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IMPACT OF PLAYING CHESS ON COGNITIVE SKILLS IN SCHOOLS UNDER CHESS ASSOCIATION OF AMPARA DISTRICT, SRI LANKA

Sakeer Ahamed,
Selliah Joniton[i]
Department of Sports Sciences and Physical Education,
Faculty of Applied Sciences,
Sabaragamuwa University of Sri Lanka,
Sri Lanka

Abstract:
The primary purpose of this study is to investigate the impact of playing chess on cognitive skills in schools under the chess association of Ampara district. A quantitative research approach was followed to analyze that respective objective under the chess association of Ampara district and identify the strategies chess players and coaches can take to improvise the impact of playing chess among the school students. Thirty students as an experimental group and thirty students as a control group from schools participated in this study. The experimental group underwent a ninety minutes of chess practice three-day per week over three months and the control group student's regularly attended school activities after class. The experimental group's performance on the test was not different from the control group's performance. However, as per the statistical analysis control group, students achieved 50.13 on average while the experimental group students achieved 51.47 on average in the pre-test exam. In the post-test exam control group, students achieved 51.20 on average while in the experimental group students achieved 64.27 as on average. Based on the result there is a significant improvement in the cognitive skills of the experimental group after the chess training ($p=0.000$) and there is no significant improvement in the cognitive skills in the control group ($p=0.174$). Which shows the improvement in the cognitive skills of the students who are playing chess compared to the non-playing chess students. Moreover, all chess-related pupils should concentrate on the publicity of chess among the school students and give their full support to the best outcome for chess-playing students for their development of cognitive skills. Hence, the investigator successfully identified the impact of playing chess on the development of cognitive skills in schools under the chess association of Ampara district.

Keywords: chess, cognitive skills, the impact of chess, benefits of chess

[i] Correspondence: email amsakeer69@gmail.com, jonilan333@gmail.com

1. Introduction

Chess is a strategic game that was invented in India about 1500 years ago. According to a researcher, the emperor of India instructed his wise man to design a method of teaching the royal family's children to become better thinkers and battlefield generals. That chess has expanded to every country on the planet in the centuries since its creation (Meyers, 2002).

Chess has long been acknowledged as a tool for developing strong intellects across the world, but it is only recently that the United States has begun to recognize chess's capacity to boost cognitive capacities, rational thinking, and reasoning in even the most disadvantaged youngsters (Palm, 1994). Chess brings to light hidden qualities that might otherwise go unnoticed by regular instructional methods. It encourages rational thinking, builds self-esteem and self-worth, and enhances communication and pattern identification abilities (Graham, 1990).

Chess is one of the most effective instructional instruments for building a child's intellect. It's not difficult to pick up the game. The majority of six or seven-year-olds are capable of following the fundamental rules. Some children as young as four or five years old can participate (Dauvergne, 2000). Chess, on the other hand, is beneficial not just for the development of exceptional children's talents. Average and even below-average students can profit as well (Lacrimosa, 2005).

Furthermore, chess may aid in the development of patience, attention, and self-control in youngsters. It has the ability to encourage youngsters to become eager problem solvers who can spend hours quietly engrossed in logical reasoning. Chess may also be used to emphasize the significance of being forward-thinking (Sala, Gobet, Trinchero, & Ventura, 2016). The evaluation process is an essential aspect of chess, 3 since it requires one to think forward a few steps during a chess game and examine and assess different situations. According to Sala et al. (2016), by visualizing a sequence of events before they occur, chess may teach youngsters how to focus and visualize. As previously stated, the schematic thinking style in chess is similar to trees and branches in sequential-decision analysis and may be valuable and transferrable to math abilities (Sala et al., 2016).

Chess is an important element of the student curriculum's logic and creative problem-solving section. It helps students develop critical thinking abilities, which benefits their personal development as well as their academic progress (American chess school, 1987). It leads to encouraging other school districts to explore providing kids with opportunities in this exciting topic area. Chess is frequently used by instructors to teach critical thinking abilities. Students are taught that knowing how to think is more essential than learning how to solve a problem (American chess school, 1987). Chess teaches students how to come up with innovative solutions to issues. They learn to examine a situation by concentrating on the most crucial aspects. Chess works because it is a self-motivating game (Topping, 1988). The game is innately engaging, and the aims of attack and defense, culminating in checkmate, inspire young people to use their mental resources to the fullest (Ferguson, 1988).

Modern chess was unique in that it featured two fundamental traits that were shared by all subsequent chess variants: various pieces had differing capabilities, and success was determined by one piece, the modern chess king. Persia, the Byzantine Empire, and, probably most importantly, the burgeoning Arabian empire all brought a form of chaturanga to Europe (Gamer, 1954). The contemporary rules and look of the pieces evolved through time, with regional variations. The pawn, for example, had gained the ability to move two squares on its initial turn by 1300, rather than just one (Gordon, 2009).

The approval of the final two significant rule modifications, castling and passant capture, took longer. Both rules were recognized as early as the 15th century, but their use was limited until the 18th century.

2. History of Sri Lankan Chess

Here are some of the milestones of Sri Lankan chess that everyone should know about. Even before the establishment of the Sri Lankan Chess Federation, there is evidence of a formal organizational structure and competitive events. The Ceylon Open, won by B. W. Atkinson in 1959, is the first competition we could discover in the archives. In the 1960s, the Ceylon Open and Premier were held on a regular basis. The most prominent players of the era were Christopher Parakrama and G. A. S. Dissanayake. The founding of CFSL was in 1972. Due to the achievements of Robert Fischer, whom singlehandedly dethroned Soviet chess dominance in 1972, there was a worldwide chess fever. In 1972, the historic Fischer-Spassky encounter sparked an extraordinary wave of interest in the game in 5 Western countries. The notion of forming an official body to administer the game arose, and the Sri Lanka Chess Federation was born. Sri Lankan chess has become stronger in the new century thanks to the active roles performed by the CFSL and the Schools Chess Association.

3. The Basics of Chess

Chess is a two-player strategy and tactics game played on an 8-by-8 chequered board. Although there are many other types and colors of chess sets, the conventional colors are white and black, which is how we shall refer to the two players on this page. The goal of the game is to checkmate your opponent's king by trapping it. A game can also be won if your opponent quits up (in chess, we term this 'resigning'), and there are a multitude of ways a game might conclude in a draw, in which case neither player wins. We'll go through things in further depth later (Anonymous, 2015).

3.1 Chess and Cognitive Skills

Chess is a unique approach to addressing the long-standing issue of inadequate education Chess has been implemented as an effective tool for teaching students (Jankovic & Novak, 2019). The cognitive talents may then be transferred to other fields.

Chess, for example, is said to engage and maybe improve cognitive qualities such as working memory, fluid intelligence, and attention capacity (Burgoyne et al., 2016; Sala) These qualities are predictors of mathematical success. It would explain why chess improves students' math skills. A similar argument is deployed in the study. (Deary, Strand, Smith, & Fernandes, 2007; Peng, Namkung, Barnes, & Sun, 2016). Chess can help with arithmetic skills and, more broadly, scholastic accomplishment by improving attention and problem-solving abilities (Jerrim, Macmillan, Micklewright, Sawtell, & Wiggins, 2018).

Despite the fact that several studies have found a link between a student's educational success and chess play Chess has only been utilized irregularly by school districts to try to improve student performance. Surprisingly, chess activity appears to be the most closely linked to improved student conduct and attitudes (Dauverrgne, 2000; Liptrap, 1999). Chess is a mentally challenging activity, according to the given theories. Chess necessitates domain-general cognitive abilities that may be honed via game practice (Bart, 2014). Chess is regarded as an efficient educational instrument capable of improving not just mathematical skills but also other 21 academic skills such as reading, general cognitive abilities such as focus and intellect, as well as children's heuristics and habits of mind. (Costa & Kallick, 2009)

A lot of studies have been done on the psychology of chess-playing, and a lot is understood about the cognitive basis of chess talent, aside from an educational interest in general, empirical data implies that high levels of performance require practice rather than pure aptitude. Chess mastery necessitates the development of specialized knowledge, which includes the recall of a vast number of chess-specific patterns that might prompt proper movements, assessments, or strategies (Charness, 1992).

If chess has a beneficial impact on IQ, chess players should be more intelligent than the overall population. The outcomes of studies aiming at answering this topic have been varied. In an early study, who studied a group of eight of the finest grandmasters of the period found no differences in general intelligence or visuospatial memory when compared to a control sample (Djakow, Petrowski, & Rudik, 1927).

Chess has long been seen to be a good way for kids to improve their mental acuity, focus, memory, and analytical abilities. It should come as no surprise to anybody who has played chess that these assumptions have been proved in various studies on how chess may help pupils improve their grades (Ferguson, 1988). The top chess players typically have a keen sense or intuition about which move is the correct one. This might be a valuable educational tool (Chan et al., Eling, Derckx, & Maes, 2008).

3.2 Benefits of Playing Chess for Children

The advantages of chess for benefits are enormous; this is a fact. Chess improves children's intelligence by allowing them to acquire or strengthen the following skills:

- Focusing - Children are taught the benefits of paying attention and focusing. They won't be able to react to what's going on if they attempt not to focus on it, no matter how smart they are (Meyers, 2002).

- Visualizing - Children are asked to visualize a series of events before they happen. We greatly strengthen their ability to visualize by training them to move the pieces to them, first one, then a few movements ahead of time (Meyers, 2002).
- Thinking in Advance - Children are taught to think first, then act (Meyers, 2002).
- Planning - Children are taught to set long-term objectives and to take measures toward achieving them. They are also taught the need of re-evaluating their plans as circumstances change (Meyers, 2002).
- Chess is a game for people of all ages - Chess may be learned at any age, and unlike many other sports, it does not need you to retire. When it comes to finding an opponent, age is irrelevant; young can play old, and old can play young (Ferguson, 1988).
- Chess develops memory - Chess theory is difficult to grasp, and many players remember several opening variants. You'll also learn to distinguish different patterns and recall long variations (Ferguson, 1988).
- Chess improves concentration - During the game, you have only one major goal: to checkmate your opponent and win (Ferguson, 1988).
- Chess develops logical thinking - Chess necessitates some knowledge of rational strategy. For example, you will understand the importance of bringing your pieces into the game early on, keeping your king safe at all times, not creating major vulnerabilities in your position, and not giving your pieces away for free (Ferguson, 1988).
- Chess promotes imagination and creativity - It inspires you to think beyond the box. There are an infinite number of exquisite combinations that have yet to be created (Ferguson, 1988).

4. Scope, Objective and Hypothesis

4.1 Scope

To establish the impact of playing chess and cognitive skills, a comprehensive literature review was carried out to identify the impact of chess practices among the students and their backgrounds and the technical strategies associated with chess and its impact on the cognitive skills of a student by referring books, journals, dissertations, web sites, etc. The impact of playing chess and cognitive skills by conducting IQ test exam who are studying in the Ampara district schools in grades 6,7 & 8. IQ test was conducted with the support of the teachers and principals who teaches in the relevant schools.

4.2 Overall Objective

The aim of this research was to compare the development of cognitive skills among chess-playing students and non-chess-playing students in registered schools under the school chess association in Ampara district.

4.3 Specific Objectives

- Identify the history of chess and its background.
- Summarize the reason why chess is not a first-choice sport (lack of participation) compared to other sports among the students.
- Illustrate the benefits for a student that playing chess can produce.
- Analyze the impact of playing chess on the two groups of students who are playing chess and who are not involved in chess.
- Develop strategies ways which can reach out to the students about the impact of playing chess on improving their cognitive and IQ skills.

4.4 Hypothesis of the Study

H_0: There is no significant deferent between playing chess and cognitive skill.
H_1: There is a significant deferent between playing chess and cognitive skill.

5. Methodology

This research is based on numeric facts, so the quantitative data approach was suitable. A quantitative approach was adopted since the research concentrated on identifying the impact of playing chess, its contribution to the studies as well as the strategies which chess players can follow to mitigate the challenges. Data collecting methods include surveys, questionnaires, interviews, case studies, observations, and triangulation (Fellows & Liu, 2015). When selecting acceptable data gathering methods, reliability, efficacy, appropriateness, and the volume of data are all crucial factors to consider (Polonsky & Waller, 2011). This research it is carried out an experimental survey for the data collection.

5.1 Data Collection

5.1.1 IQ Performance Test

This study was experimental quantitative research. There were two groups of respondents in this study, the experimental group and the control group. Both of them were not involved with any chess activities. These two groups of students were given an IQ test exam for measuring their IQ level. After that experimental group was taught by the investigator (as chess instructor and lecturer) for easy control and observation. A series of chess lessons and practices were planned and implemented for the experimental group only during weekly classes. The planned contents of this chess course were listed briefly as below: the 25-items IQ assessment was conducted twice for students for both groups, the pre-test during the before-treatment process and the post-test during the after-treatment process. The purpose of this assessment used in this study was to measure the students' cognitive skills achievement.

5.2 Sample Data

The sample consists of 30 students (Control Group-CG) and 30 students (Experimental Group-EG) who participated the in chess practicing program in grades 6-8. CG includes 30 boys and EG 30 boys. Students were distributed randomly in CG and EG and they received parental consent to participate. IQ was determined using the Dearborn test (a nonverbal intelligence test). All 60 students were chosen randomly. But those students should have the following pre-qualification for the selection as a sample.

- Should be able to read and write.
- Should not be a disabled student.
- Should have good quality and behavior.
- Should be a common-sense personality.

As well as for the experimental group, there are some added pre-qualification criteria, such as:

- Should be able to participate in all the chess practice classes.

5.3 Procedure

EG students received two-day training sessions per week for six weeks. All the training sessions were conducted at two different places due to the covid-19 restrictions and easiness of the students. In the last week of the research, a chess tournament was held. Chess lessons, which included e-learning, were provided by national chess players (computer-based animations, tutorials, interactive games, and knowledge testing). Board and chess pieces, how chess pieces move, checkmate with a queen and rook, checkmate with two bishops, checkmate with bishop and knight, basic endings, multiple attacks, pinning pieces in chess, and basic concepts in the opening were among the topics discussed.

5.4 Structure of the IQ Performance Test

The IQ performance test includes 25 items. The students were asked to answer all the questions. The maximum IQ test score was 100 points (100 is the maximum mark and 50 is the minimum required to pass the test).

5.5 Data Analysis Techniques

The obtained data were analyzed using descriptive statistical analysis in this study. For data analysis, it is used IBM SPSS Statistics version 22 software and MS Office Excel. SPSS is a commonly used analysis software program. The investigator used pie charts, bar charts and tables for the data presentation of the study.

6. Research Findings and Data Analysis

The findings and interpretation of the data obtained from the IQ test exam are part of this chapter. In addition, this chapter was carried out with the intention of reaching the conclusions of this report. With the aim of upgrading the knowledge of the benefits of

playing chess, a board literature review was conducted on the impact of playing chess on the development of cognitive skills in schools under the "Chess Association of Ampara district". This chapter is largely focused on data gathered from students in the schools in the Ampara district by conducting IQ tests and seminars. The prime intention of this chapter is to explicate the research findings and identify the impact of playing chess and, how it can affect the development of cognitive skills through the necessary chess practices in schools under the Chess Association of Ampara district.

6.1 Results and Discussions

In this study, 60 respondents representing Ampara district school students were chosen for the IQ test. Their background was analyzed with respect to their education, and the year of study at the school.

There was a class of 30 students assigned to the experimental group while the control group consisted of a class of 30 other students.

6.2 Data Analysis

6.2.1 Control Group Pre-test

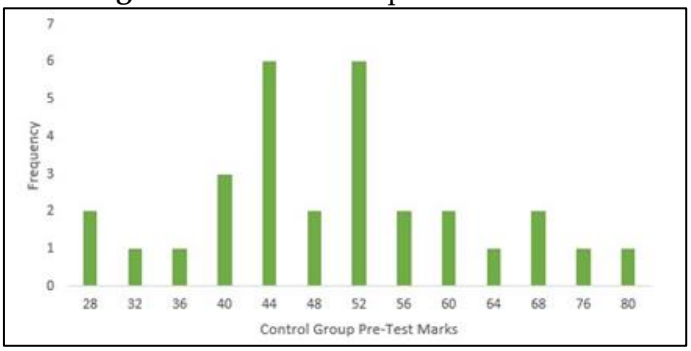
As per the statistical analysis control group, students achieved 50.13 as an average in the pre-test exam. In the exam, the minimum score achieved by a student was 28 and as the maximum score achieved by a student was 80. The range is 52 and the standard deviation is 12.768.

There were two students have got 28 marks and only 1 student was able to achieve 80 marks in the pre-test exam. The following chart shows the marks according to the number of students who achieved the marks in the pre-test exam.

Table 1: Control Group Pre-test Marks

Item	
Nr. of Students	30
Mean	50.13
Median	50.00
Std. Deviation	12.768
Range	52
Minimum	28
Maximum	80

Figure 1: Control Group Pre-test Marks



6.2.2 Control Group Post-test

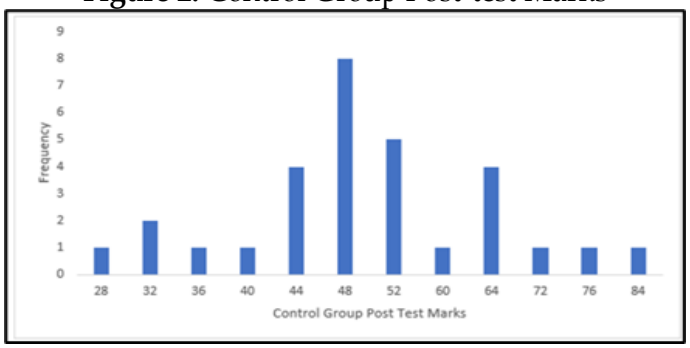
As per the statistical analysis control group, students achieved 51.20 as an average in the post-test exam. In the exam, the minimum score achieved by a student was 28 and the maximum score achieved by a student was 84. The range is 48 and the standard deviation is 12.840.

There was only one student who got 28 marks only as a minimum and one was been able to achieve 84 marks in the post-test exam as the highest. The following chart shows the marks according to the number of students who achieved the marks in the post-test exam.

Table 2: Control Group Post-test Marks

Item		
N	Valid	30
	Missing	0
Mean		51.20
Median		48.00
Std. Deviation		12.840
Range		56
Minimum		28
Maximum		84

Figure 2: Control Group Post-test Marks



6.2.3 Comparison of the Pre and Post-test Exam of Control Group

As could be seen when comparing the pre and post-test results of the control group is shown that an increase in the result. The mean is increased by 1.07 points. The maximum score increased to 84 and the minimum score frequency decreased to only one person. The following table shows the details with the respective analysis factor.

Table 3: Comparison of Control Group Marks

		Control Group Pre-Test Marks	Control Group Post Test Marks
N	Valid	30	30
	Missing	0	0
Mean		50.13	51.20
Median		50.00	48.00
Std. Deviation		12.768	12.840
Range		52	56
Minimum		28	28
Maximum		80	84

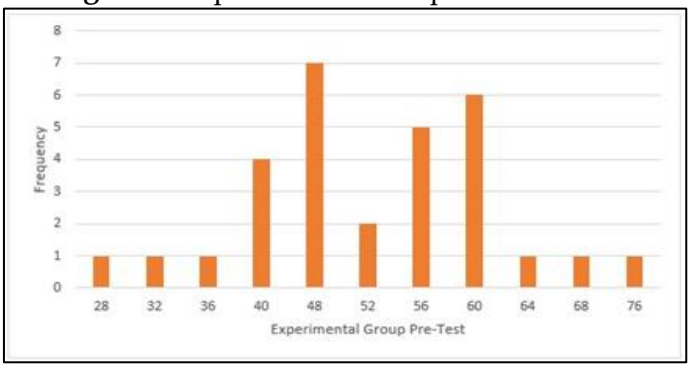
6.2.4 Experimental Group Pre-test

As per the statistical analysis, experimental group students achieved 51.47 as an average in the pre-test exam. In the exam, the minimum score achieved by a student was 28 and the maximum score achieved by a student was 76. The range is 48 and the standard deviation is 10.750.

Table 4: Experimental Group Pretest Marks

Item		
N	Valid	30
	Missing	0
Mean		51.47
Median		52.00
Std. Deviation		10.750
Range		48
Minimum		28
Maximum		76

Figure 3: Experimental Group Pretest Marks



There was one student who got 28 marks only and one was able to achieve 76 marks in the pre-test exam. The following chart shows the marks according to the number of students who achieved the marks in the pre-test exam.

6.2.5 Experimental Group Post-test

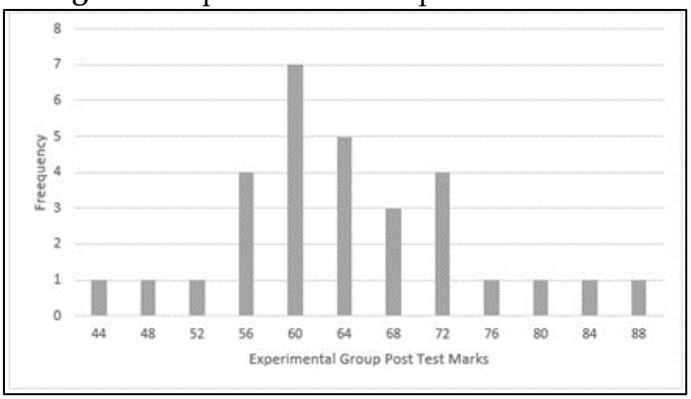
As per the statistical analysis, experimental group students achieved 64.27 as an average in the post-test exam. In the exam, the minimum score achieved by a student was 44 and the maximum score achieved by a student was 88. The range is 44 and the standard deviation is 9.906.

There was only one student who got 44 marks and only one was able to achieve 88 marks in the post-test exam. The following chart shows the marks according to the number of students who achieved the marks in the post-test exam.

Table 5: Experimental Group Post-test Marks

Item		
N	Valid	30
	Missing	0
Mean		64.27
Median		64.00
Std. Deviation		9.906
Range		44
Minimum		44
Maximum		88

Figure 4: Experimental Group Post-test Marks



6.2.6 Comparison of the Pre and Post-test Exam of Experimental Group

As could be seen when comparing the pre and post-test results of the control group is shown that an increase in the result. The mean is increased by 12.8, the minimum score also increased to 44 and the maximum score increased to 88. The following table shows the details with the respective analysis factor.

Table 6: Comparison Experimental Marks

		Experimental Group Pre-Test	Experimental Group Post Test Marks
N	Valid	30	30
	Missing	0	0
Mean		51.47	64.27
Median		52.00	64.00
Std. Deviation		10.750	9.906
Range		48	44
Minimum		28	44
Maximum		76	88

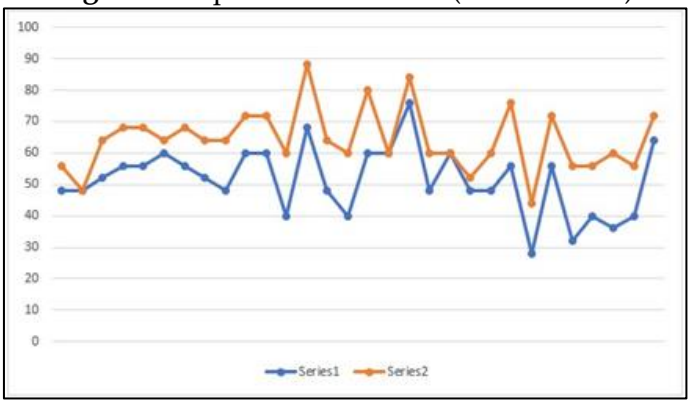
6.2.7 Comparison of the Marks of the Students

The following figure shows the marks of the control group students. There were 16 students who have an increment in the post-test exam; the others failed to obtain more marks than on the pretest exam.

Figure 5: Control Group Marks (Pre and Post-test)

The following figure shows the marks of the experimental group students. All of the students have an increment in the post-test exam except 3 students.

Figure 6: Experimental Marks (Pre and Post)



When comparing the difference between the pre and post-test marks of the control group and experimental group, it is clearly showing that the experimental group achieved a significant increase compared to the control group.

Table 7: Comparison between the Groups

		Difference % of Control Group	Difference % of Experimental Group
N	Valid	30	30
	Missing	0	0
Mean		0.93	12.80
Median		4.00	12.00
Std. Deviation		4.025	6.677
Range		16	24
Minimum		-8	0
Maximum		8	24

In the control group, the average increment is 0.93 in the range of 16. But the experimental group of students could able to achieve 12.80 as an average in the 24 range. Although the median in the experimental group is 12.00 greater than the control group which is 4.00. In the control group, there are 10 students who failed to show an increment

compare to the post-test exam and they got 4 fewer marks in their post-test exam compared to the pre-test exam. As well as the highest increment of a student in the control group is 8 and the least is -8. In the experimental group, all the students could able to show an increment in the post-test compared to the pretest exam except for three students. As well the highest increment of a student in the experimental group is 24 and the least is 0.

6.3 Overall Summary of the Analysis

In the overall summary, the mean score of the pretest and post-test for the experimental group were 51.47 and 64.27 respectively with a percentage increase of 12.8%. At the same time, the mean score of the pre-test and post-test for the control group were 50.13 and 51.20 respectively with a percentage increase of 1.07% only.

Table 8: Difference Percentage (%) Control Group

	Control Group Pre-Test Marks	Control Group Post Test Marks	Experimental Group Pre-Test	Experimental Group Post Test Marks
Nr	30	30	30	30
Mean	50.13	51.20	51.47	64.27
Median	50.00	48.00	52.00	64.00
Std. Deviation	12.768	12.840	10.750	9.906
Range	52	56	48	44
Minimum	28	28	28	44
Maximum	80	84	76	88

Hence, in conclusion, there was a significant improvement for the experimental group after chess playing treatment in their cognitive skills. Meanwhile, the control group, they had achieved more post-test performance. This result indicated that this study provides good evidence for the research topic. Thus, in conclusion, there is a significant improvement in the cognitive skills of a student when playing chess. The following table shows the paired sample T-test performance result of the post-test and pre-test of the control group and experimental group students. Based on the result there is a significant improvement in the cognitive skills in the experimental group after the chess training (p=0.000) and there is no significant improvement in the cognitive skills in the control group (p=0.174). Which shows the improvement in the cognitive skills of the students who are playing chess compared to the normal school student.

Table 8: Paired Differences Between Groups

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	Control Group Post Test Marks - Control Group Pre-Test Marks	1.067	4.193	0.766	1.393	29	0.174
Pair 2	Experimental Group Post Test Marks - Experimental Group Pre-Test	12.800	6.677	1.219	10.500	29	0.000

7. Conclusions and Recommendations

7.1 Conclusions

School students from the Ampara district were recruited for this study; the male students were picked randomly from grades 6, 7 & 8 who are interested in participating in chess coaching classes. The sample consisted of 60 students from the Sainthamaruthu, Sammanthurai, Kalmunai and Nintavur educational divisions. Introduction of chess, yoga practices for developing endurance, basics of chess, a little bit advanced special preparation of chess, tactics and final chess tournament were carried out for the students as chess training classes during COVID-19 pandemic periods. As well as some extra lessons were also conducted via Zoom video calls due to the requests from the training students.

Chess is popular among students because of its discreet, disciplined gameplay. Chess gives them tough gaming with their peers and community members, according to students. Chess players acquire social skills that can be enhanced. Given instructor expectations, coaching connections, tournament play with new friends, and peer networking within clubs, educators must recognize the social capital earned from chess play and how it may be leveraged to enhance the self-esteem of engaged students.

7.2 Recommendations

As a researcher of this study, I advise implementing the following strategies for increasing the participation of the students in chess by:

1) Arrange more home base exercises or skills to improve the students' performance.
2) This study can be used by all the chess coaches in Sri Lanka to be aware and educate the students.
3) Arrange awareness seminars related to the benefits of playing chess during the school period for students, teachers, and parents.
4) Similar study may be undertaken by selecting a large sample.

Conflict of Interest Statement

Both authors have seen and agree with the contents of the manuscript and there is no financial interest to report. They certify that the submission is original work and is not under review at any other publications.

About the Authors

Sakeer Ahamed, BSc in Physical Education, is a chess coach, school chess association, Research interest: coaching philosophy, training method.

Selliah Joniton, PhD in physical education, is a Senior Lecturer at Department of Sports Sciences and Physical Education, Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka, Sri Lanka. Research interests: health and fitness, yoga and meditation, test and measurement, physiology. Web: http://www.sab.ac.lk/staff-directory/370

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