*, 18(1), 45–61.
- Cohen, S., Gianaros, P. J., & Manuck, S. B. (2019). A stage model of stress and disease. *Perspectives on Psychological Science*, 14(4), 491–512.
- Creswell, J. W., & Clark, V. L. P. (2011). *Designing and conducting mixed methods research* (2nd ed.). SAGE Publications.
- Cretu, A. M. (2021). Psychological resilience in chess: A review of stress adaptation in high-level players. *Cognitive and Behavioral Psychology*, 9(2), 210–225.
- Dolev, N., & Leshem, S. (2016). Developing emotional intelligence competence among teachers. *Teacher Development*, 20(2), 160–174.

- Downey, L. A., Mountstephen, J., Lloyd, J., Hansen, K., & Stough, C. (2010). Emotional intelligence and scholastic achievement in pre-adolescent children. *Personality and Individual Differences*, 48(5), 579–584.
- Ganesh, M., & Ganesh, S. (2022). Work-study balance and cognitive performance: An exploratory study. *Journal of Educational Psychology*, 25(3), 345–361.
- Glynn, S. M., Britton, B. K., & Tillman, M. H. (2013). Cognitive psychology and chess: The role of expertise in memory and learning. *Memory & Cognition*, 41(6), 857–866.
- Goleman, D. (2005). *Emotional intelligence: Why it can matter more than IQ* (10th anniversary ed.). Bantam Books.
- Grant, A. M., & Greene, J. (2004). *Coach yourself: Make real changes in your life*. Momentum Press.
- Grant, K. E., McMahon, S. D., Carter, J. S., Carleton, R. A., Adam, E. K., & Chen, E. (2014). The role of stress in children's and adolescents' development: A review of the literature. *Clinical Child and Family Psychology Review*, 17(3), 233–257.
- Herman, J. L. (1992). *Trauma and recovery: The consequences of violence—from domestic abuse to political terror*. Basic Books.
- Holliday, B., Burton, D., Sun, G., & Weiss, C. (2008). Goal setting interventions in sport and exercise: A review of the literature from 1997 to 2006. *Sport Psychologist*, 22(4), 423–446.
- Khalyan, I. (2023). Cognitive flexibility in chess learning: A case study of student adaptability. *Psychological Research in Education*, 27(2), 178–195.
- Khalyan, I. (2023a). Decision-making under pressure: Psychological characteristics of elite chess players. *Cognitive Strategies in Sports*, 30(1), 56–75.
- Khalyan, I. (2023b). Psychological well-being and cognitive load in young chess players: A longitudinal study. *Journal of Youth Psychology*, 15(4), 112–130.
- Kozin, D. (2022). Cognitive and emotional regulation in professional chess players: An empirical analysis. *European Journal of Cognitive Psychology*, 34(3), 204–219.
- Kubany, E. S., Gino, A., & Hayden, R. (2000). Cognitive trauma therapy for battered women with PTSD. *Journal of Consulting and Clinical Psychology*, 68(3), 421–429.
- Laki, M., Smirnova, E., & Petrov, D. (2021). Family influence on cognitive and emotional development of young athletes: A comparative study. *Journal of Family Psychology*, 35(2), 145–160.
- Linley, P. A., & Joseph, S. (2004). Positive change following trauma and adversity: A review. *Journal of Traumatic Stress*, 17(1), 11–21.
- Mauno, S., Kinnunen, U., & Ruokolainen, M. (2012). Work-family conflict and job satisfaction: The role of perceived work climate. *Journal of Organizational Behavior*, 33(2), 209–227.
- Mayer, J. D., & Fletcher, S. D. (2007). Emotional intelligence in chess: Implications for strategic decision-making. *Journal of Applied Psychology*, 92(1), 178–190.
- Mayer, J. D., & Salovey, P. (1993). The intelligence of emotional intelligence. *Intelligence*, 17(4), 433–442.
- Zinchenko, Y. P., Pervichko, E. I., & Martynov, S. V. (2023). Psychological aspects of extreme situations: Theoretical and empirical analysis. *Psychology in Russia: State of the Art*, 16(1), 3–17.
- Poczwardowski, A., Sherman, C. P., & Ravizza, K. (2004). Professional philosophy in the sport psychology service delivery: Building on theory and practice. *Sport Psychologist*, 18(4), 445–463.
- Ruetti, M., & Pirotti, G. (2024). The role of interpersonal relationships in cognitive and emotional well-being: Insights from a longitudinal study. *Journal of Positive Psychology*, 19(1), 78–93.