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Physical and mental exercise to create new congenial neurons, to increase intelligence and the role of ICTs.

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Abstract

Sports activities offer significant benefits to the human body. In addition to the physical benefits that exercise offers, it also provides mental benefits because the human brain is practiced to meet the needs of the sports. The human brain is the one that activates the members of the human body to make the necessary movements. However, over time the brain is not limited to this function but exerts itself on choosing the right movements that will help in taking a specific path to the sport that will lead to an even better performance. This is more visible in games and sports that do not require physical movement like chess. In such games, the athlete is not limited to performing movements but the brain is constantly working because it has to memorize certain movements, remember them, use them in the right order, while calculating the movements of the opponent. Consequently, sports activities offer a strong mental practice to the person involved in the exercise by increasing his or her intelligence, which is used to achieve better performance. The improvement of intelligence is also evident by the fact that the athlete is able to use the moves that are considered best in different situations at different times and with different opponents by appropriately adapting their technique.

Key words: human intelligence, brain activity, physical activity, neurons

Introduction

The theory of multiple intelligences advocated by Gardner has emerged from the concerns regarding the cases where exceptional talents and charismatic skills are identified. According to this theory, there are seven independent types of intelligence. These types are linguistic intelligence, spatial intelligence, logical-mathematical intelligence, musical intelligence, bodily-kinesthetic intelligence, intrapersonal intelligence and interpersonal intelligence. Intrapersonal and interpersonal intelligences relate to one's relationships with oneself and with other people in the context of understanding the behavior, the incentives for action and behaviors, and emotions (Schulze & Roberts, 2005).

The relationship of emotional intelligence with student academic performance has emerged in the research, and this has led to the development of a series of programs focusing on the cultivation of social skills, self- management, problem solving, and a range of other competences that can lead the student to better academic performance. Most of these programs that promote emotional intelligence focus on six of its key perspectives. The first is

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the problem-solving, the second is the perception and understanding of the emotions of oneself and of others, the third is the control of the impulses, the fourth is the regulation of emotions, the fifth is the dealing with stress and negative emotions, and finally, the sixth is the development of the ability to be able to understand the perspective of another person (Schulze & Roberts, 2005).

The concept of intelligence

According to Fagan (2000), the definition of intelligence as a process is also governed by cultural elements and has social implications. He argues that the definition of the term intelligence has brought many conflicting views because of its historical course characterized by the size of a person's knowledge and not how it is being processed. He uses as an example the measurement of the intelligence quotient (IQ) based mainly on the knowledge one possesses compared to other people of the same age. Thus, he shows that while intelligence is measurable and can therefore be measured by a person's performance, but in specific cognitive goals, the intelligence quotient on the other is not based solely on the processing of knowledge but on the content taught to a person, namely the knowledge that has been transferred to the individual. Therefore, it is not only the processing knowledge that is important but its content too. The processing is important because it can cause a change in the state of mind and this is the phenomenon that is called knowledge. The degree of processing depends on the genetic state of the mind and the cultural context since culture is the means of transferring information to humans (Fagan, 2000).

The issue of intelligence has raised conflicting views. For many years, there was the conviction that a number of problems could be solved through the intelligence quotient, such as the accurate measurement of intelligence, and the prediction of one's school performance and professional career. But there were other beliefs about intelligence such as that it is inherited, that it is not being heavily influenced by environmental factors, and that the racial differences in the intelligence quotient may be due to genetic causes, and that factors such as teachers do not have a great impact (Nisbett Et al., 2012).

According to Nisbett et al. (2012), there are many new research findings in the field of intelligence that invalidate these beliefs. First of all, heredity cannot be taken for granted because the factor of the social order is also influential. In addition, genetic factors do not have the great importance that they have been attributed to in the past since no genetic polymorphisms related to the differentiation of the intelligence quotient have been identified. In addition, the environmental factors have proven to be of particular importance especially in cases of adopted children who have been examined and while their biological environment comes from the working class, they are transferred through adoption to middle-class houses. In addition, the research findings have shown that there are changes in the views of the past which were based on factors such as gender and race. In particular, the issue of gender-based intelligence differentiation is partly due to biological factors but also to socializing factors, and the gap between people of different races that existed in the past has now been reduced (Nisbett, 2012).

From the above it can be seen that intelligence as well as the IQ are in fact units of measurement of the human capacity in relation to specific conditions. In 1995, a team of 11

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American psychologists attempted to formulate a definition of intelligence on behalf of the American Psychological Association, according to what was previously known for it. According to this definition, intelligence is a complex phenomenon consisting of the skills and capacities of a person to perceive complex ideas, to change the experience into a source of learning, to be able to justify through different perspectives and approaches, to overcome obstacles and problems through thinking, and finally to effectively adapt to the environment. The only reaction that the above definition faced was the issue of adapting to the environment because this is a skill that all living beings have, which is why they have survived, though this does not mean that they all have intelligence but instead it is a biological and genetic ability and not a mental. Lynn (2006) cited the lowest class in economically developed countries as an example to confirm that adaptation to the environment does not require a parallel and high IQ. This class is characterized by negative conditions such as long-term unemployment, crime and delinquency, drug abuse and other addictive behaviors, and at the family level it is characterized by single parent families whose livelihood depends exclusively on the state, which is a sign of lack of responsibility. However, these people manage to survive, regardless of whether they do so with welfare benefits and to reproduce. However, according to surveys their intelligence quotient is low and cannot be considered intelligent according to the way and standards of measuring intelligence (Lynn, 2006).
From the above, it appears that the definition formulated in 1994 by Gottfredson is more appropriate, covering cases such as the above, which was endorsed and approved by 52 leading experts. This definition refers to intelligence as a very general cognitive ability that includes, among other things, the elements outlined in the previous definition, but it clarifies that intelligence does not just develop through education or learning. It is not an academic skill in order for an individual to be able to respond to specific examinations that demonstrate intelligence but a wider ability that can be used to understand situations and conditions and to invent ways to respond to the challenges and to everything occurring around the individual (Lynn, 2006).

Brain and physical activity

The movement of the body requires the involvement of all human systems. In order for the human organism to be able to respond to the environmental conditions and to deal with the obstacles presented to it, it uses its different skills. Each function also requires a specific skill category (Jetz & Lola, 2015).
The human body systems work together to enable the skills humans need to adapt to the environment. This also applies in learning new moves and skills. Especially in sports and athletes who have a lot of experience, in order to be able to perform during a sport, the systems, members and capabilities are coordinated through its brain. Which systems contribute the most depends on those that play the key role in each activity. This is because sensory organs perceive the stimulus they receive, but their recognition by the brain takes place by comparing them with others. Once recognition has taken place, the brain selects the appropriate response from the ones that exist, and then gives the body the appropriate command to be able to perform the skill needed. This is how the information is processed, the evaluation of which takes place based on the response time. The sooner the individual

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perceives a situation, the more directly the right decision is taken to help in performing an activity effectively. If, for example, a player in a team sport has the ball thrown at him, then this individual perceives the situation, the speed of the ball, the distance, and the direction and chooses the appropriate response, i.e. the movement to be taken, whether he will keep the ball or it he will make a shot or whether he will pass it to another player. His brain then gives the appropriate command to the muscles and body joints to perform the movement chosen (Tzetzis & Lola, 2015).

It should be noted that the choice made by the brain does not imply that it will perform it effectively because this depends on the individual's psychomotor skills. This means that the movement is correct in terms of capture but incorrectly executed. Therefore, in each case the brain's response takes place in three stages:

- The brain understands the environment and the conditions prevailing in it.
- The brain decides what to do and how to do it.
- The brain commands the body to move he muscles and to produce movements (Tzetzis & Lola, 2015).

The processing of information is based on the fact that information received by the human brain is processed. According to this approach, the human brain works in a similar way to the computer by gathering the information collected through the sensory instruments as stimuli. The procedures required for the processing of the information cause functions that in turn create motor activities (Tzetzis & Lola, 2015).

These procedures are interpreted differently. One of these interpretations is the stages in the processing process from which the information passes. These steps are:

- Identification of the stimulus as information
- Selection of the appropriate response per case
- The planning of the response through the commands given (Tzetzis & Lola, 2015).

Therefore, the stages follow a rationale in which humans first perceive and then respond. The environment or the human body provides humans with the necessary information that is introduced into the system and is processed through the stages, successively, with the next being done after the completion of the previous one and the result is the kinetic execution. To understand this, the processing of information through the brain can be compared with a computer that processes the information it receives and provides a result (Tzetzis & Lola, 2015).

The perception is linked to the movement through the motor control that examines the kinetic behavior because there is a belief that there is an interaction and an interdependence between motion and perception as one helps the other and vice versa. Thus, humans understand the environment and their interaction with this takes place through the movement. If humans are engaged in a physical activity in which they have no experience, then they rely heavily on their perception and the information they receive and their kinetic performance is slower. The perception is also the one that creates variations in the movement. If humans realize that they are moving uphill, then their body moves forward for example (Tzetzis & Lola, 2015).

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It should be noted that the connection between perception and movement is that both are activated by the same neurons. This is the reason why when adults try to persuade the infant to open its mouth to feed it, they also open their mouth (Tzetzis & Lola, 2015).
The more the experience of an individual in an activity, the greater the activity of the brain is. This is why when people who are dancers are watching a dance for example, their brains are more active than people who watch others dancing but are not dancers themselves (Tzetzis & Lola, 2015).

Physical activity and increase of intelligence

As shown in the above, intelligence is a complex process that gives people different skills to help them learn what they need in order to adapt to their environment. This is also evident from a series of research findings that show that physical activity offers such skills to children as well.
Spanaki (2014) conducted a research on the effects of psychomotor therapy involving elements of theatrical play on the development of infants with and without special educational needs. Psychomotor therapy was implemented through a special intervention program in kindergartens. Out of the 62 kindergarten students in which the program was implemented, 41 did not have any special educational needs.
The children were selected by random sampling and were allocated in an experimental group and a control group. The design of the intervention program was performed after assessment trials of the children and the experimental groups with the cooperation of the departmental teachers, taking into account the needs and abilities of each student. The implementation of the program was carried out in the experimental groups, while the control groups were attending the regular kindergarten program. The implementation of the program was done twice a week for a period of 10 weeks.
The children of the population with no special educational needs, the motor skills that were assessed included: 1) speed and agility, 2) balance, 3) bilateral coordination, 4) upper limb coordination, 5) long jump, 6) response speed, 7) visual-kinetic coordination and 8) speed and dexterity of the upper limbs. After the implementation of the program, the children showed significant improvements in these skills, especially in skills 2, 4, 5, 6, 7 & 8. The results demonstrated the significant impact of such methods on the child's motor development.
It should be noted that a total of 16 interventions and 16 theatrical activities took place in which the children were involved. It should be noted that theatrical activities were designed according to the theme but evolved according to the children's inspiration and initiative. In addition to all actions and tests, the children were deciding on their own how to participate and how to perform what they had to do. The tests, the motor ability to which they focused and the theatrical activity that accompanied them were as follows:

- Games with fingers - Tracing (fine motor skills) - Pirates who make up their treasure (cutting pieces of magazines with their fingers and sticking them like puzzles).

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- Body movements in a variety of ways (gross motor skills / balance) - Pirates in search (body movements in various ways such as rolling and jumping with the help of chairs, mattresses, etc.).
- Exercises using a ball and a target (individual game) (visual-kinetic coordination)
- -Pirates and treasure (throwing balls in target circles). Bilateral activities (space-body perception) - Games in the river (the children pretend they are paddling while mimicking sounds and the rhythms).
- Balance on objects (gross motor skills) - Save the fish from the oil spill (the children try to go through several obstacles to save as many fish as possible).
- Sports (like a relay race) (gross motor skills)The children try to save the fish from the oil spill (children use buckets, glasses and sacks and try to cooperate with each other to save the fish by transporting them to a lake).
- Shapes with brushes (fine motor skills) - Typographers in action (the children try to write the news of the day using images and shapes on newspapers).
- Orientation activities along with balancing exercises (body movement perception in space) – Selling newspapers (children try to sell newspapers which they support differently).
- Positions and movements (perception of movement in space) – Selling newspapers (moving in the space, front, back, etc.).
- Simultaneous or successive kinetic reaction to sounds (perception of movement in space) - Encountering parades and demonstrations (parading with poles and flags in various ways).
- Bouncing, running, crawling, turning, etc. (gross motor skills) – Routes with obstacles (routes with different obstacles in different ways).
- Balancing on objects (gross motor skills) - In the circus (movement on blocks, tires, ropes, etc.).
- Body shapes, planes, and moving along with an object in use (perception of movement in space) - Planets in the square of the universe (playing with body and ball contact).
- Upper-limb actions and tools-objects (development of fine motor skills) -Old professions (children use different objects and pretend to be professionals and clients in pairs).
- Body stances and contacts, gestures and expressions (non-verbal communication with movements) - The senses animate in front of the mirror (children use different objects, stand in front a mirror and make moves imitating one another).
- Changes of directions, steep, gradual, etc. (knowledge of the body and its abilities - The four elements of nature (children jump, run, turn according to their imagination).

Pavlidou (1998) studied the effects of rhythmic gymnastics on preschool children. The research methodology was research- intervention. The axes around which the program was implemented as an intervention were the following:

- Fine motor skills
- Placement and orientation of the body in the space

- Rhythm
- Creative movement
- Expression
- Understanding instructions and reproduction of moves
- Children's communication relationships
- Breathing-relaxation

The program was applied to two groups of children. One group consisted of 20 children aged 5 to 5.5 years old and the second group consisted of 29 children aged 4 to 4.5 years old. The program was applied to children from October to March, which is about an entire school year. As the program was carried out, the exercises were reformed according to the reactions of the children. The reformation took place in the duration, the form and the plot of the exercises but did not affect the axes that had been set. At the level of structure, over time, the exercises were made more complex in order to stimulate the interest of children who gradually acquired the physical abilities and the experience to cope with them.

The evaluation of the children took place on a regular scale, ranging from 0 to 2. For the child that failed to fulfill the purpose of the exercise or did not want to participate in the activity, the score received was 0. For the child that hesitated initially but then tried to participate and followed the instructions of the exercise, regardless of the result, the score was

1. For the child that participated without hesitation and without delay, the score was 2. The children were systematically observed during the exercises and notes were taken by the researcher.

The results of the research showed that on average they had the level of skill expected for their age in the areas of gross motor skills, perception of space, rhythm, expressive and creative movement and communicative relationships. They were also able to understand the instructions of the exercises satisfactorily because of their perception and linguistic competence. They also managed to correctly reproduce the movements they were asked to do and to properly coordinate movement with their breathing.

While initially the children showed a small amount of creative movement, over time and through their participation in the exercises they developed a satisfactory level. The greatest improvement was observed in the relationship between breathing and movement, the expressive and creative movement and the communication between the educator and the children.

The findings of the research have shown that the expressive arts included in the program, namely music, dance and pantomime, combined with the cooperative game and the main features of the program that was implemented, can improve children's performance. To do this, however, rhythmic exercises should not be limited to rhythm and pace, but in combination with other characteristics and their implementation should be systematic.

Panou (2009) conducted a research on 108 girls aged 5-9 years old. Girls were divided into three groups. In one group, basic exercises and activities of the classic ballet were performed, in the second group rhythmic gymnastics and the third was the control group. The courses lasted a total of 24 weeks. The results showed that groups with rhythmic gymnastics and classical ballet showed a greater improvement in their assemblage abilities.

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Zaragas's (2016) research was carried out through the implementation of a program on 44 kindergarten students (23 boys and 21 girls). The children had an average age of 62 months and attended public kindergartens. The children were divided into two groups, one experimental and one control group. The children in the experimental group received a psychomotor treatment program for 5 months, 3 times a week for 40 minutes. The program included musical activities and dramatization of stories and fairy tales. These activities included improvisation by the children and cooperation between them, always with the guidance and supervision of the kindergarten teacher. In the other group the curriculum of the kindergarten was implemented. The results of the research showed that while the groups initially did not show any differences between them, after the implementation of the program, the group that participated in it improved not only its motor performance but also the social behavior of its members as well as their self- esteem.

The research by Zachopoulou et al. (2003) was also carried out on 72 preschool children. Of these, 34 were girls and 38 boys, and their age ranged from 4 to 6 years. The children were divided into two groups, the experimental and the control group. The children of the experimental group participated in a music and motion program while the others participated only in free-game activities. The results of the research showed a significant impact of the program on all the rhythm objectives set and it was shown that this program can make a significant contribution to the development of rhythmic ability.

Galani (2007) conducted a research on 22 kindergarten children, divided into two groups, one experimental and one control group. The two groups were evaluated before and after the implementation of the program through questionnaires completed by the kindergarten teachers and with tests that were performed on children to assess their psychomotor development on the basis of dynamic assemblage, kinetic memory, spatial orientation and spatio-temporal assembly.

The program applied to the experimental group was based on the theatrical play and activities related to theatrical art. Children in the control group participated in motor activities that included only imitation.

The program was implemented for 7 months and its results showed that the children who participated in it showed significant psychomotor development and also developed their social skills. The theatrical elements included in the program helped children to develop their courage and, by extension, their kinetic performance and social behavior.

The research by Zachopoulou et al. (2004) was carried out on children of 4-6 years old. The children who participated in the program were 90, of whom 42 were girls and 48 boys. Fifty of the children participated in an experimental group in which a music and motion program was implemented for 2 months. The rest of the children were the control group that for the same time followed the basic physical education program.

The results of the research showed that the children who participated in the experimental group significantly improved their dynamic and jumping balance.

Benta's (2010) research included 180 kindergarten children (5-6 years old). Ninety of them attended a 6 week music-kinetic intervention program with two 45-minute lessons per week while the other 90 children were not taught any kinetic program (control group).

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The children were measured before the application of the experiment and no significant differences were found between the two groups. The program was based on the Orff and Dalcroze approach and included the following stages:

- Acquaintance with the musical instruments of Orff's orchestra.
- Knowledge of instruments - playing and orchestrating rhythmic phrases
- Sound properties tone, intensity, duration 4-5. Acquaintance with rhythmic values
- Rhythmic values - measure.
- Acquaintance with pause-action concepts.
- 8-9. Acquaintance with notes - pentagram - song with notes.
- Concept of pitch in music.
- Tempo - rhythm.
- Rhythmic combination - rhythm change.

The measurements after the implementation of the program showed that the children in which the program was implemented developed their rhythmic capacity significantly compared to the children of the other group.

Nasios (2005) investigated 50 children who attended the fifth grade and their average age was 11 years. The children were divided into two groups, the experimental and the control group. Both teams were taught 8 basketball skills:

- defensive slide
- jump-stop
- chest pass
- bounce pass
- set shot,
- lay-up
- triple control
- triple speed.

In the experimental group, these skills were taught with the help of music while in the other normally. The experimental group followed exercises accompanied by music corresponding to the rhythmic motif of each skill. The program lasted for 4 weeks, and after completion, an evaluation was carried out involving 8 tests that took place in both groups. The results demonstrated greater improvement in the experimental group.

Apart from physical activities, sports that do not have intense physical activity like chess can also contribute to the development of intelligence. Chess is a game of intense intellectual activity, and for a long time it was believed that it is totally connected with the existence of intelligence to play chess. This was because most of the investigations only looked at the existence of intelligence in the case of players without considering whether other possibly influencing factors existed (Bilalic et al., 2007).

The connection of intelligence to chess was made because of its important role in many activities such as kinetics in sports that are not considered mentally superior as the chess. But in fact, in renowned chess players there is no connection between their good performance and intelligence. There are many explanations for this phenomenon. One of these is that the skills required in chess are based more on knowledge than on intellect. The chess player learns how

to move based on standards and moves and does not use analytical skills such as research or variance calculations. It has also been estimated that chess players have stored in their memory from 10,000 to 100,000 moves which they use as appropriate. In the case of computer simulations, these moves reach 300,000 (Bilalic et al., 2007). But in order for an individual to memorize the large number of moves and their combination, continuous training is required to help the brain to store them and then to recall them when they are required to play (Bilalic et al. 2007).

Conclusions

All sports activities help people to develop their intelligence, whether physical or mental. They help them to acquire skills by providing information to their brain, which they process appropriately and then recall as appropriate.

One of the purposes of participating in a sport is the victory or the effective performance. However, no matter how mechanically a person has learned some things like chess moves for example, or how to kick a ball or jump, in a game environment the individual is confronted with a complex environment that includes rules, developments and conditions that cannot be predicted, as well as other players. In football, for example, a player needs to make the right move when there is a need to cooperate with fellow players and avoid the opponents to score. The same goes for games like chess. No matter how many moves or combinations the player knows, during the game and with the opponent's moves acting as a stimulus the player should choose the ones needed to be able to make the correct moves.

From the above, it is clear from the sports activities that humans acquire specific mental abilities such as the calculation of their movements, the sharpness, and perception that drive their movements. In this sense, there is a clear contribution to the development of intelligence, since humans can adapt and function effectively in their environment.

Finally the exploitation of digital technologies in training and education domain is very productive and successful, facilitates and improves the educational procedures, but moreover they train mental abilities and the brain to develop new synapses and neuronal paths for perception and reaction in specific space-time demands of the electronic environments, via Mobiles [21-30], various ICTs applications [31-63], AI & STEM [64-75], and games [76-81]. Additionally the combination of ICTs with theories and models of metacognition, mindfulness, meditation and emotional intelligence cultivation [82-105] as well as with environmental factors and nutrition [17-20], accelerates and improves more over the educational practices and results and enhances the brain functions, awareness, speed, perception, self-regulation, adaptability, resilience and finally the intelligence.

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