

# ‘Nine months before the mother's birth.’ Teaching and assessment of music literacy skills

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## Introduction

Improving music reading skills forms a central part of music education. It includes instrumental, vocal and solfège training. Music reading plays a special role in music learning in the sense that an adequate level of reading skills can be regarded as a prerequisite to all further learning. Music pedagogy methods and the improvement of music reading should build on analyzed data collected by reliable tools for educational measurement and accepted methods, similar to general reading. Although a great number of students learn music reading, only a few studies aim to examine the skill, its processes, strategies, development and its connections with singing and instrumental playing. Our online tests can provide opportunities for both modelling the music reading process and on the areas of the pedagogical practice in diagnostics and in evaluation.

It was the research carried out by Erős in 1993, which formed the basis for the definition of the model of basic musical skills. They explored the musical skills of children aged 10, 14 and 16 as well as university students, including music listening skills, communication, music reading and writing.

The longitudinal study conducted by Turmezeyné and Balogh in Hungary in 2009 was also a milestone in the field of music perception, singing, music reading and writing among 7-10-year-old children.<sup>1</sup> Technology-based assessment is a rapidly developing area, which can be extended to musical skills and provides new possibilities for diagnostic testing. The research of Asztalos and Csapó was the first attempt to develop an online test to examine music perception skills and their developmental trends among 7- to 12-year-old students in 2016.<sup>2</sup> However, we still lack data about the music reading skills of students aged between 10-14. Neither are there tests to assess their music reading skills.

In our study, one fundamental component of music literacy, i.e. music reading, has been explored. The purpose of our cross-sectional studies conducted on a national sample were to measure the success rate, the evaluation of music reading skills acquired from public and specialized music education based on the Kodály concept.

## Zoltán Kodály's music pedagogical concept

Music education in Hungary is based on the well-known Kodály concept. In order to enhance students' reading skills, Zoltán Kodály composed a series of music reading materials which is currently used in all levels of music education. According to the Kodály concept, musical training should be an integral part of the general curriculum and music should not only be accessible to the elite, but for everyone.

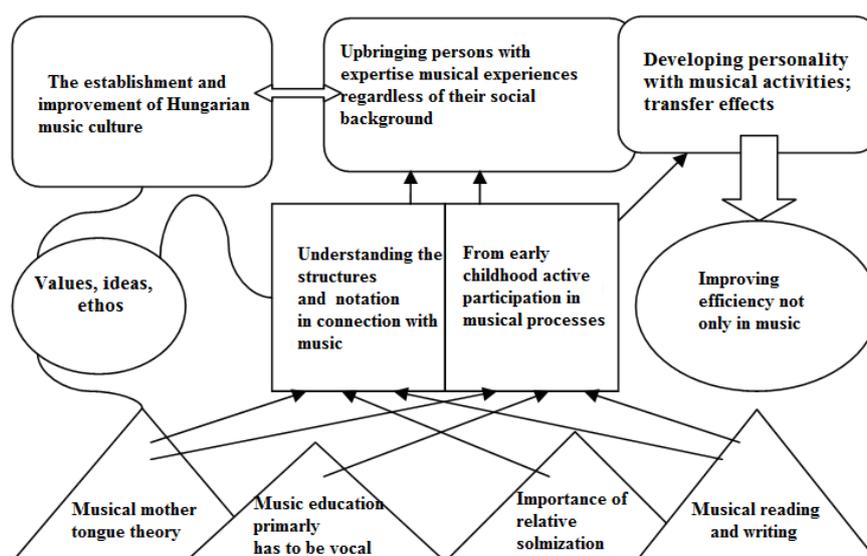
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<sup>1</sup> Erika TURMEZEYNÉ HELLER/László BALOGH, *Zenei tehetséggondozás és képességfejlesztés*. Kocka Kör Tehetséggondozó Kulturális Egyesület/Debrecen, Faculty of Central European Studies, Constantine the Philosopher University, Nyitra 2009.

<sup>2</sup> Kata ASZTALOS/Benő CSAPÓ, 'Zenei képességek online diagnosztikai mérése', in: Benő CSAPÓ/Anikó ZSOLNAI (Eds.), *Online diagnosztikus mérések az iskola kezdő szakaszában*, Oktatókutató és Fejlesztő Intézet, Budapest 2015.

Gönczy created the hierarchical illustration of the main elements of Kodály concept following Ittzés, who highlighted four principles which define the essence of Kodály's ideas: 1) all children should receive music education; 2) the bases of the music education are the human voice and singing; 3) meeting with music should take place respecting the principles of value-orientation, and musical mother tongue means the guarantee for it; 4) the prerequisite of educating music experts is the acquisition of musical literacy (music reading and writing) with the use the relative solmization.<sup>3</sup> The application of the relative sol-fa syllables can serve as a memory aid for reading pitch. The listed principles can be interpreted in several categories, and with each other in a hierarchical relationship (Figure 1).

**Fig. 1** – The hierarchical illustration of the main elements of the Kodály Concept (Gönczy, 2009)



Although the application of Kodály's ideas on music education in Hungary is rooted in Hungarian folk music, his concept is easily adaptable to the folk music of any other nation. Kodály promoted the teaching of general musicianship to both instrumental and solfege students.

In the 1960s, Zoltán Kodály encouraged a four-year, and multi-institutional type of study launched by Klára Kokas that systematically tracked children who regularly studied music in school effectiveness. The results showed a better outcome for children involved with music activities in arithmetic, writing, and creative problem solving and in the area of movement in contrast with their peers in normal education.<sup>4</sup> This exploration in the musical education pointed out the transfer effects of the Kodály concept that proved that the regular musical activity results in a positive change in other non-designated areas of knowledge. The results imply that music education might have a possible compensatory effect in the development of creativity and the modification of the structure of intelligence. Correlations between creativity and intelligence also increase due to musical education, with regard to the relationships between personality and intellectual performance; the results suggest that high creativity is combined with emotional sensitivity and inner control in children exposed to more music, and they tend to mobilize energy and activity in the convergent tasks requiring more disciplined thought.

<sup>3</sup> László GÖNCZY, 'Kodály-koncepció: a megértés és alkalmazás nehézségei Magyarországon', in: *Magyar Pedagógia* 2009-109/2, p. 169–185.

<sup>4</sup> István BARKÓCZY/Csaba PLÉH, *Music makes a difference*, Petőfi Nyomda, Kecskemét 1982, p. 18–21.

## Music literacy

Written language is a relatively recent cultural invention which came into existence some 5,000 years ago, but remained the privilege of only small proportion of the world population until a few hundred years ago. Almost 90% of all children can learn to read alphabetic as well as non-alphabetic scripts and write fluently without obvious problems.<sup>5</sup>

Music literacy, or *music reading comprehension* is traditionally defined as an acquired musical knowledge and a skill to translate notation into vocal sound (reading/singing) and sound into notation (notating/ writing). Both reading and notating skills are fundamental prerequisite for comprehensive musicianship. As reading, music reading is a highly complex activity on multiple levels, and the acquisition of reading literacy means to learn, use and perfect a corresponding set of highly interrelated operations, skills, and strategies. The most important period of their development is the first years of primary school. The acquisition of music reading is similar to that of reading, i.e. we learn, use and improve those interacting and related activities, skills and strategies that can be improved till adulthood.<sup>6</sup>

The term, functional music literacy, is defined by Jorgensen in 1981 and means the minimal level of musical skills which enables students to function with musical materials<sup>7</sup>. Functional reading literacy is generally seen as an enculturation process where literacy practices at school are designed, so that they resemble literacy events, practices, and authentic texts used for specific purposes in real-life contexts, emphasizing social interaction and collaborative construction of meaning.

The principal aim of music education is to develop functional musical literacy through solo or group (choir/chamber/orchestra) performances. The first step to functional music literacy is the development of an aural/oral vocabulary of tonal and rhythm patterns. Teachers should proceed through the tonal and rhythm lessons in parallel, preparing students for the discrete tonal- and rhythm-reading activities and the eventual synthesis of these patterns during melodic reading. However, sight-singing achievement is usually weak, only a few music programs address reading skills beyond the most prefatory level.<sup>8</sup>

From a cognitive perspective, music reading requires several simultaneous processes including coding of visual information, motor responses and visual-motor integration<sup>9</sup>. Studies find that music reading achievement at a high level is determined by the speed of information processing and psychomotor speed. This means that the decoding ability and the motor response are important in music reading but the integration of these abilities may be the key to a successful execution. Studies on perception indicate that pitch information and timing information are processed separately and good rhythmic reading abilities have a high positive correlation with music reading.<sup>10</sup> There are no research studies at all that deal with other elements of a music score, such as dynamic or agogic and how these signs can affect music reading. Research is needed in the field of singing from a music score with text or singing polyphonic compositions.

<sup>5</sup> Benő CSAPÓ/Valéria CSÉPE, *Tartalmi keretek az olvasás diagnosztikus értékeléséhez*, Nemzeti Tankönyvkiadó, Budapest 2012, p. 9–27.

<sup>6</sup> Wolfgang SCHNOTZ/Edit Katalin MOLNÁR, 'Az olvasás-szövegértés mérésének társadalmi és kulturális aspektusai', in: Benő CSAPÓ/Valéria CSÉPE (Eds.), *Tartalmi keretek az olvasás diagnosztikus értékeléséhez az első hat évfolyamon*, Nemzeti Tankönyvkiadó, Budapest 2012, p. 79–128.

<sup>7</sup> Estelle JORGENSEN, 'School Music Performance Programs and the Development of "Functional Musical Literacy", A Theoretical Model, in: *College Music Symposium*, 1981-21/1, p. 82–93.

<sup>8</sup> Don ESTER, *Sound Connections: A comprehensive approach to teaching music literacy*, Fishers, Educational Exclusives 2010.

<sup>9</sup> Helga GUDMUNDSDOTTIR, 'Advances in music reading research', in: *Music Education Research* 2010-12/4, p. 331–338.

<sup>10</sup> David ELLIOTT, 'The relationships among instrumental sight reading ability and seven selected predictor variables', in: *Journal of Research in Music Education*, 1982-30/1, p. 5–14.

Music reading as a reconstructive process that involves a number of sub-skills, one of which is the ability to recognize patterns and match them with a previously acquired vocabulary of musical concepts such as tonal and rhythmic patterns, high or low pitch, duple or triple meter, descending or ascending scale, neighboring tones or large leaps. Familiarity with such basic concepts develops a readiness in the learner for decoding music notation<sup>11</sup>. By the age of seven, children are able to reproduce complex rhythm patterns nearly as well as adult non-musicians.<sup>12</sup>

Essential step is the chunking process that allows students to organize and memorize a large number of vocabulary items, which can facilitate the music reading process. The principle behind Gordon's music learning theory, and the elements of the Kodály concept all support the idea that the building of tonal and rhythm vocabulary can be started with beginners through vocalization. The experience with the tonal and rhythmic vocabulary via singing would provide beginners with conceptual knowledge with which they can associate the symbols of music notation. The prerequisite of students' good reading comprehension is an adequate musical vocabulary. A curriculum for the improvement of vocabulary is considered well-structured if it can provide for the growth of students' musical vocabulary in various topics and fields.

Teaching reading strategies is also the task of the music teachers. With their help, students can become successful music readers. In music we can distinguish between music reading comprehension strategies that are also important to many musicians who consider themselves to be skilled readers. Reading comprehension and the richness of the vocabulary are related, which is true in the field of music reading as well. The prerequisite for reading comprehension is that the reader knows the meaning of 95% of the words in the text.

### **Sensitive periods of music training**

The theory of *critical* or *sensitive period* originates from language acquisition<sup>13</sup>. According to him, some biological events related to language and hemispheric specialization can occur only at an early sensitive period. If language acquisition takes place at a specified and predetermined age, it can be easier and more effortless. After the critical period, i.e. at about the age of 10-12, it is more difficult to acquire a language. The closure is based on the stabilization of the cerebral hemispheres functional asymmetry, which would be in conjunction with the start of puberty. Instead of one single critical period, Pléh assumes that different ages exist for the different sub-systems of language acquisition as particularly sensitive periods.<sup>14</sup>

Certain musical skills are inherited, and some are acquired after birth. As students are born with different musical talents, skills or biological predisposition into different environments, they develop their innate capacities in different ways. Correlations were found between the size of the musicians' neurophysiological responses and the age of onset of music lessons, suggesting that a sensitive period for attaining the brain changes associated with musical expertise may end around ten years of age.<sup>15</sup>

The language has not a privileged status in the newborn brain, but rather that music enables us to acquire not only the musical conventions of our native culture, but also enables us to learn languages.<sup>16</sup>

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<sup>11</sup> Edwin GORDON, *The aural/visual experience of music literacy*, GIA Publications, Inc/Chicago 2004.

<sup>12</sup> Carolyn DRAKE, 'Reproduction of musical rhythms by children, adult musicians, and adult nonmusicians', in: *Perception and Psychophysics*, 1993-41, p. 642–656.

<sup>13</sup> Eric LENNEBERG, *Biological foundations of language*, Wiley, New York, 1976.

<sup>14</sup> Csaba PLÉH, *A mondatmegértés a magyar nyelvben*, Osiris, Budapest 1976.

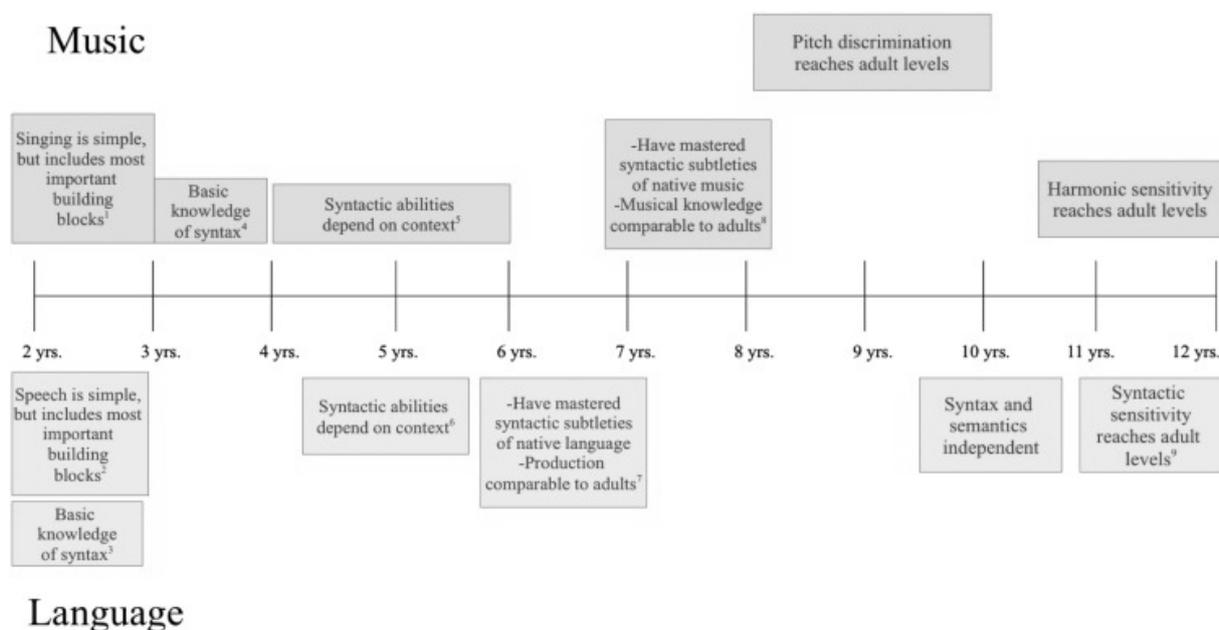
<sup>15</sup> Laurer Trainor, 'Are there critical periods for musical development?' in: *Developmental Psychobiology*, 2005-46, p. 262–278.

<sup>16</sup> Anthony BRANDT et al., 'Music and Early Language Acquisition', in: *Frontiers in Psychology*, 2012-3, p. 327.

Without the ability to hear musically, no one would be able to learn language. The duration of acquiring musical skills is not slower than that of speech (Figure 2).

The acquisition of music and language is closely linked in the early period, and they develop in parallel. Due to developmental processes, speech is interpreted as a special type of music that fits into music systems.

**Fig. 2** – The parallel development of music and language skills (Brandt et al., 2012)



### Research on testing musical skills

Füller divided music tests into four basic standard musical test groups. We can distinguish musical ability or aptitude tests (Seashore, Drake, Gordon, Gaston, Bentley) and also achievement tests (Beach, Hutchinson, Allen, Knuth, Colwell, Wagner). Vocal and instrumental tests were constructed (Hildebrand, Mosher, Watkins-Farnum), and music preference tests were also developed (Hevner, Schoen, Kyme).<sup>17</sup>

The first test of musical skill on musical talent was designed by Seashore in 1919. However, it was revised and published several times, e.g. *Measures of Musical Talent* (Seashore et al., 1960), where the norms are given for boys and girls between 10 and 22 years of age. The test contains six subtests; pitch discrimination, loudness discrimination, rhythm, sense of time, timbre discrimination and tonal memory. The Seashore test principally examines aural skills and the musical phenomena are presented without any musical context. Kwalwasser-Dykema's test (1930), designed for students aged between 10-22 shares similarities with Seashore's; however, music notational exercises were added. Arnold Bentley developed his *Measures of Musical Abilities* (1966), which appeared on LP records and was used in many schools in the United Kingdom. There were some negative remarks about the test; for example, it was said to be too simplistic to be able to test 7- and 14 year-olds objectively. Szende's most important theoretical objection to the test is that it is independent of any concrete goal of education.<sup>18</sup>

Over several decades Edwin E. Gordon developed musical tests which are still used in the United States. Gordon's Primary Measures of Music Audiation (1986) was designed for kindergarten children and 1st-3rd graders in primary schools. It comprises a tonal and a rhythmic

<sup>17</sup> Klaus FÜLLER, *Standardisierte Musikalitätstests*. Diesterweg, Frankfurt 1974.

<sup>18</sup> Ottó SZENDE, *Intervallic hearing: its nature and pedagogy*, Akadémiai Kiadó, Budapest 1977.

subtest with 40 pairs of tasks each, and children are asked to make a same/different judgment. Gordon Musical Aptitude Profile (Gordon, 1965) is designed for 10-18-year-old students. It is made up of several subtests, e.g. tonal imagery (memory, harmony and tonal), rhythm imagery (tempo and metre), musical sensitivity (phrasing, balance and style). In the tonal imagery and rhythm imagery tests, the items consist of pairs of phrases, and students have to determine whether the items are the same or different. In the subtest of sensitivity, the pairs of phrases differ in terms of musical expression (phrasing), endings (balance) and tempo (style), and the pupils are asked to decide which the better of the two is. The strength of this test is that it has an excellent reliability (Cronbach's alpha of 0.9).

Music achievement tests, on the other hand, are dependent on the given educational system, since they test musical theoretical knowledge (names of sounds and rhythms, time signatures, music symbols, scales, and music history), as well. The common property of music achievement tests is that all of them test skills related to notation.

Gordon's *Iowa Tests of Music Literacy* (1991) includes a *Rhythmic Concepts* division with three subtests. In *Audiation/ Listening*, the participants discriminate between patterns in which beats are subdivided into duplets and triplets. *Audiation/ Reading* requires determining whether aural patterns match notated patterns. The *Audiation/ Writing* section requires filling in noteheads, flags and rests to make a notated pattern match an aurally presented pattern.

The test developed by Erős in 1993 examines musical perception, singing ability and skills related to music notation. It has a great significance, because unlike other popular music tests, it focuses on students' singing, music reading and writing skills between the ages of 10 and 22. The test battery contains 61 items listed in 14 subtests. The measured musical skills are defined as basic musical skills. Reading skills are tested by comparing and reproducing musical notation. In the research of Asztalos and Csapó the music ability test was administered through an online assessment platform. The sample consists of 155 students from a music primary school and 498 students from non-music schools. The reliability of the test was excellent with a Cronbach's alpha of 0.917. The age group results show that musical abilities develop most dynamically during the first school years. In their research, they used visual connection tasks to examine the basic ability of music reading and writing, the relationship between the acoustic input and visual signs. They found that the performance of students from music primary schools was significantly better than that of regular primary school students. The reason for that is that music reading and notation have an important role in music school curricula as early as in the first few years.<sup>19</sup>

### Goals and research questions of the empirical research

The aim of our study was to analyze students' music reading skills on the basis of Zoltán Kodály's philosophy of music education and to develop and test technology-based assessments to measure music reading skills. The musical tests were developed to measure the disciplinary dimension of music reading among upper graders in public and music schools. In the research, the explicit knowledge of the rhythmic and melodic elements, dynamic and tempo signs and musical forms were examined.

Generation Z, unlike the previous student populations, can have different habits, which is the reason why students' music skills were tested with technology-based methods and tools. The data was recorded on the eDia platform. The advantage of an electronic diagnostic system over paper-based measurements is that the tasks can be made more enjoyable and lifelike with images, sounds, animations and varied response forms (selecting, clicking, coloring, moving, rearranging). The unique feedback system can give information to the students and their teachers about the test results. Our research can help to give more detailed information about the music reading skills of pupils, with the use of an objective measurement tool the quality of music education can be improved. Our research questions were the followings, (1) can online testing of music reading skills be implemented in general school settings, (2) what is the level of 10-14 year old students' music reading skills, (3) what is the relationship between the students' achievement in music reading and the background variables, (4) do visual-spatial skills correlate with music reading skills, (5) what are the differences between the results of students in different school type, (6) Is gender a factor in the performance of the music reading test?

<sup>19</sup> Kata ASZTALOS/Benő CSAPÓ, 'Zenei képességek online diagnosztikai mérése'. in: Benő CSAPÓ/Anikó ZSOLNAI (Eds.), *Online diagnosztikus mérések az iskola kezdő szakaszában*, Oktatókutatató és Fejlesztő Intézet, Budapest 2015.



Students were asked to discriminate a few rhythmic patterns, such as syncopation, Lombardic rhythm or different types of musical rests that are contained in a four or eight bar period (Figure 4).

**Fig. 4** – Example of rhythmic pattern identification

Click on the syncopation!

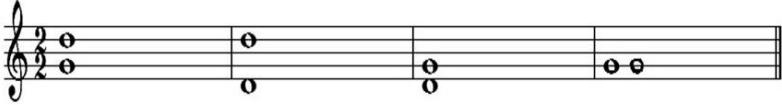


previous next

We asked students to identify the basic kinds of intervals, scales, chords, such as major, minor, diminished or augmented. As the basis of polyphonic hearing and interpretation, the perception of harmonies requires multimodal musical thinking (Figure 5).

**Fig. 5** – Example of an interval exercise

In which bar is the perfect fifth?  
Click on it!



1 2 3 4

previous next

The ability to perceive the connection between the visual and the auditory modality determines the development of music reading and writing. In our tasks participants had to choose one of two musical examples that fit the melody or rhythmic soundtrack being heard (Figure 6).

**Fig. 6** – Example of an exercise with soundtrack

Which melody do you hear? Click on it!



The screenshot shows a digital interface for a music reading exercise. At the top, the text reads "Which melody do you hear? Click on it!". Below this is a speaker icon indicating an audio track. Two musical staves are presented: 'a)' and 'b)'. Both staves are in the key of G major (one sharp) and 4/4 time. Staff 'a)' contains the notes G4, A4, B4, C5, B4, A4, G4, followed by a whole rest. Staff 'b)' contains the notes G4, A4, B4, A4, G4, F4, E4, followed by a whole rest. At the bottom of the interface are two buttons: "previous" on the left and "next" on the right, both with circular arrows.

To gather contextual information, students were asked to respond to the background questionnaire that took 15 to 20 minutes to complete after the online music reading tests. The questionnaires contained 36 questions for students to investigate the relationship between music reading skills and several background variables. We were asking students about the music reading test itself, their school results, social backgrounds, attitudes towards different music lessons, singing and reading, concert experiences and future musical plans. We also investigated metacognitive strategies and included questions relating to technology, especially the internet. In our survey we gathered information about students' access to a computer at home, attitudes towards using a computer, and the frequency of computer usage.

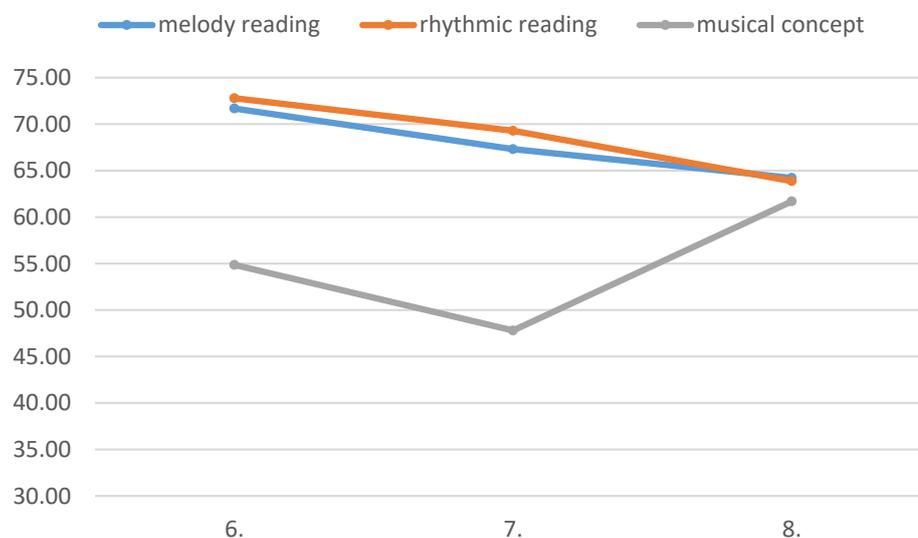
## Results

The online platform made data collection accurate, and it proved to be suitable for data recording, processing and was easy-to use for the participating students. On the basis of the results, it can conclude that the online testing of music reading skills can be implemented in general school settings. The reliability of the test battery for music school students was good (Cronbach's  $\alpha=0.832$ ). The music reading test matches the skill level of the grades tested in music schools. Music students' achievement was 76.69% with a standard deviation of 12.35. We found that the rhythm reading subtest was easier for the students than the melodic reading subtest. There were no significant differences between the music reading performances of the consecutive grades. However, significant difference was found in the music reading achievement between grade six and grade eight ( $F=4.206$ ,  $p=0.007$ ) Therefore, the students' music reading skills show an improvement between these grades. In Table 1 the descriptive statistics of the subtests are presented.

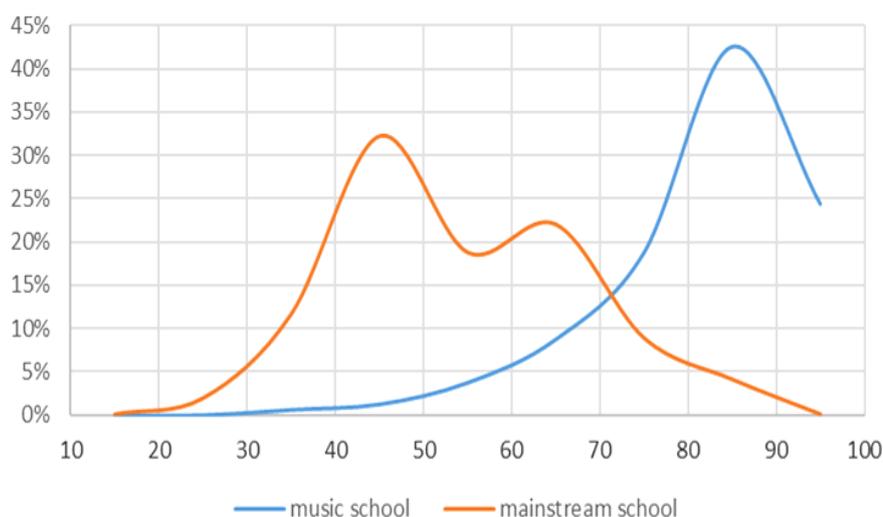
**Table 1** – Descriptive statistics of the music reading test of music school students

		Grade 5	Grade 6	Grade 7	Grade 8	F	Sign.
Rhythm reading	M	80.74	76.89	81.74	85.57	2.03	n.s.
	SD	16.03	16.39	16.40	16,42		
Melody reading	M	82.37	80.89	82.84	85.92	0.99	n.s.
	SD	15,60	12.94	13.25	13.57		
Aural skills	M	60.00	57.67	62.11	71.43	4.89	p<0.01
	SD	20.41	16.59	17.73	15.86		
Music concepts	M	68.650	70.23	79.47	85.71	4.782	p<0.01
	SD	28.496	30.76	18.88	17.82		
Visual/ spatial	M	53.70	55.04	65.79	69.84	2.92	n.s.
	SD	34.06	30.76	28.46	24.20		

Mainstream school students' mean performance on the music reading test was 54.84% with a standard deviation of 18.65. There were no significant differences between the four grades. The knowledge of sol-fa hand signs had a high performance (81%). Tasks in connection with timbre (29%) and dynamic reading got the lowest average (34%). Students' performances in the subtest performed in Figure 7.

**Fig. 7** – The development in the different types of the music reading of mainstream school students by grade (%p)


35 items were part of both version of the music reading tests in the two school types. The core test was filled by 811 10-14 year-old students. The distribution curves of the core test of the music reading tests in the two school types were examined. It is obvious that these tasks were easier for the music school students, and more difficult for the primary school students. 67% of the music school students performed better than 85%, while only 4% of the primary school students managed to do so. The music school students' distribution curve is located more to the right of the mean, so the music reading test with only these 35 items proved to be easy for them, and cannot differentiate properly (Figure 8). Mainstream school multimodal distribution falls to the left that means the test was difficult for them. 63% of them had poorer achievement than 50%.

**Fig. 8** – The distribution of music reading performance of the two school types (%p)


We compared the results of the music reading core test between the different types of schools. We found significant differences in each grade (Table 2).

**Table 2** – Differences in the achievement of music reading test in the two types of schools by grade

Grade	Mainstream school		Music school		T-test	
	M	SD	M	SD	t	p
5	55.19	17.16	79.65	13.83	13.837	<0.001
6	52.33	17.59	78.25	11.81	11.889	<0.001
7	55.89	20.09	81.81	11.37	11.378	<0.001
8	55.49	19.57	85.08	10.74	10.741	<0.001
Total	54.84	18.65	81.21	12.14	12.147	<0.001

When we compared the results of the map reading test, significant differences were found each grade, as well.

### The influence of background variables on students' performance

The relationship between the music reading skills and the background variables was analyzed. Moderate and strong correlations were found between music reading achievement and most of the academic subjects (Hungarian literature, grammar, mathematics, biology, history and English); however, it does not show any correlations with the grades in music. Therefore, the grades in music do not reflect the components of music reading. There are correlations between some components of functional music literacy (the attitudes towards choir or solo performances) and the music reading achievement.

Several studies reveal that there is a correlation between the achievement of students in schools and their motivation. We found correlations between the students' attitude toward some activities of the solfège lesson and their achievement in rhythm reading ( $r=0.286$ ,  $p<0.01$ ), attitude toward singing ( $r=0.237$ ,  $p<0.01$ ) and between students' achievement and their attitude towards listening activities ( $r=0.245$ ,  $p<0.01$ ). A positive attitude towards singing correlates with music reading achievement ( $r=0.305$ ,  $p<0.01$ ), which accounts for 9.3% of variance in the music reading achievement. It also correlates with the achievement of the rhythm reading subtest ( $r=0.204$ ,  $p<0.05$ ), the melody reading subtest ( $r=0.274$ ,  $p<0.01$ ) and with the musical signs and concepts subtest ( $r=0.177$ ,  $p<0.026$ ).

We collected data about the students' achievement in the prior school year with the help of a background questionnaire. The students' school performance is represented by grade. No correlations were found between the students' grades in music and their music reading test achievement. Thus, the grade in music does not reflect the level of music reading skills, although music reading is one of the fundamental concepts of the Kodály concept. Most of the correlations were found with the grades of literature, grammar, biology, art, behavior, or self-discipline (Table 3). Strong positive correlations can be observed between the music reading achievements and the grades in English. This relationship may be accounted for by phoneme awareness, intonation, and listening skills that are crucial factors in language and music learning, as well. These results correspond to the literature, which claims that music has positive transfer effects on students' cognitive, metacognitive and affective skills. It is interesting to note that grades in PE also correlate with music, which has a positive effect on physical well-being.

**Table 3** – Correlations between students' test performance and academic achievement

<i>Subject</i>	<i>Grade 5</i>	<i>Grade 6</i>	<i>Grade 7</i>	<i>Grade 8</i>
Literature	0.132	0.446*	0.101	0.105
Grammar	0.028	0.476*	0.726**	0.632**
Maths	0.149	0.439*	0.289	0.616**
History	0.216	0.466*	0.654*	0.682**
English	0.151	0.569**	0.507**	0.632**
Biology	-	0.523*	0.552**	0.511**
Physics	-	0.115	0.333*	0.441*
Chemistry	-	-	0.261	0.586**
Geography	-	0.231	0.680**	0.539**
Music	-	0.069	0.067	0.241
Art	0.011	0.499*	0.321*	0.327
PE	0.044	0.338*	0.371*	0.384*
IT	-	0.344*	0.165	0.042
Behaviour	0.065	0.492*	0.494*	0.311*
Diligence	0.159	0.437*	0.723**	0.577**

Note: \*= $p < 0.05$ ; \*\*= $p < 0.01$

Music school students study different musical subjects. In grade 6, the grades in every musical subject correlate with the achievement of the music reading test, whereas grades in solfege do not show correlation with test achievement in grades 5 and 8. So it seems that the grades in solfege do not reflect the level of students' reading skills. Correlations were found between the solfege and orchestra grades of the students and their achievement in the music reading test (Table 4).

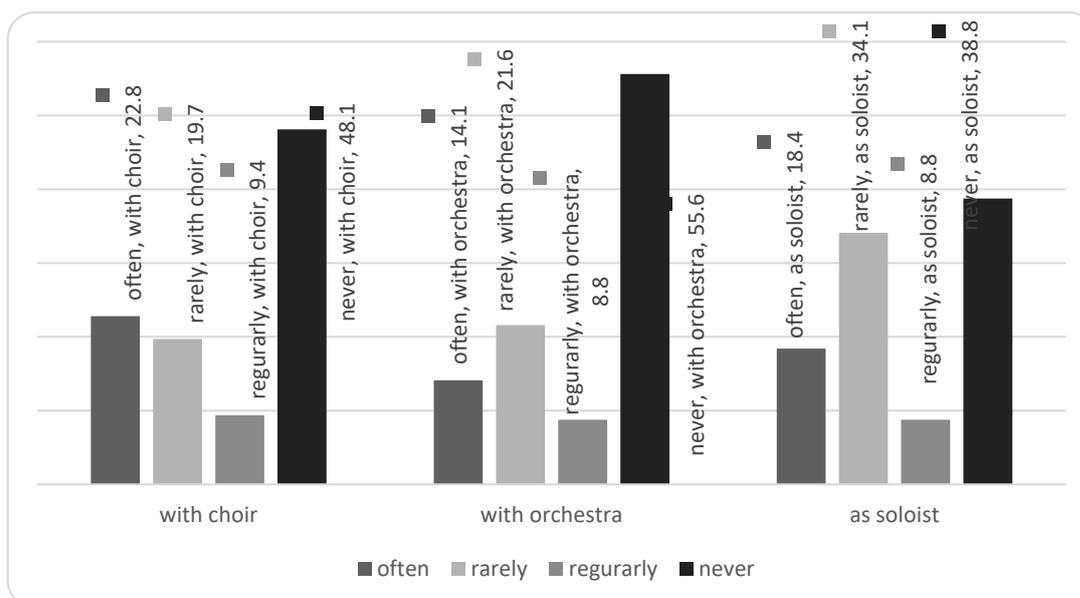
**Table 4** – Correlations between students' achievement and music school subjects

<i>Music school subject</i>	<i>Grade 5</i>	<i>Grade 6</i>	<i>Grade 7</i>	<i>Grade 8</i>
Solfege	0.275	0.451*	0.381*	0.192
Music history	0.146	0.724*	0.801**	0.085
Instrument	-	0.396*	0.205	0.122
Orchestra	-	0.734**	-	-

Note: \*= $p < 0.05$ ; \*\*= $p < 0.01$

27% of the students sing in a choir, while 37% of them are members of different orchestras. Students were asked how often they give a performance with an orchestra, a choir, or alone as a soloist. Most of the music school students (34.1%) perform at concerts as soloist. More than half of them have never played in an orchestra. Figure 9 shows the frequencies of different types of performances. The rhythm reading subtest correlates with performing in a choir ( $r=0.226$ ,  $p < 0.05$ ).

**Fig. 9 – Means of different types of performances (%p)**



It was also asked how much experience the music students have with performing, and if they liked to perform individually or in different music groups – a five-point Likert scale was used. More than 20 percent of the students agreed that they liked to perform very much, whereas approximately the half of them had never performed. The most popular performing activity among music school students is singing in a choir. Weak correlations were found between the attitudes towards two performing activities (singing in a choir and performing, as a soloist) and the music reading test achievement (Table 5).

**Table 5 – Correlations among attitudes towards performing and music reading achievement**

	<i>Attitude towards performance with a choir</i>	<i>Attitude towards performance with an orchestra</i>	<i>Attitude towards performance as a soloist</i>
Music reading achievement	0.214**	0.074	0.210**

Note: \*\*p<0.01

Weak correlations were also found between rhythm reading subtest and students' attitude towards performing in a choir ( $r=0.236$ ,  $p<0.05$ ), and performing with an orchestra ( $r=0.176$ ,  $p<0.05$ ) and performing as a soloist ( $r=0.233$ ,  $p<0.05$ ). Music reading achievement does not depend on maternal education or on the socio-economic status. In the sample of the music school students, gender differences are not related to the music reading achievement. However, our expectations that the girls' results are significantly better than those of the boys in each mainstream school grade were justified. There is a difference between the results of girls and boys in favor of the girls.

### Summary

Our online tests require the direct application of music reading skills in a realistic context, thereby providing a valid and instructive measurement. The findings of this research can provide information for the educational system about how familiar students are with the components of music reading. They can further support the teaching of music reading and reading strategies as a curricular objective and the development of detailed curricula. Our researches were novel in the field of digital technology. It was demonstrated that the procedure is suitable for a large-scale assessment of music reading skills. Moreover, the online test proved to be a time and cost efficient objective measurement.

The research investigated the music reading skills of students in the upper grades. Further research can involve the online assessment of students' strategy use utilizing the method of eye-tracking.

This further research could serve as a basis for developing training programs of music reading comprehension. Further research can also include the investigation of the effect of beliefs and strategy use on reading comprehension, involving the motivational characteristics of students.

In music education the text is the score. Textual-analyses are needed in the field of music on the basis of linguistic researches in order to enhance student's reading skills. Besides the diagnostic evaluation, the online system can provide a great opportunity for the development. We aim to create programs that can provide music reading exercises in an adaptive way.

The assessment of general reading skills, including reading as a tool, is a central issue in most international system-wide surveys. Extending the online music reading testing across different cities in different countries can increase the generalizability of the results. The online platform makes it possible to bridge distances. The test has a version in German as well which was used to test the music reading skills of primary school students in Luxembourg on the eDia platform. Assessment is an essential component of music teaching and the learning process. With the help of a valid, reliable, and individualized assessment, students are able to develop important musical skills and move closer to reaching the ultimate goal of music literacy instruction: independent musicianship.