Treasure Chess: Worthy Contributions of the Game in the Lives of Student Champions

Gener Santiago Subia
Wesleyan University, Philippines
subiagener@yahoo.com

Abstract This study explored the holistic benefits assimilated by former chess university varsities who became regional champions. Using basic qualitative research design, the researcher uncovered and described the experiences of 15 purposively sampled participants in their years of playing the game. Five major themes emerged in the thematic analysis. The first theme "the kickoff" pertains to the participants' acquisition of chess skills. The second theme “sharp as a tack” refers to the developed thinking skills, and the third theme “mathemathchess” (mathematics utilized by the participants while playing chess), which they have found useful in their studies and in taking government examinations. The fourth theme “feather in the cap" makes public of the merits and achievements of the participants as recognized chess players. Lastly, “the treasures within" discloses good virtues developed among the participants in their years of continuous training, playing and studying chess. The findings of the study have valuable implications for policy regarding chess and education.

Keywords: *chess, critical thinking skills, education, Mathemathchess, sports, virtues*

Introduction

The development of thinking skills, particularly “critical thinking”, among learners is one of the objectives of 21st-century education. It is very necessary to train oneself to think critically since it allows people to make sense of, to give meaning to, to make decisions, to act, and to know whether something is right or wrong. Thinking is everything that a conscious mind does, from mental arithmetic to remembering a phone number (Saini, 2014).

"With a trend towards globalization, UNESCO further visualizes education to provide globally competitive citizenry" (Morales et al., 2016, p.2). Likewise, Marquez added that "one of the most prominent effects of globalization and the steady advance of capitalism is the increase in demand for skilled human capital". She even emphasized that "Filipino children and youth should not only be sent to schools to be taught skills that would make them competent laborers for capitalist markets but more importantly, they should be trained to become critical thinkers (Marquez, 2017, p.272)."

Critical and mathematical thinking skills are very vital in solving a problem, searching for an explanation, and in completing certain tasks. However, these abilities have not been developed well, even with middle school students. Hence, educators should exert efforts in analyzing, studying, and applying instructional models that are expected to help improve students' learning particularly in mathematics (Husnaeni, 2016).

Other researchers in the Philippines suggest to consider studying and applying different pedagogical approaches that will help improve the learners of the country to attain global competitiveness such as in the study employing participatory action research cum action research (Morales, 2016), the pedagogical content knowledge-guided lesson study (Lucenario et al., 2016), and modified alternative co-teaching approach (Angeles et al., 2019). Moreover, Barrows (1996) suggests that the problem-based learning is "effective in facilitating and is focused on building content knowledge coupled with developing problem-solving, self-directed learning, and collaborative teamwork skills (Harvey et al., 2013, pp.114-115)." Additionally, supplementary methods for improving the teaching-learning process particularly the integration of technology and games such as mobile-aided pedagogy (Cacho,2017), flipped classroom approach (Gonzales, 2019) and game-based learning (Abdul Jabbar & Felicia, 2015; Qian & Clark, 2016) should also be considered by Filipino educators. In fact, other countries are using games like chess as a tool for instruction, and is proven useful in developing higher-order thinking skills since the game demands high cognitive abilities to be played well (De Bruin et al., 2014; Grabner, 2014; Sala, Gorini & Pravettoni, 2015).

Chess in Education

"Chess is a game that requires calculation and planning ahead, hence learning chess may influence the ability to concentrate, the working memory and other types of executive function. It may as well directly increase intelligence and problem-solving abilities"(Gumede & Rosholm, 2015, p.3). It was ascertained in several studies that chess training and instruction can improve thinking skills, math skills and cognitive development of students (Aciego, et al., 2012; Gumede & Rosholm, 2015; Sala & Gobet, 2016; Sala, Foley & Gobet, 2017), are beneficial to their scholastic or academic performance (Joseph et al., 2016; Trinchero & Sala, 2016), and that there is a similarity of thought processes in math and chess (De Bruin et al., 2014).

Likewise, Sala, Gorini and Pravettoni, (2015); and Subia colleagues (2019), recognized that people who started playing chess when they were young will be good in any problem-solving situation. According to Dr. Bernie C.Sadey (personal communication, August 1, 2018), a chess promoter and a former varsity player in Cabanatuan City, “Both of my daughters -Rinoa (13) and Chessica (11)- are regional chess players and national math competitors. Their skills in playing chess and knowledge in math were simultaneously developed that led to good results. Solving chess puzzles helps them develop love for problem-solving situations that they apply in their mathematics subjects."

The inclusion of chess in the school curriculum in primary and secondary schools across the Philippines was approved by President Gloria Macapagal Arroyo in July 2009 (Fdration Internationale des-checs, FIDE 2009). After the approval, the then Department of Education Secretary Jeslie A. Lapuz stated that the reasons for the inclusion are "chess is a game that improves organizational and analytical skills, and children who were exposed to this game at an early age achieve academically better, have good memory and concentration, self-confidence, self-esteem, perseverance, honesty and sportsmanship" (FIDE, 2009, p.2.) which are some of the traits needed by globally competitive individuals. However, chess inclusion in the curriculum was not implemented in the country and is currently not realized as well. Thus, the researcher supports the call to consider reviving the

implementation of the integration of chess in the Department of Education curriculum through the experiences of chess varsities.

Purposes of the Research

This study examined the all-inclusive benefits espoused by former chess university varsities who became regional champions. It aimed to describe and have an understanding of how they learn the game, what cognitive abilities and skills do they use while playing chess and what other benefits did they acquire and realities they went through as recognized chess players engaged in the game for more than 10 years.

Methodology

This study utilized basic qualitative research. "The most common form of qualitative research is the descriptive qualitative design wherein its main goal is to give meaning to a person's experience. Narrative transcripts are derived from interviews, observations, and documents which are then analyzed to come up with solutions to the research problems. Findings are richly descriptive and presented as themes/categories" (Merriam & Tisdel, 2016, pp.41-42).

Study Context

Fifteen participants were selected through purposive sampling from Region 3-Central Luzon, Philippines in the provinces of Aurora, Bulacan, Nueva Ecija and Tarlac. Inclusion criteria were: chess player who became Region 3 champion; former university varsity players; are playing chess for at least 10 years; and are young professionals. Identifying information of the participants was deliberately reformed to ascertain secrecy. Their demographic data are shown in Table 1.

Table 1. Demographic Data of the Participants

Pseudonym	Age	Sex	Work
1.Bart	22	Male	Accountant
2.Ben	24	Male	Marketing Specialist
3.Heart	22	Female	Nurse
4.Love	22	Female	Teacher
5.Bill	23	Male	Engineer

6.Luck	23	Female	Loan Officer
7.Kid	25	Male	Teacher
8.King	25	Male	Policeman
9.Jack	25	Male	Math Teacher
10.John	26	Male	Math Teacher
11.Jun	26	Male	Policeman
12.Hope	26	Female	Accountant
13.Gem	24	Female	Payroll Officer
14.Gold	25	Female	Accountant
15.Ken	25	Male	Engineer
n = 15			

After getting the approval of the ethics committee, the permission of the participants and their signed informed consent; the researcher utilized an interview protocol in gathering the data. Patton (2015) claimed that "A researcher's review protocol is an instrument utilized by the researcher to solicit answers from his or her participant. It contains pertinent information related to the study, it also directs the flow of the interview process (i.e., someone's life or certain ideas and experiences)" (Paton as cited by Montoya, 2016, p.813). The protocol aimed to report the exposure of the participants from the time they started playing chess up to the benefits they have gotten (see Appendix A). Participants responded to the interview protocol by writing their thoughts on a given sheet of paper. They were given 45 to 60 minutes to write their responses. The researcher was present the entire time to clarify any questions the participants had regarding the interview protocol.

The data that was gathered in this study underwent thematic analysis (Bulusan, 2019). Braun and Clarke as cited by Galea (2018), explained that thematic analysis is a flexible analytic method wherein the researcher may create and establish meaningful patterns using rich descriptions of data to form thematic networks. Furthermore, the researchers followed a coding process using six phases: 1) transcribing data and taking note of important events 2) initial coding of data gathered, 3) looking for similar themes among codes generated, 4) creating a concept map of combined themes, 5) finalizing themes and defining them, 6) creation of the final write-up. The study was conducted over a five-month period of time.

Findings

Table 2. Themes that Emerged from the Analysis of the Transcripts

Theme	Subtheme	Description
Kickoff	Nature	Chess comes naturally because they were exposed to a family of chess players.
	Nurture	Chess was part of the environment they grew up in.
Sharp as a Tack	Critical Thinking Skill	Critical thinking is a learned trait as participants plan ahead and learn to think ahead of their opponent.
	Problem Solving Skill	Playing chess made the participants good at looking for solutions to problems.
	Computation and Calculation Skills	The participants developed a skill of quickly analyzing situations and deciding on appropriate course of actions quickly.
	Memorization Skill	Playing chess has made things more vivid to participants as it allows them to easily recall patterns, figures, and numbers.
Mathemathchess	Basic and Business Mathematics	Chess allows you to use basic computations.
	Algebra	Chess allows you to solve complex problems.
	Probability and Statistics	Chess allows you to infer and make intelligent guesses and determine an opponent's playing style.
	Geometry	Chess squares are equated with angles and triangles.
Feather in the Cap	Financial	Chess afforded players financial gains with wins from competitions.

	Intellectual	Chess provides players better judgment.
	Mental	Chess changed players mindset and perspective.
	Social	Chess improved interpersonal skills.
The Treasures Within	Patience	Chess teaches you to wait for the right moment before you pounce on your opponent.
	Determination	Chess teaches you to make calculated moves.
	Humility	Chess teaches you that there will always be someone better than you.
	Sportsmanship	Chess teaches you to accept defeat.
	Responsibility	Chess makes you feel accountable for your actions.

Five themes with corresponding subthemes were extracted from the experiences of the participants regarding their years of training and playing chess.

The Kickoff (Learning the game)

Emerged as the first theme is “the kickoff” in which the participants shared the information on how they begun to learn chess. Two subthemes arose around this theme. The participants claimed that they acquired chess because they were taught by their family members (Nature) or they were influenced by other people in the environment (Nurture).

Bart, Heart, Love, Jun, Bill, Luck, Kid, Hope, and Gem are under "Nature" since they claimed that their skills in chess were taught by their fathers, grandfathers, and mothers who are also chess enthusiasts. They admitted that they learned and liked chess at their pre-school age easily as if it was part of their genes. In contrast, the acquisition of chess of Ben, King, Jack, John, Gold, and Ken is under the "Nurture” subtheme. They explained that nobody from their family is fond of chess and they discovered and assimilated the game because of their classmates,

teachers, and friends when they were in their elementary and secondary education.

> "Learning chess was easy for us (Gold)… we were taught chess by our families (Ben), we grew up seeing our friends and relatives playing (Hope). Playing chess came naturally to us as it was something we grew up with (Bart, Heart, Love)."

Responses provided by the participants show that they learned chess when they were young. According to Graham as cited by McDonald (2011), "Chess is called a past time game for brains, it is actually so easy to learn that even four or six or seven-year old kid can learn the rules right away (p.14)." Learning to follow rules and procedures is very influential to the development of young children (Pawilen,2013) as these are prerequisite skills needed in English, Mathematics and Science -the basic education core subjects.

Sharp as a Tack (thinking skills developed as a chess player)

The participants expressed that their thinking skills were enhanced in their years of playing chess and they became mentally agile. Four subthemes emerged out of this. These are critical thinking, problem-solving, computation and calculation, and memorization skills.

Critical Thinking Skill. Skill found most enhanced by Ben, Love, Luck, and Gem is their critical thinking skill. They narrated that they always encounter problems in chess matches and their best way to deal with it is to think about what their best moves will be. Likewise, thinking about what their opponent's next moves are their goals to predict to be able to prepare and to counter their adversaries' plans and exploit their weaknesses.

> "Chess made us think critically (Luck, Gem)… we always think what best moves to take (Ben, Love)"

Problem Solving Skill. The participants shared that by playing chess they have learned to think ahead of their opponents and anticipated their moves. They also shared that their minds have thought of every possible move when stuck in a position.

> As claimed by John: "In my years as varsity, I have experienced that playing chess improved my problem-solving skill since I encountered complex and difficult situations that I need to solve accurately in order for me to win." Bill added that "I always love to solve chess puzzles and I believe that it enhances my problem-solving skill which I was able to apply in mathematics subjects and most especially when I took my engineering board examination." Gem, Gold, and Ken added that "playing chess is like solving math problems the mind. Looking for solutions and good options mentally."

Computation and Calculation Skills. Heart, King, and Jack mentioned that they developed an unusual speed in computation and calculation because of always playing speed chess or blitz (a chess were both players are given 5-minute or less to finish the game). They learned to calculate faster and they have experienced that they can make right choices quickly and confidently.

> On his part, Jun opined: "Because of my years as a varsity chess player, I developed my speed in the calculation. I can solve problems in the shortest possible time and I'm glad that I was able to apply this skill when I took my Civil Service Professional Examination."

Memorization Skill. Bart and Kid shared that their virtual memory was enhanced due to their years of playing chess. They can easily remember things, places, patterns and numbers. They narrated that years of reading chess books, playing chess in computers and solving puzzles helped them enhance their memorization skills.

> "….playing chess strengthens our memory since we shoud be familiar with patterns and techniques of the game to win (Bart and Kid)."

The thinking skills enhanced as narrated by the participants showed that playing chess is a big part in helping them become capable students and professionals. The participants were able to transfer the skills they utilize in chess in their other important undertakings. It is evident that chess training improved the participants' thinking wherein utilizing a general rule taught to individuals effectively promotes learning acquisition (Trinchero & Sala, 2016).

Mathemathchess (Mathematics utilized while playing chess)

Mathematics utilized by the participants while playing chess like basic and business mathematics, algebra, probability and statistics and geometry was coined Mathemathchess by the researcher and materialized as the third theme of this study. Below are the narratives given by the participants when they were asked if they believe that mathematics is connected to chess, and what type of mathematics did they utilize while playing the game.

Basic and Business Mathematics. Ben, Love, and Luck, believe that mathematics is connected to playing chess and a chess player can be a good mathematician if properly trained and with years of practice.

> "I use simple computations of pieces of good and bad exchange. Add versus subtract. I consider the values of the pieces. I utilize mathematics and critical thinking because these are crucial in winning the game (Love). "
>
> "I use simple and basic computation of pieces; my pieces against the pieces of my rival. I use addition, subtraction, ratio, and proportion. I just add and subtract pieces that I and my rival have taken from each other. For example, the equivalent of 3 pawns is 1 knight or 1 bishop. When I'm using ratio and proportion, a pawn, if promoted, can be replaced to any piece higher than it, either knight or bishop (3points), rook (5points), queen (9 points), so, 1 point can be equal to 3 or 5 or 9. I usually promote my pawn to its higher equivalent off-course, to win easily (Luck)."
>
> Also, Hope claimed that "When I am playing chess, I am using addition, subtraction, multiplication, and division. I just add and subtract pieces that I and my opponent have taken. For example, I captured the rook of my opponent that is 5 points, this will be equivalent to 2 pawns (1 point each) and one knight (3 points). So, 5 – 5 = 0. Thus, we are equal in pieces."
>
> Gold detailed that "Based on my experience, I started only as an average student in our accounting subjects but when I played chess and started winning in the competitions, I developed my accounting skills and became a Certified Public Accountant (CPA)."
>
> Correspondingly, Gem opined "I use business mathematics when playing chess. I use debit, credits, and percentage in terms of exchange of pieces. I always calculate to earn and not to lose

> money, just like in playing chess, I always like to win. The bigger percentage in terms of points is very necessary for me such as I choose 1 rook over 3 pawns since 3 pawns are only 60% of 1 rook."

Algebra. For King, Bart, Heart, and Jun they need exact calculation in order to choose the correct move and win. Just like in mathematics, exact calculations are needed to solve a certain problem.

> King uttered: "I play chess like I solve unknown letters in Algebra. I just think of the constant and variable pieces and then I add and subtract like signed numbers in terms of exchanges of pieces. For instance, he captured my knight that is -3 for me and in exchange, I captured his rook and that will be +5 for me. So, by adding -3 and 5, I still have +2 points advantage."

> Jun enthused: "Yes, I experienced it! Playing chess makes me smarter and a good problem solver especially in Algebra. Chess develops my mathematical skills, analytical and strategic thinking and my computational skills."

> Bart added that "Chess is like Algebra which is a complicated subject wherein you always need to find the right solution in order to find x and y. When difficulties and problems come, I need to find the correct solution even if it's in a very complicated position in order to survive the game. It's like I'm solving equations using letters and numbers. Notations of chess games will also train an individual to be familiar with variables and constants since it involves letters and numbers such as e4, d5, Nc6, etc."

Probability and Statistics. Jack, Bill, and Kid claimed that there is a link between chess and mathematics.

> Jack mentioned that "when I learned chess from my mathematics teacher I also developed my love for mathematics. I became a regional champion at the same time a regional math competitor." I even use mathematics while playing chess, especially probability. I use probability in trying to predict the moves that will be executed by my opponent in advance so that I can think of different variations that will counter his/her offensive."

> In the same manner, Bill added that "I use statistics in gathering pieces of information regarding my opponent's favorite chess opening and his/her playing style or what type of player is he/she so that I can prepare the proper opening and style that may defeat him/her."

> Kid conveyed: "I use probability for having the right steps/moves in decision making when playing chess. For instance, my queen has 5 possible moves, which among the 5 are the bad and good moves. If 2 are good moves and 3 are bad, I only have a 40% chance of executing the proper move. I usually research on the chess played by other chess players and always watch them play so that I have data that can be studied and I can estimate my probability of defeating them."

Geometry. John and Ken confirmed that they believe that chess and mathematics are related and mentioned that they are using geometry while playing chess.

> In his experience, John said that "When I play chess, I use geometry because of understanding the squares and relationship of the squares to the pieces and where I place the pieces in the stronger positions. One example of using it is to place the pieces in the center of the chessboard where all the pieces can occupy the strategic location. There is a saying in chess that "he who controls the center, controls the game."

> Ken also added "Yes, while playing chess, I use geometry because I study the shapes. It is like I am computing using angles and triangles. I also play as if I'm proving something." One example is my favorite "rule of the square of the endgame" wherein you may eventually know if the King can capture the passed pawn before it is promoted just by merely looking at the square from the promotion place to the pawn. If the King can enter the said square, then the pawn will be captured before its promotion.

Based on their responses, the participants appeared to be using various Mathematics subjects while playing the game. Chess constantly aided them to practice and engage in Mathematics, which helped them have positive attitudes and have loved their different courses eventually. In the article in Essays, UK (2013), it was mentioned that "Playing chess is significantly related to mathematics." For example, 18th century mathematician Lagrange suggested moves in chess wherein every number can be written as the sum of four-square numbers (310 = 172 +42 + 22 + 12)"(Chessdom,2008, p.1). Aside from Lagrange, many famous mathematicians (e.g., Euler, Legendre and Gauss) studied chess problems, which merited a place in recreational mathematics. "The most known problem of this kind is Eight queens

puzzle, which has a connection to graph theory and combinatorics (Gik as cited in Essays, UK, 2013)."

Feather in the Cap (achievements and rewards' reaped as champion chess player)

The fourth theme that emerged in this study based on the participants' responses pertains to their achievements and rewards realized during their stint as varsity players and as chess champions. This theme includes four subthemes: financial, intellectual, mental and social.

Financial. The first benefit that was indicated in the finding was financial. As stated by Ben, Luck, Jack, Jun and Gem, scholarships and allowances provided to them by their schools as chess varsities and champions helped them finish their college education. Likewise, John and Hope narrated that they earned and brought home money in the chess competitions they had participated in the different places in the Philippines.

> Luck mentioned "I was able to finish schooling because of the scholarships I received from playing chess." John added "we earned and brought home money in the chess competitions we participated in."

Intellectual. Participants noticed that they acquired profound analysis, accuracy in planning, gave good verdicts and provided better judgment.

> Bart, for his part, mentioned that: "I believe that solving chess puzzles enhances my intelligence quotient (IQ) that is why I was able to pass my Certified Public Accountant (CPA) Board Examination comfortably."

> Bill added that: "being a chess player taught me how to foresee things and prepare for what will happen intelligently", and Jack shared that "I acquired profound analysis, accuracy in planning, good verdict, and better judgment."

Mental. According to Jun and Ken playing chess is their way of training their minds. This was confirmed as:

> Heart said: "It changes the way I plan and think" while Ben stated that: "chess improves my memory." Kid added that: "playing chess regularly improves my mental imagination and creativity."

Social. King, Gold, and Ken narrated that the different competitions in chess they had participated in helped develop their interpersonal skills. They were able to gain new friends and even some of their adversaries became their close friends up to now.

> Gold explained: "We are adversaries in the competition proper, but outside, we became good friends." Ken shared "other schoolmates befriended us since we became known for representing our school."

The fourth theme pivoted on the accomplishments of the participants and the advantages of being well-known varsity players. They were very proud of what they've attained. They shared how chess aided them to be capable and popular. They were able to bring glory to their schools and family, support their education and earn money. The participants were also able to have more companions and confidants since chess can even improve the socio-affective growth of people who practice it (Aciego et al., 2012). As proven by Tummala-Narra (2009), improving the socio-affective skills of every student is very vital in the learning process since it reduces test anxiety which resulted to an increased learner's achievement.

The Treasures Within (virtues acquired from playing chess)

The last theme that came into view was based on the good virtues assimilated by the participants in their years, months and days of non-stop training, playing and studying chess. The participants have experienced hardships, failures and struggles but in the end, they become nubile and amicable. Based on the narration of the participants, five treasures (good virtues accumulated) were identified and classified into five subthemes: patience, determination, humility, sportsmanship, and discipline.

Patience. This is the first virtue acknowledged by the participants that were developed in them.

> As claimed by Jun: "Patience-I learned how to improve my skills in chess by practicing repeatedly-wait until you become", and Ken said: "Patience-since you need to wait and think of all the options and the right move to be able to achieve your plans."

Determination. Love, Bill, and Gem shared that their determination to win improved and they always strive hard for perfection since they believe that in chess, one wrong move is enough for a player to lose the game.

> As expressed by them: "As chess players, we learned to be goal oriented and work hard towards reaching our goals in spite of obstacles".

Humility. Hope and Ben claimed that they became humble persons because of chess. As stated by them:

> "In chess there are so many good players, and every now and then, a player can suffer defeat. The game teaches an individual not to be arrogant and to accept that there is always a better person than him/her."

Sportsmanship. Bart, Luck, King, Jack, John, and Gold narrated that playing chess for many years helped them to become a sport. They have learned that the game is not about winning but the most important thing is the respect gained from other players. Additionally, according to them, it is very important to willingly accept the result of the game, whether a player wins or loses.

> Gold stressed "Win or lose, you have to be a sport about it." Kind added "Yes, you must accept every win or every defeat with your head held high."

Responsibility. Responsibility is the virtue that was developed in Heart, Kid, and Gem. As claimed by them, they become responsible persons because of chess. They feel obliged to finish their courses at the same time perform excellently in chess tournaments.

> Heart explained: "my thoughts become my actions… I have to be responsible for them."

The participants acknowledged that it takes a lot of time and effort to become very good at playing chess. Nonetheless, they claimed that

the result is considerable. The virtues and values they acquired were relevant and useful. The traits developed in them were needed by globally competitive individuals (Lapuz in FIDE, 2009) in order to steer with the world's various working environments.

Discussion

This study explored the thinking skills and virtues developed to former chess university varsities in their years of playing chess. The experiences of the participants specify how chess became valuable and contributory to their lives. From learning how to follow rules and procedures to improving their socio-affective skills which greatly improved their test-taking skills and school's achievement. Furthermore, long years of playing chess helped them to like and apply mathematics in chess which in turn enhanced their cognitive skills and school performance (Joseph et al., 2016; Trinchero & Sala, 2016). Likewise, long years of training aided them to become young professionals who possess values and virtues appreciated by employers in every country in the world.

The result of this study can be used as a baseline in reviving the implementation of the integration of chess in the Department of Education curriculum. Curriculum planners could design a framework (Pawilen & Manuel, 2018) for chess instruction in each school in the country. Each educational leader should support the cry for the integration of chess instruction in the schools beginning from the pre-school level. As a start, they may wish to follow the studies conducted in schools in Zaire, Belgium, Chinese University in Hongkong, Venezuela, Moldovian Republic, Pennsylvania, New Brunswick Canada, New York City Schools Programs and Texas that resulted in students' cognitive improvement, enhanced school performance and increase in scores in specific subjects such as science and mathematics (Sala & Gobet, 2016; Sala, Foley & Gobet, 2017). Moreover, mathematics teachers who are also chess players should utilize chess puzzles to deepen the understanding of students in the subject and propose an easy and efficient way of solving problems (Salangsang & Subia, 2020) to reduce students' difficulties in mathematics at schools. Lastly, educators may explore and adopt other game-based instruction in their classroom and discover those that can help increase the

engagement and achievement of their students and cater to their individual learning styles.

One limitation of this research is the number of participants interviewed. To fully validate the result and for the study to be generalizable, additional number of samples using a quantitative research design is recommended to be done. Another constraint of this study is the proper measurement of the participants' improvement in mathematics and the enhancement of their cognitive skills because of playing chess. Thus, it is suggested that an experimental study measuring the critical thinking skills and mathematical abilities of the participants must be conducted to prove that such a causal connection exists.

…

References

Abdul Jabbar, A., & Felicia, P. (2015). Gameplay engagement and learning in game-based learning: A systematic review. Review of Educational Research. SAGE Publications Inc. https://doi.org/10.3102/0034654315577210

Aciego, R., García, L., & Betancort, M. (2012). The benefits of chess for the intellectual and social-emotional enrichment in schoolchildren. *The Spanish Journal of Psychology, 15*(2):551-9. doi: 10.5209/rev_SJOP.2012. v15.n2.38866

Angeles, A., Joaquin, M., Mabilangan, R., Macale, A., & Lapitan, M. (2019). Modified alternative co-teaching approach: Effects on student procedural fluency in Algebra. *The Normal Lights, 13*(2), 90 – 110.

Barrows, H. S. (1996). Problem-based learning in medicine and beyond: A brief overview. *New Directions for Teaching and Learning, 68*, 3-12.

Bulusan, F. (2019). Selecting potential instructional materials for literature teaching in the 21st century milieu: Findings from a systematic review of literature. *Asian EFL Journal 21*(2),218-231.

Cacho, R. (2017). Exploring the potentials and essentials of mobile-aided pedagogy in teacher education. *The Normal Lights, 11*(1), 1-17.

Chessdom (2008). Chess, math, and mythology. Retrieved from https://mathematics.chessdom.com/the-mathematics-power-of-chess.

De Bruin, A., Kok, E., Leppink, J., & Camp, G. (2014). Practice, intelligence, and enjoyment in novice chess players: A prospective study at the earliest stage of a chess career. *Intelligence, 45*(1), 18–25. https://doi.org/10.1016/j.intell.2013.07.004

Essays, UK. (November 2013). Mathematics in the game of chess maths essay. Retrieved from https://www.ukessays.com/essays/media/mathematics-in-the-game-of-chess-maths essay.php?vref=1.

FIDE (2009). Philippine government includes chess in schools' curriculum. Retrieved from https://www.fide.com/component/content/article/1-fide-news/3977-philippine-government-includes-chess-in-schools

Galea, M. (2018). The two faces of spirituality in time of traumatic loss: a thematic analysis study. *Open Journal of Social Sciences, 6*, 49-63. https://doi.org/10.4236/jss.2018.68004

Gonzales, R. (2019). Flipped Classroom Approach: Experiences from a Philippine State University. *The Normal Lights, 13*(2), 67 – 89.

Grabner, R. (2014). The role of intelligence for performance in the prototypical expertise domain of chess. *Intelligence, 45*(1), 26–33. https://doi.org/10.1016/j.intell.2013.07.023

Gumede, K., & Rosholm, M. (2015). Your move: The effect of chess on mathematics test scores. Discussion Paper No.IZA 9370, 1-24.

Harvey, R., Tahereh, P. & Reyes, W..(2013).What teacher education students learn about collaboration from problem-based learning. *Journal of Problem Based Learning in Higher Education, 1*(1), 114-134.

Husnaeni (2016). The enhancement of mathematical critical thinking ability of Aliyah Madrasas student model using Gorontalo by interactive learning setting cooperative model. *Journal of Education and Practice, 7*(8), 159. ISSN 2222-288X

Lucenario, J., Yangco, R., Punzalan, A., & Espinosa, A.(2016). "Pedagogical content knowledge-guided lesson study: Effects on teacher competence and students' achievement in Chemistry," Education Research International, Article ID 6068930, 9 pages. https://doi.org/10.1155/2016/6068930.

Joseph, E., Easvaradoss, V., & Solomon, N. (2016) Impact of Chess Training on Academic Performance of Rural Indian School Children. *Open Journal of Social Sciences, 4,* 20-24. http://dx.doi.org/10.4236/jss.2016.42004

Marquez, L. (2017). Critical thinking in Philippine education: What we have and what we need. Retrieved from http://www.jceps.com/wp-content/uploads/2017/10/15-2-10.pdf, pp. 272-303.

McDonald, P. (2011). The benefits of chess in education. A collection of studies and papers on chess and education. Retrieved from http://cis.fide.com/images/stories/downloads/McDonald_-_Benefits_of_Chess_in_Education.pdf.

Merriam, S., & Tisdell, E. (2016). Qualitative Research: A guide to design and implementation. California, U.S.A.: John Wiley & Sons, Inc.

Montoya, M. (2016). Preparing for interview research: The interview protocol refinement framework. *The Qualitative Report, 21*(5), 811-831.

Morales, M. (2016). Participatory action research (PAR) cum action research (AR) in teacher professional development: A literature review. *International Journal of Research in Education and Science, 2*(1). ISSN: 2148-9955.

Morales, M., Avilla, R., & Espinosa, A. (2016). Exploring gender disparities in science and mathematics classrooms in the basic education. *International Journal of Research Studies in Education, 5*(3), 39-58. doi: 10.5861/ijrse.2015.1263

Patton, M. (2015). Qualitative research & evaluation methods (4th ed.). Thousand Oaks, CA: Sage.

Pawilen, G. (2013). Integrating indigenous knowledge in the elementary science curriculum. *Harris Education Journal, 1*(1), 21-31.

Pawilen, G. & Manuel, S. (2018). A proposed model and framework for developing a curriculum for the gifted in the Philippines. *International Journal of Curriculum and Instruction, 10*(2), 118-149.

Qian, M., & Clark, K. (2016). Game-based Learning and 21st century skills: A review of recent research. *Computers in Human Behavior, 63,* 50–58. https://doi.org/10.1016/j.chb.2016.05.023

Saini, P. (2014). Why is it Important to Think? Retrieved from https://www.quora.com/profile/Poonam-Saini.

Sala, G., Foley, P., & Gobet, F. (2017). The effect of chess instruction on pupil's cognitive and academic skills: state of the art and theoretical challenges. *Frontiers in Psychology, 8*(238). doi:10.3389/fpsyg.2017.00238

Sala, G., & Gobet, F. (2016). Do the benefits of chess instruction transfer to academic and cognitive skills. *Educational Research Review, 18*(1), 46-57.

Sala, G., Gorini, A., & Pravettoni, G. (2015). Mathematical problem-solving abilities and chess: Sage Open, 1-9. doi: 10.11772/2158244015596050 sgo.sagepub.com.

Salangsang, L., & Subia, G. (2020). Mathematical thinking on problem solving and self-regulation strategies of Filipino primary grade pupils. *International Journal of Scientific & Technology Research, 9*(2). ISSN 2277-8616

Subia, G., Amaranto, J., Amaranto, J., Bustamante, J., & Damaso, I. (2019) Chess and Mathematics Performance of College Players: An Exploratory Analysis. *Open Access Library Journal, 6*, 1-7. doi: 10.4236/oalib.1105195.

Trinchero, R., & Sala, G. (2016). Chess training and mathematical problem solving: The role of teaching heuristics in transfer of learning. *Eurasia Journal of Mathematics, Science & Technology Education, 12*(3), 655-668.

Trinchero, R. (2012). Gli scacchi, un gioco per crescere. Sei anni di sperimentazione nella scuola primaria [Chess, a game to grow up with. Six year of research in primary school]

Tummala-Narra, P. (2009). Teaching on diversity: The mutual influence of students and instructors. *Psychoanalytic Psychology, 26*(3), 322-334.

Appendix A

Questionnaire/Interview Protocol

1. How did you learn how to play chess? Who taught you?
2. Do you believe that playing chess for more than 10 years improves your cognitive abilities/skills? In what ways?
3. Have you experienced using Mathematics while playing chess? Are chess and mathematics-related/connected? If yes, state your Mathematics and describe your mathematical process.
4. What are the advantages of being a recognized/champion chess player?
5. Does playing chess influence your values? Are there virtues acquired/enhanced in playing chess?