# Considering the benefits of Digital Music Grammar in a music educational program

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**Digital Music Grammar**

In pedagogical practice at the first stage of musical teaching the natural abilities of children were always taken into consideration, it is the main principle on which the pedagogical process is based. The child's psychoemotional status and neurophysiologic peculiarities of mechanisms of brain's activity; perception of the information from sheet; analysis of the information and realization of the neuromotor function of hands on the keyboard of an instrument are not taken into consideration in due measure. It is known that the process of teaching how to play a musical instrument includes the following stages of psychic activity: the reading of the melody from sheet, analysis and synthesis of received information, its correlation with the keyboard, fingering, with movement of fingers and sounding of an instrument. In this regard, the great total load appears in the child's psychic sphere. With the purpose of transforming the music structure into clearer and easier information to be perceived by the child, new methods of musical teaching have been elaborated. It is the system of a digital key based on the mode of perception of music sounds by means of digits. The digital method of teaching enables the child to be actively involved into the process of learning to play an instrument, to achieve self-realization with fewer negative emotions, and it means excluding of undesirable mental, emotional strain and, as a result of it, reducing of the possibility of appearance of negative attitude to the educational process.

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**Physiological Basis**

The physiological substantiation of the digital system application for coding and decoding of a melody is the following: 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. 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 the rate of training, causes psycho-emotional discomfort and 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, as it speeds up teaching of children.

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## Practical Basis

With the purpose of studying the physiological influence of the digital key method upon the psycho-emotional status of the child, practical experiments have constantly been carried out. The first group of children was taught with the help of the standard music system, the second group of children was taught using the digital system. The obtained results of teaching on different methods were carefully analyzed and studied. The important practical moment has been noted: the first group of children spent a lot of time to study the necessary material and to master practical skills of playing the music instrument. Their working capacity is characterized by instability of attention, low activity of analytical thinking and fast mental fatigue. Another practical moment has been noted: the second group of children has shown high stable result as compared to the first group. Experimental research has revealed certain dependence, in particular: children taught with the help of the digital key method easily adopted the material and the process of learning passed twice as quickly on positive psychoemotional basis with desire to master the practical skills of playing on an instrument. The experts on pedagogy and medicine have objectively arrived to the common conclusion: the fast and easy reading of the melody written down in figures allows the child to dynamically realize the potential musical opportunities and has a great practical importance in the development of intellectual and creative abilities. The quality, speed and efficiency in mastering practical skills depend on music abilities of an individual, psychoemotional status and method of teaching of a subject taking into account the neurophysiologic peculiarities of mechanisms of brain's activity.

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## Parallel Description

In practical work, applying the generally accepted music grammar, the child connects the definition of the melody notes to the pitch i.e., to the system of dimension, which is written down in the form of an expanded construction, both on x – horizontal and on y – vertical. In reading the music information from sheet, the direction of eyeballs 'movements is spasmodic – it has a multi – stage combination both on y – vertical, from the G-key up to the F-key, and on x- horizontal often with return of eyesight to the initial point i.e., to the key point "g" or to the mainstay point "c", which the child knows very well. For integration, synthesis and the modification of complex pattern of the received information the structures of the central nervous system require an additional period of time. It is a neurophysiologic process proceeding in an interval of time between the moment of perception of the music information from sheet and the moment of the hands' response on the keyboard of an instrument. A great number of irregular nervous impulses is transferred to the central nervous system per unit of time and, as the consequence of this, fatigue of hand muscles is considerably increased (Berosov, Korovkin1990). An amplitude of muscle tension is directly dependent on the stimulation frequency, when each subsequent nervous impulse coincides with the phase of increased excitability of a muscle (Green, Stout, Taylor 1990 ). On the level of synaptic terminal we can see untimely synthesis of neurotransmitter, deep and stable depolarization of postsynaptic membrane and, as a result, the convulsive reflexes are thus formed. An important neurophysiologic moment has been noted: during a short time interval the contracture, i.e., constantly high muscular tension is formed, that in turn, is harmfully reflected on the contents and character of a melody.

In practical work, applying the method of the digital key, the child connects the definition of a melody to the system of dimension, which is written down in the form of an integrated construction both on x – horizontal and on y – vertical. Reading the digital information from sheet the trajectory of eyeballs 'movements on y–vertical is projected to the exact determinant (digit, sign, symbol), the trajectory of eyeballs' movements on x – horizontal are projected in one direction, forwards. In the given system of dimension, the integration of the digital information works 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 amplitude between muscle tension and the resulting movement and, as a consequence of this, the time intervals between effort and accuracy of pressing of a key are considerably shortened. On the level of synaptic terminal we can see allocation of neurotransmitter directly proportionally to the frequency of generated impulses by neurons, in result of it, the coordinated reflexes are thus formed. An important neurophysiological moment has been noted: reciprocal muscular innervation is formed, i. e. 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. The principal thought is in the fact that at the expense of melody perception by means of digits its realization becomes faster and easier, that in turn, is positively reflected on the psychoemotional status of the child and enables him to dynamically realize the potential music abilities in psychosomatic action as a result (Rumiantseva, Loseva, Bunina 1986). Physiologically correctly and rationally performed actions contribute to the solid technical progress of the majority of beginners, develop their mental capacity to perceive the music sounds analytically and will speed up process of learning and mastering professional skills.

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**Neurophysiological Aspects**

It is well – known that the difficulties in perception of any information, including musical one, cause strain of the main functional systems in the child's organism. The developed digital technology of musical training is perspective, has practical result, but it requires physiologic and psychology researches devoted to study of influence of a recommended method to psycho-emotional status and to a condition of the main functional systems of the child's organism: the central nervous system, the muscular system and others. With this purpose the experimental researches are to be performed, namely: ENG, EMG, EEG – tests on study of a degree of mental load that the child has received in perception of the information written down in the melody notes in comparison with the load that a child has received in perception of the music information written down in number signs.

The test of electronystagmography allows us to investigate eyeshot, positional nystagmus and also to determine quantity of fluctuations of eyeballs during perception of the melody written in the music marks and digital symbols. The test of electromyography allows us to investigate a threshold of muscular irritability (min – max) and amplitude of muscle tension depending on effort and accuracy of pressing of a key on the keyboard of the instrument. The method of ENG and EMG joins the visual

analyzer with neuromotor function of the hands and explains, from the scientific point of view, the ratio between the load on muscles of eyes and muscles of hands, and also it proves the possibility of development of muscular fatigue in hands depending on quantity of eyeballs' fluctuations.

The test of electroencephalogram allows us to make up the comparative diagrams of dynamics of the proceeding neurophysiologic processes, and also it offers an opportunity to investigate functional activity of neurons during synthesis both of music and digital patterns.

The realization of the described scientific researches in this direction will allow us to approach closer to understanding of more subtle mechanisms of the child's mental activity and to detect the physiological factors in promotion to the enhancement of the speediness, quality and efficiency of musical education.

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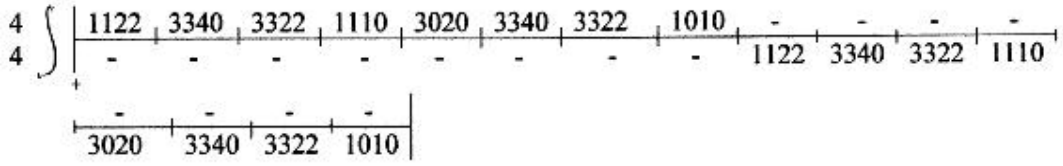
**Mathematical Aspects**

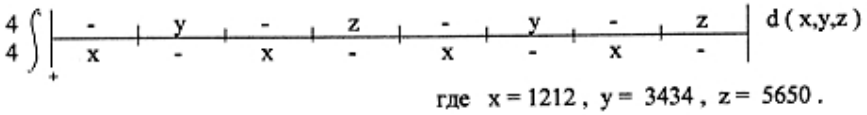
The main positive feature of the digital methods is that it does not deny the generally accepted music grammar, and is as an additional material in the initial period of the child's contact with music. The developed new technology includes the integration of entire music structure by means of digits, fraction: the information in numerator – right hand, information in denominator – left hand. For example the melody of the Russian popular song has the following digital expression:

Fig.1




In differential system of digital notation of music information it is necessary to mark out repetitions in a melody and integrity of these segments through variable mathematical values or symbols ( x, y, z ), such methods of cording simplifies the information pattern for visual perception and it allows the child faster to make analyses and synthesis of a melody as a whole, and then to decode precisely this information without special efforts with growing skill of performing mastery.

Fig.2

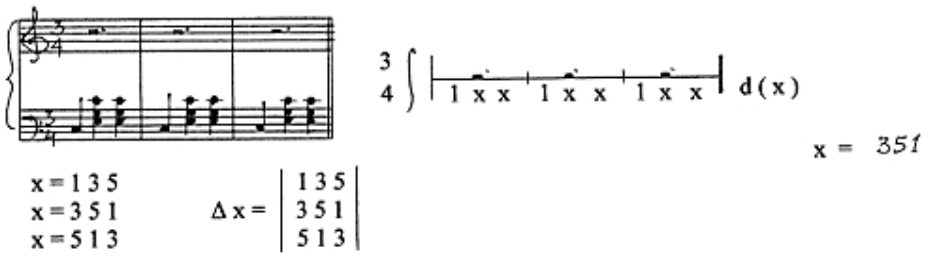



For natural time organization of sounding melody it is necessary to change only the

tempo of the play but the code of the melody should be performed with the help of digits and relative quantity of zeroes for definition of a longitude of sounds.

The digital marking of a chord with the help of a matrix and expression through the determinant allows creating a visual – motor stereotype of perception of a chord as a composed element of music structure.

Fig.3




The matrix mode considerably simplifies the work with accompaniment, frees the child of great volume of difficult and tiresome work (Chervatiuk 1990). The clear and simple interpretation of the music information through an integral key enables the child to make up a correct mental notion about the contents and character of the music play.

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**Summary and Conclusion**

Throughout many centuries the musical structure had numerous modifications. We can observe constant use of digits for convenience of notation of the music sounds, for example: digital organ bass, lute tablatures, guitar jazz ciphers (Bril 1985). Nowadays the digital system of teaching is absent in the educational program and is not applied in practice because of teacher's insufficient professional knowledge in the sphere of the child's physiology.
The scientific work entitled "Reflection" is closely connected with related sciences: pedagogy and medicine, requires support and realization of the neurophysiologic researches in accordance with the elaborated Project.
On the basis of pedagogical experience we have come to the following conclusion: digital system has great practical consideration, is based on physiological point of view and can be applied in the teaching with aid of computer and MIDI – technology. The developed number technology is simple and accessible in teaching children both of preschool age (5 -7 years old) and children of early school age (7 – 9 years old).

The authors' main task is to describe the peculiarities of digital technology, to reflect the neurophysiologic aspect of scientific investigations, to raise a question on the necessity of application of the digital system in stage-by-stage practice of music education.
The scientific article " Digital Music Grammar " is intended to help teachers, students, psychologists to become acquainted with system of intensive music teaching on the methods of number key. We shall be grateful to all readers for their valuable recommendations, reviews and offers which will be taken into consideration and applied in scientific investigations in this direction with benefit for children.

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