

THE EFFECT OF MUSIC ISLAND (COMPUTER PROGRAM) ON THE DEVELOPMENT OF MUSICAL ABILITIES IN SCHOOL MUSIC LESSONS

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Abstract

Several research deals with using of digital devices effect on students' motivation on music lesson. However, only a small number of publications focus their impact on the development of musical abilities and knowledge. Therefore, in our seven month-long experiment, we aimed to improve musical abilities and musical knowledge in a digital learning environment among first graders.

We had an experimental (N=135) and a control group (N=111) in this study. The newly developed Music Island computer program (Szabó, 2018) was used in the experimental group. The computer program based on the Hungarian national core curriculum. We also applied several other computer applications in the experimental group. The Rhythm Master was used to practice rhythm tasks and the NotateMe Now application to learn music scoring. The students worked individually on their own tablet on music lesson. We applied the traditional teaching methods in the control group.

Musical ability was measured by a musical ability test (Surján & Janurik, 2018). It consisted of two parts. The first part (64 items) involved discrimination tasks; the second part (30 items) measured reproduction skills, singing and rhythm clapping. (Cronbach- α discrimination .80; reproduction .94; total test .91). Musical knowledge test covers eight components: rhythm writing (3 tasks); solmization (4 tasks); name of instruments (4 tasks).

We applied a pretest-posttest experimental design. On pretest there was no significant difference between the experimental and the control groups in musical ability and socioeconomic status. However, results show a significant difference between the two groups in the development of reproduction skills on the posttests (experimental: $M=41.28$, $SD=24.26$; control: $M=33.11$, $SD=21.99$, $p=0.008$; Cohen- $d=0.35$) and musical knowledge (experimental: $M=84.77$, $SD=14.34$; control: $M=72.92$, $SD=23.57$ $p<0.001$, Cohen- $d=0.61$). Based on our results, we can say that music and singing lessons in digital learning environment were more effective than the traditional music teaching method.

Keywords: musical abilities, reproduction skills, musical knowledge, Music Island.

1 INTRODUCTION

In 2017 in the United States children aged 0-8 spent 2 hours and 19 minutes in front of a screen of some kind of electronic device [1]. We see a dynamic increase when following the data for the previous years. If we focus on the data of mobile devices from the digital tools examined (mobile phones, tablets), we see that whilst in 2011 this age group used a mobile device for 5 minutes, in 2017 they use it for 48 minutes. During the same investigation period the time spent watching television decreased by 11 minutes.

Another part of media consumption which is more relevant from the point of our topic is the gaming activity on digital tools. According to the survey conducted by Common Sense Media the age group 0-8 years plays for about 25 minutes. Within this group children aged 2-4 years play for 21 minutes, children aged 5-8 years for 42 minutes. On the basis of the report made by Entertainment Software Association in the United States more than 150 million people regularly play video games, which is almost the half of the population. 18 % of the people regularly playing video games are under the age of 18. 70 % of the parents questioned think that video games have positive effect on their children's life. Considering recent data and tendencies growth and expansion of digitalisation seem to be unstoppable. However, from the point of view of our topic it seems to be even a more important question how the education can take advantage of this vast quantity of digital information/ and how the education can transfer (digitalise) and build it into the activities of children in and outside of the classroom. In the long run what will happen to the course books (the paper based media)? How will

the information, which can be found in the digital space, become useful knowledge? What will be the role of the school and the teacher in shaping the orientation in the digital space?

A number of research proved the positive effects of digital games on the learning outcomes ([2], [3]). The effects of digital educational games were focused on software supporting literacy development ([4], [5]). Researchers show growing interest in digital game applications developing STEM (science, technology, engineering and mathematics) skills.

The digitization of music education is lagging behind, while the first international research examining the possibilities of using digital devices in the music classroom started in the 1990s ([6], [7], [8], [9], [10]). With the use of digital tools, students can develop not only musical skills, but also improve other competencies and skills, e.g.: language, digital skills, problem solving, and they facilitate students' creativity [11], they increase motivation ([12], [13]), and support collaboration and teamwork, as well as enhance functional music literacy [14].

In Hungary the curriculum of music education is largely based on Zoltán Kodály music pedagogical method. At schools which do not specialise in music it is rather difficult to teach music. The lower level of music skills [15], the lack of the students' interest and motivation are typical [16], in addition, the prestige of music education is really low [17]. All these findings call the attention to the need of the methodological renewal of music teaching. In Hungary digital opportunities have been seldom used till recently in the everyday pedagogical practice of the music lessons. There are not enough digital teaching materials in Hungary and there are just a few software products. In order to fill this gap our research group, the MTA-SZTE Methodological Research Group, has joined the subject methodological research programme, which was initiated by the Hungarian Academy of Sciences and the University of Szeged. Our aim is to work out the possibilities of the implementation of digital tools in music lessons. In our research we focused on revealing the opportunities, methods which use the 21st century technical tools as well as the traditional singing and activities involving movements methods. During the fulfilment of our program we researched the effects of music teaching in a digital environment using digital tools on music skills and musical knowledge as well as its effects on students' motivation. In our study we are going to introduce the results of our programme we conducted for first grade children. The foundation of our research was the application called "Zenesziget" (Musicsland) developed by our research group. It is a software, which can be run on various platforms and both its appearance and its language were designed for teaching music to primary school children.

1.1 The most important aims of Hungarian music education in the first grade

The aim of the Hungarian music education is – following Kodály's conception – the multifaceted development of personality with the methods of music. The most important principles of his music pedagogical concept include introducing music learning at a young age, regular everyday music learning activities, the importance of singing, acquiring the important elements of music literacy starting from the first grade and learning based on musical experiences and activities [18].

1.1.1 Importance of singing

Singing is naturally available for everybody and at the same time, it is a tool of music self-expression, enjoyment and development of musical abilities. Therefore singing gets a significant role in teaching music. According to research, the sensitive period of singing ends at the age of eight and in the absence of training the development of the skill is bogged down [19]. On the one hand, this fact supports the early development suggested by Kodály, and on the other hand, it emphasizes the importance of the systematic development of singing and the opportunity to practice. In the first grade, learning songs, developing singing abilities (the proper articulation, the clear intonation, the proper rhythm) and the pleasure of singing are placed in the center of attention. Singing as well as activities involving movement have a significant role in the formation of cognitive schemes, which are necessary for musical perception and notation [20].

1.1.2 Music perception

Music involves the manipulation of sounds. The perception of music is thus influenced by how the auditory system encodes and retains acoustic information. Music perception is the basis of all musical activities like playing a musical instrument. The development of music perception adds to the musical experience and cognitive development. This development is determined by certain universal aspects of musical structure as well as by the environment. Based on the modular model of music processing

the pitch processing and temporal processing are organized separately from each other [21]. Thus the development of pitch processing and the temporal processing have different features [22]. The development of music perception is realized in Hungarian schools by the performance of children's songs and folk songs with children's active participation [23]. This includes the didactic arrangement of selected folk songs and methods according to age groups and difficulty.

1.1.3 Music reading and writing and musical knowledge

Reading music is a process in which we convert special visual symbols into sounds and rhythms [24]. The essence of music reading and writing ability is the development of the associations connecting the symbols of notes and sounding. The formation of music concepts, which is the basis of both music reading and writing, is an important principle of the Hungarian music pedagogy. The musical cognitive process develops through the development of singing ability and the music perception. The graphic representation of music is based on this [25]. Gordon [26] calls the cognitive schemes making this development possible "audiation" and he connects this concept to the language. Hungarian music pedagogy uses the concept of "inner hearing" in the same sense. According to Gordon, acquiring musical notation from the beginning of music learning does not improve musical thinking, what is more, it can hinder musical thinking at an early stage of music learning. However, Kodály is convinced that the ability to read and write musical notation is fundamental to the development of musicality [27]. Thus he considers important to start teaching it as early as possible, in the first grade applying relative solmization. The music material of the teaching of music notation includes playing songs as well as folk songs.

Tools used in Kodály's method are the moveable-do solfa, rhythm syllables, stick notation, and the use of hand signs. Movable-do refers to the concept in which the tonal centre of a song is "do" in the major and "la" in minor modes. The rhythm syllables system allocates a specific syllable to each note value (for example a quarter note is "ta", two eighths is "ti-ti"). Stick notation is a simplified form of music notation devised by Kodály where the rhythm is separated from the pitch. Teaching of notation is always preceded by systematic observation based on listening discrimination and musical experience. For example, rhythm writing is always introduced by listening, clapping and rhythmical saying of rhythm values, singing and activities involving singing and movements, and only after this children will learn how they should be written [28].

The curriculum of elementary level of music education includes acquiring basic musical knowledge. Thus it includes teaching different instruments, groups of instruments, vocal ranges as well as choir and orchestra sonority. The introduction of music studies in the first grade is connected to the sounds of natural phenomena, the environment and animals in folk and classical music. All this is connected to children's previous experiences. We also regard the ability of reading and writing music as musical knowledge.

1.1.4 The motivation of Hungarian students to school music lessons

Hungarian students have an indifferent or rather a negative attitude to learning music [29]. Among the subjects, music is the most refused, both the parents and the pupils put its usefulness to the last place. In a survey conducted with seven graders only the 0.5 % of students named it as his/her favorite subject [30]. According to Csíkszentmihályi [31] musical activities can give the opportunities for a flow experience. However, comparing to other subjects, for example to the literature and the maths lessons, not only give music lessons less pleasure, but also children experience more apathy and boredom. Besides, their negative attitude towards classical music can be demonstrated too [32].

2 THE MUSIC ISLAND

Music Island is a software, which can be run on various platforms and both its appearance and language were designed for teaching music to primary school children. There are four main components of Music Island: (1) the sounds of our environment and musical instruments (SoundForest); (2) rhythm exercises (RhythmDesert); (3) music theory and the reading and writing of music (MusicRepublic); (4) music editing (MusicFactory). To design the tasks, the following aspects of the curriculum were taken into consideration: (1) the improvement of listening skills, tune, rhythm, harmony, tone and dynamics; and their relations; (2) identifying moods and characters; (3) knowledge of musical styles and forms; (4) improvement of musical memory and internal hearing; (5) music theory knowledge; (6) music scoring, (7) singing (karaoke). The recent version of the software was optimized for a classroom application, that is you can enter the game at every point, but we plan to create a Story mode where the player is developing as a character of a story.

2.1 Thematic parts of MusicIsland

2.1.1 SoundForest – the world of musical and non-musical sounds

A. Introduction to the sounds of instruments

Children can get acquainted with the sounds of musical instruments, the way of producing sounds with them through short examples taken from classical, folk and of pop music of high standard (Figure, 1). All instruments demonstrate their range of sounds by playing a scale in a low and high register. Specific effects of instruments are presented too (for example, string pizzicato, harp glissando, frullato, trumpet glissando etc.). Here the roles of the icons are worth mentioning. The speaker icon plays the sound of a sound effect (for example horse neighing or some instrumental music part), the music note icon plays a part of an instrumental musical composition, the yellowed music sheet icon presents the sheet of the song on the screen and the microphone starts the karaoke file belonging to the song. The instruments and groups of instruments are presented are the following:

- woodwind instruments (recorder/pipe, flute, oboe, clarinet, bassoon)
- brasswind instruments (trumpet, cornet, trombone, tuba)
- string instruments (violin, viola, cello, contrabass)
- plucked string instruments (harp, classical guitar, electric guitar, bass guitar)
- keyboard instruments (piano, harpsichord, celesta, organ)
- percussion instruments (timpani, brass drum, side drum, vibraphone xylophone).



Figure 1. The opening screen of SoundFores

B. Introduction to the sounds of animals

Outline of sounds, songs, instrumental music pieces related to different animals – horses, goats, lambs, chickens, pigs, hens, roosters, cows, cats, dogs, geese, donkeys, and frogs – (Figure, 2). A significant part of the lessons at primary school is related to animals. We collected the musical examples so that the children could get acquainted with the representation of an animal in musical pieces or in lyrics of a song from as many sides as possible. We made music foundations to the songs, which are the bases of karaoke files as well.



Figure 2. The screen shot of domestic animal's menu

C. Introduction to the sounds of nature

Appearance of sounds, sound effects and their representation in different music pieces related to different natural phenomena – spring, summer, autumn, winter, morning, noon, night, rain, cosmos, wind and lightning/thunder (Figure, 3). The professional standards of the music pieces are ensured by the lawful recordings given by Szeged Symphonic Orchestra sound archive. Besides, the lecturers and students of Faculty of Music Szeged University contributed to the recording used for the programme.



Figure 3. The menu of nature sounds

D. Introduction to the sounds of vehicles

Typical sounds of planes, tractors, fire engines, ambulance and police cars. We considered important to present not only musical sounds but also the sounds of our environment because their recognition can be useful in other areas of life. In addition, there is an opportunity to develop musical skills like differentiating pitches, recognition of the sameness or difference in volume and the sameness/changes in tempo.

✦ Music Store

The songs and pieces of music included in the programme can be found here in an alphabetical order. By tapping the icons the piece can be played and the music sheet of the song can be seen in a picture format as well as in the form of a digital music sheet (MuseScore format), in addition, karaoke videos can be started from here.

2.2 The types of activities

There are four different types of activities with three different levels of difficulty.

1. Music train: The music train type activities can develop many different types of music skills depending on the topic the exercise belongs to (for example, horse) and it also depends on what sort of exercise is assigned to the music elements. In order to develop skills in many ways we created variations of wagons and baskets.

In the example represented in figure 4 the player's task is to find the music elements where the tune is ascending – and to pull them into the first wagon – while the ones with descending tune are to be put into the second wagon. The programme displays the results of the children in points after solving each task. The number of points is given according to the time spent on the exercise and the accuracy of the solution.



Figure 4. One type of Music Train

2. Domino: According to our experiences, nowadays the traditional domino game is less known. In our experimental groups we had to start teaching the rules and only after this we could start getting acquainted and playing the game.

Similarly to Music Train there are several options to define activities.

3. Memory: The game is a new musical version of our traditional memory game since here the task is more than simply finding picture and sound matches, that is the different combinations of those. For example, the picture of an instrument is to be matched with its sound or a real sound of an animal must be matched with a tune which belongs to the animal (Figure, 5). Two or three memory game icons (similarly to the game icons) mean some difference in difficulty. In the case of a memory game it can be the increase in the number of pairs or finding the picture-sound effect, sound effect-music pairs.



Figure 5. Animal memory game

3 METHODOLOGY

3.1 Research Questions

In this study we were looking for the answer for the following questions: How does the use of digital tools in music lessons influence the development of following factors?

- 1 Musical abilities
- 2 Musical knowledge
- 3 Motivation about learning music

3.2 Research design

In the framework of our research we conducted a pedagogical intervention developing musical abilities and motivation. We used the control group and experimental group design among the first grade students. The pretest was conducted in September, 2017 and the post-tests were organised in May, 2018. The intervention programme took place in the framework of two 45-minute music lessons every

week. The course books used both in the control group and in the experimental group were same; the students had to meet the same course requirements. The difference between the experimental and control group was the applied teaching methods namely in the use of the digital tools. In the control groups children were taught with the frontal method, digital methods were not used. In the experimental groups digital tools were used as well.

3.2.1 Participants

The experimental group consisted of 135 pupils (60 boys) from five first- grade classes of two schools. The control group also consisted of five classes from two schools. It included 111 first-grade students (55 boys). In the experimental and control group mothers' education was not significantly different ($Z = -1.544$, $p = .123$).

3.2.2 Measures

★ Musical aptitude test

The test consisted of two subtests: (1) Listening discrimination (2) reproduction (singing and clapping). The instrument was developed for testing on tablets.

The first part is the *listening discrimination*. In these tasks the pupils had to decide about sameness or difference of musical item. Tasks: (1) melody-discrimination (8 items); (2) chord discrimination (8 items); (3) rhythm- discrimination (8 items); (4) pitch- discrimination (7 items); (5) tempo changes (6 items); (6) pitch-discrimination – direction of variance (7 items); (7) tone-discrimination (7 items); (8) chord- discrimination (7 items); (9) volume discrimination (6 items). The second part is the *listening reproduction*. Clapping of the recorded rhythms, singing melodies and intervals after listening. Tasks: (10) rhythm reproduction (14 items); (11) interval singing (8 items); (12) melody singing (8 items). A test has a good reliability Cronbach's α : discrimination .80; reproduction .94; total test .91.

During testing listening discrimination students used headphones and solved the tasks on tablets, they could listen to the instructions related to the tasks in the form of sound files. The examination of the skills related to listening reproduction requires individual testing. The students could listen to the sound files of the exercises related to singing and rhythm clapping individually and the reproduction was recorded by the leader of the research. The completion of the test: listening discrimination 25 minutes; reproduction 10 minutes.

★ Music notation test

This test is a paper-based instrument. It consists of eight exercises, which are based on the curriculum for the first graders. Three exercises refer to rhythm writing: (1) drawing "stick" rhythm pattern after hearing its name; (2) drawing "stick" rhythm pattern from dictation; (3) drawing "stick" rhythm pattern of a song given with its lyrics (27 items, Cronbach's α : .88).

Four exercises relate to reading and writing melody: 4) Recognition of hand signs of a given song and recognition of the song ; (5) placement of the letters of solmisation sounds in the five-line system (mi, do, so, la); (6) copying the notes of a given melody, writing solmisation names under the note; (7) noting down sounds given by a letter music sheet in the five-line system (49 items, Cronbach-alpha: .95) The reliability of total test is high (Cronbach's $\alpha = .95$). The last part of the test was task to recognize instruments: (8) piano, flute, violin and bassoon based on pictures. Children solved these tasks in writing in a lesson.

★ Motivation to learn music

Students' motivation was measured on a five-point Likert-type scale (5 items, Cronbach's α : .70).

4 MUSIC INTERVENTION PROGRAMME

The basis of our intervention programme was *Musicsland* application [33] <https://urlz.com/ncD6z>).

The primary aim of our six-month intervention programme was introduction and investigation of the impact of *Musicsland* application in the first grade. In addition, the teachers could use several other computer applications. They played rhythm exercises with Rhythm Master. In the application students had to knock on the screen the rhythms which appeared on the screen. Musical reading and writing skills were supported by NotateMe Now application. The programme makes it possible to write down the musical notes in various ways. In addition the complete music material can be listened to. In the

experimental group tablets were available for the children, and with the help of headphones children could work individually. In addition, *MusicIsland* application is suitable for being using on a smart board. In the first months of the experiment teachers preferred working on the smart board because at the beginning of the academic year not all the students were experienced at using tablets. On the one hand, in this period they applied the frontal teaching method, on the other hand, they formed small groups which worked together.

They observed the features of musical and non-musical sounds together; they got acquainted with animal sounds and or the sounds of our environment and parts from classical music pieces which were related to them. In the framework of the intervention we accomplished the skill development and acquirement of knowledge partly through traditional, partly through digital tools using tablets. During the experiment we considered it important not to put the traditional methods used for teaching music into the background, for example singing and musical activities requiring movement, thus to give the children the opportunity to sing songs accompanied by game activities involving movements and practising rhythms. Although the main teaching profile of *MusicIsland* educational programme is not singing, it gives opportunity to sing as the accompaniment of part of the songs belonging to the topics can be found in the programme.

5 RESULTS

5.1 Development of music perception and reproduction

There was no significant difference between the musical perception and reproduction skills at the pre-test between the experimental and the control group. At the post-test singing (experimental: $M=37.46$, $SD=31.10$; control: $M=27.19$, $SD=28.60$, $t=2.23$, $p=.03$) and rhythm clapping (experimental: $M=55.79$, $SD=20.62$; control: $M=47.83$, $SD=21.29$, $t=2.48$, $p=.01$), as well as the aggregate index of the reproduction skills (experimental: $M=43.76$, $SD=24.80$; control: $M=34.07$, $SD=22.51$, $t=2.67$, $p=.009$) is significantly higher in the experimental group. The development of listening discrimination skills is not significantly different in the two samples (experimental: $M=59.37$, $SD=11.02$; control: $M=60.00$, $SD=10.53$).

5.2 The development of music reading and writing

In the experimental group the aggregate index of the acquirement of musical knowledge is significantly higher (experimental: $M=84.77$, $SD=14.34$; control: $M=72.92$, $SD=23.57$ $p<.001$). Among the different areas solmisation skills are significantly more developed (experimental: $M=86.39$, $SD=13.35$; control: $M=73.55$, $SD=25.63$, $t=4.923$ $p<.001$). In the field of the development of rhythm writing skills we also found a significant difference (experimental: $M=93.40$, $SD=9.66$; control: $M=90.56$, $SD=22.97$. $t=1.99$ $p=.04$), as well as at the averages we got for the knowledge of instruments (experimental: $M=84.52$. $SD=20.03$; control: $M=72.71$. $SD=28.78$. $t=3.50$ $p<.001$).

5.3 Attitude towards music lessons

The attitude towards music lessons is significantly higher in the experimental group (experimental: $M=4.03$, $SD=1.27$, control: $M=3.55$, $SD=1.49$, $t=2.53$ $p=.01$), as well as the index showing love of singing (experimental: $M=4.19$, $SD=1.23$, control: $M=3.85$, $SD=1.43$, $t=1.85$ $p=.05$).

6 CONCLUSIONS

The aim of our experiment was the assessment of the impact of using digital tools in music lessons. We endeavoured to promote the efficiency and motivation of music learning. Our impact assessment was related to the development of music perception and reproduction, the music reading and writing and musical knowledge, and motivation to learn music.

Our results show that the use of digital tools in the lessons promoted the development of musical abilities, apart from this, they supported the students in acquiring musical knowledge. At the post-test we found a significantly higher development of reproduction and music literacy (music reading and writing and knowledge related to instruments) in the experimental group. The listening discrimination was the only area where at the post-test the two groups were not different. On the basis of our earlier studies singing abilities do not develop in the first year in the school after kindergarten [22]. While the results we got in the control group support our earlier findings, development of singing was revealed

among students in the experimental group. We might suppose that more possibility of practising, frequent singing songs happily with accompaniment could contribute to the development of psychomotor development necessary for singing.

We also consider important that students taking part in the experiment showed a significantly higher level of development in musical knowledge. Music reading and writing can be regarded as a problematic area of music teaching at schools which do not specialise in music teaching [25]. It is important to ensure a good foundation for teaching to read music sheets. The development of skills, defined in the curriculum, related to solmisation is significantly higher in the experimental group than in the control group. The efficiency of our programme is supported by the fact that the standard deviation of the children taking part in the experiment is lower than in the control group, which means that the individual differences are lower.

Our intervention programme in a digital environment proved to be successful from the point of view of creating a more positive attitude to music lessons. During the programme children were singing a lot with great pleasure. They enjoyed music lessons – compared to the control group – their attitude was more positive towards singing. Earlier studies on the attitude towards music lessons showed that they were not among the favourite subjects (e.g. [30], [29], [17]). The majority of students in older age groups were unmotivated about music lessons (e.g. [32], [34]). The results we got in the experimental group support the idea that the indifference about music lessons start in the first grade. In our experiment the digital teaching environment we designed could give an opportunity to create a more positive attitude towards music lessons in the first grade.

The results of our research support that music education in a digital environment can be successful and useful from the point of view of the development of musical abilities, acquiring musical knowledge and the motivation to learn music.

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