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TEAM USAGE IN CHESS INSTRUCTION WITH DIGITAL TECHNOLOGY*****

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Abstract

One helpful set of resources for chess instructors is the many chess-related websites on the internet. Chess instructors may now make extensive use of this chess-related digital technology. Three case studies support the exciting phenomenon of human participants enjoying forming teams to play chess against chess bots available on chess-related websites. These teams may be viewed as cooperative groups that preferred to engage in this activity. This phenomenon occurred among school-aged children, undergraduate students, and elderly participants. One recommendation is that chess instruction involving digital technology should allow human participants to form small groups to play chess games against chess bots.

Keywords*: chess instruction, digital technology, chess.com, lichess.org, chess bots, Stockfish, cooperative learning.*

INTRODUCTION

Chess is typically taught with physical pieces and chessboards. The use of physical pieces and chessboards in chess instruction is international and commonplace worldwide. A prominent example of an approach to chess instruction is the SMART Method to Teach Chess, developed and advocated by the European Chess Union Education Commission (2024). That approach features physical pieces and chessboards, as it does not explicitly endorse using chess-related digital technology.

However, some chess instruction programs are incorporating contemporary digital technology. For example, the Kasparov Chess Foundation Academy (2024a) provides chess instruction at four levels: (1) Level 1: Novice (Elo ratings 1000 – 1400); (2) Level 2: Intermediate (Elo ratings 1401 – 1700); (3) Level 3: Advanced (Elo ratings 1701 – 2000); and (4) Level 4:

Master's path (Elo ratings 2001+). The instruction is presented online, and chess trainers present chess lessons using the Zoom platform. Additional resources, such as tests to assess chess learning, are available electronically on the Kasparov Chess Foundation Academy website (2024b). The instructors periodically use the chess software termed ChessBase (2024) to illustrate chess game positions.

Magnus Chess Academy (2024) provides another example of chess instruction, including digital technology. The online service allows students to learn and play chess. The website reports that the service has trained over 100,000 students in chess. The service uses a chess engine to play chess at 30 different skill levels.

Although promising and worthwhile, those three approaches to chess instruction have yet to be studied in empirical reports published in refereed academic journals. This is unfortunate because research such as that of Bart (2014) and Poston and Vandenkieboom (2019) proved that chess training improves scholastic achievement, especially in mathematics achievement.

One component of contemporary chess instruction that warrants empirical research is the chess engine, which permits the analysis of chess positions and opportunities for chess play against human or artificial opponents. Stockfish (2024) is such a chess engine—indeed, a powerful one. Stockfish has been used in empirical research (e.g., Bart, Ritter, & Ritter, 2021).

But how do students engaged in chess instruction interact with chess engines? Do students merely play chess against chess engines when the chess teacher tells them to play a chess engine? These are questions addressed in this article.

With much digital technology and many online chess-related websites, chess instruction is now possible with judicious usage of chess-related digital technology. Not only can one access chessboards and chess positions on laptops and desktop computer screens with pieces that can be viewed and moved with a computer mouse, but one can also play chess against artificial opponents termed bots that are usually weakened forms of a powerful chess engine such as Stockfish that can play chess at a very high level.

The author has taught introductory chess using digital technology to various groups of individuals: early-grade students, undergraduate students, and elderly individuals. As the instructor, the author has witnessed a totally unexpected phenomenon in all three cases. It is that phenomenon that will be described and interpreted. This surprising phenomenon likely has substantial significance for introductory chess instruction (Elo ratings 0 -1000). It may even have significance

for intermediate chess instruction (Elo ratings 1000 – 1700) and advanced chess instruction (Elo ratings 1700 and above).

METHODS

The research program will be described in the form of three case studies in which a phenomenon occurred that was completely unexpected by the instructor in each case study. Each case study will describe chess instruction with a sample of human participants and the surprising phenomenon the instructor witnessed with each group.

The setting in Case Study 1 was a public charter school in St. Paul, Minnesota. The school serves students in grades K (kindergarten) – 12. It is a Title 1 school receiving special federal governmental funds. Those funds permit the school to provide additional educational services to students at risk of failing or not meeting the state's academic standards. Students in Title 1 schools tend to be economically disadvantaged and must meet grade-level state academic standards and assessments. The school used for this case is an Afro-centric school that features African culture and the contributions of African culture and Africans to Western communities.

The site for chess instruction within the school was an early-grade classroom for students in grade 3. The regular teacher permitted chess instruction for approximately 50 minutes bi-weekly for approximately ten weeks.

There were 14 students in the classroom. Many students were immigrants born in Ethiopia, Kenya, or Somalia. The students were primarily Somali. They were between 8 and 9 years of age. The chess instruction occurred during the 2007-2008 academic year. There were boys and girls in the classroom.

The chess instruction involved physical chess pieces and chessboards provided by the United States Chess Federation to the instructor for chess-related research. The instructor provided bi-weekly 50-minute lessons in which each pair of students would receive a chessboard and a complete set of chess pieces. The set of pieces and a chessboard given to each pair of students permitted the students to study chess positions suggested by the instructor. The students received rudimentary chess lessons that allowed them to play chess at a basic level, at least, with only legal moves being made.

In addition to the chess sets, desk computers in the classroom had a relatively simple chess program called Nagaskaki available to the students. Nagaskaki provided access to artificial

opponents at various Elo rating levels. The instructor demonstrated to the students how to operate the desktop computers to gain access to and play the chess program. The aim of the chess instruction in Case Study 1 was to examine the scholastic effects of the instruction.

The setting for Case Study 2 was a course for first-year undergraduate students entitled "Freshman Seminar: Beginner's Chess and 21st Century Thinking Skills," presented at the University of Minnesota. The course extensively used digital technology as each student had access to a desktop computer, and the instructor had access to an instructor's desktop computer that could project web-based images onto a large screen with a projector. The instructor taught the course by projecting content from websites such as chess.com, lichess.org, and chessgames.com.

Although a textbook was cited as an optional text, it was never actually used in the instruction. The course was taught several years in succession. The enrollment tended to be between 15 and 20, with a few more male students than female. Bart (2021a) discusses this effort to teach introductory chess to first-year university undergraduate students.

The purposes of the chess instruction were the following: (1) to teach the fundamentals of chess, including basic rules, fundamental endgames, and primary openings and defences; and (2) to indicate how higher-order thinking skills such as problem-solving, decision making, and critical thinking are fostered in chess.

The setting for Case Study 3 was a program of chess instruction for elderly individuals in a community centre and school for adult learners. Ten individuals participated in the chess instruction in a community centre for adult education and, at times, in a public library. The participants were all at least 65 years of age, with a majority being male. One participant needed to respond better to the lessons and quit the program. That participant seemed to have dementia.

The chess instruction initially solely involved physical chess sets and chessboards. After starting the lessons at a community centre, the instruction moved to a public library, a conference room with an instructor's desktop connected to an overhead screen. Bart (2021b) discusses this effort to teach introductory chess to elderly individuals.

The aims of the chess instruction were: (1) to teach the fundamentals of chess, including basic rules, fundamental endgames, and primary openings and defences; and (2) to explore how elderly individuals respond to chess lessons. The instructional program was to be a precursor to a more extensive chess instruction program to investigate the extent to which chess instruction will reduce the incidence of dementia among elderly individuals.

RESULTS

In Case Study 1, students presented certain exciting behaviours. At the end of each lesson, the instructor would ask the students to place the chess pieces into their chess set bags. Unfortunately, near the end of the lessons, some students engaged in destructive behavior by throwing the pieces on the floor and breaking some of them pieces. Students who broke chess pieces were restricted from using the chess sets. However, they were allowed to play chess on desktop computers. The students who engaged in chess-related property damage tended to be male students.

After several weeks of chess lessons, the instructor would arrive at the classroom about 10 minutes early. When he did arrive early, he witnessed unusual student behaviour. Many students, especially those who broke chess pieces, formed pairs to play a chess bot on the desktop computers. In other words, students who engaged in property damage and challenging behaviour with physical chess sets also demonstrated productive volunteer behaviour when presented with digital chess technology!

In Case Study 2, the students enjoyed the class. They especially enjoyed having opportunities to play chess games against chess bots such as those available on chess.com and lichess.org. The students tended to pair off in teams of two students when playing against chess bots. This phenomenon of students enjoying playing against chess bots was evident in each offering of the Freshman Seminar.

Regarding Case Study 3, the participants seemed more engrossed in the chess lessons as they were moved from the community centre to the conference room in a public library where digital technology was available. They enjoyed learning about chess-related websites and how to access them. They especially enjoyed playing chess against chess bots and took turns making moves after consulting classmates about the best possible moves.

The instructor monitored the chess games between the elderly group and the chess bots. The instructor did not suggest moves but did comment on moves made by the group in constructive terms. The instructor also maintained a pace to the game so that the group produced moves on time, 2-3 minutes per move. The chess bots made their moves within a few seconds.

DISCUSSION

Regarding Case Study 1, early-grade students who engaged in destructive behaviour gravitated spontaneously in small groups to productive behaviour with digital technology, which is

a finding that should inform chess instruction that features digital technology. The members in each group could share their analyses of the chess positions in their respective games by working together against the opposing chess bots.

In Case Study 2, the students, when playing against the chess bots, shared their chess knowledge in terms they could understand. This enhanced the students' motivation toward learning chess. The male students enjoyed the chess competition between human and artificial players.

Regarding Case Study 3, the elderly participants seemed to enjoy discussing the merits and demerits of various moves and probing deeply into the different positions with each other. The group-based chess activities enriched their knowledge of chess.

The three case studies support the role of group-based activity in chess instruction using digital technology. Pairs of participants enjoyed playing against chess bots when the participants were either children or young adult college students. Elderly participants preferred playing against chess bots in groups larger than groups of two, such as groups of six or seven.

The elderly participants seemed to enjoy the social camaraderie, learning, and studying together as a team. The child and young adult participants seemed to be more competitive and motivated in their efforts to defeat chess bots.

The unexpected appeal of group-based activities in chess training that feature digital technology warrants explanation. One theoretical framework that warrants consideration is Cooperative Learning, an instructional method in which students work in small groups to accomplish a common learning goal with the teacher's guidance (Johnson & Johnson, 1975; Johnson, Johnson & Holubec, 1984). Cooperative learning involves personal interdependence, individual accountability, equal participation, and simultaneous interaction.

Johnson (2009) determined that students in cooperative learning settings achieve more academically, reason better, gain higher self-esteem, and enjoy the learning tasks more than those in individualistic or competitive learning settings. Participants cited in the three case studies seemed to enjoy forming cooperative groups to pursue success against chess bots.

CONCLUSION

A recommendation from Case 1 is that chess instructors who feature chess-related digital technology should consider allowing students to play chess games against chess bots by forming teams of small groups.

A recommendation from Case 2 is that chess instruction featuring digital chess technology at the college level should include opportunities for students to form pairs of students and play chess bots. The students will likely enjoy the opportunities.

A recommendation from Case 3 is the use of group-based chess activities in chess instruction for elderly individuals. Elderly individuals seemed to enjoy working as a group when learning and studying chess with digital technology.

Although chess is customarily a solitary activity, with one individual playing chess against another, individuals forming small groups have a place in chess instruction, especially when digital technology is used. The three case studies supported small groups playing chess bots as a dynamic and valuable component of chess instruction using digital technology.

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REFERENCES

Bart, W. M. (2021a). Insights on teaching chess to undergraduate university students. *Revista Mundi Engenharia, Tecnologia e Gestão, 6*(1), 318–10. https://doi.org/10.21575/25254782rmetg2021vol6n11495

Bart, W. M. (2021b). Insights on teaching chess to elderly citizens. *Revista Mundi Engenharia, Tecnologia e Gestão, 6*(1), 316–10. https://doi.org/10.21575/25254782rmetg2021vol6n11492

Bart, W. M., Ritter, J., & Ritter, N. (2021). An empirical study of artificial participants: A factor affecting game length in chess. *Journal of Technological Advancements, 1*(1). https://doi.org/10.4018/JTA.20210101.oa2

ChessBase. (2024). ChessBase 17. Retrieved from https://www.uscfsales.com/chessbase-17.html

Education Commission of the European Chess Union. (2024). *CIE Package.* Retrieved from https://edu.europechess.org/cie-package/

Johnson, D., & Johnson, R. (1975). *Learning together and alone: Cooperation, competition, and individualization.* Englewood Cliffs, NJ: Prentice-Hall.

Johnson, D. W., Johnson, R. T., & Holubec, E. J. (1994). *The nuts and bolts of cooperative learning.* Edina, MN: Interaction Book Company.

Johnson, D. W. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher, 38*(5), 365–379. https://doi.org/10.3102/0013189X09339057

Kasparov Chess Foundation Academy. (2024a). *Programs – Four Levels.* Retrieved from https://kcfacademy.org/programs/#4level

Kasparov Chess Foundation Academy. (2024b). *App.* Retrieved from https://app.kcfacademy.org/

Magnus Chess Academy. (2024). *Play Magnus.* Retrieved from https://www.playmagnus.com/en

Poston, D. I., & Vandenkieboom, K. K. (2019). The effect of chess on standardized test score gains. *SAGE Open, 9*(3). https://doi.org/10.1177/2158244019870787

Stockfish. (2024). *Stockfish Chess Engine.* Retrieved from https://stockfishchess.org

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