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EVALUATING THE IMPACT OF CHESS LEARNING ON CHILDREN WITH AUTISM SPECTRUM DISORDERS

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ABSTRACT

Chess Scientific Research Institute examined the impact of learning chess on children with Autism Spectrum Disorders (ASD). Using a mixed-methods approach that combined qualitative data collecting and quantitative analysis, it sought to determine how chess affects these kids' cognitive, social, and behavioral development. The results showed that although children with more developed verbal skills had more excellent chess development, behavioral features, and other factors also had a significant impact on their learning outcomes. Eye contact and engagement levels varied even when communication and social interactions improved. The study emphasizes the need for more research and individualized teaching strategies to prove that chess is a valuable tool for helping kids with ASD.

Keywords: *chess education, Autism Spectrum Disorder (ASD), cognitive development, social skills, behavioral traits, special educational needs (SEN), verbal communication, personalized teaching*

strategies.

INTRODUCTION

Chess has garnered academic interest as several studies have contended and demonstrated (Mohammad, 2015) that chess abilities enhance academic performance owing to their applicability in various domains (Smith, 1998). The meta-analysis undertaken by Gobet et al. (2017) highlights how chess training can positively impact cognitive skills, including spatial orientation, which can benefit children with autism. Researchers have found correlations between chess knowledge and experience, attention, pattern recognition, spatial and logical thinking, and other cognitive capacities (Ferreira & Palhares, 2008; Horgan & Morgan, 1990; Saariluoma, 1984).

Sigritmac (2012) evidenced the beneficial effect of chess on the conceptual learning advancement of six-year-old youngsters, revealing no significant disparities between male and female participants. Chess can be a valuable resource for students on the periphery; it may be a practical component of mathematics instruction for those receiving special education assistance (Barrett et al., 2011).

While researchers underline the cognitive and academic benefits of chess, there is a significant inconsistency between the practical steps in teaching chess to children with autism spectrum disorders and its theoretical and empirical scientific justification, which is the primary reason for the importance of this research problem. The issue lies in the fact that while many practitioners and professionals addressing these issues acknowledge the connection between chess and autism, there is a dearth of scientific research in this area. For instance, a Dutch psychologist and journalist, Karel Van Deft conducted a thorough analysis of the connection between chess and autism. They concluded a significant lack of international research in this field (Van Deft, 2010).

The purpose of the current research is to explore the impact of learning chess on the development of children with autism spectrum disorders (ASD) from the perspective of the project participants.

The evaluation research was undertaken within the FIDE "Infinite Chess" project, which "aims to increase knowledge and awareness of chess for children with autism spectrum disorder (ASD), give practical advice to teachers and parents, study the benefits of introducing to chess and develop various teaching methods" (https://infinitechess.fide.com/)

Research Questions

1) What is the impact of chess teaching and learning processes on the cognitive and behavioral development of children with ASD?

2) How can chess instruction improve the social interaction skills of children with ASD, and

what strategies are most effective in this process?

3) What is the overall impact of learning chess on children with ASD in terms of cognitive, emotional, and social development?

LITERATURE REVIEW

Chess, with its various features, has become an effective means for discussing and solving these issues. In addition to its cognitive value, chess also holds value pedagogically and socially (Aciego, et al., 2012), as it fosters the development of social competencies such as socializing, patience, perseverance, respect for the opponent, and self-control. Including so many skills and competencies in a single board game renders chess an excellent choice for social, mental, and educational settings.

Since chess became a compulsory subject in the Republic of Armenia's primary school curriculum, Armenian scientists have conducted numerous studies. Scientific works have focused on the impact of chess on cognitive and intellectual development (Sargsyan et al., 2016), the effectiveness of chess in education (Mirzakhanyan et al., 2017), the social-psychological analysis of factors affecting chess education (Sargyan et al., 2021), and other related topics.

The overview and analysis of the inclusive working group of the Chess Research Institute conducted by Charchyan and Karapetyan (2022) underscore the influence of chess on children's cognitive, and social-emotional development, and behavior. They emphasize the necessity for continued study to substantiate chess as a therapeutic approach and a resource for assisting students with specific educational needs.

Additionally, CSRI researchers emphasized that "chess as a general education subject has great potential for the development of children," according to research in chess education (Gevorkyan et al., 2023, p. 129).

When discussing the benefits of chess training for children with autism spectrum disorders, experts (Schwartz & Golden, 2015) primarily highlight its ability to foster social interaction. The study showed the effectiveness of unique psychological-pedagogical methods in developing spatial orientation.

Another chess instruction intervention in the United States that lasted thirty weeks evaluated the mathematics achievement of thirty children with health, auditory, learning, emotional/behavioral, speech, or autism impairments who regularly received special education services (Barrett & Fish, 2011).

According to researchers (Greenspan, 2006; Baron-Cohen, 1995), children with autism do not join in with others in typical pretend play situations but may be able to “imagine” within their narrow play routines. They have the most difficulty learning in new situations, problem-solving, and broadening interests outside the ones that dominate their thinking and behavior.

Differences in the play of children with ASD can affect their behavior. If a child with ASD is unable to independently engage in typical play behavior, they may miss the benefits of play, which leads to enhanced cognitive, social, and emotional skills. Impairments or delays in these key areas will likely result in challenging behavior as the child attempts to communicate and meet their needs **(Thornton & Cox, 2005).**

Research indicates that autistic children can learn to play-act if prompted (Sherratt & Peter, 2002). They proposed that the child may initially imitate the caregiver's conduct. Studies also indicate that this behavior can evolve into functional play by incorporating predictable play routines and explicit instruction. As the child's comprehension matures, they may begin to participate in play with peers and exhibit more significant consideration for their emotions and goals. Consequently, Sherratt and Peter (2002) delineated essential principles for instructing play sequences. These included:

- Any play sequence can utilize a simple narrative structure.
- Teachers are leading the play.

Researchers **(Phillips & Beavan**, 2007) suggest using “Identiplay” as a form of play for children with ASD. It involves a table divided into two, two chairs, a pack of toys, and a typed script. Observing the child's free play and skill level before using “Identiplay” to ensure the toys are appropriate for their level is crucial. We found some similarities between chess and “Identyplay”’s arrangements as a possible area for future research.

Researchers have not yet shown interest in chess as a psychological support tool. Researchers and practitioners sometimes describe an extensive range of symptoms while trying to understand the main benefits of chess. Deep and systematic studies in this direction can reveal the great potential of the chess game in working with children with autism spectrum disorders while also significantly expanding scientific understanding of the characteristics of these children's behavior.

1 METHODOLOGY

The research was organized according to the "step-by-step" method. The procedure commenced with formulating the research's primary ideological element, encompassing identifying the problem and hypotheses and articulating research questions. The procedure thereafter involved the development of tools, execution of tests, and performance of fieldwork, concluding in data analysis. This concise overview of the research implementation process encompassed concurrent efforts by the “Chess” Scientific Research Institute team, the FIDE “Infinite Chess” **(https://infinitechess.fide.com/)** team, and participating experts. The team executed the task collaboratively, ensuring continuous active communication, as several phases of the activity were interrelated and interdependent, thereby

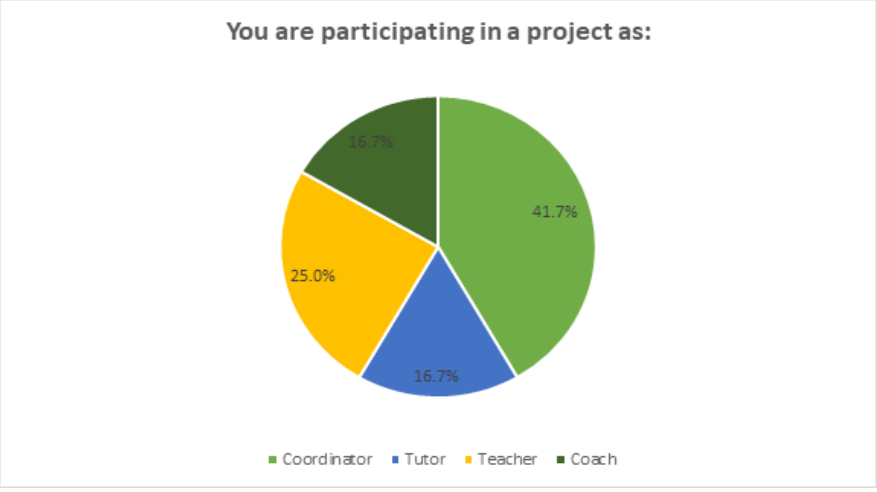
exercising collective oversight. We conducted weekly meetings during the research to discuss ongoing projects and revisions, among other subjects. We had additional sessions to resolve concerns necessitating immediate attention. We offered both the preliminary and conclusive research materials.

The study used a mixed-methods approach, combining secondary data review with qualitative data collection methods to gain deep insights, meet all the assignment goals, and ensure that the data sources and collection methods were checked three times.

We used the purposive sampling method, which includes the entire group—in this case, representatives from all countries participating in the "Infinite Chess" project. Such a sample has high reliability and minimal error probability and represents the entire study group. A multi-layered approach was used. The first layer of the research sample encompassed all project-participating countries, from which the coordinators from each country formed the second layer, followed by the teachers and trainers in the third layer. The mentioned layers form a standard chain, which can be superimposed or subordinate to each other based on their functions. However, all informants in this study provide information of equal value. We have defined a unified program and toolkit to ensure the universality of the sampling. We carried out preliminary universalization and testing of the research tools to neutralize the cultural, gender, age, professional, competence, and experience differences of the informants participating in the research. Target groups for the research program include trained lecturers, tutors, and teachers from chosen institutions with experience working with children with ASD. A methodological guide (Popova et al., 2021) for teachers to conduct chess classes when working with children with autism spectrum disorder has been developed before delivering chess to the students.

Diagram 1.

Project participants.



The research sample includes all the specialists planned by the project. The percentage ratio shows that the overwhelming majority of participants were coordinators (42%), followed by teachers (25%), tutors (17%), and coaches (17%) (Diagram 1).

The table below mentions the number of coordinators, tutors, coaches, and teachers involved in the project in each region.

Table 1.

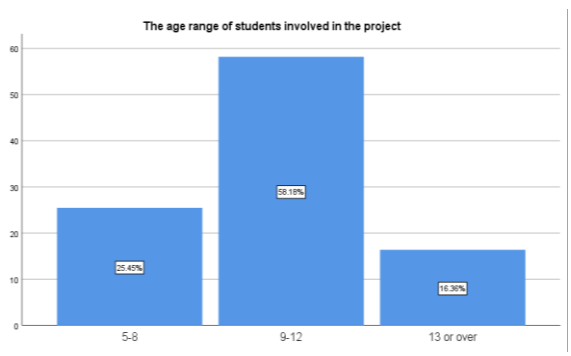
Number of assistive staff.

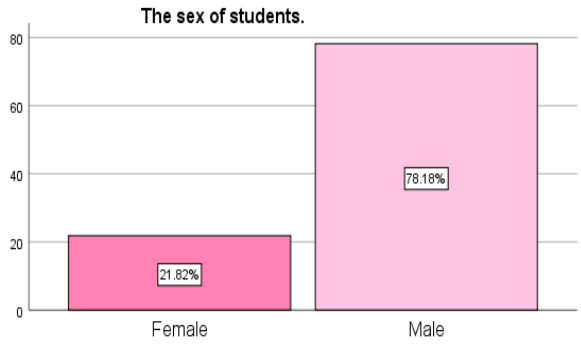
Please mention how many coordinators, tutors, coaches, and teachers are involved in the project in your region.				
Country	*Coordinators*	*Tutors*	*Coaches*	*Teachers*
Gibraltar	1	2	3	1
Spain	2	3	4	3
South Africa	1	1	1	1
Turkey	2	-	-	1
Total	*6*	*6*	*8*	*6*

As a rule, the mentioned group of specialists is sufficient to conduct chess courses with children with ASD. Further, the primary information about the children involved in the project is presented.

Diagram 2.

Demographic data.



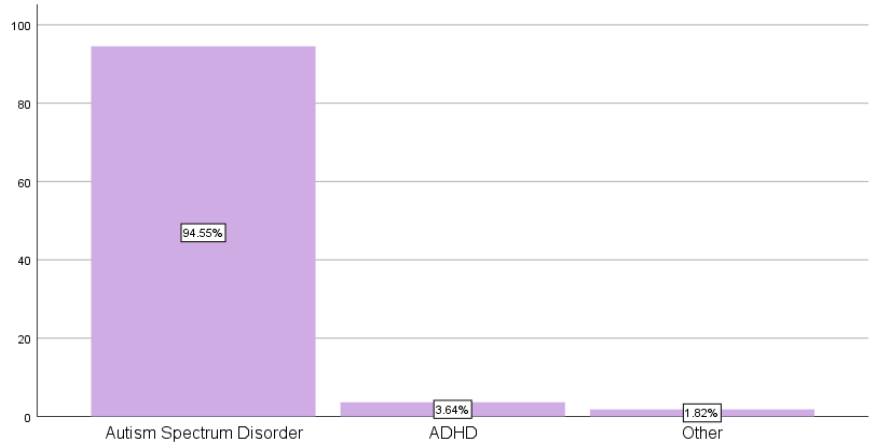


The majority of participants are children from 9 to 12 years old (58%), less than half are in the 5-8 age range, and the fewest are 13 or over. As is common in general autism statistics, 78% are boys, and 22% are girls (Diagram 2).

Participants report that the vast majority of students have autism spectrum disorders as introduced in Diagram 3.

Diagram 3.

Number of children with ASD.



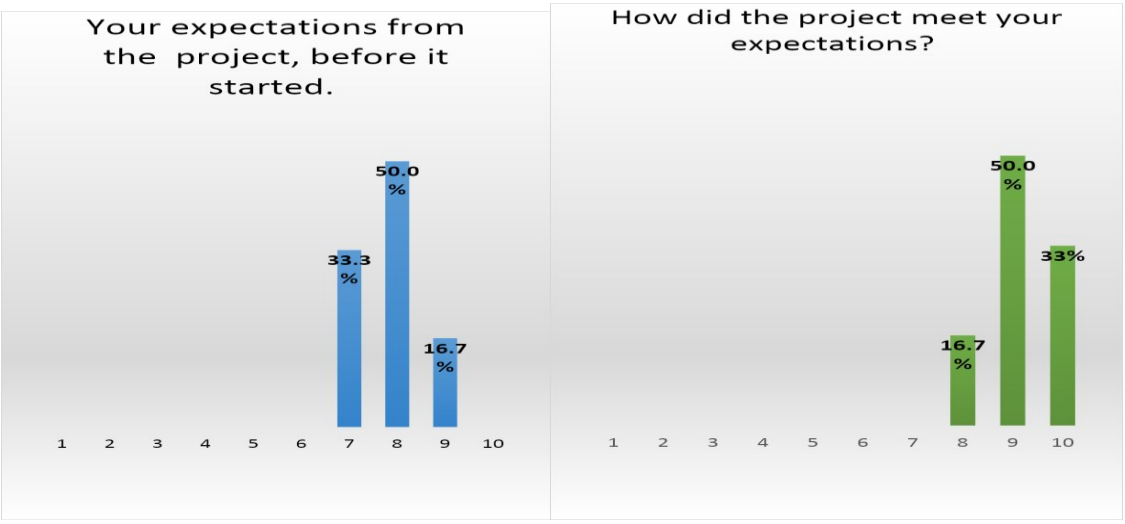
2

3 **RESULTS**

The two presented figures graphically show that the expectations from the project were quite high, for example, half of the respondents rated it with 8 points. And to what extent those expectations were met, it becomes clear from the next figure, where it can be seen that, in general, the expectations were exceeded, for example, one third of the respondents scored 10 points (Diagram 4).

Diagram 4.

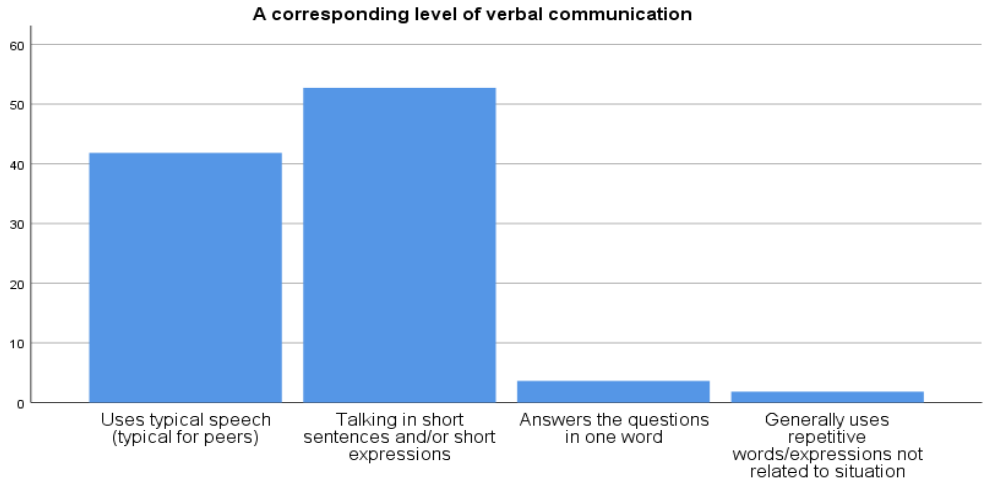
Expectations of the participants.



The influence was revealed in several directions by extracting the manifestations of social interaction, behavioral and emotional features. In order to evaluate the progress of children involved in the project, the initial level of their skills have been identified based on survey responses.

Diagram 4.

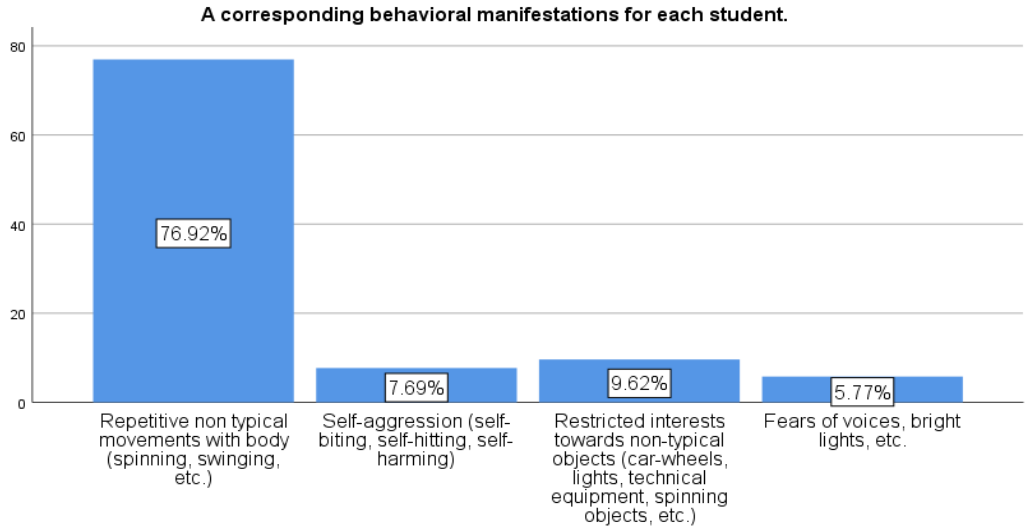
Level of verbal communication



There were several requirements for involving children in the project. And one of these requirements was the level of their verbal communication. As depicted in Diagram 4, most of the students were able to use typical speech or communicate in short sentences and expressions. But also there were cases where students were limited in their verbal skills, such as the situations of answering the common questions in one word or using repetitive words and expressions.

Diagram 5.

Behavioral manifestations of participants.

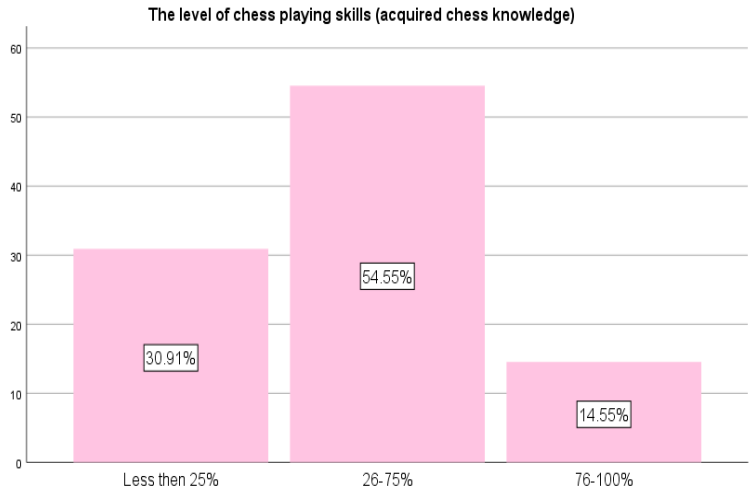


What comes to behavioral patterns (Diagram 5), the most common manifestation was the repetitive behavior in forms of non-typical body movements. The other forms of usual behaviors for ASD, such as self-aggression, restricted interests and fears have been observed relatively rare (8%, 10% and 6% accordingly).

On the diagram 6 the results of acquired chess knowledge is presented. Only 15% of students have achieved the highest level of chess knowledge based on the guideline. In terms of activities this is the level of independently playing the game (even with errors).

Diagram 6.

Chess playing skills

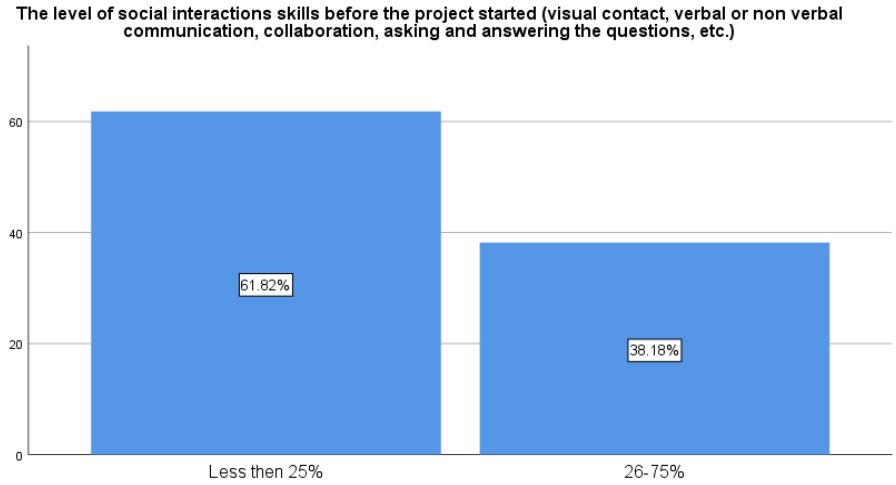


About 55% of children's progress in chess has been evaluated in the range of 26-75 (from 100). These results show that in general the recommended chess level is relevant to abilities and potential of most of the students. But apparently not for all, as 31% of participants have acquired just less than 25%

of provided chess materials.

Diagram 7.

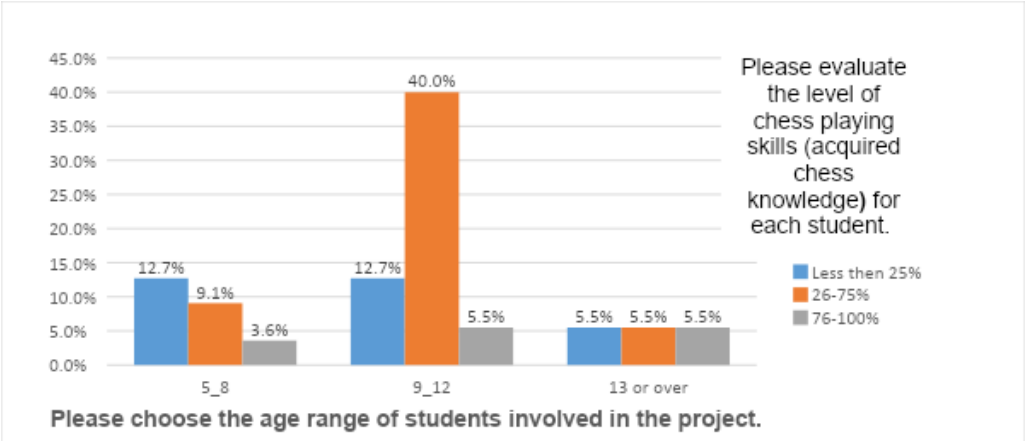
Level of social skills



Evaluating the social interaction skills before the project started, the coordinators mentioned that most of the students had lack in the sphere. In particular 62% of them had been assessed as having less than 25% of these skills (Diagram 7).

Diagram 8.

Evaluation of chess playing skills in relation to age



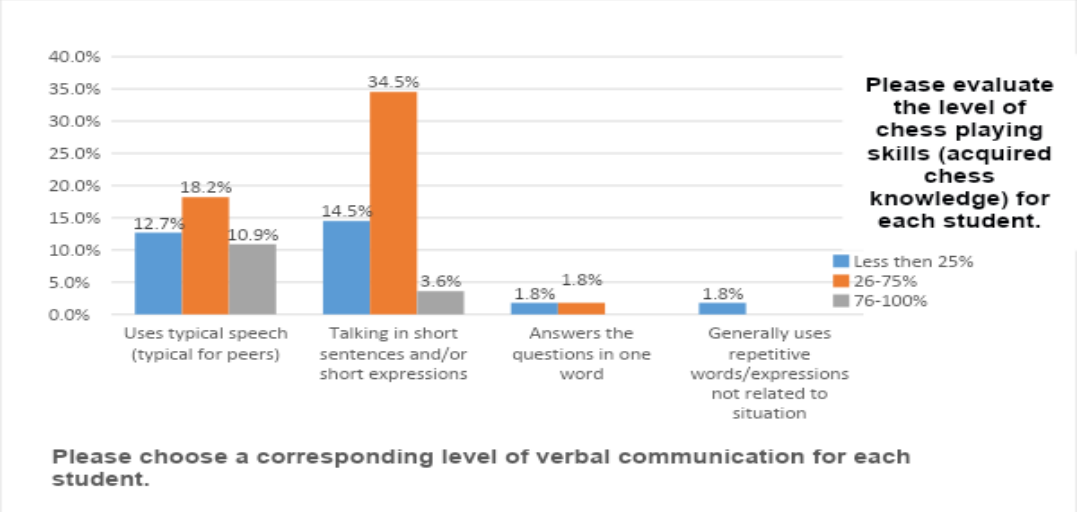
One thing that can be assumed from the diagram 8 is that children with ASD from 9-12 years old are more likely to manifest good performance in learning chess and this is the age range we believe well-designed interventions may affect better results.

Diagram 9 shows children's performance in terms of learning chess content during the project. As it is presented here, just about 10% of children with ASD have shown the highest results of chess playing

skills. Most of them (more than 50%) have middle performance. One evidence that has attracted our attention is that 2 children with ADHD have been involved in the project and both have been assessed with higher levels of acquiring chess skills.

Diagram 9.

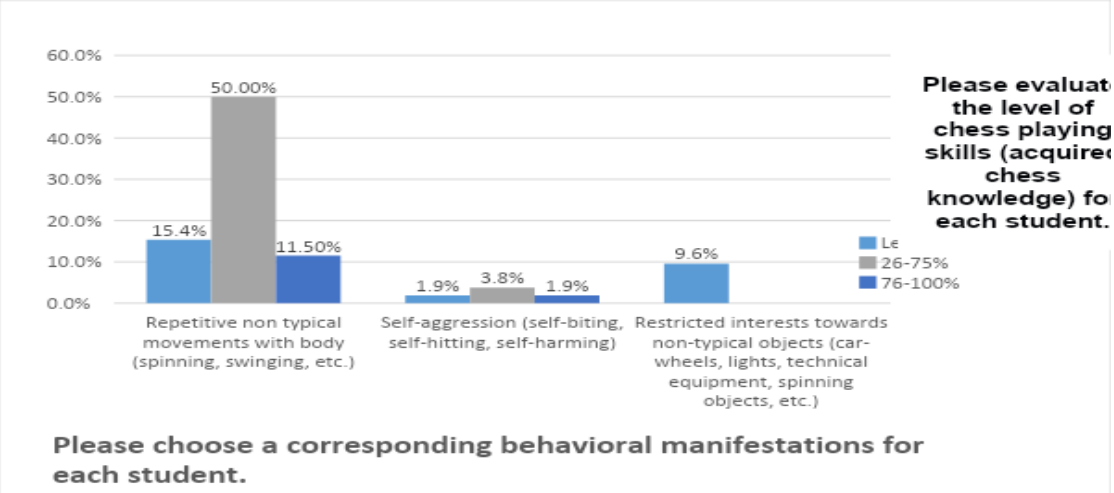
Evaluation of chess playing skills in relation to communication skills



The results shown in Diagram 9 are controversial. On the one hand, it is visible and logically predictable, that level of verbal communication correlates with chess-playing skills performance. More children with typical speech have performed well in chess than children with restrictions on verbal skills. On the other hand, we can see that 12.7% of children with typical speech have performed lower than 25% in chess. That allows us to assume that verbal skills are necessary, but not sufficient for acquiring chess knowledge, so other factors should be considered as well.

Diagram 10.

Evaluation of chess playing skills in relation to Behavioral manifestations

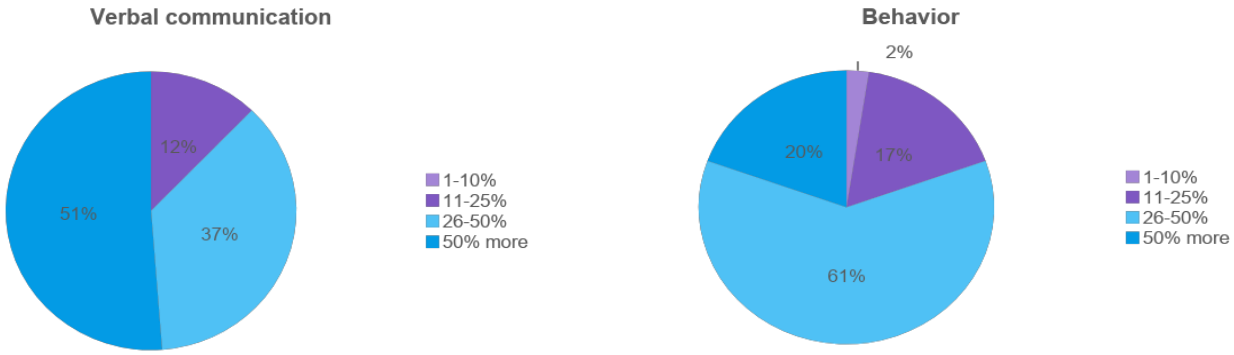


Another remarkable finding about the correlation between chess and manifestations typical of ASD is presented in Diagram 10. We can see that repetitive manifestations in behavior affect the level of acquired chess skills. But here we would like to emphasize the impact of restricted interests on the level of learning the content. All the children with restricted interests in non-typical objects have the lowest achievements in acquiring chess skills.

By the end of the project, the progress of each student in each field of skills that has been initially observed has been evaluated once more. Near in diagrams, the results of students' progress are presented.

Diagram 11.

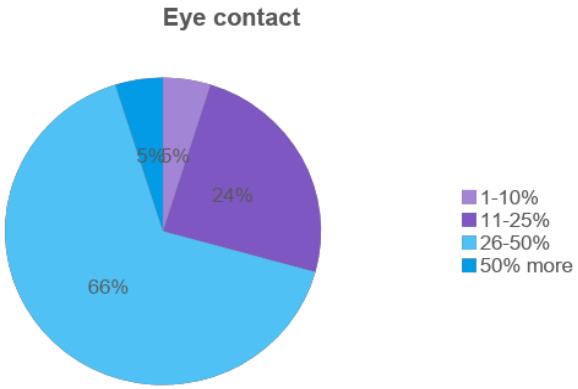
Verbal communication and behavioral factors



All the experts have confirmed that after a short period of time the students have progressed in their verbal communication mostly from 26 to more than 50%. And while discussing the main reasons for this, everyone agreed they have improved their communication correspondingly to the environment becoming familiar and safer for them. Accordingly, the behavior has increased to more compliant and enthusiastic manifestations, mainly following the instructions and concentrating on teachers' explanations (Diagram 11).

Diagram 12.

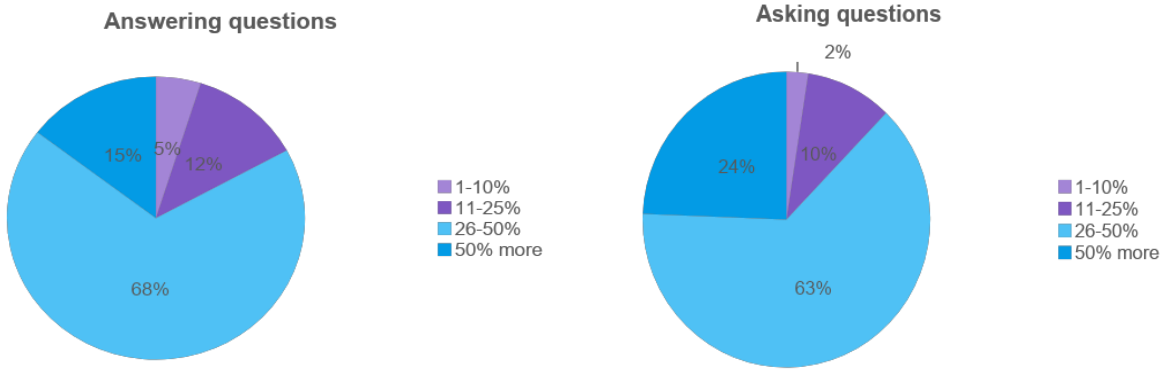
Eye contact



Meanwhile, the students haven't progressed so well in having eye contact, as the experts mentioned that by the end of the program it increased to not more than 15 seconds for the majority of the students (Diagram 12). On the other hand, in comparison with the first lessons, while there even were no eye contact, these results are really impressive. Although here again we can see mostly the contribution of the environment, rather than the activities.

Diagram 13.

Questions and answers.



The students had significantly enhanced their question-asking and answering skills, but mainly during the communication with the teacher. Only some of the participants have demonstrated the same skills both with teachers and classmates and what is also important, that communication is mainly connected to the lesson situations. Overall, the students have created good relationships with teachers and classmates, some of them were even trying to teach others, while the others know they can learn also from these "veterans". Meanwhile, some children still avoid physical contact, but communicate

verbally.

4 DISCUSSION

The overall summary of the survey results is following:

- The level of acquiring chess knowledge correlates with the age, level of verbal communication, and restricted interests of students involved in the project.
- As a result of chess lessons has been observed a progress in students' communication, behavior and relationship spheres, which are mostly interpreted as a result of an environment that became safe and comfortable during the project process.
- The participants of surveys and interviews agree that the time of the first stage of the project was too short to achieve stable progress.

The results of the interviews have been analyzed in accordance with criteria of project challenges, good practices and benefits of learning chess.

Taking into account that the majority of participants considered the children's emotions of joy and happiness as an important indicator of the progress of the project, we propose to introduce mechanisms during the project evaluation that will enable the objective evaluation of these indicators along with the feedback tool.

To successfully teach chess to a broader range of children, it is important to consider alternatives to using only verbal communication during lessons. Best practices in educational research (Chen, et al., 2023; Cucinotta et al., 2024) suggest that the more senses engaged in the learning process, the higher the likelihood of success for all students. Research indicates that incorporating methods like the "Identiplay" approach, as suggested by Phillips and Beavan (2007), can be valuable in aligning the game of chess with the specific needs of children with autism.

Survey results involving 55 participants (45 boys and 10 girls) revealed that children with typical speech abilities generally performed better in chess than those with verbal restrictions. Storey (2000) advocated that playing chess strengthens these skills. However, it was also observed that 12.7% of children with typical speech scored below the 25th percentile in chess performance. This finding implies that while verbal skills may be important, they are not solely sufficient for acquiring chess knowledge; other factors must also be considered.

Research has demonstrated that chess can improve students' patience, perseverance, concentration, and creativity (Smith, 1998). This project holds significance as it introduces a novel topic in the research field, specifically examining chess instruction for students with ASD.

One notable observation from the study is that repetitive behaviors and restricted interests

significantly affect the acquisition of chess skills. Children with a narrow focus on non-typical objects tended to show the lowest levels of chess proficiency, highlighting the need to address these specific challenges in the teaching process.

Successful experiences were often linked to personalized approaches, combining both individual learning and teamwork, which contributed to better engagement and progress. Participants also noted that while children enjoyed solving problems, their enthusiasm did not always extend to the game itself, emphasizing the need to showcase the inherent benefits of learning chess.

Participants stressed the significance of assessing each child's progress and the difficulties in measuring success accurately. Effective practices highlighted during this process included collaboration with specialists, adapting chess materials to meet individual needs, and integrating the game as part of a comprehensive educational strategy.

Cooperation emerged as a key theme during the interviews and surveys, with particular emphasis on challenges related to engaging parents and involving multiple specialists in the learning process. These findings support the necessity of implementing interventions like the DIR/Floortime methodology in 1979, which is currently one of the most effective methods for working with children with ASD. Work on external behavior and symptoms is not the main goal of therapy within the framework of the DIR concept and the "Floortime" method (Greenspan, 2006). First and foremost, they focus on laying the groundwork for the child's healthy development when open communication among educators, specialists, and families is a crucial element.

A cause-and-effect framework for action was developed based on thematic analysis, highlighting the importance of smart planning, comprehensive assessments, and continuous cooperation with the professional community and parents.

The experts noted that, over a short period, students showed notable progress in verbal communication, with an increase from 26% to over 50%. However, improvements in eye contact were less significant, with most students managing no more than 15 seconds of sustained eye contact by the end of the program. Overall, the students demonstrated significant enhancements in their question-asking and answering abilities, primarily during interactions with their teachers. Behavioral indicators, such as relationship-building and verbal communication, improved considerably, with increases of up to 51% in some areas, underscoring the positive impact of chess instruction on social and cognitive development.

5 CONCLUSION

Chess teaching affected kids with ASD more as the experiment proceeded. We found key factors that determine chess's developmental value for these children by carefully examining qualitative and

quantitative data. The main findings and their implications for teaching are summarized below:

The extent of speech development is essential for acquiring chess abilities. Children with enhanced verbal skills tend to comprehend chess principles more rapidly, indicating that linguistic development can substantially affect cognitive processing and the strategic thinking necessary for the game.

Behavioral traits significantly influence chess proficiency. Various behavioral manifestations, like repetitive activities or restricted interests, might either impede or facilitate a child's capacity to concentrate, adapt, and participate in the game. Comprehending these subtleties is essential for customizing chess education to address individual requirements.

The project participants unanimously agree that chess positively impacts children with ASD, although they concede that the specific processes via which chess affects cognitive and social development are still ambiguous. Additional research is required to comprehend how chess induces these advantageous transformations in domains such as problem-solving, social engagement, and emotional regulation.

The integration of personalized education and cooperation in chess classes, coupled with active engagement with parents and the wider professional community, has demonstrated significant efficacy. Creating tools such as progress diaries not only facilitates children's educational development but also substantially improves the project's durability and effectiveness.

The project has resulted in a significant enhancement in multiple facets of children's conduct, encompassing their capacity to inquire and respond, sustain eye contact, engage in verbal communication, and cultivate positive relationships with peers. These advancements illustrate the transformative capacity of chess when included in a systematic educational framework.

The pleasure of children and the quality of their communication and interactions were identified as crucial measures of the program's effectiveness. Facilitating an attractive and socially engaged learning experience is crucial for motivating children and cultivating a supportive environment that promotes their development.

Prioritizing personalized teaching strategies, systematic assessment, and active collaboration with all stakeholders - such as educators, parents, and specialists—can result in substantial improvements in children's cognitive, social, and communication abilities. This comprehensive technique not only aids children with ASD in the near term but also establishes a foundation for their long-term growth and integration into wider social and educational environments.

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