Research Proposal: Utilizing Chess.com to Measure Growth in Cognitive Ability

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Introduction

Chess is a game beloved by players across the world. It connects all sorts of communities with an intelligence based game entailing strategy, planning, and problem solving. The game involves two players, white versus black, with a set of six different types of pieces at the player's disposal to use, aiming to force the enemy player into a "checkmate". The game can be simple to understand, but complicated in its plethora of strategies and concepts to aid the player to victory. Considering its capability to be studied in regards to its effects on a player's brain, researchers have long wondered whether chess allows players to improve their cognitive skills outside of the game. This discussion is certainly difficult, as the construct of intelligence can be hard to measure and prove a correlation between higher chess skills equating a higher overall intelligence. In fact, researchers sometimes stumble into the opposite findings, that it is likely a higher measure of intelligence is what leads to stronger chess abilities (Sala and Goblet, 2016). Other studies uncover a growing understanding that chess, regardless of its difficulty to measure, can comparatively see improvements in the players intelligence. Some researchers found that chess, as a sport, does much better in improving the cognition of players compared to physically active sports (Aciego, García, and Betancort, 2012). Another research group studied young children who were trained in chess on their ability to complete complex mathematical problem solving questions, finding an improvement in the group who was taught most efficiently by real chess instructors compared to either school teachers or no instruction (Trinchero and Sala, 2016). This finding demonstrates that perhaps a growth in intelligence does not rely just on playing chess, but rather how it is taught. Another study also utilized chess instructors to see change. Researchers studied a much older group, senior citizens, and found that not just cognitive skills were improved, but quality of life and happiness was increased (Ciberia, Lorenzo-López,

Maseda, Blanco-Fandiño, López-López, Millán-Calenti, 2021). All in all, there is an overwhelming positive response to the teaching of chess and its benefits, as aptly compiled by a data analysis team, finding to the conclusion that more work still needs to be done (Meloni and Fanari, 2021). It is becoming clear within these studies that this topic is of great importance and its discussion is needed; ranging from young to old, engaging players to have fun and develop their cognitive skills at the same time would be a great benefit to many in our world. From the research previously demonstrated, a lot of users found success in developing their own growth through the help of trained chess instructors. The reality is many people might find it difficult to receive this kind of treatment. A way that players of all types and different places can gain access to this game is through the website chess.com. The website is free, easily accessible to those who have a device with internet connection, and can learn all about the game. In this research, a study on this website and how users engage with it will be examined. This technology will allow the observation of chess improvement to be more readily observed, as it more accurately reflects the daily lives of individuals, who can more easily access chess. Another observation to take away from previous research is the explanation and definitions given to the construct of intelligence. Research has struggled to come to a total consensus on the benefits of chess as it can be hard to quantify what exactly we mean by intelligence and how to accurately reflect cognitive improvements in the lives of those studied. In this research, an evolving focus on high school student's and their overall GPA will be conducted, entailing both direct observations of tests to be graded as well as indirect measures of self reports, detailing students' attitudes towards approaching school work, managing time, and problem solving. This study asks the question: does the usage of chess.com to learn and play chess impact high school student's and their GPA performance? This question can evolve during the research, examining how students engage with

the learning, the methods of studying and problem solving, and ability to achieve the grades they wish to get.

Literature Review

As we have introduced above, chess is a game that has long been studied with its fascinating appeal of smarts, wits, and cognitive thinking needed in order to become a master at play. In order to understand this concept fully, we can analyze previous research. Researchers in the past have become captivated by this understanding, determined to find if the game has hidden cognitive benefits to those who indulge in its material. If capable of increasing an individual's intelligence, researchers want to find if this is possible to ignite the growth of an individual's own cognitive ability in either reading or math skills.

One demographic researchers put focus on is young children. One study hypothesized that if students engaged in chess training as an extracurricular activity, their competence and cognitive ability would increase as reflected in their measure of study (Aciego, García, and Betancort, 2012). In this study, students were found to have more positive results on self reports regarding their feelings towards school, teachers reports on their behavior, and higher scores on the designated tests of the study for those who played chess compared to those who played other activities such as sports. As these results appear great in their findings, the researchers make an important note that the students who participated had self enrolled in the decision to either play chess or not. I believe this is an important factor, as students who choose to play chess might already be more intelligent than others or have premature chess skills, and therefore don't demonstrate the desired transfer of skills researchers are looking for. We see this same barrier in another study, where researchers split students into two groups of 48 students playing chess and 37 students in control to find if students, when tested on writing and math comprehension skills,

would have differences in their test results (Meloni and Fanari, 2021). While there was no improvement on writing skills as researchers predict no similar skills overlap in writing to chess, there was growth in the students' performance on math. Factors that the researchers deduce this to include organizational and categorizing skills. Just as before, researchers continue to encounter trouble regarding the wide variety of how students behave and act towards education, making their overall basis of meta-cognitive improvement to see little improvement.

Self motivation and prior knowledge of either chess or school topics seems to be an underlying influence on the cognitive ability of a student. Researchers similarly found trouble in defining intelligence as a consistent construct that can be transferred from chess to math ability when trying to examine a total consensus of 64 past studies regarding chess improving cognition (Sala and Goblet, 2016). This study even excluded those they believed only showed correlated results, not causated, but still ultimately concluded that the positive effect of chess was slightly under their desired zone of interest. We are beginning to recognize that measures can be hard to define when demographics are large and many factors such as teaching style and type of skill are underlying the study. To try and deepen these findings, some research groups have specified their demographic of students. One research team examined the effects of chess training in a group of students from multiple schools who were a part of special education, made up of physical, auditoral, and emotional impairments (Barrett and Fish, 2011). This study integrated chess learning as a once a week activity in the student’s program. The results demonstrated improvement in the student’s scores, as compared from the beginning of the year to the end. That being said, the researchers do note they aren’t confident the improvement can be entirely linked to the chess training and perhaps the variety of students and different schools made of different teachers had an impact on their growth. A study found similar results when researchers focused

on the demographic of students who were at risk of academic failure, defined by being a year or more behind their age level in math and reading skills (Hong and William, 2006). Academics measured by multiple pre and post tests showed an effect by playing chess, but just as before, researchers feel that the limitations of how rigorous the chess training could be and the own motivation behind the student's to learn is an underlying factor that might be influencing the results.

To dissect these conclusions further, one study decided to shift gears from the examination of school life and student behavior to much older members of society, researching senior citizens at nursing homes and their involvement with chess. Between two institutions of 32 individuals meeting the criteria of being older than 60 years of age and following their guidelines of competency, two groups were created to contrast chess instruction to a lack thereof it (Ciberia, Lorenzo-López, Maseda, Blanco-Fandiño, López-López, Millán-Calenti, 2021). With improvements in quality of life and general mood, the group who engaged with chess instructors to learn the game appear to be in a position of great benefits. What I deduce from this finding, though, is how the individuals who partook in the learning of chess were given the decision to make for themself. The underlying motivation to engage with an activity rather than to not might have subconsciously influenced the cognition of these individuals who were tested on; as we continue to see, experiments need to find ways to control outside variables with much stronger measures. This is an understanding that has been deduced already, as one study that compares the findings across numerous experiments regarding measuring intelligence and chess cites a list of factors that can influence an individual's cognitive ability (Gobet and Campitelli, 2002). The research team finds an individual's psychological factors can contribute to general attitude towards approaching education and growth in the mind, influencing how players might approach

chess and what play style to use, how much enjoyment they garner from it, and how strong of a drive the individual has to learn and improve. These factors can be rooted in the environment they come from and the people that they are surrounded by, something research teams might consider. I believe it is then important to research participants in chess experiments from a consistent source, similar education, and make distinctions between what form of skills is being examined.

A pairing of authors (Trinchero and Sala, 2016) have taken a lot of what has been considered and created their own measure of chess experimentation, this type with a focus on the variety of demographics and testing grounds. With a much larger group of students who participated at a total of 931 students, three groups were created: a group taught by chess instructors, one taught by teachers, and the control group who was not taught at all. In their measure of both chess quizzing and math tests, the team of researchers found that those who were taught by chess instructors with a stronger and rigorous course structure in regards to teaching how to heuristically approach chess did much greater on the post testing than both those who were taught by teachers and not taught at all. This study brings a crucial component to the world of cognitive growth related to chess: the method of teaching is a factor with great significance. The playing of chess and how an individual goes about it or how they approach the game relates to what skills can be transferable to learning in other subjects at school, meaning that an understanding of heuristics and how to reach a desired outcome in itself becomes an important element of chess improving intelligence.

With my own research question I have proposed, I aim to avoid a variable of method of teaching by focusing in on the specific platform of chess.com and observing how students can learn best using this website; the implementation within the participants daily lives on a website

easier to access, easier to monitor, and can stretch across a wide selection of individuals who can be randomly generated will be of great benefit. I aim to observe the study for a great length of time, much longer than those I have dissected above, as to see the full effects of chess learning on the mind of an individual as they continue to go about their life. The tests conducted will consist of multiple measures, observing both the improvement of chess playing as well as the academic growth in an individual.

Research Design

Upon reviewing previous literature, we have a much stronger understanding of this topic and can begin to detail a new study. For this research, I propose a longitudinal experimental study inspired by the efforts of previous research designs related to chess and its effect on similar constructs as those this study is interested in. Before I explicate the process I am creating, it is important to understand the constructs that relate to this research and how they can be measured. As I have laid out in my introduction, the primary construct to be examined is intelligence. Intelligence can be a difficult construct to examine, as it can encompass a variety of factors, including logic, reasoning, and creation. In this research, intelligence is related to an individual's ability to perform well in school, succeeding in a variety of subjects.

Previous chess studies have determined that the skills used in chess training are not comparable to English and reading comprehension ability, so tests put a focus on math problem sets (Meloni and Fanari, 2021). Researchers feel there is a stronger link between the pattern recognition and deductive reasoning skills required in chess to math solving skills than there is reading skills, and as such, this research will also put a stronger emphasis on math ability. While the numerical findings in quantitative test results help in observing improvements, it is possible it doesn't tell the whole story. Another study found that in order to measure the growth of the

students and their ability, they needed to have the students self evaluate their own abilities and make observations (Aciego, García, and Betancort, 2012). That's why in this study, alongside examining the students within the experiment itself I will lay out below, the research team will interview students periodically throughout the course of the study in order to report student's own feelings on the process, their personal feelings and affiliations to chess and the website, and their thinking behind working with the school material. Questions that are to be asked are listed here; "How has your experience with chess gone and what do you like/dislike?"; "How do you feel you have been doing in school and why?"; "Do you find that chess.com improves or hinders the chess experience and could you name some of the features of the website that contribute to your answer?". The interviews are loosely structured, with the conversation allowed to be guided by the respondent themself. These instruments together will help make the measuring of intelligence an easier construct to define as it is based upon the ability to succeed in math and problem solving ability.

The experiment itself, like stated, will contain a longitudinal design, lasting at least a full year in time to allow for patterns to emerge. Researchers will observe students' activity on chess.com via their accounts and their skill rating. It will highlight a panel design, where the participants observed are the same group to be consistently observed along the entire study. Throughout the year, students will take standardized math tests to act as another instrument to be considered when combined with the evaluation of the students grade point average throughout the year. As this study proposes a question related to how students can interact with technology to teach chess and improve in their academics, a study that is great in length will allow for students the learn over the entirety of a school year and grapple with the chess technology and get used to the incorporation of it into their daily routine. Previous studies have utilized a similar

process to help observe the integration of chess. One previous study observed chess as it was utilized once a week, and the study proposed here aims to increase the amount of chess activity through the strength of the website, chess.com, being available online for free to better observe how chess can improve the intelligence of an individual (Barrett and Fish, 2011). The study, observing the same students in numerous intervals of time during the entirety of the research, will help improve upon the limitations found in previous studies where only pre and post tests were conducted (Hong and William, 2006).

There are some notable problems, though, that may arise in this study that are of concern. Chess as an activity can be hard to isolate in a daily life of an individual, and it is possible students may learn or grow based on factors outside of the researcher team's control (Sala and Goblet, 2016). As students continue to learn within classrooms and their own real world experience, information as knowledge can be acquired via means outside of measurability in the effects of chess playing. This effect could be present in this study and demonstrate difficulty in gathering reliable data from the participants. That being said, this study aims to minimize this as best as possible with frequent interviews with the students to help report the impact of chess playing informed by their true thoughts, the observation of their grades throughout the year, and the tests students will take to measure their evolving ability in the courses. The students selected for the research will be taken from local high schools in the surrounding area. Ideally, the research should acquire around 100 students, ensuring a large enough group to have a variety of students in their demographic and cognitive ability, but also not being so large that it would be impossible to keep track of and interview all of them. The research team should aim to contact the administration of the local high schools, allowing for signs and notices to be put up encouraging students to sign up for the study. Any sort of student can sign up, ranging in age

from 14-18 years old and male or female. In the process of signing up, the form will inform the user of the process and intent of the research, gathering informed consent – which will also be stated once more to the students before the experiment begins – and also ask the user for some information such as their age, gender, and their experience with chess up to this point. This will allow the research team to conduct non-probability sampling of a certain quota of students, ensuring a variety of chess experience, gender, and age. It will also confirm that participants are comfortable with their chess accounts being monitored as well as their school grades. These questions aim to minimize the limitation of self-selection bias and why students would be motivated to self enroll. Considering all this together, the research aims to create a fun environment for the students to learn. It will include a mix of different types of students, a lengthy study that allows total examination of the growth of the individuals, and plenty of instruments to effectively measure the results.

Expected Findings

Now that I have gone over previous research and the design of the study, we can begin to predict the outcome if it were to be conducted. As previously stated during the outlining of this potential study, the research question I have proposed is does the usage of chess.com to learn and play chess impact high school student's and their GPA performance? This study is putting a focus on the construct of intelligence, aiming to break it down as easy to understand through the understanding of math problem ability and the student's overall performance in high school as measured by their standardized grade point average. High school students being the focus means there is a specific age range, as we will see a range from 14-18 years of age in students. Gender, race, and other characteristics are not considered as this study feels they are not relevant to the matter of chess learning and its impact on the research team's understanding of intelligence. This

study has hypothesized that the usage of chess.com consistently will allow students to more thoroughly engage in chess learning with stronger enjoyment, resulting in improved GPA scoring and higher math comprehension ability.

The proposed study predicts certain results to reveal interesting ideas regarding this topic of chess learning. To begin, this study predicts that those who play chess are more likely to score better on comprehension and pattern memorization ability than those who do not. As seen before, one study compared students who played chess as an extracurricular instead of a sport such as basketball or soccer, acting as a casual activity for students to get involved in (Aciego, García, and Betancort, 2012). In their findings, they discovered that those who were involved in chess all consistently showed higher scores on their posttests matching for factors of attention and memory. This is similar to this proposed study's own predictions that cognitive ability can be improved when one plays chess compared to those who don't, showing a positive result from the experiment. Chess.com is quick and accessible, allowing students to easily add it to their schedules as a potential extracurricular, which falls in line with this previous study. Another interesting idea outside of cognition is discovering whether students enjoyed the learning of chess. As the demographic of participants is young, it is important for these children to enjoy the experience at some level in order to stick with the learning for the length of this study. Another study previously conducted observed that senior citizens who involved themselves with chess saw significant improvements in their overall mood and measure of depression (Ciberia, Lorenzo-López, Maseda, Blanco-Fandiño, López-López, Millán-Calenti, 2021). Although a different age group, this past study also observed similar incorporation of consistent chess playing as this proposed one will, so a finding of overall improved enjoyment from the activity could potentially be observed. This would be a fascinating positive relationship observed that

could lead into further research regarding different age ranges and their mood. An important finding that was found in another study was that chess learning as a means to improve academic success was only found in those who were taught efficiently by a chess instructor (Trinchero and Sala, 2016). This implies that it isn't just chess itself that can show results of improvement, but rather the important process of learning and being instructed, developing heuristics ability. As this proposed study utilizes chess.com as a form of teaching, with the website entailing a composition of professionally designed lessons and instructional videos, I believe that this study will also be able to avoid a potential negative effect of chess learning being ineffective, with the data showcasing a clear pattern of cognitive improvement from the many features available.

Overall, there are numerous patterns of growth in cognitive ability, strength in learning skills, and enhanced lifestyle that could emerge in the data from this study. This study is based upon these previous findings found in studies in order to seek the best possible results, seeking a stronger understanding of the relationship between human ability and chess learning.

Conclusion

Chess is a fascinating creation of humankind, not just in its simple yet complex playstyle, but the effects the game's design might have on the mind of its players. This paper embarked on a process, beginning with observing previous research on the topic of chess and discovering the complications in the construct of intelligence and how it relates to the game of chess. Along different demographics, from youth to the elderly, chess has been researched to find if participants can grow in cognitive ability measured by math or literature skills. There have been cases of problem solving skills, social confidence, and general sense of happiness measured as factors that arise from the findings in chess research studies. Alongside these interesting new

discoveries, difficulties become quickly apparent, as there is no consistent and reliable measure of intelligence or human emotions, making chess ultimately difficult to be researched.

Considering the possibilities and difficulties that can arise in studying chess, my research proposal aims to minimize factors of inhibition by utilizing a powerful modern software called chess.com. This website acts as a platform where users can engage with other users and learn chess for free. This paper has proposed a potential study to be conducted observing young participants at high school age who utilize the website, interviewing them on their learning process and monitoring their activity on their account. It seeks to last an entire academic year to fully witness the impact of the experience on their academics and watch trends in the cognitive tests given. The topic of chess can be a difficult one to pin down and measure properly, but with the length of the study, the specific age group, and the many features of chess.com, this paper predicts a significant result demonstrating a strong causation of chess improving cognitive ability and intelligence. This design is formatted to ideally be replicated and promote further research on the subject, aiming to demonstrate the power of an information technology such as chess.com and what its effects hold for our future.

Works Cited

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), 551-559. doi:10.5209/rev_SJOP.2012.v15.n2.38866

Barrett, David & Fish, Wade. (2011). Our move: Using chess to improve math achievement for students who receive special education services. *International Journal of Special Education*, 26.

Ciberia, N., Lorenzo-López, L., Maseda, A., Blanco-Fandiño, J., López-López, R., Millán-Calenti, J. (2021, June 4). Effectiveness of a chess-training program for improving cognition, mood, and quality of life in older adults: A pilot study. *Geriatric Nursin*g, 42(4), 894-900. https://doi.org/https://doi.org/10.1016/j.gerinurse.2021.04.026

Gobet, F., & Campitelli, G. (2002). Intelligence and Chess. *Board Games in Academia*, 103-112. http://bura.brunel.ac.uk/handle/2438/2274

Hong, S., & William, B.M. (2006). Cognitive Effects of Chess Instruction on Students At Risk for Academic Failure. *International Journal of Special Education*, 22, 89-96.

Meloni, C., Fanari, R. (2021). Does Chess Training Affect Meta-Cognitive Processes and Academic Performance?. In: Ifenthaler, D., Sampson, D.G., Isaías, P. (eds) *Balancing the Tension between Digital Technologies and Learning Sciences. Cognition and Exploratory Learning in the Digital Age,* 19-32. https://doi.org/10.1007/978-3-030-65657-7_2

Sala, G., & Goblet, F. (2016, February 27). Do the benefits of chess instruction transfer to academic and cognitive skills? A meta-analysis. *Educational Research Review*, 18, 46-57. https://doi.org/https://doi.org/10.1016/j.edurev.2016.02.002

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 and Technology Education*, 12(3), 655-668. https://doi.org/10.12973/eurasia.2016.1255a