Some Aspects About Using Brain Based Learning in Education

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Abstract: - In this paper the concept of Brain Based Learning, the informatical structure of the human brain, the neuron and neuronal networks is presented. In the first part are highlighted the complexity of neuronal network of the hemispheres of brain, and the way to synapse connections with the neurotransmitters. In the last part are analyzed the connections between the brain and the information process. Next are studied the relationships between long term memory and short term memory and the operating mode of brain, emphasizing the principles brain based learning. In final the principles and the modality to integration in the curriculum of brain based learning are presented.

Key-Words: - e-learning, Brain Based Learning informatical structure of human brain, neuron, neuronal networks model.

1 Introduction

Brain Based Learning is a new procedure recently in education and means using the neuro-psycho-pedagogical methods for transmitting and teaching the information's for the assimilation, the learning and the assessment. Although there is still controversy about the methods of learning one thing is clear, brain based learning can become a new pathway in education by using new researches on the anatomical structure and bioinformatics of the human brain.

Those researches have highlighted how the brain works, the way of knowledge acquisitions, what is it the thinking, what is it the memory, what is it the human intelligence and the wisdom etc. Nevertheless together with the experience of the psycho-pedagogues and the teachers led to use this new knowledge in the education process under the paradigm of "brain based learning" [6].

Data of the human brain shows a weight between 1250 and 1450 grams, representing about 2% of body weight and 20% of the oxygen consumption, 25% glucose and 15% of the blood of body. In absolute value the brain weight is exceeded only by the cetaceans (whales) and the pachyderm (the elephant) that at the weight of 5000-6000 kg have the weight of brain approximately 9 kg.

The processing capacity of the brain depends on the "report of encephalisation" EQ, which takes into account the weight of the brain, the number of neurons, the flexibility neuronal networks training and the processing speed. To human EQ is between 7 and 8, the cat is 1, the dolphin between 5 and 6 and in mice is 0.3.

The emergence of the cortex had increased the number of neurons, if the mouse has 4 million, the cat has 300 million, the dolphin has 5.8 billion, the elephant has 11 billion, the man has 11.5 billion. The total number of human neurons (approximately) is 100 billion (10^{11}) with that is equipped at birth. Throughout life the neurons it connects between them to form the networks the information processing. The number of connection options is 100 trillion (10^{15}). Other neurons are not formed during life, but many of them die.

It is said that everything that we see to Earth, the relief, the water, the forests and even the human creatures are the work of God, but the homes, the artwork, the cars and guns, the food processed and computers are the work of man brains.

While other animals in evolution have developed organs based on energy (muscles, teeth, wings, etc.) man has developed an informational organ, the biological computer - the brain by which has surpassed them all.

One principal place of neural networks is in cortex, being arranged in 6 layers compared to 3 layers from the first vertebrates. Compared with other vertebrates the man is only able to realize the creative imitation, the grammar language and so-

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called theory of mind. Thus the creative imitation has produced all the artefacts in the world, the syntactic grammar has produced all this communication including reading and writing and theory of mind, developed the conscience and of the discernment between good and evil.

In fig. 1 is presents the shape and the relative weight value for a number of vertebrates [8].

The taxonomy	The weight	The degree of encephalisation EQ	The number of cortex neurons (in millions)	The picture
The elephant	4200	1.3	11000	
The human	1250-1450	7.4-7.8	11500	
The chimpanzee	330-430	2.2-2.5	6200	
The dog	64	1.2	160	
The mouse	0.3	0.5	4	

Fig.1 The brain evolution

2 Simplified structure of cortex

Each cerebral hemisphere has an area of approximately 0.125 m^2, i.e. as a rectangle of 0.5x0.25m. In this area, which measures in total 0.5 m^2 is folded and twisted cortex to fit in the intracranial cavity of the two hemispheres. The cortex stretched can reach up to 2 m^2 and contains a variety of areas.

Each area is responsible for primary processing of stimuli arriving from the 5 sensory apparatus, but accompanied by the superior processing results and making decisions. The decisions are transmitted at muscles, which are the primary engines of the organism.

The most used sensors by man are the first 3, and of these is the most developed is the visual sensor, which occupies most of the cortex. Next we will refer to each of these 3 sensors, which have the greatest involvement in education.

Sensors are added in the Broca and Wernicke areas (found usually only in the left hemisphere). The Broca area is responsible for the formation and control of grammatical language.

In Fig. 2 are presented the structure of cortex and areas described above. But the brain have and another quality that is: the lateralization, that defines the way that the hemispheres left and right processes the information and control the motors of the two parts of the organism.

On grounds yet unknowns the processing and the control of processes are crossed: for example the processing images from the left deject is makes in left retina.

Also the sensors of driving and the motor control of the left side of the body are processing, in the right hemisphere and reverse.

There are also many the cerebral activities that originate only in one hemisphere like:

- The left hemisphere is - Logic and Analytical
- The right hemisphere is - Analog and creative

All sense organs and all body engines transmit or receive stimuli. Stimulus send he signal through the nerve fibers along spinal cord to the brain areas. The path connecting the sense organs and cortex is achieved by nerves and is called "the nervous channel" or "pathway".

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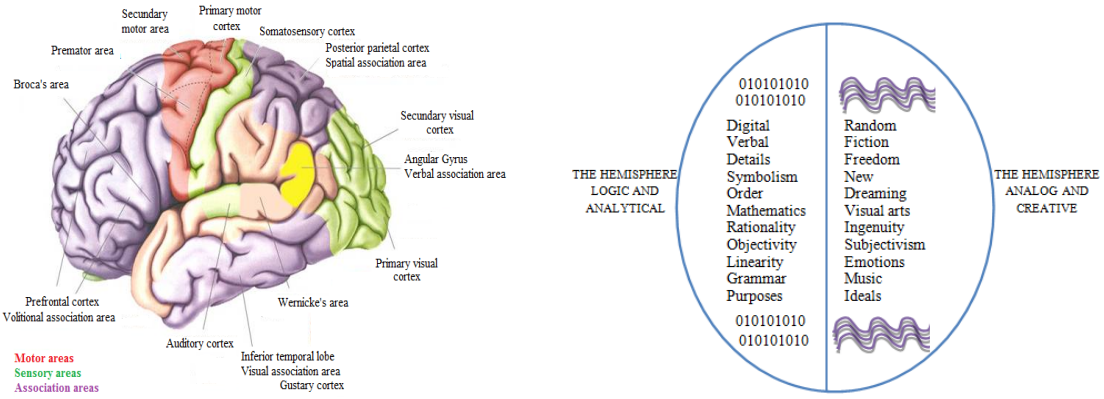
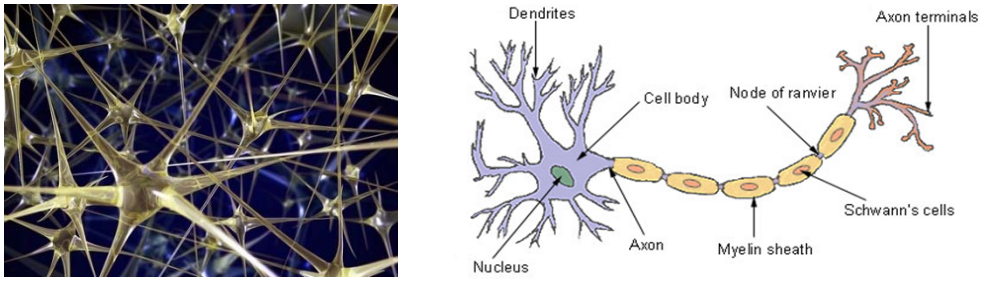


a) b)

Fig. 2 The brain: a) Cortex parts b) Hemispheres activities

Nerve fibers are consisting of "neurons", the name given in 1881 by the German anatomist Wilhelm Waldeyer. The neuron or the nerve cell is an excitable cell that is the functional basic unit of the nervous system. The neurons receive bioelectrical signals, which are also nerve impulses or "paternal impulses". The structure of a neural network and of the neuron is given in Fig.3.



a) b)

Fig.3 The neurons: a) The neural network; b) The neuron structure

The neuron is consists of a body called the soma or the body of neuron and two types of extensions: the axon, which alone produces electrical impulses and dendrites, which are until 7000 per neuron. The diameter of neuron body vary it's of type, from 5 to 120 microns and contains nuclei and cytoplasm. Most connections transferring electrical signal, but the formation of the chemical synapses participate the molecules called neurotransmitters.

These 4 elements: the neurons, the synapses, the neurotransmitters and the electrical impulses are based in the human thinking process that occurs in neural networks in the brain. All neurons operate by changing the voltage. The rest have a rated voltage of 70 millivolts. In the absence of an external signal neurons discharge the impulse, with (7-15) Hz. For transfer the neuron generates a pulse frequency up to 100 Hz.

The neurotransmitters are chemicals that ensure the transmission of signals from one neuron to another through the synapses. They are produced by some glands like adrenal glands.

The most important neurotransmitters are:

- The serotonin, responsible of impulsivity.
- The noradrenaline, responsible of vigilance.
- The dopamine, responsible of pleasure.

Together these chemicals produce certain states of the body (Fig.4).

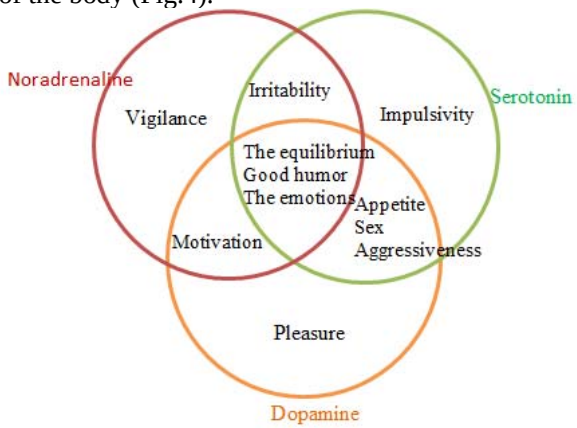


Fig. 4 The main neurotransmitters

In a single day millions of messages are sent and received by the brain, because some

neurotransmitters create a feeling of "happiness" and another of "sadness". As long as there is a balance between them all goes "well", but when stress or other complex events enters into brain, chemical imbalance conditions appear that is called “depression” [5].

3 Model of the senses and memory

The human senses are of two types: internal and external. Internal senses have an important effect on the process of thinking and are triggered when its internal operations do not work properly.

The external senses are represented of the five organs to witch: three of these are more complex: sight, hearing and touch, and the other two are micro-laboratories of analysis for odor and taste. Nature was concerned the acquisition of information that needs the human body, through external senses to detect stimuli that are threats and opportunities. In figure 5 is a present a simplified block diagram connecting channels nerve between the 3 human senses together with the muscle motor control an place of cortex [8] [9].

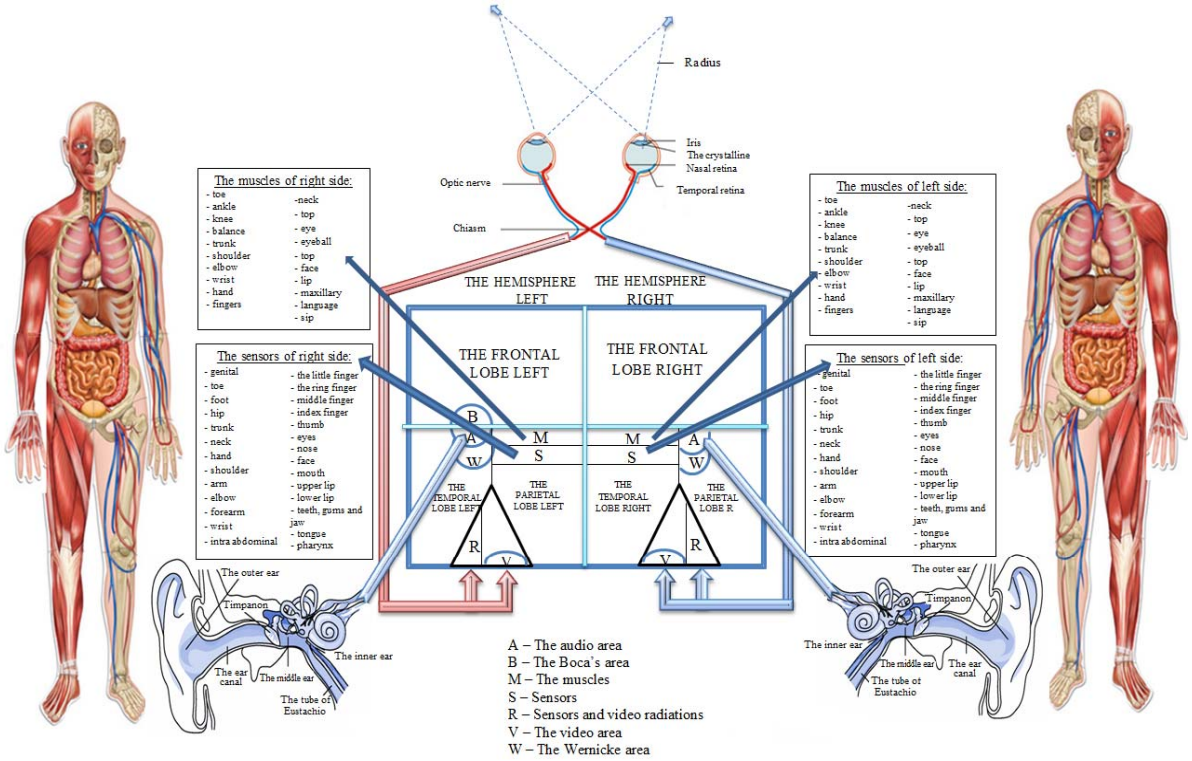


Fig. 5 The connection of senses and muscular motors

One of the most important functions of the human body is its ability to preserve and restore the information acquired from real world. This operation is the memory. But human memory is unlike that of a computer because nowhere in the human body is not a body have memory function.

The human body has distributed the memory along connecting channels of the neurons and neural networks. Memory is formed by connecting neurons through synapses and this is achieved by transmitting impulses senses paternal connection channels. Each passage of a signal through a synapse causes a discharge of neurotransmitter molecules, preparing synapse for the next use. If used frequently, synapses are extensively connected. The information of the sensory signal is kept only as long as the path sensory synapses are connected. So, maintaining sensory pathways by strengthening synapses is a key element in the mechanism of learning and memory. A neural network unused is released for another need.

Memory can be subdivided in a variety of ways. A situation refers to "recognition memory", i.e. that which is remembered of the past. This is done by detecting a similar set of stimuli from the past.

Learning is the first detection of a set of stimuli. The most often the repetition, i.e. the signal recycling is necessary for enhance the strengthening of synapses from newly formed sensory way.

Most often effective learning occurs through an expansion of information that is already present in

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the brain that means the forming a “associative memory”.

"Short term memory" consists only of newly formed memories or slightly enhanced. If those synapse are strengthened very least, this way loses the connection completely, the memory was "forgotten".

A synapse enhanced begins to lose strength connection even immediately after use, but if this connection has a higher level of consolidation is slower loss, and memory is preserved days or weeks. This is the "the intermediate memory" [6].

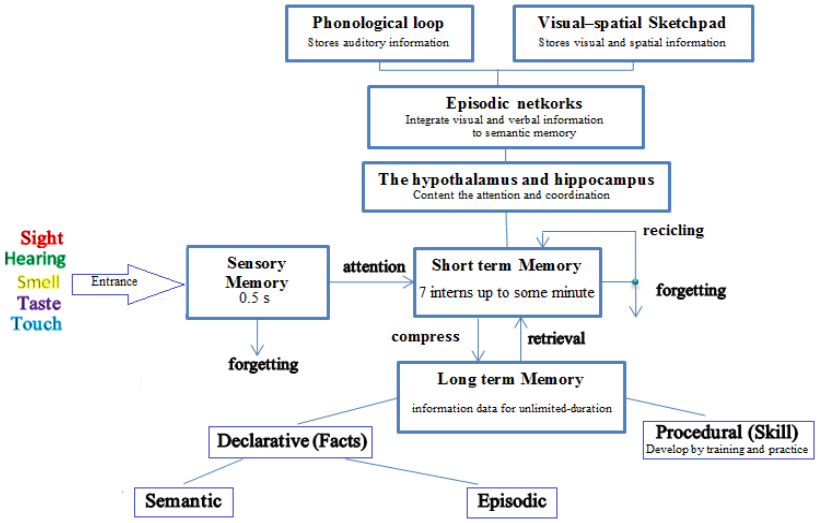

Fig. 6 Memory clasification

"Long-term memory" is the intermediate memory restored. The memory formation begins with data acquisition by sensors, sensory memory retention continues with a short retentions (short term memory) and then by consolidation became that slowly in long term memory. This may be explicit (declarative) and implicit (procedural). "The declarative memory" is formed by descriptions in words, facts, events or names and concepts (places, people, events), it is also divided into "the episodic memory" or "semantics" (Fig. 6).

4 The education oriented by Brain

As said L. Hart since the early 1983: "All around us are compatible with human hands, from tools, machinery and even keypad is designed to fit it.

Teachers forced billions of children in the school to use their brains without equipment oriented to it, moreover some activities are antagonistic” [2].

Mode of work of the brain has following features:

- The brain is a biological supercomputer parallel but is not compatible with a PC;
- The brain perceives as a whole and the entire simultaneously;
- Information is stored and distributed in neural networks and neural pathways;
- The man has no innate resources to understand the facts and things;
- Learning engages the senses, motors and the whole body chemistry;
- Emotions are critical for the perceived model, for attention and memory;
- The brain grows well in cooperation with other brains, integrated in a proper context;
- The activity to complex learning develops by challenge and inhibited by stress.

On the basis of above were developed the paradigm “Brain Based Learning” using the principles:

The intellectual models

Before starting the work the brain has refreshed its short-term memory and be prepared to intermediate term retention of knowledge transmitted using sensors sight, hearing and touch. This is good practice to have one or two issues not necessary correlated to the subject taught, but to produce curiosity, awaken the imagination, excitement or challenge not exceed a few minutes.

The emotions

A positive emotional state characterized by a state of alertness, relaxation, positive emotion and openness to new information is essential to the student's ability to acquire new knowledge the dehydration causes a higher level of salt in the blood

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which raises blood pressure and stress, so students should drink fluids to hydrate.

Learning in the classroom

Students can participate actively in teaching and learning in the classroom become more excited about their education. Teachers can create a positive environment by encouraging students and praising their efforts.

The memory

The memory is based on affective emotion that memory networks are strengthened with use, requiring the use of 4 actions (touch, sight, hearing, movement), for sufficiently strong retention in long-term memory formation. Permissions breaks between activities increase student performance.

The evaluation

In a Brain Based Learning, evaluation means reaching expectations, providing motivation. The evaluation should be designed to accommodate students and not vice versa. Provide time at the end of the course each student to think about the lesson and discuss any subject with colleagues.

The biology of brain

The brain relies on networks that must be "consolidated" because knowledge base to remain in place. Students learn better when teaching is accompanied by commentary and synthesized to form the associative memories.

The unity: body, mind and brain

Part of the cortex that processes movement is the same area with the part to learning process. Suggests that one effective tool to maximize student learning is physical involvement to lessons (laboratories, visits, practice, sport and so on).

The time

Duration of time for a task is directly proportional to the complexity of time that students are assigned to process information and reflect on them. Studies reveal that young people's attention and concentration may not exceed 20 minutes.

Learning by collaboration

Learning is based on collaboration, which could briefly summarize "knowledge must be socially created". If students and teachers working collaboratively, this is equivalent to connecting brain between them, it helps to create a creative, relaxed and comfortable which helps concentration.

The training on thematic

The lesson is cut into pieces and the student participate in the thematic topic is motivated in some way to participate actively and to complete the work.

5 Conclusion

This paper is a study of Brain Based Learning concepts, the informatical structure of the human brain, the neuron and neural networks. A comprehensive presentation of the structure, of the functions and the built of memories can be the fundamental for the improvement of education and Brain Based Learning principles. The developed principles of Brain Based Learning paradigm are very important for designing the didactical curricula for teaching learning and evaluation.

These concepts open a large possibly for the teachers and educators to design his activities more attraction and efficient.

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