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Chess as a Powerful Educational Tool for Successful People

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Abstract

*In accordance with the challenges brought out by modern times, it is necessary to adapt to the new circumstances in the field of education. Classical education programs do not provide enough opportunities for individual development, so recently there are many noticeable attempts to refresh existing programs through the introduction of new educational techniques with the aim of better knowledge acquisition in school and preschool age. One of those new techniques is the use of chess, which has proven to be an excellent educational tool through its beneficial factors. Important benefits can be divided into cognitive elements: concentration, memory and logical thinking, as essential skills for the development of each individual; critical thinking factors: improving the ability to assess strengths and weaknesses, establishing value judgments and making decision; and improving creativity through problem solving. Along with these main factors, there are causal-connections with better results in mathematics, improvements in attitude and general behavior, as well as in literacy. What is actually the main advantage of using chess as a formal or informal learning tool in education is that all these benefits can be gained while playing, which is exceptional value in preschool and school age! It is important to emphasize that the chess program also allows to teachers certain freedom for their own creative expression in program implementation in order to raise the attention of children. The aim of this paper is to present in more detail the process of introducing chess as possible education tool in Croatia (and applicable in other countries). Advantages achieved in correlation to the existing programs should be point out, as well as the skills acquired through contact with chess that become one of the most important skills with which individuals can compete in a competitive la*bor market and in their further life roles, even at the highest management levels.

Keywords: *chess, cognitive abilites competitive skills, creativity*

Track: *Education*

Word count: *7.684*

1. Introduction

Chess is a new way of solving the old problem of poor education. From the streets of Johannesburg to Venezuela's public schools, chess has beeen implemented as an effective tool for teaching students (the term students refers to both genders and will be used in the same meaning through the whole article) to utilize their higher order thinking skills and to strive to overcome personal problems to reach their full potential. And, there is overwhelming resarch demonstrating the benefits of chess in the schools. Chess in primary education curriculum for the first time occurs in the late twentieth century, in Canada and the United States. In that way, a game of chess, as a spiritual activity whose sources date all the way back to the past, begins to adapt to educational standards and teaching goals. The education of young generations, when facing the challenges of continual and rapid changes in the world,

requires finding new and more successful models of teaching. The game of chess can be considered a model of solving complex tasks in changing circumstances. Thus this ancient game, which already has been present in many countries in schools through chess sections and extracurricular activities programs, adapted to educational standards and fully put into teaching. This was a result of many studies conducted, which not only point to the usefulness of playing chess, but also underline increasing flexibility of the educational systems which, in the search for more modern methods of teaching, place students at the center of that process and emphasize the need to develop all of their creative potential. The education and training of young generations, who will have to deal successfully with the challenges of the world in constant change, can found in chess a valuable teaching tool because it is by its very nature a model of solving complex tasks in changing circumstances.

The aim of this paper is to structure the present partial analysis of the particular advantages of chess for the purpose of education, to explain them in detail and at the same time to set up a model in which these benefits will come to the fore. Defining the clear goals that are to be achieved with the implementation of the elements mentioned in this paper, would create the preconditions for upgrading the existing curriculum both in Croatia and other countries as well.

1.1. European Parliament Declaration

The project's major support was given by the 2012 European Parliament Declaration, which encourages member states to encourage the introduction of the 'Chess in Schools' program into their education systems, and the Parliament's committees to pay attention to the program in the debate on sport and to provide sufficient funding to its implementation from 2012 onwards. Main points of the Declaration to implement the project:

- whereas chess is an accessible game for children from every social group and can help social cohesion and contribute to policy objectives such as social integration, combating discrimination, reducing crime rates and even the fight against various addictions;
- whereas whatever the age of the child, chess can improve children's concentration, patience and persistence and can develop the sense of creativity, intuition, memory, and analytic and decision-making skills; whereas chess also teaches determination, motivation and sportsmanship;

1. Calls on the Commission and the Member States to encourage the introduction of the programme 'Chess in School' in the educational systems of the Member States;
2. Calls on the Commission, in its forthcoming communication on sport, to pay the necessary attention to the program 'Chess in School' and to ensure sufficient funding for it from 2012 onwards;
3. Calls on the Commission to take into consideration the results of any studies on the effects of this programme on children's development

2. Educational research

Numerous studies and academic research has been conducted in various locations around the world, showing that playing chess has a beneficial effect on the development of mental abilities of students (e.g, in increased scores on standardized tests for both reading and math) which contributes to success in overcoming all educational tasks. Following are highlights of some of these studies:

1965 – In Moscow, a facultative course on history and chess theory at the University of Muga was introduced. From the next year, chess got a permanent position at the Faculty of Physical Culture.

1969 – Ph.D. Hans Klaus, the Dean of the University of Hamburg, in his speech at the 40th World Chess Congress, commented on the results of studies conducted in Germany: ''Chess

helps human psyche in developing new methods of thinking and learning chess is useful from a very early age. Instead of traditional learning methods, learning through play will always be more fun for children.‘’

In a 1973- 74 Zaire study, conducted by Ph.D. Albert Frank, employing 92 students at age 16- 18, the chess- playing experimental group showed a significant advancement in spatial, numerical and administrative- directional abilities, along with verbal aptitudes, compared to the control group. The improvements held true regardless of the final chess skill level attained.

1989-92 New Brunswick, Canada study, using 437 fifth graders split into three groups, experimenting with the addition of chess to the math curriculum, found increased gains in math problem- solving and comprehension proportionate to the amount of chess in the curriculum.

1991-92 Ph.D. S. Margulies conducted a study in New York which assessed the reading skills of 53 students (chess program participants), compared to 1.118 students who were not part of that program. The Chess group achieved greater progress compared to the control with results that were statistically significant at 0.1 level (probability of random outcome is 1%). After this study, the city of New York prepared a program for introducing chess in the teaching of all elementary schools.

In a 1974- 1976 Belgium study which was performed on a sample of 40 students of average age of 10.6 years, a chess- playing experimental group of fifth graders experienced a statistically significant gain in cognitive development over a control group, using Piaget’s tests for cognitive development. Perhaps more noteworthy, they also did significantly better in their regular school testing, as well as in standardized testing administered by an outside agency which did not know the identity of the two groups. Quoting Ph.D. Adriaan de Groot: ”In addition, the Belgium study appears to demonstrate that the treatment of the elementary, clear- cut an playful subject matter can have a positive effect on motivation and school achievement generally.’’

In a 1977- 79 study at the Chinese University in Hong Kong by Ph.D. Yee Wang Fung, chess players showed a 15% improvement in math and science test scores .

A four- year study (1979- 83) in Pennsylvania found that the chess- playing experimental group consistenly outperformed the control groups engaged in other thinking development programs, using measurements from the Watson- Glaser Critical Thinking Appraisal and the Torrance Tests of Creative Thinking

The 1979- 1983 Venezuela “Learning to Think Project,” which trained thousands of teachers to teach thinking skills and involved a sample of 4,266 second grade students, reached a general conclusion that chess, methodologically taught, is a incentive system sufficient to accelerate the increase of IQ in elementary age children of both sexes at all socio- economic levels.

During his governor’s teachergrant from the New Jersey State Department of Education, William Levy found that chess consistently (1980- 1987) promoted self- esteem after a year of exposure. Many students’ self- images improved dramatically.

1982 – Former United States Minister of Education, Terrel Bell, in his book, 'Your Child's Intellect,' states: 'The best and most fun method you can apply to encourage your child's intelligence is to show him how to learn and play chess!'.

According to a two- year study conducted in Kishinev, under the supervision of N.F. Talisina, grades for young students taking part in the chess experiment increased in all subjects. Teachers noted improvement in memory, better organizational skills, and for many increased fantasy and imagination (Education Ministry of the Moldavian Republic, 1985).

In his 1986 pilot study, Ph.D. Ferguson found that it is possible to enhance achievement by focusing on individuals’ modality strengths, creating a individualized thining plan, analyzing

and reflecting upon one's own problem solving processes, sharing his/her thinking system with peers, and modifying the system to integrate other modalities.
During the 1987- 88 "Development of Reasoning and Memory through Chess,'' all students in a rural Pennsylvania sixth grade self- contained classroom were require to participate in chess lessons and play games. No one of the pupils had previously played chess. The pupils significantly improved in both memory and verbal reasoning. The effect of the magnitude of the results is strong (eta 2 is .715 for the Memory test gain compared to the Norm). These results suggest that transfer of the skills fostered through the chess curriculum did occur.
1990- 92 study using a sub- set of the New York City Schools Chess Program produced statistically significant results concluding that chess participation enhances reading performance.
"Playing Chess: A Study of Problem- Solving Skills in Students with Average and Above Average Intelligence," a study b y Philip Rifner, was conducted during the 1991- 1992 school term. The study sought to determine whether middle school students who learned general problem solving skills in one domain could apply them in a different domain. Data indicated that inter- do main transfer can be achieved if teaching for transfer is an instructional goal.
In a 1994- 97 Texas study, regular (non- honors) elementary students which participated in a school chess club showed twice the improvement of non- chess players in Reading and Mathematics between third and fifth grades on the Texas Assessment of Academic Skills. During the 1995- 1996 school year, two classrooms were selected in each of five schools. Students (N = 112) were given instructions in chess and reasoning in on classroom in each school. Pupils in the chess program obtained significantly higher reading scores at the end of the year. It should be noted that while students in the chess group took chess lessons, the control group (N = 127) had additional classroom instruction in basic education. The control group teacher was free to use the "chess period'' any way he/she wanted, but the period was usually used for reading, math or social studies instruction. The control groups thus had more reading instruction than the chess groups. Even so, the ches groups did better on the reading post- test; therefore, the gains in the chess groups were particularly impressive

2.1. Chess affects both sides of the brain and improves mathematical abilities

Logic games like chess are a challenge to the brain and stimulate dendrite growth by sending signals from the neuronal brain cells. Dendrites are an integral part of the neuron, and with more dendrites the nervous system improves and thus affects brain development "Knowing chess rules, basic principles, and to have knowledge of some chess opening is within easy-to-reach educational goals, accessible to almost all students." In Germany, a study was conducted involving chess experts and beginners. The study examined at activities in the left and right brain hemispheres. The left half is logical, analytical and rational, and the right half is sensual and intuitive. The research has shown that chess experts use both sides of the brain when it comes to reactions to shapes that are shown to them, and they also used both sides of the brain to answer questions about chess positions faster. A recent German study, in which traditional math classes were replaced with chess lessons, had an impact on increasing the results on mathematical tests. Various studies on chess and mathematical abilities of children in schools have also been conducted in Croatia, and the article written by Darija Brajković has raised it to a higher level by setting mathematical tasks on chessboard. Chess increases the ability to think about the problem in advance and improves memory.In a chess game, players play the moves they think of during the game since almost all games are unique. Players are thinking of few moves ahead to develop a plan of the game, and how to execute that plan till the end. All this affects on the ability to evaluate, plan and solve problems, as well as memory improvement.

To point out the benefits that chess can yield during the educational process, it is necessary to take into account experiences collected at several levels. Psychological research has provided a deeper insight into the thought processes that take place in the mind of an individual during chess games. At the empirical level, psychological researches were carried out where chess players were used as means to examine the cognitive process in creative task solving. In that way the interest for chess was stimulated by A.Binet along ago in 1894 while studying the traits of human memory. Exploring the ability of chess players to play without looking at the table, he concluded that they were using imagination, experience and memory. A deeper insight into the chess process of thought was contributed by A. De Groot, explaining the way in which the choice of moves is made or the search for an optimal solution. This process takes place in a number of stages: initial gathering of information, examination of options by calculating particular variations, evaluation and selection of probable best options, checking of previous operations and final selection for a solution. Prior to the final decision, the player often returns to the previous stages and reconsidered the rejected combinations of moves, now with new ideas and knowledge, where each stage leads to a better understanding of the problem.

Chess is a game with definitive solution, however this solution requires examination of immeasurable number of possibilities, expressed in a typical tree-like branched structure. As this structure is too large for human mind to explore it, people approache the problem solving by dividing it into smaller areas of tasks, when processing is available to their abilities. In doing so, a good player uses the following analytical method (methodology): defining a problem, dividing a complex task into smaller entities, etching solving tasks, synthesizing the whole thereby continually undergoing an analytical process of evaluation position and synthesis of the treated material for the purpose of formulating the optimum plan. The aforementioned way of thinking also makes the basic value that chess can offer, so it is important to determine if it is present in the simple form in which the students can adopt it.

This methodology and way of thinking are the fundamental values of chess game that contribute to the development of intellectual ability of students and improving their achievements in all educational areas. “Creativity is the most important aspect of chess on the master level, but can chess stimulate creativity and level of beginners?“ - Question asked by Dr. R. Ferguson in his study 'Teaching the fourth' R 'through Chess.

The results of his research, as well as numerous others in the last thirty years, indicate that chess really affects the development of cognitive abilities of students and their achievements in teaching. These studies, unlike the aforementioned, are primarily carried out to clarify the issue of role of chess in education.

3. Benefits of chess for children

The benefits of chess for children are enormous, it is a fact. Chess makes kids smarter, through learning chess, children develop or sharpen the following skills:

Focusing – Children are taught the benefits of observing carefully and concentrating. If they do not pay attention to what is happening, they can’t respond to it, no matter how smart they are.

Visualizing – Children are prompted to imagine a sequence of action s before it happens. We actualy strengthen the ability to visualize by training them to shift the pieces in their mind, first one, then several moves ahead.

Thinking Ahead – Children are taught to think first, then act. Teachers should teach them to ask themselves “If I do this, what might happen then, and how can I respond?” Over time, chess helps develop patience and thoughtfulness.

Weighing Options – Children are taught that they do not have to do the first thing that pops into their mind. They learn to identify alternatives and consider the pros and cons of various actions.
Analyzing Concretely – Children learn to evaluate the results of specific actions and sequences. Does this sequence help me or hurt me? Decisions are better when guided by logic, rather than impulse.
Thinking Abstractly – Children are taught to step back periodically from details an consider the bigger picture. They also learn to take patterns used in one context an apply them to different, but related situations.
Planning – Children are taught to develop longer- range goals and take steps toward bringing them about. They are also taught of the need to reevaluate their plans as new developments change the situation.
Juggling Multiple Considerations Simultaneously - Children are encouraged not to become overly absorbed in any one consideration, but to try to weigh various factors all at once.

There are other benefits as well are:
Mathematics Development
– Adding and Subtracting
– Division
– Multiplication
– Introducing numbers
– Counting
– Categorizing
Algebraic Concepts and Pre-Concepts
– Spatial Orientation / Directions
– Graph Reading & Coordinates
Pre-Reading & Writing Skills
– Shape recognition
– Fine motor skills/ hand-eye coordination
– Word and sound recognition (Listening exercises)
– Visual memory
Life Skills Development
– Creativity
– Colour and Pattern recognition
– Steriognostic development
– Planning & Strategic thinking
– Reasoning & Problem solving
– Comprehension

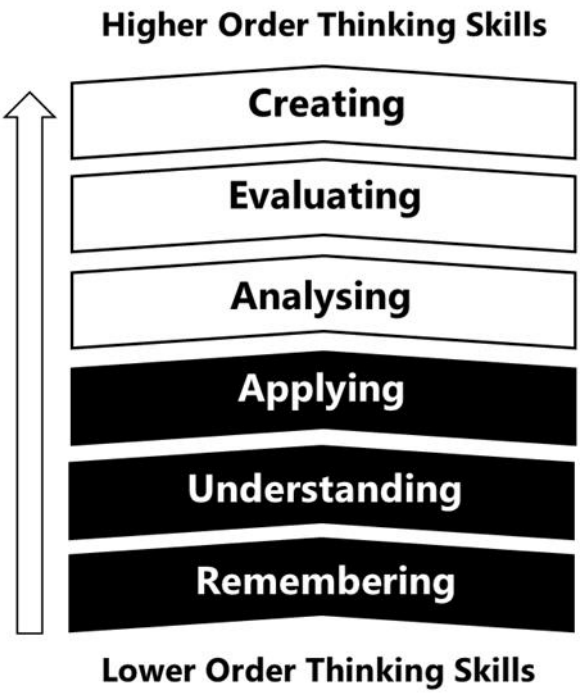

Figure 1: Thinking skills

Applying, understanding and remembering are skills which current educational curriculum offers to children, however with chess it is possible to develop more valuable skills like analysing, evaluating and creating. Can the abstract skills and knowledge, which chess undoubtedly develop, in time find their real use in solving everyday life tasks? The answer would be that chess works on the development of certain abilities, its role can not be regarded as special because it is surely possible to develop these abilities with some other creative activity. However, attractive part of chess as an educational asset lies above all in the exceptional suitability of a form that allows creativity to develop through the game.
The beneficial role of chess also can be seen through the prism of the experience and the opinions of those who are involved in the process. Although their estimations have avoided the strict statistics judgement and have not gone through reliable standards of scientific research, it is about people whose long-standing observations and thinking about the subject are a sufficient reason to take them into account. After all, we already owe the already familiar opinions about the positive role of chess to that great community of chess professionals, coaches, pedagogues and other chess fans who created and revealed them on the basis of their own experiences. Adopting such a standard allows to point out the following positive aspects that learning chess can bring to young people:

- *Chess teaches how to solve problems* - "Learning how to think is more important than learning a solution to a problem. Through chess, students learn how to analyze the situation, focusing on important factors, and how to reach a creative solution to the problem."
- *Chess rewards perseverance and patience in solving tasks*.
- *Chess encourages originality, inventiveness and imagination* - because it is an inexhaustible source of unknown situations that require far more than memorized solutions
- *Chess requires consistency in implementing your own ideas.*

- *Chess develops self-confidence, realistic assessment of one's own abilities and respect for the opponent* –since it develops sence for value of success which is not accidental. On the other hand, even world's champions lose their games and learn from other players.
- *Chess teaches responsibilities* - because it teaches independence in decision-making; learns that only persistent work brings results ..
- *Chess is a model of the world in constant change* - it offers endless selection of new positions, subject to constant changes, and demands new approaches and solutions.
- *Chess develops memory* - chess content steers to developing memory patterns instead of individual data.
- *Chess requires the ability to provide high-quality information processing and decision-making speed* - the amount of information processed in the search for a solution is huge and decisions are always made in the context of time constraints.
- *Chess quickly reveals superficiality, rashness and other negative aspects of behavior* - because it inevitably results in errors and poor solutions. Chess is an effective tool for detecting them, but it also helps for their removal.
- *Chess teaches logical and effective thinking* - the positive outcomes come with constant search, evaluation and selection of the best opportunities.
- *Chess connects children independently of the social and economic status of the family and the environment they come from*.
- *Chess helps in socialization and the prevention of harmful habits* - a large number of young people in the poor neighborhoods of American megapolises found protection from harmful street life and self-esteem in systematic school chess activities.
- *Chess crosses the boundaries and opens the door to the whole world* - we are in the period when playing a game and watching important competitions online is enabled for everyone. A game partner can be found at any time, competitions can be visited and join the expert commentaries - daily and on all continents.
- *Chess protects against harmful impacts in the virtual world* - the Internet does not provide enough protection against the choice of harmful and destructive content. Instead in chess, demolition, destruction and selection of solutions that do not respect the position of the rival is unknown. Chess is preventative for youngsters because its contents and built-in values emphasize the importance of cooperation, respect for diversity and different opinions.
- *Chess is fun. Chess is a game*.

Benefits of applying chess in socially vulnerable parts of the population:
- Reduced delinquency
- Reduced drug use
- Improved ethical sense
- Improved discipline
- Improved sense of fairness
- Integration of minorities
- Improved social mobility

4. Chess in school program

A brief historical review and preconditions of further development:
1984 – World chess federation (FIDE) establishes Commission for “Chess in Schools“
1985 - In Canada, “Chess & Math Association“ was established, devoted to introducing chess to schools. Soon after, chess with the program 'Challenging Mathematics' became part of the

curriculum. The program is intended for the age of 2 to 6 years. Province of Quebec was first to introduce chess in schools and soon achieved the best rating in Canada, while also Canada achieves better results than the US in international math competitions.
1986 – Faneuil Adams (the successor of John Adams, 2nd President of the United States) the President of "America's Foundation for Chess" is launching a chess project in Harlem and Bronx schools in New York (USA) as part of the fight against bad habits in young people. Children who were involved in chess activities raised ratings by 17.3% while children focused on other activities achieved an improvement of 4.56%. The chess has also had a significant impact on the socialization of children with behavioral problems. It was the beginning of the 'Chess in the Schools' project that is currently present in 160 schools, of which 95% are in economically poor neighborhoods.
1989 – The Province of New Brunswick, Canada, introduces the chess program "Challenging Mathematics" to all elementary schools in the French sector. After several years the French sector achieved significantly better results in mathematics than the English sector.
1992 – The State of New Jersey (USA) was first to introduce chess as an elective subject in the curriculum of the US primary schools.
Chess Olympiad report from Turin (2006) mentioned that 30 countries have already introduced, or started introducing, chess into the curriculum. How big the project is, can be show from geographically diverse list of the included countries, among others the USA, Canada, Venezuela, France, Argentina, Australia, The Philippines, China, Turkey, Iceland, Norway, Sweden, Spain ... The same report also says that almost 70 countries have been involved in some form of extracurricular chess activities. The list of countries that introduced chess as an electoral subject today includes also our neighbors - Slovenia, Serbia and Montenegro.
Past experience in other countries suggests that the cooperation of sports and education structures is crucial in creating the conditions required for successful implementation of the project. As an example of the environment in which the system of school competitions and chess activities is highly developed, France can be taken, with a significant progress in 2005, by introducing chess in "teaching time". Since 1994, the Chess Federation has been involved in the training of instructors and trainers, and has thus become competent to issue a permit for school work. FCF was offering training programs to interested teachers, as well as to members of chess structures who have already acquired the initial level of coaching and want to engage in work at schools, the possibility of further professional training with the acquisition of the necessary qualifications. By offering a permanent training process, the constant presence of chess professionals in the project was also facilitated, avoiding the possible adverse effects of single, short training. The partnership of the French Ministry of Education with the Chess Federation continued by signing the "Convention of Chess in Schools introduction 2011-2014" which identified the areas of responsibility and action in the further development of the project.
Kasparov Chess Foundation in Africa – KCF in cooperation with the "Moves for Life" program has taught more than 50,000 students since its inception in 2011, mostly in South Africa.
Kasparov Chess Foundation in Europe – Endorsed by the Europeaan Parliameant, the "Chess in European Schools" program is being customized for schools across its 27 member states and beyond.
Kasparov Chess Foundation in the USA – is present in more than 3,500 schools in all 50 states.

4.1.Chess in school – subject curriculum recommendation

Educational contents (teaching topics and educational outcomes)

1. What is chess?
Development of social competencies:
-mutual acquaintance of students in the group through discussion of chess
- learning about the student's precepts and the pre-conceptualization of the chess game, raising awareness of the social value of this game that promotes respect for the rules, responsibility, patience, persistence, politeness in mutual behavior

2. Origin of chess and legends about it
Development of social competencies:
- awareness of the value of communion, unselfishness, coexistence with other people in the community
Legends about chess can be very instructive for students, there are many stories from ancient mythology about different social games and chess is no exception. One of the most well-known is about Greek hero Palamedes, who invented chess during the siege of Troy, to spare the troops their time. While playing the game the Greeks have noticed that a knight can enter the opposite camp and attack the weak points when the position on board is closed and tends to equal outcome. Soon after this discovery, clever Odysseus invented the creation of the famous Trojan horse by which Troy was finally conquered.
Also well known is following story: Once in India, a sage and a mathematician called Sissa Ben Dahir lived. He was always troubled by the fact that people were fighting each other and so he invented a game for peaceful resolution of military conflicts of the name "chaturanga". Chaturanga literally means a four-part and the game itself reflects the composition and order of the then Indian Army that consisted of the following units: infantry, cavalry, elephants (nowdays bishops) and chariots (rooks). In the middle were the raja (king) and his counselor (queen). After thinking a lot about the game and playing many games with himself, Dahir offered the game to the greatest ruler of India at that time - emperor Sharma. The monarch was so thrilled with the game that he decided to reward the wise sage with whatever he wanted. After a brief thought, Sissa Ben Dahir said he wanted a wheat for reward and that the amount should be counted as follows: On the first square of the board, place one grain, on the next one two, on the third four, and so on doubling to the last, sixty-fourth square. Surprised by the modesty of the reward, the monarch ordered to begin immediately with the gathering of grains.Soon after the order was issued, the monarch's advisers calculated that so much grain does not exist anywhere in the world, let alone in his empire. After a couple of days of consideration, the monarch came in and said to the wise man: "Dear good man, surprised with your modesty I insist on receiving the reward in full. As I do believe that no one can be more right than you to check if all the grains are on the number please begin with counting, grain after the grain. As you count my servants will bring you your grain. By hearing this, the sage just smiled and said there is no need for reward then and left. Today, chess squares in India are called similar to granary. The total number of grains in the legend is 2 power 64 or 1844674407709551616.

3. Chessboard
Development of mathematical and learning competencies:
- learning about spatial relationships (observing the rhythm of white and black squares and the need to mark certain squares)
- creative problem solving during a game in pairs "Guess where I am?"

4. Movement on a chessboard
Development of mathematical and learning competencies:
- learning about spatial relationships

- awareness of the need to get acquainted with(and mark the direction or path) of a movement

5. Identyfing squares on a chessboard
*Development of mathematical competencies**:***
- learning about spatial relationships
- awareness of the need to accurately identify and mark the position of the body in space and on the chessboard(notation)

6. Hide and seek play on chessboard with notation
Development of mathematical competencies:
- learning about spatial relationships
- remembering the notation of each square

7. Familiarizing with chess pieces(pawns, knights, bishops, queen, king)
Development of learning competencies:
- learning about the name and shape of all pieces, their number and initial position on the chessboard
- learning the exact setting of the chess board (a1 = dark square) and that each piece is placed exactly in the middle of one square
Development of social competencies:
- awareness of the need for firm and strict compliance with the rules
8. Diversity in chess
8. 1. Pawns movement and promotion
Development of learning competencies:
- observing, defining and remembering pawns unique characteristics in relation to other chess pieces:
a) numerous
b) limitation of movement in only one direction (forward for one square)
c) taking pieces in different movement
d) two-steps move from the starting position
e) conversion capability
- learning to extract essential details from the whole
- linking the information extracted into new units
*Development of social competencies**:***
- patience and follow-up of opponent response to the game
- self-control exercises and delay of rewards
For instructive purposes student's should start to play games without pieces, just pawns, first who comes to the end(promotion) is winner. After that one by one piece should be added so that students can easier grasp the basics.
8. 2. Castling in chess
Development of learning competencies and problem solving:
- getting to know the situation when castling is possible in chess
- understanding the need and importance of castling
- development of play and simultaneously applying of all the rules that have been learned so far
Development of social competencies:
- self-suppressing, thoughtful behavior and compliance with learned rules of the game

9. Codes of the polite behavior of two players involved in a chess game
Development of social competencies:

- familiarizing and learning about the ways on polite behavior of opponents in a chess game
- self-recognition, self-suppressing and consistent compliance with the rules of courteous behavior during chess games

10. Chess and mathematics
Development of mathematical and learning competencies:
- recognizing the relationship between math and chess
    a) defining dark or white squares by mathematical operation
    b) determining the value of individual squares in the magical quadrat 3x3(only one soquare as a solution) by memorizing the movements of chess pieces
- solving the magic quadrats by applying the learned rule
Development of social competencies:
- socializing, mutual respect and appreciation during chess games

Competencies which students can acquire through training
a) social competencies (the ability to respect and apply socio-cultural and educational values)
- ability to create good relationships with peers, understanding the situation and opinions of other students
- ability to accept and respect set of values, beliefs and personality of other people
- ability to create environment in which they feel accepted and successful
- ability to effectively handle emotions
- self-confidence and trust in personal abilities
- organizational capability: planning and setting goals, managing and solving problems
- ability to collaborate in learning and communication, solving problems through discussion and conversation
- ability to be responsible and independent in decision-making
- ability to responsibly carry out undertaken tasks
- ability to recognize the consequences of their own and other views and actions
- skills for solidarity and polite behavior, mutual help and acceptance of diversity
- ability to perform in public and speak to others.

b) work competencies
- ability to define the project and set goals
- skills to perform complex tasks requiring careful planning, realization, analysis and evaluation of work results
- ability to determine priority objectives and their development
- ability to use the resources needed to achieve multiple goals
- ability to steadily and patiently fulfil undertaken tasks
- ability to monitor and evaluate project progress and adaptation to new circumstances during work
- ability to consistently carry out their own ideas

c) competencies for communicating, learning and solving problems
- ability to interactively use languages, symbols and technology
- ability to interactively use knowledge and information
- ability to understand spatial relationships, correct perception and clear idea of object position in the space, percepting and predicting changes of position
- developed mathematical skills (identify and define unknown, organize knowledge and information

- ability for quality information processing: analysis of the situation, identification of causes and anticipation of the consequences of certain procedures, proofing and verification of solutions, linking and comparing data, conclusion ...
- ability for original and creative handling in unknown situations (chess game is an inexhaustible source of unknown situations)
- ability to perform convergent thinking operations that result in good logical and mathematical conclusions
- ability to perform formal-logical operations that are a precondition for success in mathematics, grammar, physics, chemistry, geography, and all other areas of learning in which knowledge is based on a formal-logical conclusion

4.2 .Principles for achieving successful chess in school curriculum

- Chess in schools must allow students to connect and make friends, regardless of the social and economic status of their families and background
- Each student is entitled to maximum development of his or her abilities.
- The basic knowledge which student acquires at school is the basis for further learning and advancement in chess clubs
- In the Chess School, the social-emotional and educational needs of each student, especially those who find it difficult to meet the requirements of regular school work, will be respected
- The educational program, methods and procedures will be based on contemporary scientific knowledge
- Educational activities in the Chess School will be based on true respect for every child and every person as well as on the dignity of a human being

In this sense, students need to be taught and prepare to live by the demands of the changing world, which requires highly developed cognitive abilities, abilities of abstract thinking, abilities of independent learning and independent problem solving, permanently developed intellectual behaviors, and abilities to achieve human interpersonal relationships. The game of chess, which in its essence carries the features of a model for solving complex tasks, bestows its value to those who are ready to constantly develop the abilities that are mentioned.
The impulse in the development of scholastic chess, enhanced by the knowledge of the useful role of chess and the more open standards in education, has brought other positive steps. Thus, the initiative to introduce chess into the curriculum is increasingly taken up by the most developed countries, in which research on the potential benefits of chess in the education process has taken place, and in places where chess has not yet been given green light, public debate about its introduction has been, or is being, attempted to experimental programs. The World Chess Organization (FIDE) puts the “Chess in Schools“ project among its priorities, and the FIDE's election campaign recently was unmistakably bringing slogans to this topic as well. The Congress of the USA discusses the introduction of chess in schools, while the FIDE programs emphasize: The goal of chess in schools is not to create professional players-grandmasters. The most important goal is to teach chess and to provide the youth with an educational tool in their life.
Along with the steady increase in support, the project also gains insight into the widespread distribution of chess between young people and the fact that a noble game leaves its mark on all levels: „Playing chess helps students in developing thinking and analytical skills, concentration, greater self-control and self-confidence ... We have reliable indicators to show that chess in schools works positively.“ W.J.Clinton's words. The former US president participated as a colleage student in the chess academy at Georgetown University and was admitted to introducing chess to US school. But he is only one of a number of well-known

national leaders who publicly support the project. M. Gorbachev is an honorary sponsor of the "Chess in School" FIDE project since 2011.

4.3. Chess in school in Croatia through past activites

Chess has been a part in the educational system so far through the extracurricular activities of school chess sections. These activities, thanks to the more opened choice of methods for implementation of the educational work, allowed the students to realize the learning and development of skills and abilities in a significant way through creative play and sporting competitions. This way of achieving program content is essential and irreplaceable, so even after introducing chess in teaching, it should be further developed. What is difficult to implement in elective chess lessons (for example: assessing competitive qualities or taking into account the results achieved in a practical game), as part of extracurricular activities gets its scope for implementation. This would also ensure a practical assessment of the knowledge gained within the course, of course for those students who show such interest. A whole range of useful features that can be promoted in the development of children's chess (as was mentioned before) are emphasized through this link between educational methods and teaching methods, so chess as a teaching subject gets a special educational dimension.

In our larger centers, such as cities Zagreb and Rijeka, extra-curricular work with children is additionally organized through the activities of sports schools. So in Zagreb, since 1977, chess section in schools were organized, so today we have many chess schools that organize work with students. These schools are under the jurisdiction of the sports federation, and the professional pedagogical work is carried out by teachers-managers of chess sections and chess instructors as external associates. The system of school competitions is organized at all levels (school, city, county, state), with the Association of Student Sports Clubs as the main bearer of these activities. The championships take place in the competition of teams and individuals, where the latter are divided into groups of up to 9, 11, 13 and 15 years old. According to a research by the Croatian Chess Federation in 2014, 190 schools, with just over 4000 students, had chess section. In Croatia's capital, city of Zagreb, according to City Office for Education survey in 2013, 85 high schools with 438 students had chess section and 108 primary schools with 1860 students. At the moment, almost two hundred primary schools and student dorms in Croatia are holding extracurricular chess activities. Over 4000 students and about 150 managers of these activities are involved. Most of them are the staff of the schools where the activities take place, but about one third are external associates who already have chess qualifications. Teachers /chess section managers are, to a lesser extent, qualified instructors and lower chess players, who already possess a sufficient base of chess lessons for teaching, and for the most part chess fans who need additional professional training.

In the preparation of the program, it is also necessary to determine the age of students within which chess teaching will be applied. Today, it is generally accepted that the age of 7 to 11 years is best suited for the initial adoption of abstract chess skills. It relies on the well-known psychological theory of J. Piaget, according to which children undergo different development periods of perceiving reality. With the occurrence of specific operations, between 7 and 11 years old, the beginning of logical thinking is emerging in children. In this way it is possible to adopt abstract content in the form of a game, which can also stimulate the further development of the child by the next period. Practical confirmation of this thesis was the inclusion of children under 8 years of age in chess competitions, since FIDE has been taking this age group into account in its official competition program since 2006.

5. Correlation between chess and success in life

According to research in 2012 made by YouGov, global public opinion and dana company from UK, chess players now make up one of the largest communities in the world: 605

million adults play chess regularly, at that time a number comparable to regular users of Facebook. Across varied national demographic profiles (US, UK, Germany, Russia, India), a surprisingly stable 70% of the adult population has played chess at some point during their lives. Even if they played as children, but left it behind as they grew up, they still retain a deep admiration for the game. Across the board, chess players and non-players alike rank chess significantly higher than any other game or sport for attributes such as intelligence, sophistication, strat-egy, perfection and complexity confirming top branding agency Pentagram's view: "Chess is about Thinking and Winning." Most surprisingis the percentage of adults who actually currently play chess (either weekly, monthly or during the past year): 12% in the UK; 15% in the U.S. 23% in Germany; 43% in Russia; and 70% . Further, in the real world, when Enrique Peña became the new president of Mexico, the NYT attributed his success to "the same attention to strategy he applies while playing chess." And, when US trader Boaz Weinstein cleaned up after JPMorgan lost $1.8bn, the NYT explained it: "He is a chess master."But the raw numbers themselves are astonishing: over 6m, 35m, 16m, 50m and 85m people in the U.K., U.S., Germany, Russia, and India (ABC1), respectively, are playing chess regularly and more than half are 18-34 years old. And, when YouGov dug deeper, they found out how people who play chess regularly differ from those who do not. Current chess players are better informed than those who either used to or never played chess: they are 5 times more likely to read The Guardian, The New Scientist or The Week (in the U.K.) or 2.5 times more likely to read The New York Times, The Wall Street Journal, The Economist or The New Yorker (in the U.S.). Although chess has very low barriers to entry and is played across the socioeconomic spectrum, in the U.S. 78% of regular chess players are university graduates and among households with incomes over $120,000, 21% are regular chess-players. Chess is regularly played by a demographic that is the holy grail of sponsors(affluent young educated men, informed, connected and active) and is attributed rare and admirable qualities by 70% of the population, most of whom first played as children (inntelligence, strategy, decisiveness, sophistication, perfection). In the U.S., more people play chess than tennis and golf, combined.

A list of successful people who dedicated their youth time for chess would be too long. They are partly responsible for numerous comments that in time have brought to chess the aura of incomparable intellectual exercise, but also its transformation into a symbol that is now ubiquitous in culture:

Chess is one of the great treasures of mankind: François-Marie Arouet - Voltaire
Chess teaches us not to lose our head in a bad situation and to persistently explore opportunities to get out of trouble: Benjamin Franklin
It is easier to break the atom than the prejudice in chess: Albert Einstein
Human life is a chess game: Miguel de Cervantes Saavedra
The chess game is a test stone of mind: Johann Wolfgang von Goethe

6.Conclusion

There is no parent, who wants to do best for his child, who would not think that the advantages mentioned in this paper are not attractive for the development and upbringing of his child. Then why chess had not taken place in the education system? The answer lies in the inadequate knowledge of benefits of chess which have been explained in the paper with many researches that had confirmed the indisputable benefits of skills development that bring comparative advantage for the individuals at the labor market, and what can even be said, in the mental health of the nation. Considering chess only as a fun playing game means denying the opportunities that are available in children's education by playing chess and just the other way around, it is not a flaw of chess that it is a geme, since learning through the game has so many advantages in today's world because the young generations through the emergence of

new easily accessible technologies had developed the habits of playing which should be utilized to steer them into chess to develop concentration, logic, strategic planning, decision-making and many other skills that can help them in their development. Education systems increasingly turn to the modernization of teaching methods, where the focus places, among other things, on a more creative way of bringing up and adopting educational content. Chess is also suitable for interrelated connections, as indicated by his involvement in teaching within the mathematics program in Canada. To develop highly prepared individuals should be of a great importance for country like Croatia, but for other countries as well, and this paper can be used as a a model for implementing chess in a curriculum system.

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