

University of Szeged, Faculty of Arts  
Graduate School of Educational Sciences

Márta Gévayné Janurik

**DEVELOPMENT OF MUSIC LISTENING SKILLS AND THEIR RELATIONSHIP  
TO SOME BASIC LEARNING SKILLS BETWEEN THE AGES OF 4 AND 8**

Theses of a PhD dissertation

Supervisor: Krisztián Józsa



Teaching and Learning Educational Program

Szeged, 2010

In ancient Greece music played a central role in education, they believed in its character-forming and health-improving power. This value-system is reflected by the Greek naming of educated, illustrious people: these were called „musical people” (*Menuhin*, 1981). Our developed western societies do not attribute such significance to the opportunities provided by music education. However, there is another way to see this problem – maybe music education is unable to reinvent itself, to find those opportunities in our continuously changing world with the help of which it would be able to develop an interest for classical music in the youth, and would be able to fill in the personality developmental as well as the experience and culture conveying role of music. Nevertheless, it can be experienced all over the world – therefore in Hungary as well – that music and singing instruction is losing ground (*Janurik*, 2007; 2008; 2009; *Janurik and Pethő*, 2009; *Pethő and Janurik*, 2009). As opposed to these unfortunate processes, a number of studies have proved that music education and the improvement of music skills contribute to personality development and school achievement. According to some Hungarian, and a number of international studies exploring transfer effects of music learning, music education contributes to the development of certain cognitive and motor skills, to school achievement and to the development of intelligence. Dealing with music helps overcome social disadvantages, and aids development of social skills (*Zsolnai and Józsa*, 2002; 2003).

Skills improvement and the exploration of development opportunities and relationships between skills play an essential role in the efficacy of school-based education. Recent research on skills development supports the belief of music educators – which can be called subjective in itself – that music education may have an important role in the development of skills essential for school-based learning.

## BACKGROUND AND AIMS

In the 1970s in Hungary pioneering scientific studies have proved the personality improving and intelligence-boosting effects of frequent, everyday music education (*Kokas*, 1972; *Barkóczy and Pléh*, 1977; *Laczó*, 1985; 1987). In later years these kinds of studies were very rare in Hungary. At the same time the number of international studies exploring the psychological background, transfer effects and brain localization of music learning along with its influence on cognitive skills and school achievement was steadily growing.

Research serving as a basis for the theoretical background of our study is summarized in five areas:

(1) Three larger fields of research on skills: *psychometrics*, *the Piaget-school* and the theoretical approaches of *cognitive psychology*. A further basis for the theoretical framework was provided by József Nagy’s model of the system and development of cognitive skills.

(2) Another basis for our research is provided by studies investigating the concept and the types of transfer effect and its significance in education (*Atherton*, 2007; 2007; *Molnár*, 2006; *Royer*, 1979). According to *Bamberger* (1996) the following conceptual structures are functionally important in music, in mathematics as well as in science: hierarchies, periodicity, units, ratio-proportion, symmetry, pattern, constants-variables. Common strategies are counting-measuring; the use of the concept pairs, parts-wholes and similar-different; classifying and naming. Despite the available empirical evidence, several researchers express doubts about the transfer effects of music learning, especially of listening to music. They draw attention to the difficulties of observing and measuring musical cognitive structures (*Bamberger*, 2005; *Hickey and Pellegrino*, 2005).

(3) Similarly little attention was paid in the past few decades to the investigation of music skills in Hungary. The modern definition and exploration of basic music skills were made possible following the work of *Erős*, *Fodor* and *Pethő* (*Erős*, 1993) under the leadership of

*József Nagy*. A further field of Hungarian music skills research is provided by the investigations of *Dombiné* (1987–88; 1992) and *Laczó* (1985; 1987) with the *Seashore* test. A more recent longitudinal study on music skills (*Turmezeyné, Máth and Balogh, 2005; Turmezeyné and Balogh 2009*) aimed at the measurement of the music skills of second grade students. In the past decades little attention was paid to the kindergarten age group and to the investigation of music skills in grade 1 and 2. Furthermore, from among the most widely used and internationally acknowledged music skills tests only a few are appropriate measures for kindergarten kids.

(4) Recent research on music skills point out a relationship between cognitive performance and music. From among the diverse studies on the topic a significant number investigates the changes occurring as a consequence of music learning, while another part of them aims at the analysis of relationships between music skills and cognitive skills.

These studies indicate a relationship between music and speaking (e.g. *Brown, Martinez, and Parson, 2006; Papp, 2004; Zatorre and Krumhansl, 2002*), between reading and music learning as well as between music and speech processing (*Anvari, Trainor, Woodside and Levy, 2002; Bultzlaff, 2000; Janurik, 2008*).

Another field of transfer research is comprised of studies investigating the relationship between music learning, music skills and mathematics achievement. Studies on the relationship between mathematics and music learning are in kindergarten e.g. *Geoghegan and Mitchelmore (1996)*; in primary school e.g. *Gardiner, Fox, Knowles and Jeffrey (1996)*; and in secondary school and higher education e.g. *Cheek and Smith (1998)*.

The third major field of transfer research concerns the relationship between music learning and intelligence (*Barkóczi and Pléh, 1977; Rauscher and Zupan, 2000; Schellenberg, 2004*).

(5) The reviewed kindergarten education programs find music education important and emphasize its many-sided skills developmental significance (*Nagyné, 2004*), although not all of them to the same extent. On the basis of the literature review, the most important thing about singing and song games to be emphasized is their multifaceted skills developmental role (*Forrai, 1974; Hovánszki, 2008*). Reviewing kindergarten music education programs, it can be concluded that for those nursery schools and nursery school teachers who would like to put an emphasis on music education in kindergarten, the opportunities are given.

(6) The test-system of the DIFER program package (*Nagy, Józsa, Vidákovich and Fazekasné, 2004a; 2004b*) which is appropriate for the measurement of basic skills essential for integration into school and school-based learning means an important opportunity for us. The criterion-oriented test-system enables the determination of the level of acquisition in case of every skill – preparatory, beginner, advanced, finishing – along with the optimum which means complete acquisition. With the help of the DIFER test-system the development of individual students can be measured and followed from kindergarten, the results can be compared to average development, and level of the acquisition of the different skills can be exactly determined. The test-system comprises a closely connected, homogenous system. No instance of relationship analyses between such system of interrelated basic skills essential for school preparation and school-based learning and music skills was found in the international literature.

## AIMS OF THE STUDY

The aim of this dissertation is, first, to acquire information of the development and developmental opportunities of early music skills. Second, the study aims at exploration of the relationship between music skills and cognitive skills. Our empirical research is comprised of four major parts.

The first – cross-sectional – study aims at the investigation of the development of early music skills between ages 4 and 8. The second study concerns itself with the relationship between the basic skills measured by DIFER (Nagy, Józsa, Vidákovich and Fazekasné, 2004a; 2004b) and music skills in ages 4 and 5. The third study was carried out with the participation of first and second grade primary school pupils and aimed at the exploration of relationships between music skills and basic skills that fundamentally determine further school achievements. Finally, the fourth study – a musical training experiment – explored the pace of development and development opportunities of music skills and some basic skills in an experimental context. Two experiments were carried out. One of them was a shorter, three-month long improvement for third year kindergarten children (ages 5 and 6), and the other was a longer, nine-month long experiment for second year kindergarten children (ages 4 and 5). This latter started in February and was continued after the summer holiday. Efforts were made to help development of skills in a way that can be implemented by anyone in any kindergarten. The core component of the experiment was making students sing and play song games several times during the day.

## HYPOTHESES, METHODS AND MEASURES

The dissertation seeks to test the following hypotheses:

(1) *Assessment of music skills*

1. We expect a development of music listening skills in each age group.
2. According to our hypotheses achievement in singing and rhythm clapping reproduction skills lag behind achievement in listening discrimination. We expect these skills to develop together, however, the development of reproduction skills presumably starts from a lower level.
3. We assume that skills related to listening discrimination, which is the implicit level of music listening, are interrelated. Skills related to listening reproduction, which is the explicit level of music listening, are also assumed to be closely connected to each other. The two levels of music listening are expected to be separated to a certain extent in case of lower age groups.
4. On the basis of the relevant literature we expect that especially in kindergarten, but also in grades 1 and 2, the developmental level of singing and rhythm clapping skills alone are not enough to determine the general development of music skills.
5. We do not expect significant gender differences in the development of music skills.
6. We assume that lower SES children will have somewhat lower achievements
7. Music education may reduce these differences in the last year of kindergarten, in grade 1 or 2.

(2) *Exploring the relationships between music skills and basic skills in age 4 and 5.*

1. We expect significant, although varying strong relationship between the developmental level of music listening skills and writing motor coordination, phonemic awareness, vocabulary of relations, elementary arithmetics, perceptual induction and social skills in age 4 and 5.
2. As for phonemic awareness, in ages 4 and 5 we assume detectable relationships with music skills. In ages 5 and 6, we do not expect strong correlations due to the relatively high acquisition level of phonemic awareness.
3. No gender differences are expected concerning the relationships between music listening skills and basic skills needed for school-based learning.
4. According to our prior expectations, the developmental level of music skills will have a greater contribution to the development of basic skills in case of low SES children.

(3) *Exploring the relationships between music skills and basic skills in grade 1 and 2:*

1. We expect positive correlations between listening skills and basic arithmetics, native-language skills as well as general intelligence both in grade 1 and grade 2.
2. As for family background, we presume that for low SES students music education and development of music skills may be of more importance. It is assumed that the contribution of the developmental level of music listening skills is more tangible in case of the performance of low SES students on tasks that require the use of basic skills.

(4) *Musical training experiment:*

1. In the case of the three-month musical training experiment we expect only modest differences between the experimental and the control group concerning the development of music listening skills. The three-month experiment is likely to have only minor effects on achievements on the DIFER tests as well.
2. The nine-month experiment is assumed to cause a detectable improvement in music listening skills. At the same time some basic learning skills will also go through a significant development that is greater than that of the control group.

The sample of the music skills assessment comprised of 198 kindergarten children aged 4 and 5, 146 kindergarten children aged 6 and 7, 154 first grade schoolchildren and 159 second grade school children. During the data analyses correlations were calculated, cluster analyses, ANOVAs and variance analyses were carried out. In the case of the relationship analysis of music skills and basic skills correlations were calculated and cluster analyses and regression analyses were carried out. When analysing results of the experiment, paired sample t-tests and independent samples t-test were applied and experimental effect sizes were calculated.

Music skills were assessed by a self-developed measure, which on the basis of the reliability indices proved to be appropriate for assessing music skills in kindergarten and grades 1 and 2 of primary school. However, tasks assessing tone- and especially dynamics-perception in grade 1 and 2 did not seem to be reliable enough. We assume that group assessment in a large classroom is not the best option to choose to measure these two skills. Therefore, these two music perception skills were not taken into account when exploring the relationships between the variables.

The sample of the relationship-analyses comprised of 195 second year kindergarten kids (aged 4 or 5), 146 third year kindergarten children (aged 6 or 7), 112 first grade and 138 second grade pupils. Music skills were measured by means of a self-developed instrument in case of each age group. Basic skills needed for school-based learning were measured by the DIFER test-system in kindergarten. In grade one the following tests were applied: synonym reading, word reading, word reading with pictures (Nagy, 2004); basic arithmetics (Józsa, 2005); spelling, writing (Józsa and Zentai, 2009), and in grade 2: basic arithmetics (Józsa, 2005), reading comprehension (Molnár and B. Németh, 2005), spelling (Janurik, 2009). The Raven-test was also administered to first grade students.

The sample size of the three-month improvement program was  $n=112$ , and that of the nine-month program was  $n=124$ . At the time of the pre- and the post-tests students filled in the self-developed music skills test and the DIFER tests.

The samples of the studies are comparable in each case with regard to parents' SES; there are no significant differences between the age groups regarding the proportion of parents having basic, secondary or higher education.

## RESULTS

### 1. Main results of the exploration of music listening skills

#### *Results of the exploration of the development of skills*

Development of basic music skills were explored with an emphasis on listening skills. During our investigations the tasks of the music test and the skills to be measured were classified according to two criteria. First, tasks were categorized according to the skills of music listening (Erős, 1993) – melody, harmony, rhythm, tone and dynamics perception, which we called the tasks of music listening skills. Second, starting out from the model of Turmezeyné, Máth and Balogh (2005), we differentiated the implicit level – which is related to listening discrimination and recognition – and the explicit level of listening - which is connected to the reproduction of perceived music patterns.

(1) On the basis of average achievements on the four tasks of *melody perception* both kindergarten children and schoolchildren performed higher on listening discrimination tasks. A significant development was found in interval discrimination between the second year of kindergarten (age 5 or 6) and grade 2 of primary school. No significant development was found in melody discrimination even in the four-year period. Results of grade 2 children contradict Turmezeyné and Balogh (2009), but correspond with Erős (1993), who found that interval perception is more developed than melody perception. However, these results apply to 10-year-old pupils.

(2) Performance on interval reproduction lags behind means of melody reproduction. Higher means of melody reproduction tasks show that a group of kindergarten kids have difficulties in reproducing intervals that were taken out of the melodic context and tonality. They rather perceive melodies as a whole.

(2) The *harmony perception* skill does not seem to develop in kindergarten, but shows a significant development in grade 1 and 2. In our cross-sectional study, second-year kindergarten children have already performed on a relatively high level, they achieved 48%p on one of the components of harmony perception that is called accord discrimination. However, further development of this skill takes place typically only in age 7.

(3) *Rhythm perception* shows a significant development in each year according to the results of the four-year long cross-sectional study.

Means of by-ear discrimination of rhythm patterns, which is a component of rhythm perception, do not differ in the second and third year of kindergarten. Significant development takes place in grade 1; however, means of grade 1 and grade 2 do not signify further significant development. Performance of grade 1 and grade 2 children vary between 60 and 90%p on the tasks. The most remarkable development – more than 30%p - occurred in by-ear rhythm discrimination.

Performance on by-ear rhythm clapping tasks – just like on by-ear melody perception tasks – is very low in the second year of kindergarten. The ratio of pupils achieving 0 point is 45%. In the third year of kindergarten half of the children could clap two rhythms, however, development of this skill, which requires motor coordination development (as well as practice), pauses in grade 1.

(4) *Perception of tone and volume* are skills that are not only connected to music listening. These skills show a relatively high developmental level – around 60 %p – already in the second year of kindergarten. From the two skills, tone perception develops significantly in grade 1 and 2 presumably due to music education and the gain in musical knowledge. Tone perception achievements of second graders are almost the same as the results of second graders in Turmezeyné and Balogh (2009) on similar tasks. As for dynamics perception our result

is only 3%p higher than that of *Turmezeyné* and *Balogh*. This similarity – despite lower reliability in our study – makes our results of tone and dynamics perception in the two grades more plausible.

(5) *Music listening skills* are organized into two factors in the two kindergarten years and in grade 1. These are (1) harmony, tone and dynamics perception and (2) melody and rhythm perception. By grade two listening skills become more unified, they are organized into one factor. Low Kaiser-Meyer-Olkin indices – between 0.61 and 0.66 – in each age group are attributable to the relatively low number of variables.

(6) In line with our expectations no gender differences were found concerning the development of listening skills.

(7) The lowest mean achievements were measured in case of children whose mothers have primary education, and the highest achievers were children with parents with higher education. These results also verified our presuppositions. According to the results of the variance analysis there are significant differences between all the three subsamples. These results draw attention to the significance of music education in kindergarten and school.

(8) Comparing the findings of the two studies on the same age group – that of *Turmezeyné* and *Balogh* (2009) and our own results – it can be concluded that achievements of second graders show similarities in more cases, for example in tone and dynamics discrimination, discrimination of rhythm formulas, rhythm reproduction and perceptual discrimination of intervals. Emphasizing the difficulties of comparing the results of the two studies, important differences between the findings of the two measurements include the opposite tendencies in the development of melody and interval singing as well as in melody and interval perception.

#### *Results of the exploration of listening on the explicit and implicit levels*

(9) The validity of the division of music listening skills into *implicit and explicit* levels are supported by the fact that in kindergarten no relationship was found between the two levels ( $r=-0.02$ ). In grade 1 the correlation is  $r=0.36$ , and in grade two it is even stronger ( $r=0.45$ ). The most stable relationships were found in the explicit skills in each age group, i.e. in melody, sound, interval and rhythm reproduction. These represent the first factor in kindergarten, and the second in the first two years of primary school. Music skills representing the implicit level of music listening depict a continuously changing pattern. In kindergarten they are more closely connected.

(10) According to the results of our cross-sectional study implicit, listening discrimination skills do not seem to develop in the second and third year of kindergarten. As opposed to this in the case of listening reproduction, singing and rhythm clapping a significant development can be traced. The implicit level of music listening goes through a significant development only in grade one as compared to the last year of kindergarten. Skills comprising the explicit level of singing and rhythm clapping seem to undergo a significant setback.

Measurements were carried out in the middle of the academic year, in January. Results of the second measurement of the three-month improvement program carried out in May show that on the implicit level of listening, both the experimental and the control group reached the developmental level of first graders measured in March. Therefore, it can be assumed that besides the setback of explicit skills, there is also a pause in the development of the implicit level of music listening.

## 2. Relationships between music skills and basic skills necessary for school-based learning in age 4 and 5

The first phase of the relationship analysis aimed at the investigation of the relationships between music skills and basic skills in age 4 and 5. In line with our expectations there are significant correlations between listening skills and some cognitive and social skills. Our major research results are as follows:

(11) Both in the second and the third year of kindergarten music listening skills have the strongest relationships with the composite DIFER-index. The correlation quotients are  $r=0.34$  in the second year, and  $r=0.32$  in the third year of kindergarten. The developmental level of music listening skills contributes to the DIFER index by 14% in the second, and 21 % in the third year. Individual correlations between music skills and basic skills are moderate but significant.

(12) A significant and unexpected difference was found between the correlations of the explicit and implicit levels of skills comprising music listening. In the second year of kindergarten all the basic skills significantly correlated with listening skills on the explicit level, i.e. with by-ear rhythm clapping, interval and melody singing. In the third year, however, an opposite relationship was found. Significant correlations existed between the implicit level of music listening, the skills of listening discrimination and the basic skills. Further research would be necessary to explain this phenomenon.

(13) From among the tasks of the music skills test – which all represent a single music skill – only few have a significant contribution to the development of basic skills. From these, the significance of rhythm hearing can already be seen in the second year of kindergarten, and by the third year of kindergarten almost only the two investigated components of rhythm hearing seem to have a contribution.

## 3. Relationships between native language skills, basic arithmetics, general intelligence and music listening skills in grade

The second phase of the relationship analysis aimed at the exploration of the relationships between music listening skills and arithmetics, reading, spelling, writing and general intelligence in grade 1. Our results have again verified our prior expectations. The major results are summarized as follows:

(14) Correlations in the two grades refer to a stronger relationship between basic skills and music skills as compared to the kindergarten age group. This is especially true for the skill of rhythm perception, in the case of which the correlation quotients are all above 0.30 with only one exception. Music skills show the strongest correlations with basic arithmetics ( $r=0.41$ ), but spelling and synonym reading have a similarly strong relationship with rhythm perception ( $r=0.37$ ) in grade 1.

(15) On the basis of regression models, which provide a deeper analysis, from among the native language skills 10% of the variation in spelling is explained by rhythm perception, which provides the only significant contribution, while 10% of variation in word reading is explained by the joint contribution of harmony and rhythm perception.

(16) It is also remarkable, and provides support for the early development of music skills, that the contribution of general intelligence, which is known as a constant feature of personality, to the variance of basic arithmetics is almost equal with that of music skills. The explanatory strength of general intelligence is 17%, while that of harmony and rhythm perception together is 16%, which is only one percent less.

(17) From among the music listening skills in grade 1 it is also rhythm perception that exhibits the strongest correlation with basic skills.



#### 4. Relationships between native language skills, basic arithmetics, general intelligence and music listening skills in grade 2

The third phase of the cross-sectional study explored relationships between reading comprehension, spelling, arithmetics and music skills in grade 2.

(18) According to the correlations, native language skills have a stronger relationship with music skills in grade 2 than in grade 1. The stronger relationship between spelling and music listening skills – the general developmental level of music skills – is demonstrated by the equal correlation quotients between music skills and word subtest results and music skills and spelling total test results ( $r=0.43$ ). The word subtest of spelling has a moderate correlation with rhythm perception ( $r=0.49$ ). The correlation between music listening skills and reading skills ( $r=0.38$ ) is also higher in grade 2 than in grade 1.

(19) Correlation between rhythm perception and arithmetics ( $r=0,38$ ) almost equals with the same correlation in grade 1 ( $r=0.39$ ) and with correlation between rhythm perception and basic arithmetics in the second year of kindergarten ( $r=0.39$ ).

(20) According to the regression analysis music listening skills contribute to arithmetics by 7%, to spelling by 12% and to reading comprehension by 10%. Listening discrimination explains 13% of the variance of reading comprehension skills and 7% of that of arithmetics. The explanatory strength of listening reproduction in the individual differences of spelling is 11%.

(21) From among the music listening skills rhythm perception has an exceptional role in grade 2 as well.

#### 5. Gender differences in the relationships between basic learning skills and music skills

According to prior expectations achievement means of the two genders are almost equal in both fields, the differences being minimal. However, contrary to our expectations relationships between music skills and basic skills exhibit significant gender differences.

(22) In the second year of kindergarten developmental level of music skills play a major role in achievement on tasks measuring elementary skills development in the case of girls; it seems that as opposed to boys they more rely on their music skills. In the third year of kindergarten stronger relationships are found in case of both genders. Regression analyses carried out by age groups show that it is rather the girls whose music skills contribute to the development of basic skills. However, by the third year of kindergarten music skills of boys also become significant contributors to the explained variance in basic skills development. Individual differences in the DIFER-index explained by music listening skills show an increasing tendency with age. The explained variance is significant in case of both genders (e.g. third year of kindergarten: boys 16%; girls 31%) although significant gender differences were found.

(23) Regression analysis shows that in grade 1 in case of girls from among native language skills besides writing skills variance in spelling is explained partly by music skills, while in case of boys, it is word reading to which music skills have a contribution.

(24) It is also remarkable that in grade 1, in case of boys, rhythm perception has a more dominant role in achievement on arithmetics tasks than does intelligence. The contribution of intelligence is 7% and the variance explained by rhythm perception is 13%. In case of girls rhythm perception has a similar explanatory strength (12%), but here the variance of arithmetics explained by intelligence is three times as high as it is for boys.

(25) Correlations of music listening skills and basic learning skills by gender show the most remarkable difference in grade 2. As for girls, correlations between individual music skills, music listening skills, the implicit and explicit levels of listening and basic learning skills are moderate in all cases with the exception of rhythm perception where the correlation is even stronger. However, in case of boys only six significant correlations were found.

## 6. Relationships between basic learning skills and music skills as a function of family background

The most remarkable contribution of music skills to the development of basic skills necessary for school-based learning was found – in line with our prior expectations – in case of children whose parents have lower education for all age groups.

(26) Results show that in kindergarten it is rather the children of parents with elementary education who fall behind others in the development of music listening skills. From the first year of schooling, however, the three subsamples' means of achievements on the total music skills test, and also on the listening discrimination test, show significant differences. This suggests that music education in its present form do not help low SES students to catch up with the others. In fact discrepancies in the developmental level of music skills between students from different backgrounds are larger at school than in the second year of kindergarten.

(27) The highest explanatory strength of music listening skills in the developmental level of basic skills in kindergarten was found in case of children of parents with elementary education. For them, developmental level of music listening skills explains 28% of individual differences of the DIFER-index in the second year of kindergarten, and 35% in the third year. In ages 4 and 5 in case of children of mothers with basic education the variance in DIFER-index explained by music skills development is twice as high as that of the total sample. Furthermore, in this age group the contribution of music listening skills is nine times as high for children of parents with basic education as for children of highly educated parents.

(28) In grade 1 the developmental level of music listening skills has the most important role in case of low-SES children's spelling and word reading.

(29) Involving the Raven-test as an independent variable, results of the regression analysis show that music skills have a more remarkable role in the development of spelling and word reading in grade 1 in case of low-SES children than does intelligence. The same applies to arithmetics in case of high-SES children. This result is especially important since, as opposed to intelligence, which is believed to be a general and independent feature of personality, music skills can be improved.

(30) In grade 2 results of regression analyses show that music skills have a 10% contribution to arithmetics in case of low-SES children, and a 20% contribution to spelling in case of medium-SES children. As for high-SES children, the only significant explanatory strength (10%) was found in case of the joint contribution of listening discrimination skills to reading comprehension skills.

## 7. Results of the musical training experiment

### *Results of the three-month experiment*

The three-month experiment was carried out in the second term of the academic year with the participation of children attending the third year of kindergarten. Our presupposition was that three months are not enough to achieve such detectable results in the development of music skills and basic skills that are significantly different from the development of the control group, therefore can be attributed to the experiment. At the beginning of the experiment

no significant difference was found between the experimental and the control group with regard to developmental level of music skills and basic skills.

(31) As for basic learning skills, our prior expectations realized. No significant differences were found in the development of the measured skills between the experimental and the control group at the time of the post-test. However, *Cohen* experimental effect sizes indicate a moderate but significant development in four basic skills – sociality, phonemic awareness, basic arithmetics, perceptual induction – and in the composite DIFER-index. Effect sizes vary between  $\sigma = 0.20$  and  $\sigma = 0.35$ . Furthermore, a remarkable –  $\sigma = 0.61$  – effect size was found for vocabulary of relations.

(32) Surpassing our expectations, as compared to the control group *music listening skills* of the experimental group developed significantly regarding the skills of singing reproduction and rhythm clapping reproduction as well as the average development of music listening skills. Effect sizes on the explicit level of music listening and on the composite index of music listening skills indicate a significant development ( $\sigma = 0.95$  and  $\sigma = 0.90$ ). However, the implicit level of music listening, i.e. listening discrimination did not develop significantly. The duration of the experiment was not enough for the implicit skills to be improved. But it was, on the other hand, indeed enough for the improvement of singing and rhythm clapping. The most remarkable developments were measured in case of interval singing (25%p), rhythm clapping (20%p) and melody singing (16%p).

(33) Results of the three-month experiment show that means of the experimental, and also the control group, at the end of the third year of kindergarten reached the implicit skills developmental level of first grade pupils measured in the cross-sectional study. On the basis of the results of the longitudinal study, therefore, the assumption may arise that the developmental level of the implicit level of music listening measured in March in the grade 1 was already reached by the end of kindergarten, and therefore development pauses in grade one.

#### *Results of the nine-month experiment*

At the time of the pre-test one significant difference was found between the experimental and the control group with regard to the developmental level of music listening skills: achievement on harmony perception tasks was significantly higher for the experimental group. As for the basic learning skills, achievements of the experimental group were significantly lower in case of writing motor skills, phoneme awareness, vocabulary of relations and the composite DIFER-index than those of the control group.

(34) In line with our prior expectations the nine-month training experiment resulted in a significant development of music listening skills in the experimental group. With the exception of harmony perception, kindergarten children in the experimental group performed better on each music skill test. Singing and rhythms clapping representing the explicit level of music listening was more than 15%p higher, while the developmental index of music listening skills was 20%p higher in the experimental than in the control group. Moreover, as opposed to the results of the three-month experiment, after nine months significant differences were found between the control and the experimental group in the means of the *implicit level of music listening*, i.e. listening discrimination, as well. As for the music listening skills, the performance of the experimental group was 10%p or even higher in three areas at the time of the post-test. These areas are the skills of melody, rhythm and tone perception. The most remarkable development (36%p) was found in case of skills belonging to the explicit level of music listening, i.e. by-ear singing and rhythm clapping.

(35) Means of music skills measured at the time of the post-test of the training – that can be implemented in every kindergarten – were higher than those measured as part of the cross-

sectional study in grade 2 in three cases. These are the explicit level of music listening, the skill of melody perception and the developmental index of music listening skills.

(36) During the nine months of the experiment all basic skills has undergone a significant development both in the experimental and in the control group. However, in the experimental group a more remarkable development is found in case of more basic learning skills.

By the end of the training experiment initial differences between the groups have cleared off. According to the post-tests no significant differences existed between the groups even in writing motor development, phoneme awareness, vocabulary of relations to the composite DIFER-index in case of which pre-test showed the disadvantage of the experimental group. Significant effect sizes were found in the experimental group in case of three basic learning skills – writing motor coordination, phoneme awareness and vocabulary of relations – and the composite DIFER-index. Effects sizes vary between  $\sigma = 0.42$  and  $\sigma = 0.54$ .

## CONCLUSIONS AND DIRECTIONS FOR FURTHER RESEARCH

One of the main findings of the *study on the development of music skills* concerns the pausing of the development of basic music skills in grade 1. Results show that music skills on the implicit level of music listening do not develop significantly from the last year of kindergarten, and music skills belonging to the implicit level show a regression instead of a development. The pause in development may be attributed to processes of maturation of the nerve system. However, our results rather seem to point to the inability of schooling to contribute to the development of music skills. A significant difference between music education in kindergarten and in schools is that depending on the attitudes and musicality of the nursery school teacher, skills development by means of singing and rhythms clapping are popular in kindergarten to a larger or smaller extent, whereas at schools these practices suddenly become less frequent. The weekly one singing lesson is only enough for the stagnation or regression of music skills. These results also support the idea that the development of motor coordination skills require continuous practising. Without this, the already acquired and automatized operations, series of conditional reflexes and dynamic stereotypes will gradually regress.

Total separation of the explicit and implicit levels of music listening skills in the kindergarten years – zero correlations both in the second and the third year – supports the idea not known enough even by pedagogy experts but present in the relevant literature that the skills of singing and rhythm clapping alone are not enough to determine the general developmental level of music skills.

Results of the *relationship analyses* draw attention to the importance of music education. Developmental level of music skills are connected to developmental level of basic learning skills in all ages.

One remarkable result of the *kindergarten* age group is that in the second year of kindergarten the explicit level, while in the third year the implicit level of music listening is related to basic skills. This finding calls for extra attention and further research on the topic. There might be more explanations of this phenomenon. First, it can be attributed to natural development with age. Second, it is possibly caused by the development of concepts related to music and listening discrimination. In the third year of kindergarten, children may have a more developed concept-system related to music listening, through which music skills and basic learning skills are linked to each other. A further possible explanation is provided by the effects of kindergarten education. It is imaginable that since in the third year of kindergarten most children have more developed singing and rhythmic skills, the relationships between musical and non-musical areas have become detectable on the implicit level. And finally, it is

also possible that in the early development of basic skills, skills related to higher order singing and rhythm-clapping play a more important role, whereas further development of basic skills may have a stronger relationship with higher order listening discrimination skills. Further research is needed to provide a more precise explanation of the phenomenon.

In *grade 1* the relationship between music skills, intelligence and basic skills deserves further attention. First, our results showed that the contribution of general intelligence – that is thought to be a constant feature of the personality – to the development of arithmetics is almost equal with that of music skills. Second, in case of boys, the developmental level of arithmetics is more dependent on rhythm skills than on intelligence. Music skills have also more contribution to the development of spelling and word reading in case of children of parents with elementary education and to basic arithmetics in case of children of parents with higher education. These results confirm the importance of early music skills trainings.

According to our music skills assessment no *gender differences* exist in music skills development. However, the results also indicate in case of each age group that girls rely more on their music skills in the development and use of their basic skills.

Neurological research may provide a remarkable contribution to the explanation for this difference. Neuroanatomical research has established that one difference between the genders concerns the paths connecting the left and the right hemisphere. The posterior end of the corpus callosum which connects the two hemispheres is somewhat larger for women (Kimura, 2002). Besides that, according to Allen and Gorski (1991), the cross section of the anterior commissure, which is another important bundle of nerve fibres, is larger for women even if the smaller size of the female brain is disregarded. These larger bundles contain more nerve fibres, therefore the flow of information is more vivid. According to our hypothesis neurological research can provide one possible explanation of our results concerning girls' different and more efficient use of music skills in ages 4 to 8.

Our results confirm the importance of music skills development that seems to be relegated from grade 1 in primary schools. Music education can help overcome disadvantages deriving from family background for lower-SES children, but development of music listening skills is also beneficial for children of highly educated parents. This is confirmed by the first grade results of arithmetics, or by the contribution of music skills to reading skills in grade 2.

Results of our *training experiment* indicated that the explicit level of music listening skills – the skills of singing and rhythm-clapping reproduction – can be successfully developed in only three months in kindergarten. The other group of skills comprising music listening – the skills of listening discrimination – also play a crucial role in the development of basic learning skills. However, these skills are harder to develop; in kindergarten only by the end of the third year can one detect a significant development. The three-month training experiment did not result in an improvement of these skills. Following the nine-month experiment, however, significant differences were found between the experimental and the control group in all skills, the only exception being harmony perception. Another remarkable finding is that from among music listening skills the contribution of rhythm perception is more important than anything else in the development of basic learning skills. Results of the nine-month training experiment indicate that this simple and easy training method, that was used and can be used in every kindergarten, can contribute significantly to the development of music listening skills. Furthermore, besides the well-known procedures it provides an alternative way of school preparation and basic skills development.

A further important research project is to find those opportunities in early development that would aid a more efficient training of implicit music listening and rhythmic skills already in kindergarten or in the first years of schooling.

In those nursery schools where the number of disadvantaged or low-SES children is higher, the methods and procedures of the training experiment could be of even more benefit.

The training program does not require much time, but used together with the well-known practices it can significantly contribute to school preparation of low-SES children. Besides the usual practice, frequent, daily singing and playing of song games incorporated into the normal course of the lesson can offer a complementary alternative. In addition, this alternative is actually an activity that children enjoy doing.

In the past decades, school education relied less and less on opportunities provided by music education. The number of lessons per week has been reduced, and music and singing education is now in a crisis. In those schools where the number of low-SES students is high, our few-minute training should also be considered. These few minutes can take up some minutes in the middle of the lesson, during which not only music skills can improve, but it can be a spice-up activity after which students feel fresh and can concentrate for longer.

A further research question might concern the implementation of a music training experiment that would focus on the first two-years of schooling and those music skill areas which is not easy to develop. These experiments are to be carried out in schools where the number of disadvantaged students is high.

Further exploration of the relationship between music skills and basic skills in higher grades of primary school would also be important as well as the investigation of the relationship between music skills and achievements in different school subjects.

A final important research direction concerns the possibility of using music trainings to improve school achievements of children with mild mental retardation.

*The dissertation was written with the support of OTKA K68798.*

## REFERENCES

- Allen, L.S. és Gorski, R.A. (1991): Sexual dimorphism of the anterior commissure and massa intermedia of the human brain. *Journal of Comparative Neurology*, 312. 97–104.
- Anvari, S. H., Trainor, L. J., Woodside, J. és Levy, B. A. (2002): Relations among musical skills, phonological processing, and early reading ability in preschool children. *Experimental Child Psychology*, 83. 111–130.
- Atherton, M. (2007): A proposed theory of the neurological limitations of cognitive transfer. Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.
- Bamberger, J. (1996): Turning music theory on its ear: Do we hear what we see: do we see what we say? *International Journal of Computers and Mathematics Education*. 1. 33–55.
- Bamberger, J. (2005): What develops in musical development? In: McPherson, G. (szerk.): *The Child as Musician*. Oxford University Press, Oxford. 69–91.
- Barkóczi Ilona és Pléh Csaba (1977): *Kodály zenei nevelési módszerének pszichológiai hatásvizsgálata*. Kodály Zoltán Zenepedagógiai Intézet – Bács megyei Lapkiadó Vállalat, Kecskemét.
- Brown, S., Martinez, M. J. és Parson, L. M. (2006): Music and language side in the brain. *European Journal of Neuroscience*, 23. 2791–2803.
- Bultzlaff, (2000): Can music be used to teach reading? *Journal of Aesthetic Education*, 34, 3–4 sz. 167–178.
- Carroll, J. B. (1996): A matematikai képességek: a faktoranalitikus módszer néhány eredménye. In: Sternberg, R. J. és Ben-Zeev, T. (szerk.): *A matematikai gondolkodás természete*. Vince Kiadó, Budapest. 15–37.
- Cheek, J. M. és Smith, L. R. (1999): Music training and mathematics achievement. *Adolescence*, 34. 759–762.
- Csapó Benő (2001): A kognitív képességek szerepe a tudás szervezésében. In: Báthory Zoltán és Falus Iván (szerk.): *Tanulmányok a neveléstudomány köréből*. Osiris Kiadó, Budapest. 270–293.
- Dombi Józsefné (1987–88): A főiskolai hallgatók zenei képesség-vizsgálata a Seashore-teszt alkalmazásával. *Acta Academiae Pedagogicae*, 13–20.
- Dominé Kemény Erzsébet (1992): A zenei képességeket vizsgáló standard tesztek bemutatása, összehasonlítása és hazai alkalmazásának tapasztalata. In: Czeizel Endre és Batta András (szerk.): *A zenei tehetség gyökerei*. Mahler Marcell Alapítvány – Arktisz Kiadó, Budapest. 207–244.
- Erős Istvánné (1993): *Zenei alapképesség*. Akadémiai Kiadó, Budapest.
- Forrai Katalin (1974): *Ének az óvodában*. Editio Musica, Budapest.
- Gardiner, M. F., Fox, A., Knowles, F. és Jeffrey, D. (1996): Learning improved by arts training. *Nature*, 381. 284.
- Geoghegan, N. és Mitchelmore, M. (1996): Possible effect of early childhood music on mathematical achievement. *Journal for Australian Research in Early Childhood*, 1. 55–64.
- Hovánszki Jánosné (2008): A gyermekfolklor kutatás hatása az óvodai nevelésre. In: Hovánszki Jánosné (szerk.): *Zenei nevelés az óvodában. Szöveggyűjtemény*. Didakt Kiadó, Debrecen. 125–138.
- Kimura, D. (2002): Sex differences in the brain. In: *The Hidden Mind*. Special Edition, Scientific American. 32–37.
- Kokas Klára (1972): *Képességfejlesztés zenei neveléssel*. Zeneműkiadó, Budapest.
- Laczó Zoltán (1976): Kodály Zoltán koncepciójának hatása a legújabb zenepszichológiai kutatások tükrében. Előadás a II. Nemzetközi Kodály Szimpóziumon. *Ének-Zene Tanítása*, 1. sz. 10–22.
- Laczó, Z. (1985): The non-musical outcomes of music education: influence on intelligence? *Bulletin of the Council for Research in Music Education*, 85. 109–118.
- Laczó, Z. (1987): The first measurement of the effectiveness of the Kodály concept in Hungary using the Seashore test. *Bulletin of the Council for Research in Music Education*, 91. 87–96.
- Menuhin, Y. és Davis, C. W. (1981): *Az ember zenéje*. Zeneműkiadó, Budapest.
- Molnár Gyöngyvér (2006): *Tudástranszfer és komplex problémamegoldás*. Műszaki Kiadó, Budapest.
- Nagy József (2002): *XXI. század és nevelés*. Osiris Kiadó, Budapest.
- Nagy József, Józsa Krisztián, Vidákovich Tibor és Fazekasné Fenyvesi Margit (2004a): *DIFER Programcsomag: Diagnosztikus Fejlődésvizsgáló és Kritériumorientált Fejlesztő Rendszer 4-8 évesek számára*. Mozaik Kiadó, Szeged.
- Nagy József, Józsa Krisztián, Vidákovich Tibor és Fazekasné Fenyvesi Margit (2004b): *Az elemi alapképességek fejlődése 4–8 éves életkorban*. Mozaik Kiadó, Szeged.

- Nagyné Szarka Júlia (2004): Hipp, hopp, haja hopp, merre van a zene, hóp? In: Döbrössi János (szerk.): *Ének-zene nevelés*. Eötvös Lóránt Tudományegyetem Tanító- és Óvónőképző Karának Tudományos közleményei, XXV. Trezor Kiadó, Budapest. 45–58.
- Papp István (2004): *Nyelvi-zenei percepciók és produciók neuroanatómiai és fiziológiai reprezentációi*. PhD disszertáció. Veszprémi Egyetem.
- Piaget, J. (1997): *Az értelem pszichológiája*. Kairosz Kiadó, Budapest.
- Rauscher, F. H. és Zupan, M. A. (2000): Classroom keyboard instructions improve kindergarten children's spatial-temporal performance: A field experiment. *Early Childhood Research Quarterly*, **15**. 215–228.
- Royer, J. M. (1979): Theories of the transfer of learning. *Educational Psychologist*, **14**. 53–69.
- Schellenberg, E. G. (2004): Music lessons enhance IQ. *Psychological Science*, **15**. 511–514.
- Turmezeyné Heller Erika és Balogh László (2009): *Zenei tehetség gondozás és képességfejlesztés*. Kocka Kör Tehetség gondozó Kulturális egyesület, Debrecen és Faculty of Central European Studies, Constantine the Philosopher University, Nyitra.
- Turmezeyné Heller Erika, Máth János és Balogh László (2005): Zenei képességek és iskolai fejlesztés. *Magyar Pedagógia*, **105**. 2. sz. 207–236.
- Zatorre, R. J. és Krumhansl, C. L. (2002): Mental models and musical minds. *Science*, **298**. 5601. sz. 2138–2139.
- Zsolnai Anikó és Józsa Krisztián (2002): A szociális készségek kritériumorientált fejlesztésének lehetőségei. *Iskolakultúra*, 12. 4. sz. 12–20.
- Zsolnai Anikó és Józsa Krisztián (2003): A szociális készségek fejlesztése kisiskolás korban. In: Zsolnai Anikó (szerk.): *Szociális kompetencia – társas viselkedés*. Gondolat Kiadó, Budapest. 227–238.

## PAPERS OF THE AUTHOR RELATED TO THE DISSERTATION

- Janurik Márta (2007): Áramlatélmény az iskolai ének-zeneórákon. *Magyar Pedagógia*, **107**. 4. sz. 295–320.
- Janurik Márta (2008): A zenei képességek szerepe az olvasás elsajátításában. *Magyar Pedagógia*, **108**. 4. sz. 289–318.
- Janurik Márta (2008): Betöltik-e szerepüket az ének-zeneórák a mai oktatásban? *Iskolakultúra*, **18**. 9–10. sz. 107–116.
- Janurik Márta (2008): Flow, apátia, unalom és szorongás az iskolai ének-zeneórákon. Tematikus előadás (absztrakt). In: Csíkos Csaba (szerk.): *VI. Pedagógiai Értékelési Konferencia: Program – Tartalmi összefoglalók*. SZTE, Neveléstudományi Doktori Iskola, Szeged. 42.
- Janurik Márta (2009): Hogyan viszonyulnak az általános és középiskolás tanulók a klasszikus zenéhez? *Új Pedagógiai Szemle*, 7. sz. 47–64.
- Janurik Márta és Pethő Villő (2009): Flow élmény az énekkórán: a többségi és a Waldorf-iskolák összehasonlító elemzése. *Magyar Pedagógia*, **109**. 3. sz. 193–226.
- Pethő Villő és Janurik Márta (2009): Waldorf iskolába járó és általános tantervű tanulók klasszikus zenéhez fűződő attitűdjének összehasonlító elemzése. *Iskolakultúra Online*, 1. sz. 24–41.
- Janurik Márta (2010): A zenei képességek és az olvasás, helyesírás, számolás összefüggései hét éves korban. Szimpózium előadás (absztrakt). In: Molnár Éva és Kasik László (szerk.): *VIII. Pedagógiai Értékelési Konferencia: Program – Tartalmi összefoglalók*. SZTE, Neveléstudományi Doktori Iskola, Szeged. 142.
- Janurik, M., Józsa, K. és Szenczi, B. (2010): Relationships between musical abilities and basic skills essential for school-based learning at the age of 4 and 5. *Conference paper*, EARLI-SIG-5 Meeting „Learning and Development in Early Childhood” Lucerne, Switzerland. August 23–25.
- Janurik, M., Józsa, K. és Szenczi, B. (2010): Development of musical abilities between ages 4 and 7. *Conference paper*, EARLI-SIG-5 Meeting „Learning and Development in Early Childhood” Lucerne, Switzerland. August 23–25.
- Janurik, M. és Szenczi, B. (2010): Flow experience during school singing lessons: A comparative study of Kodály and Waldorf schools. *Conference poster*, 12<sup>th</sup> International Conference on Motivation University of Porto, Portugal September 2–4.