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Designing a Short Term Endgame Training System to Enhance Decision Making Speed for Chess Players

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Abstract:

By employing established scientific methods in sports science, this study devised six clusters of exercises aimed at developing comprehensive endgame calculation skills, alongside three evaluative tests, for members of the Chess Club at Hanoi Pedagogical University 2. A pedagogical experiment demonstrated marked improvements in students' calculation proficiency and cognitive processing speed. These findings confirm the efficacy of the prescribed exercises in strengthening endgame calculation ability and decision making competence, thereby contributing to the overall quality of chess performance among the club's student participants.

Keywords: endgame exercises; decision making speed; chess club students; Hanoi Pedagogical University 2.

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Introduction

Chess is an intellectual sport of high educational value, demanding tactical and strategic reasoning, effective time management, and sound decision-making. The endgame phase holds particular significance, as even a minor error can decisively alter the outcome of a match. Accordingly, endgame exercises serve as a fundamental tool for players to hone their calculation skills and accelerate their decision-making processes.

At the Chess Club of Hanoi Pedagogical University 2, many students remain underprepared for endgame scenarios, especially those requiring rapid reflexes and swift judgment. In practical training contexts, the "short-term" dimension of endgame drills has often been neglected, resulting in constraints on tactical reasoning and competitive efficacy.

Prior research—such as that of Bart (2014), Ferguson (1995), Shih (2015), and D'Costa & Ramesh (2020)—highlights the pivotal role of chess in cognitive development and advocates for the integration of specialized endgame exercises to cultivate decision-making speed and quality. However, there is a dearth of focused studies examining the impact of such interventions on university-level students.

Therefore, this investigation aims to (1) analyze the cognitive structure underpinning chess players' thought processes and (2) implement a tailored system of endgame exercises designed to enhance calculation proficiency and bolster decision-making speed among members of the Chess Club at Hanoi Pedagogical University 2. In doing so, it seeks to elevate competitive performance and foster the growth of the university's chess movement.

Methods and Materials

Research Design

A mixed-methods, sequential explanatory design was employed to develop and evaluate the short-term endgame training system. The study comprised three phases: (1) instrument and exercise selection through literature review and expert consultation; (2) implementation of the training intervention; and (3) quantitative evaluation via pre- and post-testing. This design ensured that qualitative insights from coaches and instructors informed the subsequent experimental procedures, and that empirical data could validate the intervention's efficacy

Participants

Thirty-eight female members of the Hanoi Pedagogical University 2 Chess Club (age 18–22 years, $M = 19.6 \pm 1.1$) volunteered for the study. Inclusion criteria were: (a) active club membership for at least six months, (b) basic proficiency in standard endgame techniques, and (c) availability for the full 12-month intervention. Participants were randomly assigned to an experimental group ($n = 19$) and a control group ($n = 19$), ensuring equivalent baseline characteristics as confirmed by pre-test comparisons.

Materials

Endgame Exercise Modules: Six drill clusters (position studies, tactical combinations, rapid-reaction tasks, blitz matches, themed problems, and spare-move identification) standardized by scenario count, time allocation, and rest intervals.

Assessment Instruments: Three validated tests measuring rapid-reaction and quick-thinking, optimal move-selection, and endgame combination skills. Prior pilot testing ($n = 10$) established each test's clarity ($CVI > 0.85$) and internal consistency (Cronbach's $\alpha > 0.80$).

Equipment and Venue: Regulation Staunton chess sets, digital clocks set to Fischer timing, and a dedicated training room at Hanoi Pedagogical University 2 with standardized lighting and minimal external distractions.

Procedures

Literature Review & Exercise Selection: Comprehensive search of academic databases (e.g., Web of Science, Scopus) using keywords "chess endgame training," "decision-making speed," and "cognitive processing in chess." Ten candidate exercises were extracted and refined via semi-structured interviews with 15 experienced coaches and instructors.

Pilot Testing of Instruments: The three assessment tests were administered to a separate cohort of 10 club members to evaluate item clarity and timing; feedback informed minor adjustments to instructions and scoring rubrics.

Intervention Implementation: Over 12 months, the experimental group received the six specialized drills integrated into weekly training sessions (2 hours per week), while the control group continued the club's standard endgame regimen. All sessions were led by the same coaching team to control for instructor effects.

Pre- and Post-Testing: Both groups completed the three assessment tests under identical conditions (quiet room, standardized timing, no external assistance) one week before and one week after the intervention period.

Statistical Analysis

Data were analyzed using SPSS v26.0. Descriptive statistics (mean ± SD) characterized group performance. Independent-samples t-tests compared baseline equivalence, while paired-samples t-tests assessed within-group pre- to post-intervention changes. Between-group differences in gain scores were evaluated via independent-samples t-tests, with significance set at $\alpha = 0.05$.

Results and Discussion

Selection of Short-Term Endgame Exercises to Enhance Decision-Making Speed

To develop endgame calculation skills and accelerate cognitive processing among female members of the Chess Club at Hanoi Pedagogical University 2, we first surveyed existing endgame literature and conducted a needs assessment with 15 experienced coaches and instructors. Ten candidate exercise types were proposed and evaluated; six exercises achieving a ≥ 80 % "very suitable" rating were retained (Table 1).

Table 1. Expert Evaluation of Endgame Calculation Exercises (n = 15)

No.	Exercise Type	Very Suitable (%)	Suitable (%)	Not Suitable (%)
1	Endgame position studies	100	0	0
2	Tactical combination drills in endgames	93.3	6.7	0
3	Rapid-reaction and quick-thinking exercises	86.7	6.7	6.6
4	Blitz endgame matches	80	0	20
5	Themed endgame calculation problems	93.3	6.7	0
6	Spare-move identification tasks	93.3	6.7	0

Implementation of the Exercises

The six selected endgame drills were administered as follows:

- **Exercise 1. Endgame Position Studies**
  - – 3–5 positions per session
  - – 5–7 minutes allotted for each position
  - – 2 minutes' rest between positions
- **Exercise 2. Endgame Combination Drills**
  - – 5–10 problems per session
  - – 3–5 minutes per problem
  - – 1–2 minutes' rest after every three problems
- **Exercise 3. Rapid-Reaction and Quick-Thinking Exercises**
  - – 10–15 problems per session
  - – 30–60 seconds per problem
  - – 3 minutes' rest after every five problems
- **Exercise 4. Blitz Endgame Matches**
  - – 3–5 positions per session
  - – 5–7 minutes per position

– 2 minutes' rest between positions

- **Exercise 5. Themed Endgame Calculation Problems**

  – 5–7 problems per session

  – 8–10 minutes per problem

  – 2 minutes' rest after every two problems

- **Exercise 6. Spare-Move Identification Tasks**

  – 1–2 positions per session

  – 15–20 minutes per position

  – 5 minutes' rest between positions

Selection of Decision-Making Speed Assessment Tests

Through literature review, training observation, and interviews with 15 chess experts and instructors, five candidate tests were initially identified to evaluate calculation skill and decision-making speed. After establishing each test's clarity and reliability on our study cohort, three instruments were retained:

Rapid-Reaction and Quick-Thinking Test (score)

Optimal Move-Selection Test (score)

Endgame Combination Test (score)

These three tests formed the basis for all subsequent pre- and post-intervention assessments.

Application of the Endgame Training System

Experimental Design

Design: Parallel-group comparison

Duration: 12 months

Participants: 38 female Chess Club members, randomly assigned to two equal groups (n = 19 each):

Experimental Group: Received the six specialized endgame drills, systematically integrated into their annual training syllabus and each lesson plan.

Control Group: Continued with the conventional endgame training program previously in use.

Location: Hanoi Pedagogical University 2

Pre-Test Results

Prior to the intervention, both groups completed the three selected tests. Independent-samples t-tests confirmed no significant differences between groups, indicating comparable baseline decision-making speed and calculation ability.

Table 2. Pre-Intervention Test Scores for Control vs. Experimental Groups ($n_1 = n_2 = 19$)

No.	Test	Control Group (n = 19)	Experimental Group (n = 19)	t ($t_{0.5} = 1.96$)	p
1	Rapid-Reaction and Quick-Thinking Test (score)	6.29 ± 0.324	6.49 ± 0.390	0.232	> 0.05
2	Optimal Move-Selection Test (score)	6.81 ± 0.290	6.83 ± 0.270	0.433	> 0.05
3	Endgame Combination Test (score)	6.26 ± 0.320	6.35 ± 0.350	0.358	> 0.05

As shown in Table 2, the differences in test performance between the two groups were not statistically significant ($t_{calculated} < t_{table} = 1.96$ at $\alpha = 0.05$). The vast majority of component tests assessing cognitive ability revealed no pre-intervention differences between the experimental and control groups. Both cohorts produced similar solutions, indicating that endgame calculation skill and thinking speed were uniformly low and equivalent at baseline.

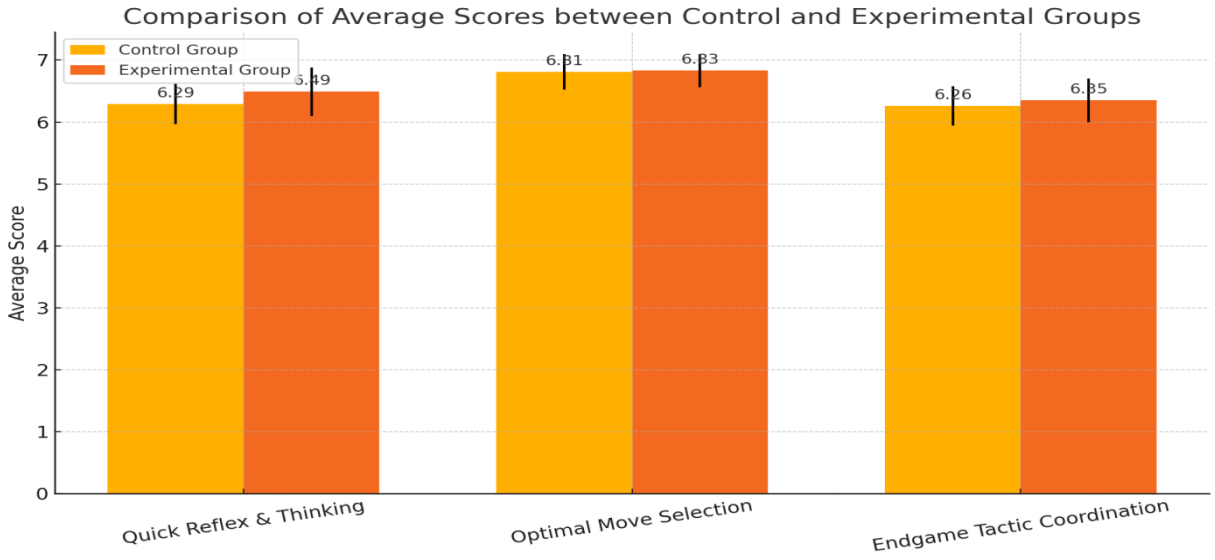

Figure 1. Pre-Intervention Growth Trajectory of Calculation Ability

Figure 1 illustrates that the experimental group's scores were marginally higher than those of the control group across all three tests; however, these differences were negligible and did not reach statistical significance ($p > 0.05$). In other words, the experimental group did not exhibit any meaningful advantage over the control group prior to the intervention.

Post-Intervention Results

To determine the impact of the specialized exercises on cognitive processing and calculation speed, both groups were re-tested after the 12-month intervention. The results are presented in Table 3.

Table 3. Post-Intervention Test Scores for Control vs. Experimental Groups ($n_1 = n_2 = 19$)

No.	Test	Control Group (n = 19)	Experimental Group (n = 19)	t ($t_{0.5} = 1.96$)	p
1	Rapid-Reaction and Quick-Thinking (score)	7.14 ± 0.42	7.50 ± 0.37	2.87	< 0.05
2	Optimal Move-Selection (score)	7.27 ± 0.43	7.81 ± 0.42	3.16	< 0.05
3	Endgame Combination (score)	6.91 ± 0.35	7.37 ± 0.34	2.73	< 0.05

Table 3 demonstrates that, for all three tests, $t_{calculated}$ exceeded t_{table} (1.96) at $p < 0.05$. Thus, at the conclusion of the intervention, the experimental group exhibited significantly greater improvements in cognitive processing and decision-making speed than the control group. These findings confirm the effectiveness of the specialized endgame exercise system in enhancing calculation skills and decision-making competence among the female chess club members in the experimental cohort.

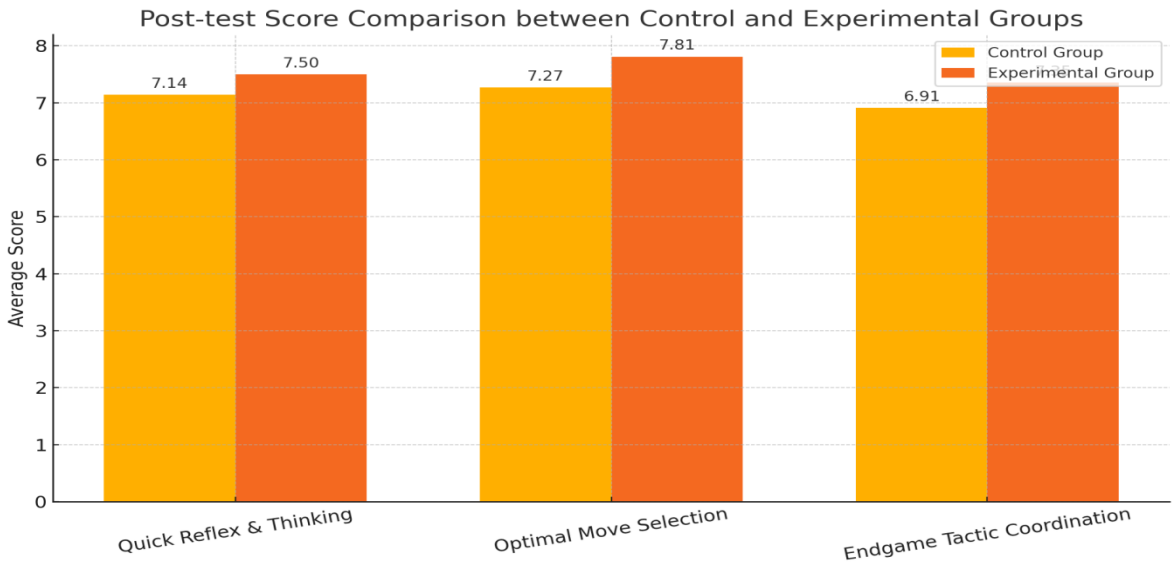

Figure 2. Growth Trajectory of Calculation Ability Post-Intervention

Figure 2 shows the comparative growth of calculation ability across the three tests for both groups. The experimental group exhibited greater gains than the control group on all measures, with especially pronounced improvements in the **Rapid-Reaction and Quick-Thinking** and **Optimal Move-Selection** tests. This pattern underscores the positive effect of the targeted endgame exercise intervention on the experimental cohort.

Conclusion

This study successfully identified six specialized endgame exercise clusters aimed at enhancing calculation proficiency and decision-making speed, along with three reliable assessment tests, for female members of the Chess Club at Hanoi Pedagogical University 2. Implementation of this exercise system yielded significant improvements in analytical thinking, variation calculation, and in-game calculation performance. These outcomes confirm the efficacy of the prescribed drills in elevating calculation skills, support the innovation of chess teaching and learning methodologies, and contribute to enhanced competitive performance.

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