FORMATION OF MUSICAL PERCEPTION OF JUNIOR SCHOOLCHILDREN ON AN INTERMODAL BASIS

[a]IRYNA BARBASHOVA

[a]Berdyansk State Pedagogical University, 4, Schmidt Str., Zaporizhia Reg., 71100, Berdyansk, Ukraine
email: [a]i.a.barbashova@gmail.com

Abstract: The importance of forming the musical perception of primary school students is justified by the reform of general secondary education in Ukraine, the introduction of a new educational standard and educational programs for first-grade schools, teaching in art education on the basis of integrative methodological approach. The concept of musical sensory ability as a specific unit of functioning of musical perception is formulated. The levels of formation of musical sensory in students in the conditions of mass experience of primary education are revealed. Exercises and game tasks aimed at forming children's perceptual musical operations are described. The effectiveness of the introduced didactic influences is proved: in comparison with the control group the participants of experimental groups, especially the first one, showed the highest efficiency of distinguishing and systematizing music sounds, variety of skills to reproduce them in singing, spatial modeling, instrumental game.

Keywords: Exercises, Game tasks, Intermodal perception, Junior high school students, Musical perception, Musical sensory ability.

1 Introduction

In state documents that reflect the content of primary education, the task of teaching junior art students is the formation of artistic subject and interdisciplinary competencies necessary for artistic and creative self-expression in personal and public life. Solving this problem is possible by students learning the units of artistic language, ways of artistic and creative activities in different arts, developing the ability to establish associations between different arts.

Applicants for primary education must, first of all, distinguish and reproduce in singing, rhythmic movements, instrumental playing the characteristic properties of the sounds of music their pitch, duration, strength, timbre. The basis of high-quality mastering of educational information about the features of musical sounds are well-developed sensory-perceptual processes for the rational examination and categorization of various nuances of music sound.

It is clear that the peculiarities of musical perception as a separate type of sensory sphere determine the purely specific educational influences on the development of musical hearing of students. However, the general laws of formation of sensory processes also apply to musical perception, so it is important to study the coordinated improvement of the perception of musical and speech sounds, the expediency of visualizing the metro-rhythmic properties of musical sounds using spatial models, in particular, depiction of pitch relations by color shades.

Scientific approaches to the purposeful development of children's musical hearing and teaching them musical literacy were developed in the 60s of the twentieth century in the context of the theory of the functioning of perceptual actions. Currently, this issue is relevant to the study of the didactic system of holistic sensory development of primary school children; updating the methods of teaching music in general secondary education institutions and specialized art education institutions in the context of reforming the national school; identification of synesthesia nature and intermodal resources for improving musical sensory operations. Thus, the formation of musical perception of students is a multifaceted problem and one that requires the consolidation of efforts of domestic and foreign scientists.

The purpose of the article is to scientifically substantiate the system of didactic influences on musical perceptual processes of junior schoolchildren. Tasks of scientific search are as follows:

- To define sensory ability as a unit of functioning of musical perception;
- To characterize the levels of musical sensory skills of students, formed in the mass experience of primary education;
- To reveal the specifics of variable experimental influences, which differ in the degree of intensity of intermodal connections of sensory channels;
- To compare the dynamics of the quality of formation of musical sensory skills in the conditions of different variants of pedagogical experiment.

2 Literature Review

A review of the literature on the research problem will begin with the definition of musical sensory ability. Based on the generalized definition of sensory ability of any modality [2, p. 38; 3, p. 102; 4, p. 16; 7, p. 22], musical sensory ability will be understood as the performance of a system of auditory interiorized perceptual familiarizing-cognitive actions based on the mastered standards of music sounds and skills of application of these standards in the examination of musical phenomena.

Based on the above definition, the structure of musical sensory skills includes introductory and cognitive perceptual actions. Introductory actions are aimed at creating the primary sensory image of the heard sound, while cognitive imply correlating the primary image of the sound with a class of standards recorded in memory, carrying out of the subsequent detailed identification of the sound image and its categorization, which is manifested in the verbal characteristics of the examined property.

In determining the musical sensory ability, emphasis is also placed on the general mechanism of its formation. It is understood as the interiorization of perceptual actions, which is carried out in several stages: in the first of them, perceptual actions with sounds have a detailed form, are performed using various movements and models that give certain properties of the subject character; on the second, actions still have the developed form, but application of subject models considerably decreases and stops; on the third musical actions are curtailed, shortened and transferred to a qualitative level of instant perception [2, p. 36-38].

A study of music theory sources proves that sounds are combined into a clear system with classification-serial relations of elements. In terms of pitch, musical sounds are divided into groups with indefinite pitch (for example, drum sounds) and definite (have an absolute pitch measured by the number of vibrator vibrations). Sounds with a certain pitch are tones that are denoted by notes and form in ascending or descending pitch homogeneous two-element seriational series with a step in the semitone (C – C sharp; D – D flat, D – D sharp; E – E flat; F – F sharp; G – G flat, G – G sharp; A – A flat, A – A sharp; B – B flat). However, at the level of sensation, individual tones differ not in absolute pitch, but in relative position regarding each other, forming ascending and descending pitch series, so the relationship between tones should be classified as serial. The timbre of the music sounds are vocal (children's, female, male voices) and instrumental (string, wind, percussion instruments).

Volume, having an absolute value, is felt as the ratio of the volume, so this property sounds are systematized into a series of nuances: *pianissimo – piano – mezzo-piano – mezzo-forte – forte – fortissimo* and vice versa. The absolute duration of sounds is measured in time units – minutes or seconds; however, the relative duration is determined by comparing the whole note with two halves, four quarters, eight eighths, and so on.

The current typical educational programs focus on the formation of reference ideas about the specified properties of musical sounds in junior schoolchildren. The expected results of learning the art of music are that the student acts as the following: sings vocal exercises and children's songs; reproduces rhythmic sequences and creates rhythmic accompaniment to the song;

selects the means of musical expression timbre, tempo, dynamics; plays simple compositions in an ensemble; improvises with his voice and on musical instruments; moves to the music, coordinates his movements with the musical accompaniment; focuses on the concepts of musical literacy [23, 24]. Textbooks in the field of art knowledge contain information about all the features of musical sounds; a) pitch and sound registers (low, medium, high); b) duration of sounds, musical rhythm, pulse and meter as alternation of long and short sounds; music tempo – slow, moderate and fast; c) the volume and dynamics of musical sound and the designation of loud and quiet sounds in Italian words; d) timbre of people's voices and musical instruments. An obligatory component of textbooks is also information about music recording – the concepts of "note", "note state", "melody", "music key", "pause", etc. are revealed [18].

In methodical works, various ways of inspection of sounds of music in exercises and didactic games are modeled. This is the recognition of sounds by given qualities (if one hears high sounds, he needs to raise hands up, in case of low sounds hands down, middle – to keep your hands at chest level); finding melodies according to their graphic models or musical notation; singing with and without accompaniment, with hand movements in the direction of the melody, with hand signs (relative solmization) and behind the column; performing rhythmic movements and gestures clapping, clicking fingers, tapping the chest, stamping feet; playing music on children's instruments, participation in orchestras; music creation and improvisation, dramatization of plot musical material, etc. [1, 8, 9, 10, 13, 14, 15, 16, 17, 20, 21, 22, 27].

It is traditional to use the method of illustration in teaching music to junior schoolchildren. Schematic and symbolic representations are used to reflect pitch, metro-rhythmic and dynamic musical relations: the scale is depicted by an ascending sound "ladder"; the duration of sounds is modeled in rhythmic scores with specific designations of short and long sounds (П П І); dynamic shades are denoted by abbreviations of Italian terms (*p*, *f*, cresc., *dim*.); also there is the use of graphic schemes and matrices, which together reflect the pitch and duration of musical sounds (square short sound, rectangle – long; the higher the figure, the higher the sound of the melodic fragment), notation as a universal schematic notation on a sheet music.

Thus, the visualization of the acoustic properties of music sounds by means of spatial models perceived by sight is a fairly common way of teaching music students and an example of organizing sensory-perceptual development of students on an intermodal basis. However, the interaction of musical perception with sensory processes of other modalities (visual color or auditory phonemic) is not presented in the method of primary education, although the expediency of forming such synesthesia is emphasized by many researchers [11, 12, 19, 25, 26, 28, 29].

3 Materials and Methods

The defining method of research is the psychological-pedagogical experiment as a way to study the system of developmental influences on musical sensory-perceptual processes of primary school students, which allows explaining the relationship between conditions and effectiveness of such a system in cause and effect. The general logic of the experiment was to manipulate the input stimuli, measure responses, identify the regular dependence of responses on input stimuli. At the same time, input and final diagnostics were carried out.

The experiment involved 312 students, evenly divided into three groups: one control (zero level of input stimuli) and two experimental – group A (high level of input stimuli using intense intermodal connections); group B (moderate level of input stimuli using moderate intermodal connections).

4 Results

Input diagnostics of the state of formation of musical sensory skills of junior schoolchildren in the experience of primary education is carried out in accordance with the provisions of pedagogical qualimetry. Criteria for the quality of the studied skills are: a) the adequacy of the distinction of musical sounds in pitch, duration, volume, timbre; b) establishment of classification-seriational relations between them – classification of sounds by timbre, serialization by pitch, duration and volume; c) reproduction of pitch and rhythmic properties of the melody in singing, spatial modeling, instrumental playing. The weight of the criteria is almost the same, but with a slight prevalence for the first of them. Within this criterion, more importance is given to the distinction between sounds in pitch and duration, because they are the bearers of meaning in music: the melody remains the same until its pitch and rhythmic characteristics change, no matter how the dynamics and timbre of the sound change (see Table 1).

Let us note also that the assessment was made not for absolute, but relative musical hearing, i.e., the comparison of several musical sounds on certain grounds. The children demonstrated the results of the survey with the help of various applause, rhythmic movements, verbal description of musical phenomena, their modeling, singing, playing instruments, etc.

The ascertaining check of musical perception of first-graders was organized by means of such diagnostic tasks.

1. Distinguish musical sounds by pitch. Students compared the sounds of melodic intervals and determined which sound (first or second) is the highest or lowest. If necessary, the experiment was given a game character – to guess who sings first – "cat" or "kitten". The musical material was the intervals: $C^1 – C^2$; $B^1 – C^1$; $D^1 – C^2$; $E^2 – G^1$; $E^1 – C^2$; $B^1 – E^1$; $G^1 – C^2$; $A^1 – F^1$; $E^1 – G^1$; $D^1 – C^1$; $E^1 – F^1$; $C^2 – C^2$.

2. Distinguish musical sounds by duration. The exercise consisted in solving non-musical and musical rhythmic tasks: a) the teacher tapped the rhythm, the student repeated it; b) a musical fragment was demonstrated, the child independently distinguished the rhythmic structure and played it when re-playing the melody. The following types of rhythmic patterns were presented: "summation" (two eighths – a quarter), "crushing" (a quarter – two eighths), "iambic oscillation" (eighth – a quarter), "choreic oscillation" (a quarter – eight), "dotted" (eight with a dot – sixteenth).

3. Distinguish musical sounds by volume. The student had to beat the pulse on the drum in the dynamics in which the teacher played the piano play by Dmytro Kabalevsky "Drummers" (the first four bars): once a piece of music was performed loudly and quietly, the second – vice versa.

4. Distinguishing musical sounds by timbre. The student listened to a musical instrumental fragment and guessed this sound among the melodies played on the piano, flute, metallophone (the same melody was performed).

5. Classification of musical sounds by timbre. The audio recording showed the sound of a certain musical instrument: violin, flute, metallophone, piano, trumpet, tambourine, bandura. After listening to a piece of music and clarifying the name of the heard instrument, the student answered the question of which group it belongs to strings, winds or percussion.

6. A series of musical sounds in pitch. The experimenter played the ascending (descending) major scale on the piano and suggested that the respondent play the metallophone in the same way. Then the student listened to three degrees of the major system in different sequences: I – III – V, V – III – I, III – V – I, III – I – V and selected the heard sound combinations (trial exercises were assumed).

7. A seriation of musical sounds by duration. The teacher demonstrated the sequence of sounds in descending and increasing order of their length (half, quarter, eighth, sixteenth lobes and vice versa) – "the rain begins and subsides"; during subsequent plays, students applauded the change in duration.

8. Series of musical sounds by volume. The experiment is organized according to the method of the previous exercise, but the musical passage once sounded with a gradual increase and decrease in volume (*crescendo*, *diminuendo*), and the next time – in the reverse combination (*diminuendo*, *crescendo*).

9. Reproduction of pitch and rhythmic properties of the melody in singing (the child was offered to perform an excerpt of a song with accompaniment); spatial modeling (the student selected to the musical phrase played by the teacher, the appropriate spatial model – one of the two presented, as well as made a spatial model of the heard musical phrase); instrumental game (the student had to play a small melody on a metallophone according to the given model).

The results of the diagnosis are presented in Table 1.

Table 1: Quality of musical sensory skills of junior schoolchildren (input section, average values)

Criteria	Validity	Indexes	Validity	Detection of indicators	Evaluation of indicators	Manifestation of criteria	Evaluation of criteria
Distinguishing musical sounds	.34	distinguishing musical sounds by pitch	.30	.453	.136	.698	.237
		distinguishing musical sounds by duration	.30	.538	.162		
		distinguishing musical sounds by volume	.20	1.0	.200		
		distinguishing musical sounds by timbre	.20	1.0	.200		
Classification and seriation of musical sounds	.33	classification of musical sounds by timbre	.25	.500	.125	.743	.245
		seriation of musical sounds by pitch	.25	.474	.118		
		seriation of musical sounds by duration	.25	1.0	.250		
		seriation of musical sounds by volume	.25	1.0	.250		
Playing a melody	.33	reproduction of a melody in singing, spatial modeling, playing a musical instrument	1.0	.125	.125	.125	.041
∑	**1.0**				Quality of musical sensory skills (input cut)		**.523**

These data show that it was difficult for all respondents to feel the pitch and rhythm. For example, in distinguishing two sounds by pitch, the following pattern was observed: the wider the exposed musical interval, the more accurate the differentiation of its components, and vice versa – the narrowing of the interval caused a proportional loss of adequacy in determining high and low sounds (it should be noted that for first-graders, it is in geneal difficult to deeply understand “high” or “low” sound, so the diagnostic task was given a substantive nature: children were asked when the cat “sings”, amd when – the kitten). Students have always correctly assessed pitch ratios in the intervals of pure octave, major and minor seventh, major sexta; errors were made in distinguishing between small sextet, pure fifth, and pure fourth; demonstrated persistent “deafness” in the sensation of large and small thirds and large and small seconds; in isolated cases (12%) no same pitch of pure prima sounds was presented.

Certain features are revealed in the distinction of temporal relations between sounds. First, children were more successful in reflecting a rhythmic pattern if they felt it without piano accompaniment; in the case of isolating the rhythm of a musical piece, respondents often replaced the characteristic combination of durations with a metric pulsation, highlighting only the supporting parts. Secondly, the easiest task for schoolchildren was to distinguish the so-called “square” rhythmic patterns, built on the alternation of two eighth and quarter or eighth and sixteenth parts, with an even sum of durations; the feeling of “non-square” rhythms with different ratios of the fourth and one eighth parts, i.e., with an odd sum of durations, caused significant difficulties in the respondents. According to the quality of the survey – from absolutely identical to completely non-identical – the analyzed rhythmic patterns form a peculiar sequence: “summation” (two eighths – a quarter), “crushing” (a quarter – two eighths), “dotted” (eighth with a dot – sixteenth), “iambic oscillation” (eighth – quarter), “choreic oscillation” (quarter – eighth). Regarding the differentiation of musical sounds by volume and timbre, we must note the infallibility of these perceptual operations, their condensed nature, and hence, high speed. Thus, among all the properties of sounds, the least informative for students are pitch and duration – those that are considered semantic features of musical language; at the same time, ideas about strength and timbre – important, but not determining qualities of sounds – are finally formed at the beginning of school.

The results of classification-type tasks prove that, despite the high quality of distinguishing sounds by timbre, children's awareness of information about the diversity and grouping of instruments as carriers of specific color of music remains incomplete. First-graders accurately attributed the violin to the strings, and the tambourine – to the percussion, and at the same time had low classification of other instruments: strings – banduras (31%) and piano (23%); wind instruments – flutes (50%) and trumpets (12%); percussion – metallophone (35%).

Specific features are also revealed in the establishment of serial pitch ratios. The seriation was carried out quite accurately (96%) in the case of reflection of the ascending or descending scale, i.e., provided a uniform and gradual increase or decrease in the pitch of musical sounds. In the case of ordering the ascending or descending major triad, when the change in pitch occurred evenly, but not gradually, with more pronounced intervals, the indicators decreased to 50%. Respondents with the lowest quality established the relationship between the elements of the triad, exposed in a mixture, with uneven increase and decrease in height, inconsistent alternation of degrees (for example, III – V – I and III – I – V) – in these cases, the number of adequate solutions did not exceed 4%. At the same time, all students performed a series of musical sounds in descending and ascending order, increasing and decreasing the volume without any complications, demonstrating the maximum numerical indicators.

Reproduction of the properties of sounds in general was aimed at organizing a kind of analysis of units of musical language, and in several respects simultaneously – pitch and metrorhythmic. During the intonation of the songs, which, due to the weak auditory coordination of children's vocal apparatus, took place with musical accompaniment, a large number of respondents (50%) were able to “purely” sing the whole melody. Other students correctly intoned only individual fragments of the melody, making mistakes in the reflection of wide intervals, and sometimes replaced singing with a rhythmic recitation of the

text. Diagnostic exercises to reproduce the pitch and duration of sounds with the help of spatial modeling and during music playing on a metallophone were difficult: respondents usually identified the heard motive and graphic models by random selection; when compiling the matrix and in the process of playing the instrument – improvised, guided by own auditory representations, rather than pitch and rhythmic relations, given in the spatial or musical samples; at best, someone property of sounds was taken into account – more often duration than pitch.

Assessing certain criteria for the quality of musical sensory skills, we can note a certain synchronicity in the formation of operations to distinguish the basic properties of sounds and the assimilation of classification and serial connections between them. This proves the presence of quite stable standards about the sounds of music in younger students. However, the ways of applying such ideas in the survey of musical phenomena are improved with a noticeable slowdown, do not have a strong support for such spatial stereotypes as “height”, “length”, “distance”, “row”, “ascending”, “descending” movement, which significantly reduces their effectiveness, does not provide the necessary materialization of units of language, and thus analytical, conscious perception of musical works.

According to individual quantitative indicators, first-graders are grouped into three groups – with elementary (27%), average (54%), sufficient (19%) levels in the absence of students with a high level of formation of the analyzed skills. The average score for the quality of musical sensory processes is .523 (relative to a possible score of 1.00).

The introduction of special development influences took place in stages. At the first stage (1st grade) the main goal was to systematize the available standards of musical sounds for students, to expand their range. In both experimental groups (EG-1, EG-2) perceptual actions were implemented using traditional intermodal connections (musical auditory and spatial visual); multiple examinations of the same sensory values were organized in order to stereotype the corresponding sensory operations, reduce their motor components, and consolidate the obtained sensory images.

In the exercises and game tasks proposed at this stage, the first-graders of the experimental groups made the following: classified sounds into non-musical and musical, musical ones – into high and low, long and short, loud and quiet; performed a series of sounds in descending or increasing order of pitch, duration, volume; classified musical sounds by timbre into vocal and instrumental, vocal – into the sounds of children's, female, male singing voices, instrumental – into the sounds of percussion, wind, stringed musical instruments; simulated with the help of graphic symbols ascending and descending scale, rhythmic patterns, dynamic shades of the melody; performed chants, accompanied by singing hand movements in the appropriate direction; reflected the rhythm of the melody with rhythmic compositions, applause, blunts, playing children's percussion instruments; transmitted the dynamics of music by metric applause of different volume, spreading the palms to the sides and bringing them closer to each other [2, p. 431-437; 5].

At the second stage (grades 2-3) the main attention is paid to the development of students' detailed methods of examination of musical sounds and phenomena on the basis of subject manipulations with their models (grade 2); reduction of sensory operations, their final translation exclusively into an ideal form (3rd grade). The developmental stimuli were clearly differentiated: for EG-1 participants – with a high degree of intensity (realization of intermodal connections of musical auditory, spatial and color visual, phonemic auditory perception); for EG-2 participants – with a moderate degree of intensity (realization of intermodal connections of musical auditory and spatial visual perception).

In the exercises and game tasks provided for this stage, second- and third-graders of experimental groups made the following: updated knowledge about the differences of musical sounds in pitch, duration, volume, timbre, systematized sounds by acoustic properties, marked with symbols; selected a graphic model for a melody-sample, a melody for a graphic model-sample; made a detailed sound analysis of the melody listened to it, sang loudly on rhyme syllables (ta, ti-ti; di-li, don) to instrumental accompaniment, reflected the movement and duration of sounds by hand, arranged models of sounds in the heard relations; performed a condensed analysis of the melody after listening it was quietly sung with the mouth closed, without instrumental accompaniment; practiced singing on the “column”, reproduced the acoustic properties of the melody in the instrumental game, musical-rhythmic movements, created their own musical compositions [2, p. 451-458; 6].

Participants of EG-1 additionally performed tasks for the formation of: a) methods of associative musical and phonemic auditory perception – selected for words articulated with interrogative or affirmative intonation, the appropriate melodic-rhythmic schemes; analyzed word schemes: determined the number of syllables, found the stressed one among them, recited “that” and “those” and applauded the melodic-rhythmic pattern, chose the appropriate words from the proposed ones; listened to the word, pronounced it with a clear accent and hand movements, made a diagram on a sheet of paper of graphic models of musical sounds, placed an accent mark, played the established ratio of syllables on a metallophone; reproduced the constituent structure of the word using a musical notation [2, p. 466-469]; b) methods of associative musical auditory and color visual perception – established the connection of high sounds with light, transparent colors, medium pitch sounds with bright, saturated, and low – with darkened, dense colors; selected to the motifs played in different registers, corresponding to the shades of the model; reproduced pitch relations between the elements of the heard musical intervals by color models of different brightness; sang on graphic models of the sequence of sounds (on the syllables “don” and “di-li”, with and without accompaniment), played them on musical instruments (metallophones) [2, p. 469-471].

At the third stage (4th grade) the achievements of the previous stages were evaluated, the deviations of the obtained results from the set goals were analyzed, the reasons for such discrepancy were revealed, the educational and perceptual activity of students of experimental groups was adjusted depending on the nature of detected deformations.

Let us note that in the control group, the teaching of musical perception was carried out by the mass method of primary education, without any experimental influences.

5 Discussion

The results of the final diagnosis suggest positive changes in the control and experimental groups, but with higher empirical data in the first experimental group (see Table 2).

The ability of the participants of the final cut to distinguish the elements of melodic intervals, as in the input diagnostics, directly correlated with the distance between the sounds: the wider the musical interval, the more accurate the categorization of pitch relationships. In the control group, the vast majority of people (62%) correctly set the elements of only wide intervals, a smaller number (38%) – differentiated the sounds of wide and medium-width intervals. In the experimental groups, we can additionally identify those children who adequately compared the sounds of wide, medium width and narrow intervals, including high and low thirds (in EG-2), and high, low thirds and high seconds (in EG-1). The percentage distribution of students by these features is as follows: 12/23/65 in the first experimental group, 13/23/64 – in the second.

Thus, the weight of students who distinguish most of the musical intervals – from a pure octave to a large second – is specific, which proves the effectiveness of the implemented development activities. This is confirmed by a comparison of the scores of the final testing – in the experimental groups, they reflect a sufficient quality of sound discrimination in pitch, in the control group – the average. We will add that differentiation of sounds

of the narrowest musical interval – a small second – caused difficulties in the majority of fourth-graders, but all of them unmistakably defined pure prima, that is unison sounding of the heard sounds.

Table 2: Quality of musical sensory skills of junior schoolchildren (final slice, average values)

Criteria	Validity	Indexes	Validity	Detection of indexes			Assessment of indexes			Assessment of criteria		
				KG	EG-1	EG-2	KG	EG-1	EG-2	KG	EG-1	EG-2
Distinguishing musical sounds	.34	distinguishing musical sounds by pitch	.30	.534	.705	.687	.160	.212	.206	.246	.280	.277
		distinguishing musical sounds by duration	.30	.544	.708	.692	.163	.212	.208			
		distinguishing musical sounds by volume	.20	1.00	1.00	1.00	.200	.200	.200			
		distinguishing musical sounds by timbre	.20	1.00	1.00	1.00	.200	.200	.200			
Classification ans seriatin	.33	classification of musical sounds by timbre	.25	.498	.703	.678	.125	.176	.169	.250	.281	.277
		seriation of musical sounds by pitch	.25	.532	.706	.684	.133	.177	.171			
		seriation of musical sounds by duration	.25	1.00	1.00	1.00	.250	.250	.250			
		seriation of musical sounds by volume	.25	1.00	1.00	1.00	.250	.250	.250			
Playing a melody	.33	reproduction of a melody in singing, spatial modeling, playing a musical instrument	1.0	.173	.567	.558	.173	.567	.558	.057	.187	.184
∑	**1.00**									**.553**	**.748**	**.738**
									Quality of musical sensor skills (input cut)		.523	
									Dynamics of quality of musical sensory skills	.030	.225	.215

Changes of varying degrees also occurred in the distinction of musical sounds by duration. In the control group, compared to the observational stage, the indicators increased insignificantly and this was due to intragroup migration: the number of respondents able to adequately transmit from one to three time dependencies between sounds decreased; respectively, the number of children who beat four rhythmic sequences out of five increased. The majority were individuals who reproduced two (38%) or three (42%) rhythmic patterns, one and four – 4% and 16%, respectively. More precisely, students repeated the rhythms of "summation" (two eighths – a quarter) and "crushing" (a quarter – two eighths), with some difficulty – "dotted" (eight with a dot sixteen), "iambic oscillation" (eighth – a quarter), with noticeable difficulties – "choreic oscillation" (quarter – eight).

In the experimental groups, we can identify recipients who correctly described two, three, four, and all five rhythms. Strong dynamics of indicators of formation of the characterized perceptual operation was provided by prevalence of students who reflected four ratios of durations – 54% in EG-1 and 56% in EG-2 (only tapping of "choreic oscillation", i.e., sequences of the fourth and eighth was wrong), and the presence of students who are able to perform a diagnostic task with absolute success – 12% in the first of these groups, 8% in the second.

Let us note also the following fact: in the experimental groups, the instrumental version of the presentation of rhythmic patterns (playing them on the piano) did not have a destructive effect on testing, recorded at the stage of ascertainment: fourth-graders who showed high performance (reflected four or five rhythmic patterns), did not replace the alternation of long and short durations with metric pulsation. In our opinion, this proves the stability of ideas about the temporal relationship between musical sounds, the ability not to be distracted by others, including the pitch of the audible melody. Representatives of the control group in the conditions of melodic presentation of rhythms quite often moved to the reflection of the pulse, i.e., accentuation of strong parts, probably following the movement of the melody.

The results of measurements of the distinction between musical sounds by volume and timbre allow asserting the absolute formation of these perceptual operations. As during the input diagnostics, at the final stage of the study all its participants responded adequately to the dynamic shades of a musical passage (*f* – *p* or *p* – *f*) by playing the drum, unmistakably guessing the timbre of a given musical instrument among the sounds of others. Thus, the exact sense of the relative volume and timbre of musical sounds is an age-old feature of the sensory sphere of younger students.

However, the classification of musical sounds by their timbre has not been completed, but its quality has increased significantly in both experimental groups up to estimates of sufficient quality against a slightly lower than average quality level of such arrangements in the control group. According to the effectiveness, students can be divided into those who performed a diagnostic task with low and medium success, and those who manifested a sufficient and high level of success.

The share of the contingent of the control group (77%) was made up of respondents who showed low and medium quality scores. Their typical achievements, with a wide range of individual differences, were the correct classification of violin to strings, flute to wind, metallophone and tambourine to percussion instruments, sometimes difficulties in defining the bandura or piano as string instruments and quite often – in the classification of trumpet as wind tool. The subsequent level of ordering caused considerable difficulties, as the children had a poor idea of keyboard and plucked strings, metal (copper) and wooden wind, noise and melodic percussion instruments. An exception to this series was the violin, which students adequately considered a bowed stringed instrument.

The majority of the experimental groups (81% of people in the first and 75% in the second one) included recipients who classified the sound of musical instruments with assessments of sufficient and high quality. The educational and perceptual achievements of these children included a strong mastery of the first level of ordering instruments – almost infallible division into strings, winds and percussion – and mastering a significant number of their internal connections. At the same time, there was a certain gradation in the establishment of these relationships: the easiest and most efficient students differentiated bow and keyboard string instruments (violin, piano), less successful – noise and melodic percussion (tambourine, metallophone) and brass and woodwind (trumpet,

flute), it was difficult to categorize the bandura as a plucked stringed instrument (we explain this by the lack of vocabulary work with the term "plucked": its correct understanding and knowledge of the technique of sound construction on the bandura would allow students to more adequately classify it).

Trying to identify the depth of mastery of the timbre structures of music sounds, the participants of the final section were directed to self-determination of classes of musical instruments (excluding indicators of such actions). After listening to an audio recording of a piece of music and naming a heard instrument, fourth-graders were asked, "What group of instruments does it belong to?" or "To which subgroup of string (wind, percussion) instruments does he belong?", without listing these groups and subgroups themselves. The results of the survey confirmed a stronger mastery of the first than the second stage in the systematization of musical instruments by timbre of sound, and illustrate a higher level of awareness of the relevant information of respondents who experienced special learning and perceptual influences compared to children who did not. It should be noted that in case of difficulties, the questions were formulated according to the option provided by the input diagnosis: "Which – string, wind or percussion belongs to the musical instrument you heard?" or "Which string instrument sounds – bow, keyboard or plucked?"

Similar quantitative characteristics were observed in the tasks of establishing serial relations between musical sounds, in particular, by their pitch. Thus, the indicators of the majority of the control group (77%) indicate low and medium quality of these sensory actions, which is caused by the inability to transmit identically to the sample uniform or uneven decline and increase in height of the elements of major tonic triad (I – III – V, III – V – I and III – I – V, III – V – I) with accurate reflection of the sequential scale in any direction (I – II – III – IV – V – VI – VII – VIII (I) and vice versa). Estimates of sufficient and high quality prevailed in the experimental groups (77% of cases in the first group and 75% in the second) due to absolutely accurate ordering by recipients of ascending and descending scale and triad with uniform increase or decrease of pitch of its components (one or two errors were observed only under conditions of exposure to triad sounds mixed); in addition, in both experimental groups, the proportion of individuals – 12% in the first and 8% in the second – who performed the control exercise with maximum results. The series of musical sounds in duration and volume was performed correctly by all participants of the pedagogical research, without any delays and mistakes, as well as at the ascertaining stage. In our opinion, these operations can be motivated to give the status of age features of the sensory sphere of junior schoolchildren.

Significant changes have taken place in the reproduction of the acoustic properties of the melody in singing, spatial modeling of pitch and rhythmic relations, playing a musical instrument. Approximately 69% of the respondents in the control group intonation "purely" and rhythmically performed the melody while singing with accompaniment. Other children (31%) did not accurately reflect the coincidence of intervals, even if they were not very wide, for example, descending pure fifth and subsequent ascending pure fourth (in the song "Oh, there is a viburnum in the forest"), or single but wide intervals, on such as the ascending great sextet (in the song Teach me Music), in some cases recited the text without reproducing the pitch of the song. As during the input measurements, the students of the control group could not choose the model to the heard musical passage, simulate its melodic and rhythmic movement with the help of conditional symbols, play a musical phrase on a metallophone according to the presented model, showing weakness of skills as height, length, duration, ascending or descending direction of movement, etc., in the perception and reproduction of music sounds.

In the experimental groups, the number of fourth-graders who did not solve any diagnostic task significantly decreased (up to 12% in the first and 13% in the second, instead of the above 31% in the control group), as did the share of recipients who completed one the task is mainly "pure" singing and rhythmic (4% in each group). At the same time, there were sets of students who were able to perform two, three, and four (i.e., all) control exercises, and with a specific "accumulation" of educational and perceptual achievements. Thus, 38% of the representatives of the first and 40% of the second experimental group reproduced the melody in singing and chose the appropriate model for the melody played by the teacher; 34% of children in the first and 31% in the second group still accurately formed a spatial model of the heard passage, 12% of students in both groups in addition to the above correctly reflected the given model musical phrase while playing it on a metallophone.

The described features quite reasonably explain the differences between low and medium ratings of the quality of reproduction of the properties of the melody in different groups and convincingly prove the effectiveness of the system of implemented didactic tasks. These same features highlight another aspect of the implemented didactic system – its positive impact on the formation of methods of examination of musical phenomena. Pupils of experimental groups, choosing a model for the heard melody, often asked to play it again, during the re-listening sang it softly, followed with the index finger its movement according to the scheme, made on this basis a conclusion about its correspondence or inconsistency of the melody; modeling a melody, listening to it, singing with parallel hand movements, and only then laid out the chips (squares and rectangles made of cardboard) on the matrix in the right proportions; before playing on a metallophone analyzed the pattern, commented on the relationship between the sounds: "The melody floats up, then sounds at the same height, again at the same height, only slightly higher, then – decreases, but now the sounds are long and used to be short", after which played the phrase, first slowly, constantly shifting his gaze from the scheme to the tool, then – faster, more coherently and almost without reference to the scheme.

In case of difficulties, the teacher corrected the actions of fourth-graders of experimental groups with leading tasks and questions. For example, in the selection of a model for a piece of music, children were given a pencil, advised to follow the scheme of the melodic movement and again played a sample melody. Modeling a given melody with symbols, students often correctly reflected the rhythmic dependencies, forgetting about the pitch, and laid out the chips in a single-level series. Then the students were asked, "Are the sounds the same in pitch?" In case of inaccurate music playing on a metallophone, the recipients were directed to the analysis of the scheme with the following questions: "How should the melody move in the first segment? Is it necessary to change the pitch on the next line?" etc.

Usually, the assistance provided contributed to the actualization of rational methods of examination of musical phenomena, provided adequate performance of diagnostic exercises (however, we did not take into account the decisions obtained in this way as positive). In our opinion, the findings are evidence of the formation of a zone of immediate development of musical perception under the conditions of the introduction of specially organized developmental influences.

The final test of auditory musical sensory skills reflects the average level of their formation in fourth-graders of the control group (.553), sufficient – in students of the first (.748) and second (.738) experimental groups. The increase in dynamics is as follows: .030 – in the control group, .225 – in the first experimental group and .215 – in the second of them.

According to individual success in the control group, 18% of students with elementary, 59% with average and 23% with sufficient quality levels of color sensory skills; in the first experimental – 12% with average, 46% with sufficient, 30% with high and 12% with consistently high quality levels of musical auditory sensory skills; in the second experimental – 13% with average, 48% with sufficient, 27% with high, 12% with consistently high levels of musical auditory perception.

The non-belonging of experimental and control groups to one general set of respondents is reflected in the graphical model of one-way analysis of variance ANOVA (Figure 1). The F-criterion is greater than one and is equal to 85,454, the significance of the statistical conclusion p is less than .05 and is equal to .0000. On this basis, we can conclude that there is a significant difference between the group averages.

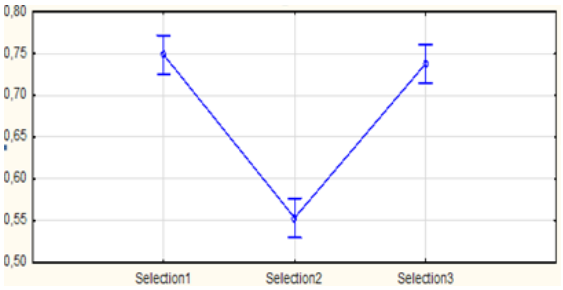

Figure 1 – Graphical model of similarity of the average values of sample 1 (first experimental group), sample 2 (control group), sample 3 (second experimental group)

6 Conclusion

The performed quantitative and qualitative analysis of empirical data allows making certain generalizations.

1. Musical sensory ability as a functional unit of musical auditory perception of junior high school students is a system of auditory interiorized perceptual familarizing-cognitive actions based on mastered standards of music sounds and skills of applying these standards in the examination of musical phenomena.
2. In the mass experience of primary education, students master musical sensory skills at the elementary, secondary, and sufficient quality levels with a predominance of secondary. Among the main features of musical sounds, to a lesser extent, in children operations to distinguish sounds by pitch and duration formed, there are some difficulties in the classification and serial ordering of sounds, the greatest difficulties students have in reproducing the properties of musical sounds in singing and instrumental play.
3. Improving musical perception is facilitated by the introduction into the educational process of a system of developmental exercises and game tasks, constructed on the basis of intermodality – coordination of musical and phonemic auditory, musical auditory and color visual, musical auditory and spatial visual sensory processes. The system of special didactic influences should be aimed at expanding and systematizing the standard ideas about the sounds of music with the subsequent transition to the formation of students' rational ways of examining musical phenomena with the help of learned standards.
4. A clear positive dynamics of the quality of musical sensory skills was found in both control and experimental groups of students, but namely in the first experimental group the increase in dynamics is most noticeable. As a result of the implementation of special didactic influences, there were changes in the structure of groups. In the control group, there were children with elementary, medium, sufficient levels of quality of musical perception in the absence of a high level. In the experimental groups of respondents with an elementary level of development musical perception was not identified, but such a level gradation was established – with an average, sufficient, high and consistently high level of mastery of musical sensory processes. Students of experimental groups, especially the first of them, have the highest indicators of differentiation and systematization of music sounds, variety and sufficient quality of skills to reproduce them in singing, spatial modeling, instrumental playing.

Literature:

1. Arystova, L., & Mustiatsa, I. (2017). Development of a sense of rhythm in music lessons in primary school. *Scientific Bulletin of MNU named after VO Sukhomlinsky. Pedagogical sciences*, 1(56), 180-183.
2. Barbashova, I.A. (2018). Didactic system of sensory development of elementary schoolchildren: theory and practice. Melitopol: Vydavnychyi budynok Melitopolskoi miskoi drukarni.
3. Barbashova, I. (2021). Formation of color perception of junior schoolchildren. *AD ALTA: Journal of interdisciplinary research*, 11/01/XVII, 102-107.
4. Barbashova, I. (2021). Formation of elementary school children's visual-spatial perception. *AD ALTA: Journal of interdisciplinary research*, 11/01/XV, 15-20.
5. Barbashova, I. (2019). Sensory development: shaping the ability to explore the sounds of music. *Primary school teacher*, 4, 4-7.
6. Barbashova, I. (2019). Sensory development: form the ability to explore the sounds of music. *Primary school teacher*, 5, 26-29.
7. Barbashova, I. (2021). Psycholinguistic foundations for the formation of phonematic skills of younger schoolchildren. *AD ALTA: Journal of interdisciplinary research*, 11/01/XV, 21-25.
8. Bonacina, S., Krizman, J., White-Schwoch, T., Nicol, T., & Kraus, N. (2019). How Rhythmic Skills Relate and Develop in School-Age Children. *Global Pediatric Health*, 6, 1-7. DOI: https://doi.org/10.1177%2F2333794X19852045.
9. Bulatova, L.O. (2020). Pedagogical conditions of formation of musical-intonational representations of junior schoolchildren. *Preschool and primary education in the modern pedagogical space.* Sumy: Sumy State Pedagogical University named after A.S. Makarenko, 114-128.
10. Cherniak, Y.B., Volska, Y.V., Mishchenko, S.P., & Yorkin, V.V. (2020). Methodical aspects of development of musical and auditory representations of pupils of junior classes of art schools. *Bulletin of Alfred Nobel University. Series: Pedagogy and Psychology*, 2(20), 89-100. Available at: https://pedpsy.duan.edu.ua/images/PDF/2020/2/11.pdf.
11. Curwen, C. (2020). Music-Colour Synaesthesia: A Sensorimotor Account. *Musicae Scientiae*, 2, 1-20. DOI: https://doi.org/10.1177/1029864920956295.
12. Hallam, S. (2017). The impact of making music on aural perception and language skills: A research synthesis. *London Review of Education*, 15(3), 388–406. DOI: https://doi.org/10.18546/LRE.15.3.05.
13. Kalinichenko, O., & Arystova L. (2019). *Art. 1st grade. The system of lessons according to the textbook of O. Kalinichenko, L. Aristova.* Kyiv: Education.
14. Kondratova, L.H. (2019). *Arts: Work-book of lessons. 1st year*. Ternopil: Textbook Bogdan.
15. Leonova, O.M., & Cherkasova, S.O. (2020). The influence of music-didactic game on increasing interest in music in junior high school students. *Innovative pedagogy*, 30/1, 83–87. Available at: http://www.innovpedagogy.od.ua/archives/2020/30/part_1/19.pdf.
16. Levytska, I.M. (2018). Development of timbre hearing of primary school children in the process of instrumental music making. *Scientific notes of the Central Ukrainian State Pedagogical University named after Volodymyr Vynnychenko. Series: Pedagogical sciences*, 170, 150–155. Available at: http://nbuv.gov.ua/UJRN/Nz_p_2018_170_35.
17. Lobova, O.V. (2020). Peculiarities of students' art education in the conditions of the New Ukrainian school (according to the textbooks "Art", 1st and 2nd grades). *Preschool and primary education in the modern pedagogical space.* Sumy: Sumy State Pedagogical University named after AS Makarenko, 187-203.
18. Lobova, O.V. (2018). *The Arts, 1 gr.* Kyiv: Shkoliar. Available at: https://pidruchnyk.com.ua/1206-mystectvo-1-klas-lobova.html.
19. Lundetrae, R., & Thomson, J.M. (2018). Rhythm production at school entry as a predictor of poor reading and spelling at the end of first grade. *Reading and Writing*, 31, 215-237. DOI: https://doi.org/10.1007/s11145-017-9782-9.
20. Masol, L., Haidamaka, O., & Kolotylo, O. (2020). *The arts. Synopsis-educainal kit of art lessons. 1 gr*. Kyiv: Heneza.

21. Medvid, T.O. (2018). Relative system of solmization as a factor in raising the level of school music education. *Scientific Bulletin of Mukachevo State University. Series: Pedagogy and psychology*, 1(7), 143-145.
22. Mishedchenko, V. (2018). Features of music education and upbringing of fourth-graders of secondary school. *Scientific Bulletin named after V.O. Sukhomlinsky. Pedagogical sciences*, 1(60), 218-223.
23. *On approval of model educational programs for 1-2 grades of establishments of general secondary education*. (2019). Order of Ministry of Education and Science of Ukraine No.1272. Available at: https://mon.gov.ua/ua/npa/pro-zatverdzhennya-tipovih-osvitnih-program-dlya-1-2-klasiv-zakladiv-zagalnoyi-serednoyi-osviti.
24. *On approval of model educational programs for 3-4 classes of establishments of general secondary education*. (2019). Order of Ministry of Education and Science of Ukraine No.1273. Available at: https://mon.gov.ua/ua/npa/pro-zatverdzhennya-tipovih-osvitnih-program-dlya-3-4-klasiv-zakladiv-zagalnoyi-serednoyi-osviti-1273.
25. Rakhmanova, O.K. (2018). Artistic and creative synesthesia of junior schoolchildren in "color music". *Musical art in educational discourse*, 3, 121-124.
26. Politimou, N., Bella, S.D., Farrugia, N., & Franco, F. (2019). Born to Speak and Sing: Musical Predictors of Language Development in Preschoolers. *Frontiers in Psycholody*, 10: 948. DOI: https://doi.org/10.3389/fpsyg.2019.00948.
27. Ruda, H.S. (2018). Musical abilities of junior schoolchildren: methodical support of development. *Bulletin of Chernihiv National Pedagogical University*. *Series: Pedagogical sciences*, 151(2), 212-214. Available at: http://nbuv.gov.ua/UJRN/VchdpuP_2018_151(2)__50.
28. Whiteford, K.L., Schloss, K.B., & Helwig, N.E. (2018). Color, Music, and Emotion: Bach to the Blues. *i-Perception*, 9(6), 1-27. DOI: https://doi.org/10.1177/2041669518808535.
29. Zhang, L., Xie, S., Li, Y., Shu, H., & Zhang, Y. (2020). Perception of musical melody and rhythm as influenced by native language experience. *Acoustical Society of America*, 147(5): EL385. DOI: https://doi.org/10.1121/10.0001179.

Primary Paper Section: A

Secondary Paper Section: AM