The Value of Elementary Music Education in Child's Cognitive Development

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Abstract

The scientific article "The Value of Elementary Music Education in Child's Cognitive Development" describes the synchronization of neural coding in interaction with learning algorithms for high-precision perception and processing of patterns. Neurophysiological algorithms consist of thousands of neural linkages interconnected between different brain regions that shape child's actions, thoughts, decisions and confidence in his decisions. Music has a complex coding system in which there are many precise mathematical elements: duration, time, interval, scale, pitch, rhythm, frequency and their relationship. Reading musical notation is a multimodal integration of different brain regions involved at the same time. The variable of neural signals from brain areas involved in learning and memory describes the activity happening in the brain preceding a decision making between effort and keystroke accuracy. Some latent neurophysiological algorithms can be deciphered and identified with a high degree of mathematical precision. The digital platform used in the elementary music education effectively integrates students' neural network architecture. In this study the involved neural and cognitive processes of cortical mechanisms allow to connect brain networks into a coherent neural center. The study topic covers both fundamental concepts of neural coding and signal processing at various levels along side the audio-visual-motor synchronization as well as strategies for children with special needs teaching (astigmatism, autism, dyslexia).

Keywords: Cognition; Music; Pattern; Synapse; Neuron; Algorithm

Summary

Scientific research devoted to the development of children's intellectual and creative abilities raises the topic of the need to use digital technologies in the system of stage-by-stage music education. Conducting scientific research in this direction will allow us to come closer to understanding the more subtle mechanisms of a child's mental activity and identify neurophysiological factors that promote to improving the quality, speed and efficiency of initial music learning. Our goal is aim-directed application of information technology will contribute to the child's cognitive development.

Key Facts

1. Digital technology for teaching music is aimed at a balanced and rational distribution of the total educational load on the psycho-emotional sphere of the child.

2. The study uses ENG, EMG, EEG techniques to measure the relationship between brain activity and muscle tension depending on fluctuations in the number of eyeballs.

3. The digital module for primary music education effectively integrates students' neural network architecture.

Source: Neuromusic Lab Reflection Ukraine

Neuromusic Lab Reflection researchers have discovered a new technology for music teaching, which illuminates the mechanisms of a child's mental activity and promotes active cognitive development.

It is known that difficulties in perceiving any information, including music, cause strain of the main functional systems of the child's organism. Statistics and practice show that the period of teaching traditional musical grammar extends over several years. This is explained by the excessive load that arises during the child's first contact with the complex format of learning music. In order to simplify and facilitate the perception of musical information, a digital key method has been developed, aimed at a balanced and rational distribution of the volume of educational load on the psycho-emotional sphere of the child.

Physiological Base

Pediatrician Kolesnyk VD, the second author of sci. research, describes, from physiological point of view, application of the digital key for coding and decoding of a melody. Children begin their contact with digits already in preschool age, when they are taught to count and this system is learned by children quite firmly, since it is often used in their daily life at every step. But the generally accepted music grammar is new for them and, naturally, requires some additional period of time to be acquired by children. It is for that reason that in the initial period of musical teaching, children inevitably spend a lot of time and efforts to read a melody written down in music signs. Naturally, it slows down rate of training, causes psycho-emotional discomfort, lowers the child's interest to music. Therefore, in the initial period of teaching, besides work with the generally accepted music grammar, it will be useful to substitute it with the use of a digital system for some time. It does not mean that we want to do without standard music grammar but at the initial stages of musical education, the system of digital coding and decoding of music sounds is undoubtedly useful since it speeds up teaching of children.

Parallel Description

In practical work, while reading the generally accepted music information from sheet, the direction of eyeballs' movements is spas-

modic, it has a multi-stage combination both on y – vertical and on x- horizontal. The ability to read music signs is due to specific stereoscopic properties of the visual system. Five horizontal-longitudinal lines cause the phenomenon of interference in photoreceptors, that creates difficulties in mixed reading a melody along the y - vertical and x - horizontal. For integration, synthesis and the modification of complex pattern the structures of the central nervous system require an additional period of time an important neurophysiologic moment has been noted: muscular tension is formed, that in turn, is harmfully reflected on the contents and character of a melody. In practical work while reading the digital information from sheet the trajectory of eyeballs' movements on y–vertical is projected in the exact determinant (digit, sign, symbol),the trajectory of eyeballs' movements on x – horizontal is projected in one direction. In numeric sequences the visual perception flows along the x-horizontal forward, that facilitates the input of tuning trajectory and visual adaptation. In the given system of dimension the integration of the digital information precedes instantly, its realization on an instrument proceeds in reflexive time-ratio. The paradoxical phenomenon is revealed: the interval of time, between the moment of perception of the digital information from sheet and the moment of the hands' response on the keyboard of an instrument, is contracted to a minimum. We achieve a reduction of load on hand muscles at the expense of decreasing of an amplitude between muscle tension and the resulting movement and, as a consequence of this, the time intervals between effort and accuracy of pressing key are considerably shortened. An important neurophysiologic moment has been noted: the rational distribution of the manual technique on the keyboard of an instrument, that in turn, is considerably reflected on the contents and character of the melody.

Neurophysiological Aspect

Dynamics of movements and actions is characterized by time, speed, spatially-time, power and others parameters .Given parameters reflect the complex neurophysiologic processes passing in leading functional systems of the child's organism: central nervous system, muscular system and others. In order to study the influence of new technology on the psycho-emotional sphere of the child, electrophysiological measurement techniques - ENG, EMG, EEG must be used. Method ENG - EMG completes one another, joints the visual analyzer with the neuro-motor function of fingers and proves, from scientific point of view, the development of muscular fatigue in hands depending on the quantity of eyeballs' fluctuations. Method EEG allows to research synaptic transmission between neurons in different measurement systems, to make the comparative diagrams of dynamics of initiated spikes while perception music metric and digital patterns, plus the time of fatigue of synaptic structures and cells - neurons of cortex is determined. We can decipher the variable of neural signals from dorsal premotor cortex and primary motor cortex, describe the activity happening in the brain preceding a decision – making between effort and accuracy of pressing key.

Practical Base

Practical experiments were conducted to study the influence of a digital key on the psycho-emotional status of a child in comparison with traditional music study. The first group of children, using traditional musical grammar, was unable to complete the task within the limited time. Their working capacity is characterized by rapid mental fatigue, instability of attention, low activity of analytical thinking. Children in the experimental group, using the digital key technique, easily adopted study material and the learning process proceeded twice as fast under limited time conditions. In the first stages of music teaching, children like reading melody in digits rather than notes. Free reading of digital melodies allows them to easily and firmly master the digital base of music-acoustic skills and abilities.

3330.3330.3512.3000.4444.4333.3223.2050.3330.3330.3512.3000.4444.4333.3554.2010. Jingle Bells

3345.5432.1123.3020.3345.5432.1123.2010. Ode to Joy Bethoven

The digital module includes the integration of entire music structure by means of digits, fraction: the information in numerator – right hand, information in denominator – left hand.
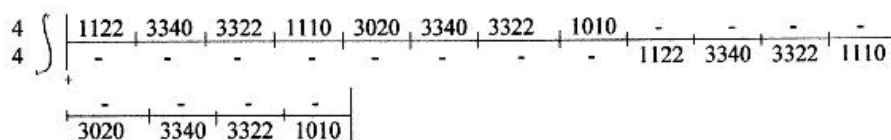
At the second stage of learning music while transition to the forms traditional music letter the breakage of the formed stereotype doesn't cause any efforts and difficulties since the child freely owns digital base of coded music-acoustic skills and habits, naturally, psycho-emotional self-affirmation of the child requires purposeful activity in study of traditional music format. The main positive feature of the digital key method is that it does not deny generally accepted musical grammar, but is an additional platform in the initial period of a child's contact with music information. Academician of the Petrovsky Academy of Arts and Sciences, professor Semeshko A.A. noted the practical value of the technology for learning of single-voice melodies converted in a digital key, and raised the question of the need to use a digital module across the curriculum of primary music education. Doctor of medical sciences A.A Besedyna, professor of Kharkiv Institute for Children and Adolescents Health Care and Danilenko G.N. noted :while applying the technique of digital format, the child rationally distributes the total study load on leading functional systems his organism, creates highly-accurate coordination without inclusion in practical activity of unnecessary muscle groups, unnecessary movements, excessive effort by pressing a key, it means, he excludes possibility of appearing of false acoustic and muscular sensations, and as a result of it, instantly creates a firm neuron code in his mind ,which in our life we call as a skill of coordinated action.

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