

The Impact of Self-made Musical Instruments on Pupils' Musical Abilities

Abstract

The contribution deals with progressively understood instrumental activities during the lessons of music education while using children's self-made musical instruments and graphical expressions of the music elements. When effectively linked to other music activities, such a concept can be a way to complex personality development of pupils. The are partially presented research results that refer to the observation of the influence of music education drawn up in this way on pupils' musical abilities in the 2nd and 4th grades of elementary schools.

Key words: *Self-made musical instruments, musical abilities, pedagogical experiment.*

Introduction

The use of musical instruments during the lessons of music education under the traditional way of teaching in Slovakia until now has not been adequate with regard to the possibilities that the use of musical instruments brings for overall personality development of pupils. By means of explorational diagnostic research we have proved that musical instruments in teaching are used only sporadically, non-systematically and spontaneously, and moreover, schools own an insufficient number of professionally made musical instruments for children. (Janeková, 2004). This is why we choose *progressive understanding of instrumental activities* in the music educational process as purposeful, systematic influence while using all musical instruments – including the body as an instrument as well as simple elementary musical instruments made by pupils – in an optimal cooperation with other

activities when developing both cognitive and non-cognitive functions and processes of pupils' personality. The results of the year-long work of international pedagogues (Jungmäir, 2003), (Wuytack, 2004) give us justification to presume that such an attitude to musical activities generates a positive influence on children's personality in all directions, even though we do not know any scientific studies specifically aimed at the use of self-made musical instruments. With respect to the use of self-made musical instruments, in Slovakia almost unfamiliar, we can consider the mentioned research to be ground-breaking. Within the long-lasting research by means of a pedagogical experiment we have proved that instrumental activities understood in this way can meaningfully influence pupils' motivation providing there is optimal linkage to other musical activities during the lessons of music education. (Janeková, 2005)

The problems and goals of the research

We wanted to find out through this research whether in this way, when compared to the traditional understanding of instrumental activities, we can also relevantly influence the development of children's musical abilities. Our aim was to prove that the use of simple self-made musical instruments is not an attractive entertainment or goalless play only; we wanted to study the influence of the systematic use of these instruments on children's musical abilities as well. Their adequate development is the basic prerequisite to fulfill the elementary goal of music education in elementary schools; that is first of all to raise a perceptive and active listener able to implement individually appropriate musical activities towards individual taste orientation. (Hatrik, 1997) Since we focused our long-term research on the pupils of the 2nd to 5th grades of elementary schools, we were primarily interested in the growth of the key musical abilities that can be significantly influenced at this age. Our effort was to optimally use self-made musical instruments, which can be available and of use for each pupil, and possibly other available Orff instruments and classical musical instruments as well. An important place within this stage of children's musical development is occupied by a possibility to illustrate and keep sound elements and music units by means of graphical sound symbols (Janeková, 2001a), through which pupils learn to distinguish various levels of basic sound characteristics and sound stories that they themselves implement by playing musical instruments. The goal of our research was to find out the influence of the systematic use of progressively understood instrumental activities, with both making elementary musical instruments and using various other musical instruments, on key musical abilities of pupils guided in this way. On the other hand, our goal was

also to find out the influence of the traditional way of teaching with a sporadic and spontaneous use of musical instruments on the development of pupils' basic musical abilities.

A survey of the applied methods, organization, and process of the research

With respect to the polarization of the contribution, we have used the following methods (Juszczuk, 2003) and techniques: a pedagogical experiment, pedagogical test – the Bentley standardized test of musical abilities, statistical method, qualitative and quantitative analysis.

In the *pre-research*, which was implemented in the Š. Moyzes Elementary School in Banská Bystrica in the 1st, 2nd, 3rd, and 4th grades with 69 respondents in the 2000/2001 school year, we pointed out the following as goals:

1. To verify some of the new methods of using instrumental activities, particularly the use of simple musical instruments and their further use for pupils' instrumental play as well as the graphic expression of music elements. These activities were first used in German musical pedagogy where we got our motives from (Auerbach et al., 1978), (Drees et al., 1980), (Grühn, 1997), (Jahnz, 1996).
2. To examine the Bentley test of musical abilities with Slovak comments, and with test sheets for 6-year-old children, designed by us.

In order to determine basic musical abilities we used the standardized test battery by A. Bentley, which is intended for all the age categories that we were interested in. It is easy to work with it, as it is applicable for group testing. The test consists of four subtests:

- I. the test of the ability to distinguish tonal height,
- II. the test of the melody memory,
- III. the test of the chord analysis,
- IV. the test of the rhythmic memory.

Since we worked also with the pupils of the 1st grade, and we could not assume their knowledge of letters so, for the Bentley test of musical abilities we suggested the use of the test sheets with a graphical expression of the required tasks. This expression proved to be right even though all the testing in the 1st grade, including task explanation, was done by almost the whole class, and there remained no time to seriously fulfill the pupils' motivation questionnaire. We therefore eliminated the 1st grade from the research and rejected the graphical expressions of the tasks during the Bentley test of musical abilities. In the first subtest the respondents

heard a pair of tones of various pitch; their task was to determine whether the second tone was higher (“V”), or lower (“N”), or the same (“R”) in comparison to the first one. In the second subtest the pupils in each task compared two samples of melody consisting of five tones of different pitch. In the case of inequality of both samples, the respondents were to write down the sequence of different tones in the sample. The third subtest required to designate the number of tones in a chord, and to write it down on the prescribed place in the sheet. In the fourth test pupils compared two samples, this time rhythmic ones, consisting of four beats, while filling in was identical as it was in the second subtest. Slovak comments acquitted well; therefore we used them in the research.

Our long-term research was implemented by a pedagogical experiment in the school year 2003/2004 with a sample of pupils from Tatranska Street Elementary School in Banska Bystrica. We used the parallel experiment (Juszczuk, 2003). In this article we are presenting the research that concerns the 2nd and 4th grade pupils. In the *experimental* groups (2.C and 4.C) teaching continued mostly according to the original time – thematic plans; we prepared methodological help to them based on the said international resources, proposals of elementary musical instruments as well as their use during music education lessons together with graphical expressions of music elements (Drees et al., 1980), (Janeková, 2001a), (Janeková, 2001b). In the *control* groups (2.B and 4.A) the teaching went on without any intervention from our part, with regular teaching tools and musical instruments.

Till the beginning of the experiment at the end of October and early November 2003, when we made *entry measurement* of key musical abilities of pupils, in all the groups several instruments of the Orff instruments were sporadically and non-systematically used. In the experimental group 2.C self-made musical instruments were used, in the experimental group 4.C the body was used during instrumental activities from the end of March on. At the close of the experiment in June 2004 we made *output measurement* of the level of the key musical abilities of the respondents in both the experimental and control groups. During statistical processing we ignored the data that concerned the pupils with additional music education beyond the lessons of music education at elementary school.

Since there are a lot of schools with a small number of pupils in classes throughout our country now, and some pupils could not participate in the entry or output test, we are aware that the output research samples are small; this was considered when we processed data by means of the used statistical methods. We figured out the basic characteristics of these packages in particular tests: average M , diffusion s^2 , standard deviation s , variation coefficient V (Riečan et al., 1992).

In order to determine the significance of the differences between the obtained averages of individual tests in both the control and experimental groups in indi-

vidual classes of entry and output measurement we used Student's t-test. For verification of the assumptions for relevant use of Student's t-test we used the test of normality by Wilks-Shapiro normality test (Wimmer, 1993), and for verification of homogeneity of diffusion we used Snedecor's F-test (Chráska, 1991). Because diffusion homogeneity was not always fully reached, in this case we used Cochran-Cox t-test (Wimmer, 1993). During both entry and output measurement, the principle of the tasks was explained by means of graphical expressions before each subtest.

The influence of the instrumental activities on pupils' key musical abilities

Instrumental activities belong to basic cognitive functions of the personality of an individual. Therefore, it is an ambition of the educational process within the lessons of music education in elementary schools to optimally develop them in every pupil. This should be supported by appropriate musical activities. This is why we decided to direct instrumental activities to the development of the musical abilities of children. We defined **the problem** of our exploration-verification **research** (Juszczuk, 2003) as follows: *Can we develop pupils' basic musical abilities through progressively understood instrumental activities by the making of musical instruments during the lessons of music education in elementary schools?*

At the same time we paid attention to the cooperation of these activities with other musical activities while already following the new textbooks of music education, for example with the method of vocal intonation using relative solmization that was appropriately complemented.

The main hypothesis:

Systematic, purposeful music education with the regular use of instrumental activities using self-made musical instruments, or additional musical instruments, has an important influence on the development of the basic musical abilities of elementary school pupils.

Special hypotheses:

1. *A systematic, purposeful music education with the regular use of instrumental activities using self-made musical instruments has a significant influence on the development of the basic musical abilities of the 2nd grade pupils of elementary schools when compared with the traditional way of music education teaching.*

2. *The phase of a systematic, purposeful music education with the regular use of instrumental activities using self-made musical instruments in combination with the phase with the systematic use of playing on the body functioning as a musical instrument, has a significant influence on the development of the basic musical abilities of the 4th grade pupils of elementary schools when compared with the traditional way of music education teaching.*

The research results

The obtained data and enumerated statistical characteristics from the measurement in the *second* grade are mentioned in the following table.

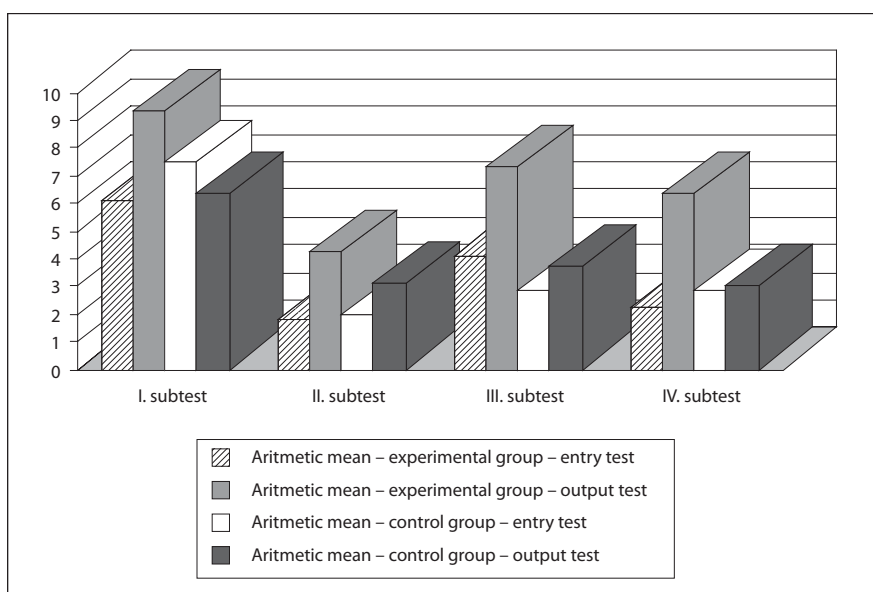
Table 1 The data from the entry and output measurement of the musical abilities in experimental (2.C) and control (2.B) groups

Entry measurement													
	Experimental group – 2.C						t-test	Control group – 2.B					
Test	Σxi	%	M	s	s ²	V		Σxj	%	M	s	s ²	V
I.	92	30.7	6.13	2.95	8.70	28.0	1.38–	136	37.7	7.54	2.37	5.60	20.4
II.	30	17.6	1.76	1.25	1.57	63.4	0.47–	26	20.0	2.00	1.47	2.17	60.7
III.	70	20.6	4.12	3.33	11.11	44.3	1.24+	40	14.3	2.86	1.99	3.98	49.4
IV.	38	22.4	2.24	1.35	1.82	51.9	1.03–	40	28.6	2.86	1.99	3.98	49.4
Output measurement													
	Experimental group – 2.C						t-test	Control group – 2.B					
Test	Σxi	%	M	s	s ²	V		Σxj	%	M	s	s ²	V
I.	159	46.8	9.35	2.71	7.37	17.6	3.33+	115	31.9	6.39	2.55	6.49	25.0
II.	72	42.4	4.24	1.60	2.57	29.9	1.88+	56	31.1	3.11	1.91	3.63	44.4
III.	124	36.5	7.29	2.66	7.10	22.4	3.88+	67	18.6	3.72	2.78	7.74	44.8
IV.	108	63.5	6.35	1.69	2.87	20.5	5.59+	54	30.0	3.00	1.85	3.41	45.3

It is clear that in all the subtests the dynamics of the quality growth was fundamentally higher in the experimental group than in the control group. We can further enunciate that during the entry measurement the average level in three subtests in the experimental group was lower and in one higher than the level in the control group, though not statistically significant. The output measurement points to the fact that profound improvement of the average in all subtests occurred in the experimental group while in the control group, in the case of improvement the difference was small, insignificant.

The variation coefficients in all the entry tests, but the first one, exceeded 33% in both groups; this means high variability of the followed signs. In the output test of an experimental class, the values reached lower figures than 33%, therefore we may claim that in this group the differences among individual pupils significantly balanced. Unlike the situation in the control group: it improved when compared to the entry test (with the exception of the first subtest), however, to a much lesser extent. A schematic comparison of the music abilities level in particular subtests in the experimental and control groups is shown in Graph 1.

Graph 1. Comparison of the musical abilities levels in the 2nd grade



For the verification of the *first special hypothesis* we formulated a zero and an alternative hypotheses:

H₀: H₀: There are no significant differences among the means of the control 2.B and the experimental 2.C groups of pupils in I. (II., III., IV.) subtest (entry) output measurement.

H_A: There are significant differences among the means of these groups in the given subtest (I., II., III., IV.).

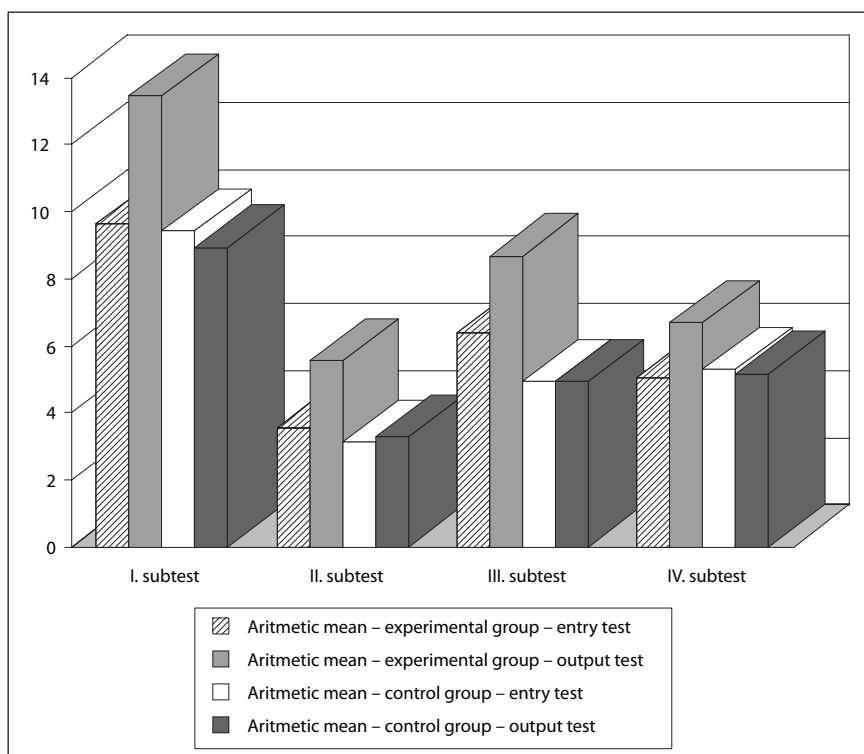
During the evaluation of the difference significance between both groups we found the closest table values of the test criterion $t_{0,01}(30)=2.7500$; $t_{0,05}(30)=2.0423$ and $t_{0,1}(30)=1.6973$. Student's t-test proved the differences between the means of the control and experimental groups during the entry measurement not statistically significant. In the output measurement of the I., III. and IV. subtests, however,

we can observe that between the experimental and control group there is a statistically very significant difference – up to the level of significance 0.01. Even though in the second subtest (melody memory) we cannot find statistical significance at the level 0.05, it is interesting to state that the enumerated value of the test criterion reaches the requirements at the significance level 0.1, which is lower than the usual one and can be linked to the risk of imperfection of the first range; however, it can point to the tendency of an ongoing increase of the difference significance between the groups under a long-term leverage of the experimental conditions; this underlines the need for further examination (Chráska, 1991), (Komenda et al., 1981). This means that in the I., III. and IV. subtests we can disprove the zero hypothesis and to confirm the accuracy of the alternative hypothesis, which in this class signifies the validity of the first special hypothesis. In the II. subtest we may claim the difference among the groups was not statistically significant enough. From the developed difference and from the dynamics of the followed sign in both groups we may assume that also reaching the level of significance 0.1 is satisfying, and during a longer-range application of the used methods we would obtain usual satisfactory statistical significance of the difference.

The data evaluation from the entry and output measurement in the *fourth grade* is shown in the following table.

Table 2 The data from the entry and output measurement of musical abilities in the experimental (4.C) and control (4.A) groups.

Entry measurement													
	Experimental group – 4.C						t–test	Control group – 4.A					
Test	Σxi	%	M	s	s^2	V	$t' / f(0.05)$	Σxj	%	M	s	s^2	V
I.	154	48.1	9.63	3.91	15.32	40.7	0.16+	160	47.2	9.43	3.04	9.21	32.2
II.	57	35.6	3.56	2.71	7.33	76.0	0.59+	53	31.2	3.13	1.36	1.86	43.6
III.	102	31.9	6.38	2.25	5.05	35.3	1.49+	84	24.7	4.94	3.15	9.93	63.8
IV.	81	50.6	5.06	1.81	3.26	35.7	-0.29 / 1.75	90	52.9	5.29	2.78	7.72	52.5
Output measurement													
	Experimental group – 4.C						t–test	Control group – 4.A					
Test	Σxi	%	M	s	s^2	V	$t' / f(0.05)$	Σxj	%	M	s	s^2	V
I.	215	67.2	13.4	3.14	9.86	23.4	4.52+	152	44.7	8.94	2.56	6.56	28.6
II.	89	55.6	5.56	2.78	7.73	50.0	2.87+	56	32.9	3.29	1.65	2.72	50.1
III.	139	43.4	8.69	1.96	3.83	22.5	3.36 / 1.75	84	24.7	4.94	4.13	17.1	83.6
IV.	107	66.9	6.69	1.92	3.70	28.8	1.76 / 1.75	88	51.8	5.18	2.94	8.65	56.8

Graf 2. Comparison of the musical abilities levels in the 4th grade

From the shown data we gather that the results of the experimental group are markedly better in all the subtests than those in the control group. The variation coefficient (V) in all the subtests in the experimental group markedly decreased, in the second subtest the most, where the output value of this coefficient does not exceed the required limit of 33% yet; considering the length of the experiment we may accept this as proportionate to the development. In all the remaining subtests the variation coefficient in the output measurement in the experimental group got under the level of 33%. In the control group entry measurement in the I. subtest the coefficient value was under the level of 33%, and in the following ones we also observe its decrease. In the remaining subtests the values of the variation coefficient in the entry and output measurement got above 33%; we can even observe its increase. The level of the mean values during the entry measurement in both groups was approximately the same. The dynamic growth of the mean value levels in the experimental group, unlike the control group where the mean values in the output measurement did not significantly change, points at the appearance of significant differences between the groups. A schematic comparison of musical

abilities in individual subtests in the experimental and control groups is shown in Graph 2.

In order to verify the *second special hypothesis* we formulated a zero and an alternative hypotheses:

H₀: There are no significant differences among the means of the control 4.A and the experimental 4.C groups of pupils in the I. (II., III., IV.) subtests (entry) output measurement.

H_A: There are significant differences among the means of these groups in the given subtest (I., II., III., IV.).

The closest table values of the Student's t-test criterion were: $t_{0.01(30)} = 2.75$; $t_{0.05(30)} = 2.042$. In the I., II. and III. subtests of the entry measurement compared with the enumerated values we state the insignificance of the differences among the means of the control and experimental groups. In the IV. subtest we found significant differences among standard deviations of both groups, and by means of the Cochran-Cox t-test we consequently disclosed the insignificance of the difference between the groups as well. In the output measurement in the I. and II. subtests there was no difference among the standard deviations, therefore we verified the significance of the difference by Student's t-test. We proved that between the groups there is a statistically significant difference at the level of 0.01. In the III. and IV. subtests there appeared a significant difference of the standard deviations, therefore we proved the significance of the difference by Cochran-Cox t-test. In the III. subtest this t-test showed the significance of the difference at the level of 0.01, in the IV. subtests at the level of 0.05. This means that we may confirm the validity of the alternative hypothesis, which in this grade means the validity of the second special hypothesis.

The research findings

As the research showed, a systematic and purposeful music education with the regular use of self-made instruments had a significant influence on the development of the rhythm memory, on the abilities to analyze the number of tones in a chord, and on the abilities to distinguish the tonal pitch. This teaching in the 2nd grade had a positive and large influence on the short-term melody memory, however, it was not a statistically significant influence. For the fourth grade of elementary school we state that a systematic teaching with the help of making and using elementary musical instruments and with the systematic use of playing the body as an instrument significantly influenced the development of all the mentioned pupils' basic abilities when compared with the traditional way of teaching.

We further found out that the traditional teaching in both classes did not reach that level we can reach with the use of instrumental activities as we understand them. In some cases then, pupils' performances varied depending on the level of their actual motivation (Poliach, 2003), which also caused a reasonable decrease of the average level in some subtests in the control groups. We can further follow significant variability in the levels of musical abilities among the respondents; this markedly changed in the experimental groups during systematic teaching with the use of musical instruments when compared with the entry measurement.

With regard to the described facts we can declare the *main hypothesis* to be valid as well because it was demonstrated that only a purposeful and systematic music education with the regular and systematic use of instrumental activities with the use of self-made musical instruments, or with other musical instruments (also the body in the function of a musical instrument), has a significant influence on the development of basic musical abilities of the pupils of elementary schools. On the other hand, uncontrolled or sporadic use of musical instruments plays no significant role in the overall musical development of personality. The researched basic musical abilities are nevertheless the presupposition for any development of additional musical abilities and skills, such as for example clear singing or the ability to remember and play simple instrumental accompaniment of a song.

Conclusion

The presented research has shown that progressively understood instrumental activities in cooperation with other musical activities are justified in music pedagogy. It would be appropriate that every child, besides vocal, perceptive or locomotive activities on the lessons of music education, has also an opportunity to adequately use instrumental activities for its complex development. Furthermore, we observed a lack of any appropriate musical instruments in our country for all the children taking a music education (Janeková, 2004). That is why self-making of simple musical instruments by children and their systematic use on the lessons of music education can become *one* of the desirable means for the complex children's personality development.

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