

NTC Learning System and ICT for Kids Analysis of a Contemporary Innovative Learning Methodology

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Abstract – The brain develops itself mostly until the age of 12. There is a connection between the number of synapsis and the cognitive performance. The NTC system starts from the correct development of the biological potential and ends with the development of complex cognitive functions. One of the biggest change in human life is the massive use of ICT technologies. There are some risks connected to the improper use of the ICT. These risks are presented together with the suggestion to educate the parents as they are the first responsible for how much their kid will use the ICT.

Keywords: movement, NTC learning system, ICT, brain development, learning

1. Importance of movement for kids

Various authors have recognized the importance of the movement for the holistic development of a child. According to Parlebas [8] the emotions, the intelligence and communication skills are connected with the movement. In early childhood the movement shapes the development of the premises

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for a proper cognitive development. Starting from our genetic premises, we shape the development firstly by movement.

Unfortunately, at school we face an underestimation of the motoric education, often relegating it to the discipline of series B, still believing that subjects of series A are the ones treating classical subject knowledge [17].

According to Piaget [10] the movement is interrelated with the development of the cognitive functions. For Montessori [6] the movement is very important as it takes to the knowledge and learning. The materials she has developed are helping the child to learn starting by the perception, which mostly is done by motoric activities. There are researches [2] that have started to use the term “bodymind” in order to express that the body and the mind have to be considered one integrated thing. According to these researches the development of motoric and cognitive functions are deeply connected and cannot be separated. When there is a change in the body, it affects the mind and when there is a change in the mind, it affects the body. Klemola and others [3] stated that the movement is very important as it is responsible for the physical, psychological and social development of youngsters.

Physical exercise has the potential to improve psycho – neuro motoric skills, fosters the development of basic motor patterns and the learning of coordinative and conditional motor skills, helps the acquisition and maintenance of the habit of movement as a lifestyle. By moving, one is constantly confronted with the environment and with others, improving the ability to manage emotions by stimulating and processing sensory information coming from outside and from the body, thus favouring the development of intellectual abilities, language and memory [17 pg. 194/195].

According to Rajović [11], the author of the NTC learning system, the intelligence is connected

with the number of synapsis. As the formation of new synapsis is connected with the movement he concluded that the intelligence is closely connected with the movement. Rajović [11] states that the 50% of the synaptic connections forms in the first five years, 75% till the 7th year and 98% till the 12th year. During the rest of life there is the possibility to create new connections, but not in the same measure as before. For these reasons, it is of big importance that the child, in this early phase of life, is in movement. As Jurišević, Rajović i Drgan [4] state, the neuro sciences have shown a close connection between the number of synaptic connections and the reasoning and memory. Another important discovery is that when the child is fully engaged in playing the number of synapsis is growing. The aim is to prepare games that foster the physical activity. During these games the child is concentrated and is learning, even though it is not aware of it. His experience is that he is playing. These natural activities for the child motivate him.

During these activities, the brain is developing itself preparing all the premises that will be used in the future as a base for cognitive learning. The child enjoys in the games he plays, as in these way, his body is secreting the hormone of happiness (dopamine) which motivates him to repeat and continue to play.

2. NTC learning system

The fundamental goal of the NTC learning system is the child's integral development and encouraging the development of his biological potential as well as setting the foundation for later successful learning [4].

The goals of the program are: 1. Raising the level of intellectual abilities of children, 2. Prevent attention and concentration disorders in the school period, 3. Developing speed of thinking, linking and concluding (functional knowledge), 4. Timely observation of gifted children and encouragement of the development of their gift

The NTC learning system have its bases on all the previous statements on the children development. It is divided in three phases:

1) Early stimulation (synapsis development)

- Motoric exercises
- Grapho-motoric exercises

2) Associative thinking development

- Visualisation and abstraction
- Mental seriation and classification
- Music and association

3) Functional thinking development (problem solving and problem posing)

- Enigmatic histories
- Enigmatic questions for convergent thinking
- Enigmatic questions for divergent thinking

Early stimulation – synapsis development

As stated before the intelligence is connected to the number of synapsis in our brain. The first phase of the program aims to stimulate the creation of as many possible synapsis. At the age of three there are almost 1000 trillions of synapsis in the child brain¹. The activities that are proposed for a proper development of the physical premises for a healthy growth are connected with the rotation, balance, eye dynamic accommodation, fine motoric and stimulation of the foets. All these activities are strictly connected with the development of the potential of the kid. Rajović [12] gives many exercises (presented to the kid as games) that are meant to develop this potential. For example, for the rotation the children can be helicopters that have to reach a place in the room. Or classic dancers performing pirouettes. For the balance the kids are invited to walk on a line or on a girder (for the older kids).

For the dynamic accommodation of the eyes games with the ball are recommended. Jumping with the rope is also a good exercise as it is walking in the woods (possibly on a leaning land).

The grapho-motor exercises for the development of the hand consist in precise movement of the hand together with a good eye-hand coordination. These exercises are similar to what Montessori proposes in her method [6]. Some activities are holding and dropping toys, keeping the spoon and feeding on themselves, grip of small items, dressing and undressing clothes and shoes, tie-up, knitting, knitting and unpacking buttons and patents [4].

NTC way of choosing activities for the kids

Rajović [13] created an instrument for choosing the activities to propose to children. It consists in a table which is summarizing all the activities which are important for the development of the children's brain: rotation, balance, dynamic accommodation of the eye, fine motoric, feet stimulation, coordination eye-hand, mental classification, mental seriation and associations. In his research Rajović found that these are the activities that develop the brain and creates the neuronal structure that will be important for cognitive processes in their future life.

For the explanation of the table 1., we took three activities: video game, catch me game and playing with marbles. For the period of 15 minutes we have a plus, if this activity is present or a minus, if it is not.

¹<http://www.naturalismedicina.it/articolo.asp?i=733> (consulted 10.8.2018.)

While playing video games there is no rotation and no balance. As the screen is flat there is no accommodation of the eye. There is a limited fine motoric as the kid is holding the joystick. There is no walking so the feet are not stimulated. The coordination eye – hand is minimal and the kid is generally not speaking. For the classification and seriation it depends on the game but in the majority

they are not present. The association is present all the time.

If we compare it with the playing outside with marbles, we see that all the activities are present. We can than state that if we want a complete development of the children’s brain we have to choose the games keeping in mind that each game develops the child’s brain in a different way.

Table 1: NTC table for game classification. Source: Rajović [13]

NTC learning	First phase (synapsis development)							Second Phase (cognitive processes development)		
	Rotation	Balance	Dynamic accommodation of the eye	Fine motor skills	Feet stimulation	Coordination eye - hand	Speaking	Mental classification	Mental seriation	Association
Video-game	---	---	---	+++	---	+	---	---	---	+++
„Catch me...“	++++	++++	++++	+	++++	+++	++++	---	---	---
Marbles	++++	+++	++++	++++	++++	++++	++++	++++	++++	+++

b) Associative thinking development

The associative thinking is defined as the association of experiences and thinking to past memories. For the stimulation of such thinking the first things to exercise are: mental classification and seriation, visualization and abstraction, music and association. The reading competence needs the development of these skills that permits the recognition of abstract symbols. This is one of the most complex processes that kids have to learn before going to school. The NTC learning system uses symbols that kids can recognize because they see them often. For example car brands, soccer teams symbols, flags and product brands (milka, kinder, etc.). All this content is given gradually to the children in order to give them the time to learn it. To learn the symbols the children make also associations on the material they learn. For example for the Italian flag they will have the following associations: pizza, boot, etc. Later they will be asked about the similarities of symbols (for example we can ask them to tell us the flags with red colour).

The same words and symbols they learn are used in classical memory games. The aim of the NTC learning system is not the learning of the symbols. The symbols are the instruments that enable them to

think, which is the goal. In this phase of the NTC learning system the following activities are suggested: classic memory games, linking symbols to certain features (which flag has a circle on it, countries bound to a particular country...)

Another component that helps the development of the child is the music. The music is rhythm, listening and dancing (which involves the movement). To connect this part of the program with the previous the author proposes the use of the hymns of the countries they learned the flags and associations. To better the learning process the kids can develop association on the music they listen. It can be happy or sad, slow or fast, etc.

c) Functional thinking development (problem solving and problem posing)

By solving problems and exercises with logical thinking, we contribute to brain development and maintain it in a "good state" [12]. This part of the NTC learning system is meant to the shift of content presentation. Instead of asking: "It is an animal that lives in Africa, it has stripes and it is similar to a horse" we can ask "On which animal a lot of pedestrian walks daily?" The answer is: zebra. The first question is typical and recalls the memory, you

know it or not. The second needs a thinking process. The question in that way stimulates the children to think. They have to find the association and to link it in a proper way to answer correctly. This is presented as a group game and all the class is included in the answering process. If the teacher is well prepared this can be a big opportunity to stimulate the learning process. The kid starts reasoning and proposes different solutions till when the class comes to the solution (normally it takes from one to three minutes depending on the difficulty of the question). The process of coming to the solution enhances the collaboration in class and has to be funny for the children. In the classes that has experimented this kind of approach to the content the learning process was perceived by the kids as playing a game. A very important part in the solving of the questions is praising the children for every answer they give. This helps to foster the divergent thinking and a positive attitude to the problem solving process.

A research with university students done by Ruzić, Rajović & Debeljuh [16] has shown that they learn much better with the NTC techniques in comparison with the strategies they were using before.

Enigmatic questions, stories and objects

These ways of play with children encourage the development of functional thinking and enhance the ability of connecting different information [12]. Through enigmatic question children develop creativity and the freedom of expression of ideas. In this way of learning, unlike reproductive learning, a bigger number of neurons is activated. The final result is an easier memorization and better brain development [13].

In the NTC learning system the role of the teacher is very important. She (or he) has to be very well prepared and able to create enigmatic questions, stories and to find enigmatic objects. The guessing process is the process of expression of ideas. Every given idea is good. The teacher repeats the idea adding something before saying it is correct or not. This way of praising the idea production helps the kid to feel free of speaking and expressing himself.

3. Children and ICT: how to use the ICT with nowadays children?

The ICT devices (pc, tablet, smartphones, video games devices) are part of kids environment. According to a research of Common sense media [1] four out of ten children, up to two years, have used mobile devices. The percentage of kids, up to eight years, that used a smartphone, tablet or similar device has doubled in two years (from 2011 to 2013).

Nearly half (45%) of the children (five to eight years old) have a TV in their room.

Ružić, Strnak, Debeljuh [14] research shows that children of 7th and 8th grade (13 to 14 years old) of the primary school in Pula spend more time playing online video games. A total of 41.7% male students and 66.7% female students spend up to 1 hour a day playing online video games, while 33.3% male students play video games two to three hours a day.

We have to be aware that a big social change has happened with the mass use of ICT devices. The new generations, called digital natives [9], have a different approach to the ICT.

As stated by Ružić, Strnak, Debeljuh [14], there is the risk of becoming addicted to online videogames. So “we have to be aware that technology is an instrument that can be used in a variety of ways and, more important, that the choice is very often imposed. In the same way that we are doing our best as individuals and as society to keep our children away from drugs and gambling, we have to do our best to teach them the proper use of the ICT tools. In the first years this will mean to create environment in which they can live (physical and virtual)”.

There are authors that are underlining the positive face of the ITC usage. Lepičnik J., Samec P. [5] state that early usage of the PC helps the child in the development of the sense of control and competence, which results in the growth of self-confidence. Even though they say that the children are ready to work with the PC at the age of three to four they underline that there has to be a time limit for the usage of the PC.

Rajović and others [11] research shows that the kids are less competent from year to year in many development segments. The research carried on with teachers that have stated that children are worse than in the past. They state that compared to 5 and 10 years ago they are worst. This estimation refers mainly on the concentration, motoric skills, reasoning and problem solving, generic knowledge and the word fund. This is a trend that shows that from year to year kids are worst. As the authors of the paper continue “One of the main problems of the modern lifestyle is the sedentary life and generic lack of movement. The sedentary life, especially the one that is in front of a screen, in children life, is connected to inadequate cardiorespiratory fitness (Sandercock & Ogunleye, 2013), higer BMI (Ullrich-French, Power, Daratha, Bindler, & Steele, 2010), diabetes type II (Henderson et al., 2012), hipertesion (Martinez-Gomez, Tucker, Heelan, Welk, & Eisenmann, 2012), astma (Protudjer, Kozyrskyj, McGavock, Ramsey, & Becker, 2012), ADHD (Christakis, 2009), and reduced executive functions (Lillard, Drell, Richey, Boguszewski, & Smith, 2015). The sedentary life is strictly connected with

the lower physical activity, whose consequences are widely known. Sibley & Etnier, (2003) with a comprehensive review of literature have shown that there is a significant positive correlation between the physical activity and the cognitive function in children (Sibley & Etnier, 2003).”

The findings of the American Pediatric Academy and the Canadian Pediatric Society report that children younger than two years should not have any contact with technology, children between three and

five years old should not use ICT technology for more than one hour per day, at the age of six up to eighteen years technology should be used up to two hours a day. There are nine reasons why children should not be given too much cell phones and tablets: 1. Rapid growth of the brain, 2. Slowed development, 3. Chronic obesity, Sleep disorders, 5. Mental illness, 6. Aggressiveness, 7. Digital Dementia, 8. Addiction, 9. Radiation [7].

4. Conclusion

There is a big need of change in the field of education. The environment has changed a lot from the one our school system is based on. Contemporary research [2, 3, 4, 8, 17] has shown us that we can not consider the motoric and cognitive development separately. Indeed, we have to take them as interconnected and both very important for the holistic development of the child.

The movement, the motoric activity of the kids is functional for the development of the needed bases for further development. The research conducted by Rajović and others [11] shows that each generation of students is worst in most of the school activities. We need to urgently invert this trend, or at least stop it. Rajović [12] has developed a learning system which has its bases on the neuroscience. The learning system has the objective to prepare the children, starting from their birth to the complex cognitive activities. The first thing to be done is to prepare the brain structures for further learning. The brain develops its synaptic structure up to the 12th year of the child. The most important period for this development is until the 7th year (75% of the synapsis). Rajović [12] states that the neuroscience discovered the rules of development of the brain. It is important to keep in mind these rules while planning the activities for children. The motoric movement, according to the neuroscientific discoveries, is the most important activity for kids up to 7 years. The most important activities for the brain development are included in the NTC table which is designed in order to be a guide for choosing the activities to propose to children. Another important thing to keep in mind is that kids learn through play. So, it is of big importance that most of the activities we propose are done as games.

The ICT is present in the life of most of the kids. Ružić, Strnak and Debeljuh [14] warn about the possibility of development of addiction to online videogames. The sedentary lifestyle connected to an improper use of the ICT by the kids affects negatively the development of the brain as the only function that is stimulated is the cognitive one. The American Pediatric Academy and the Canadian Pediatric Society report that children younger than two years should not have any contact with technology, children between three and five years old should not use ICT technology for more than one hour per day, at the age of six up to eighteen years of technology should be used up to two hours a day. Ružić, Rajović and Debeljuh [15] have documented that there is an abuse of the ICT within the young generations. Considering that the most responsible for development and the education of children are firstly the parents, there is an impellent need to educate. The purpose of this parent education have to be making them aware of the risks that their kid will face possibly a worst cognitive development. Only if the parents become aware of the biological needs of their children, the new pedagogical and didactical strategies will be easily implemented. It is obvious that in this educational process the teachers have to be trained. They should learn about the new learning approaches and about the risks of abusing of the ICT technologies by kids. They will then be able to transmit the acquired knowledge to the parents.

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