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EFFECTS OF MUSIC-RHYTHMIC STIMULATION PROGRAM ON CERTAIN MOTOR ABILITIES OF CHILDREN WITH HEARING IMPAIRMENT[1]

Abstract: *Certain research on the development of motor skills of children with hearing impairment shows that their abilities are not age-appropriate, although they have the same basis for development as hearing children. Education of children with hearing impairments is predominantly focused on hearing and speech rehabilitation, while activities related to music and sports are mostly neglected. The aim of this study was to examine the effects of musical-rhythmic stimulation on the development of selected motor skills of children with hearing impairment aged six to fifteen. For this purpose, a special music and dance program of workshops for 26 children with hearing impairments (12 boys and 14 girls) was created for the period of four and a half months. At the beginning of the program implementation, the initial measurement of body coordination and speed of movement was performed, and the final measurement through five standardized tests at the end. The paired samples t-test was used to analyze the effects of applied musical-rhythmic and dance stimulations. The results of the research indicated certain statistically significant differences in the ability to coordinate the body and speed of movement, i.e. that the program of music and dance workshops has a positive effect on the development of selected motor skills in children with hearing impairment.*

Keywords*: body coordination, music and dance workshops, speed of movement.*

INTRODUCTION

It is a known fact that sound and movement are the first and continuous companions of human development. "Sound, rhythm and movement have been of decisive importance for humans since the stage of the fetus, both for physical and mental development. Already at this stage of life, the foundation of man is laid as a being who communicates with society and feels inspired" (Bjerkvol, 2005, p. 26). When coming to the world, every human being begins (or continues) the path of upbringing and education, a process in which he comprehends and learns, grows and develops in accordance with the environmental conditions.

[1] The paper is a revised and supplemented text of part of research from the doctoral dissertation of Ivana (Gojmerac) Hadžihasanović titled *Influence of musical-rhythmic stimulations and movements on motor abilities of children with hearing impairment*, defended on February 12, 2021, at the Faculty of Education, under the mentorship of Merima Čaušević, PhD, Associate Professor., and Indira Mahmutović, PhD, Full Professor.

The historically observed development of society gives us an insight into the construct of various social systems that had as a component some form of upbringing and education. The goals of education, issues of function, as well as approaches to the realization of this significant social problem have changed throughout history depending on the economic, political, and cultural circumstances of a particular historical period, "(...) on a practical level education is strongly conditioned and the social and cultural level of the environment in which they are performed, but also the anthropological and psychological characteristics of the participants in the educational process." (Bognar and Matijević, 2002, p. 17). Although they can be viewed separately, upbringing and education are in true mutual symbiosis and only in this way they give the expected, socially useful results.

Contents, methods and all other special issues of upbringing and education were also and remain a reflection of social needs and requirements in a certain time of life, so music and exercise from the earliest periods of civilization occupied a more or less high and highly valued place in educational[2] systems. From the Akkadians to the famous ancient Greek philosophers Plato (427–347 BC) and Aristotle (384–322 BC), through humanistic and other ideas about the importance of music as well as gymnastics for education to modern scientific research on the impact of music on man, the possible effects of music on a person's cognitive and motor development, his mental state, and even its influence in situations of chronic diseases and conditions, are still being questioned.

A particularly important issue in the process of upbringing and education is special and inclusive education, i.e. the upbringing and education of persons with certain developmental difficulties and disabilities, which began to be discussed more openly and with quality in the middle of the 20th century. To date, many issues and problems in this area have received more attention, but they are still mostly partially and insufficiently resolved due to many complexities. Music and movement have a very important place in the implementation of various programs for the development and rehabilitation of people with disabilities, and especially specific research on the application of music and movement in working with people with hearing impairment will be problematic in the future.

THEORETICAL OBSERVATIONS OF THE PROBLEM

A particular and relatively recent question is whether music has an impact on people with hearing impairments and, if so, what that impact is. Certain research (Alvin, 1965; Chen-Haftack & Schraer-Joiner, 2011; Fulford et al., 2011) has shown that people with hearing impairments can perceive music. According to the authors Fulford et al. (2011, p. 448), there are two ways in which deaf people can perceive music: the first is "sound acceptance" which refers to relying on auditory information rather than vibration, and the second is "sound non-acceptance" which describes musical perception that relies on other characteristics of sound, such as vibration that we can feel through the sense of touch. If we rely on auditory information, we must know that of the six musical elements, only half of the elements can be felt by all people regardless of the severity of hearing impairment, while the other half can be felt by people with less impairment or people more exposed to sound stimuli: rhythm, tempo, dynamics, harmony, tone color and melody.

Physicist Brian Greene from Columbia University talks through his research on string theory and how everything on the globe vibrates so that the bones in our body vibrate as well (Greene, 2010), and that our body responds to vibrations like one big ear while listening to music. From this, it is clear that man feels music not only with the sense of hearing, but also with the whole body, which gives us the opportunity, if we exclude the external sense of hearing, to experience music and sound in a different way. Music can be heard in many different ways, and medical and sociological reports (Darrow, 1993; Sacks, 1990) prove that the world of the deaf is anything but quiet. The intensity of the sound that deaf people perceive through other receptors in the enlarged version makes their world much more vibrant than the world of hearing

[2] Education is a universal term that originates from the English language (*education*), and which is now used internationally as a synonym for the entire process of education and for various forms of education. In the education system of Bosnia and Herzegovina, the same term is used equally in terms of education at all levels / levels of education.

people. This is supported by the opinion that "Music (...) is the most beautiful art form that has the ability to physically vibrate the human body." 1998, p. 17).

Many researchers have confirmed that sensory deprivation in one part of the brain can affect the development of the remaining parts of the brain (Čizmić and Rogulj, 2018). When one sense is unavailable, the responsibility of the sensor changes and the processing of other parts of the brain becomes improved like some natural compensation. One of the adaptations that the brain can make is the brain of a person with hearing impairment. Dean Shibata, a doctor from Harborview Medical Centers and a professor in the Department of Radiology, University of Washington, is investigating these issues, and here is a study that included 10 young people with hearing impairments and 11 hearing people where Shibata used functional magnetic resonance imaging (fMRI).) to compare brain activity during the vibrations they occasionally received across hands (www.sciencedaily.com/releases/2001/11/011128035455.htm). Both groups showed activity on the part of the brain that normally processes vibrations, with deaf people showing brain activity in the auditory cortex, which is normally activated only by sound stimuli, while hearing people did not have this activity. It is clear that people with hearing impairments feel vibration in the parts of the brain that hearing people use to process sound, which helps us explain how people with hearing impairments can enjoy music or even become performers.

In Europe and the world, there are organizations that deal with music education for people with hearing impairments, e.g. The Music4U educational program is part of the more extensive Music Inclusion (MINC) program of the British National Youth Music Organization, local authorities and the National Center for Early Music in York (https://www.ncem.co.uk/) and certainly a few more similar ones in the UK. Among the professional, world-famous musicians of today with significant or complete hearing impairment, we will mention Evelyn Glennie, a British/Scottish percussionist who, in addition to being a percussion soloist, also acts as a composer, music lecturer, etc. It is also important to mention another British woman, flutist Ruth Montgomery (https://www.ruthmontgomery.co.uk/) with a similar development path as the previously mentioned artist. In the field of dance art, mention should be made of the Gallaudet Dance Company Theater in Washington, USA, whose members are mostly people with hearing impairments (https://www.gallaudet.edu/department-of-art-communication-and-theatre/ gallaudet-dance-company/). Among the famous artists in this field, it is necessary to mention charismatic dancers: Zahna Simon, a member of the Urban Jazz Dance Company, who proved herself with contemporary dance, while Samantha Figgins, a member of the Alvin Ailey American Dance Theater, is primarily engaged in classical ballet. Apart from the performers, the choreographer Mark Smith is also known, who in 2010 founded the male ensemble Deaf Men Dancing (https://static1.squarespace.com/static/5975f9dabebafb04b9657415/t/5d134bc2ad72940001e78eae/1561545667857/DMD%9ioF % 29.pdf).

In Bosnia and Herzegovina, work with children with hearing impairments takes place in the centers for education and rehabilitation of hearing and speech as independent institutions or as part of other institutions similar in function (Sarajevo, Banja Luka, Tuzla, Mostar). Specialized artistic, musical and sports education of children and people with hearing impairments takes place through individual projects, mainly in the non-governmental sector or through the enthusiastic work of individuals and groups. One of the very rare examples of work on issues of social inclusion through art is the regional cooperation of the Association "Tanzelarija" from BiH, "Hajde da ..." from Serbia, "Dlan" from Croatia and "Equilib institute" from Slovenia through the project *Body without text* from 2013 (https://www.youtube.com/watch?v=LvlsD74x6uI).

Montgomery (2007) believes that it is not necessary to hear well to have access to music, because the perception of internal rhythm is a very strong aspect of music that allows people with hearing impairments to enjoy music. Every man has an inner rhythm. It is innate and we can see that through the rhythm of walking or running, which is natural, and thanks to him our movements are uniform, harmonious and not strange. However, it is increasingly common opinion that today's children, regardless of whether they are hearing or hearing impaired, have reduced motor skills compared to age due to the so-called sedentary lifestyle. Today, children spend most of their free time in front of screens, and very few children engage in extracurricular sports activities. This is evidenced by the data presented in the Strategy for the

Development of Sports in Bosnia and Herzegovina from 2010 (Ministry of Civil Affairs of BiH, MCPBiH), which states that only about 30% of school-age children from all over BiH engage in sports activities in their free time, with this percentage being much lower among children of younger school age (about 15%). Prskalo (2007) obtained very similar results on a sample of 287 students from 1st to 4th grade of primary school in Croatia, which show that only 17 % of children state that they play sports in their free time. If we compare this result with the data from a study conducted in the Netherlands, which shows that as many as 43% of children with hearing impairment engage in sports activities (Hartman & Visscher, 2011), we will see that children with hearing impairments in BiH are much less involved in sports activities than children from individual European countries.

According to many studies, children with hearing impairment are born with the same basis for the development of motor skills, but their further development is not in accordance with age (Gheysen, Loots & Waelvelde, 2008; Hasanbegović and Mehmedinović, 2012; Radovanović, 1976; Sretenović and Nedović, 2019; Vuljanić, 2015; Wiegersma & Velde, 1983). The reason for this phenomenon are not factors related to hearing, but can be found in the fact that the activities of children with hearing impairment are mainly focused on speech and hearing rehabilitation (Hasanbegović and Mehmedinović, 2012; Radovanović, 1976), while all other activities such as music, sports and dance activities are mostly neglected or kept to a minimum. The presented data are worrying considering that hearing impairment is one of the factors associated with difficulties in the development of motor skills, but also social, emotional and speech areas, and any extracurricular music and sports activity that can contribute to this population is even more important for these.

The research presented in this paper aimed to examine the effects of musical-rhythmic stimulation on the development of selected motor skills (coordination of body and speed of movement) of children with hearing impairment, six to fifteen years of age. It is hypothesized that the implementation of a program of music and dance workshops lasting four and a half months will have a positive effect on the improvement of motor skills in children with hearing impairment aged 6 to 15, with additional assumptions that the level of body coordination and movement speed is inconsistent with age, and that the application of musical content with dance and movement will contribute to the increase of these motor skills in the respondents.

METHODOLOGY

SAMPLE

The research sample consisted of 26 children with hearing impairment of various etiologies, 12 boys and 14 girls, 6 to 15 years of age. The intentional sample of selected units is typical for the conducted experimental research and the specifics of the hearing-impaired population. With regard to age, the research was conducted with the consent of the parents of respondents as well as adequate institutions. Respondents had previously determined the degree of hearing impairment according to applicable standards, which was confirmed by parents through a questionnaire. According to available data, the etiology of deafness suggests the following reasons: in about 42% of the sample, the cause of deafness is unknown, about 49% is hereditary deafness, other reasons are past illnesses (e.g. meningitis). In the sample, only three children had a cochlear implant, only one attended guitar lessons and only three attended sports activities.

RESEARCH INSTRUMENTS AND PROCEDURE

The initial examination (measurement) was conducted through tests of motor skills assessment at the very beginning of the realization of music and dance workshops. The applied tests are intended to measure the ability to coordinate the body and the speed of movement. Selected motor skills (Sekulić and Metikoš, 2007) are directly related to the reproduction of rhythm as the basis of musical-rhythmic and dance stimulation, which is conditioned by coordination and thus speed of movement. After the experimental program, the final test was performed, and for both measurements the following tests were used: Eight with bending – MCYS, Steps to the side – MKKS, Envelope test – MKKT, Slalom with 3 medics – MKS3M, Long jump back – ICSU.

For the purpose of the research, we created a special educational program of music and dance workshops intended for children with hearing impairments. The workshops lasted four and a half months, from the beginning of February to mid-June 2019 at the Center for Hearing and Speech Rehabilitation Sarajevo (Bosnia and Herzegovina). They took place twice a week for 60 minutes, and the musical content consisted of compositions from different stylistic periods and different genres, from baroque e.g. Johann Sebastian Bach, *Air*; Tomaso Albinoni, *Adagio in G Minor for strings and organ*, through impressionist, e.g. Claude Debussy, *Clair de lune / Moonlight*, to works of film music, e.g. Giovanni Giorgio Moroder, *What a Feeling* and electronic music e.g. Jens Massel Senking, *Closing Eyes*. All the compositions were systematically selected due to sound frequencies, motor-rhythmic specifics, tempo, harmony / colors, etc., so that during the workshop program, respondents practiced and adopted certain movements, dance elements, etc. to selected sound content, and this led to certain changes in body coordination and speed of movement.

Musical-rhythmic stimulations are one of the educational procedures in working with hearing impaired children and are often used as a therapeutic procedure created by merging Laban's theory of movement (theory that defines the basic principles of movement, both aesthetically and functionally), speech therapy and verbotonal methods (the method is part of the verbotonal system and includes methodological procedures used in the diagnosis and rehabilitation of hearing and speech). The name "musical-rhythmic stimulation" originated from the practice at the SUVAG Polyclinic in Zagreb, which was and still is carried out by speech therapists-rhythmists of this institution, and beyond. Musical-rhythmic stimulation includes three types of stimulation: musical stimulation, rhythmic stimulation, and movement stimulation. All three types are essentially subordinate to the improvement of speech and listening, but they have a wide range of actions. According to the Tuzi (2012) study, musical stimulations brought order to motor, musical and speech expression and improved memory. Rhythmic stimulations contribute to improving the rhythmicity of speech, i.e. awareness of the rhythmic structure of speech, and in addition to stimulating movement, it works on creating a motor image and proper articulation. "By properly directing the development of motor skills and its connection with sound and movement in rhythmic structures, we create conditions for good speech" (Tuzi, 2012, p. 119). Although musical-rhythmic stimuli are created for speech rehabilitation, it can be seen from the above that they have a much wider range of action. As such, it can be used to awaken and develop the inner rhythm and its reproduction, which is the basis for music and dance creativity, and the inclusion of children with hearing impairment in active music making and dancing.

DATA PROCESSING METHODS

Data collected by the experimental method were processed in the statistical software program *SPSS 13 Statistica for Windows (Statistical Package for the Social Sciences)* which calculated the basic statistical indicators for all variables (mean, or arithmetic mean (M), minimum and maximum, standard deviation – SD, coefficient of variability – KV). A T-test was used to examine the significance of differences in the arithmetic means of the observed variables, and regression analysis was applied to examine the significance and magnitude of the influence between the observed variables in the initial and final tests. All studies were conducted with a significance level of 1% to 5% (0.01 – 0.05).

RESULTS AND DISCUSSION

The measurement of selected motor skills was performed at the beginning of the music and dance program as the initial measurement and after four and a half months of application of the program through the final measurement. The measurement results are shown in Tables 1, 2, 3 and 4, which show statistically significant differences. In order to obtain as relevant data as possible, we used the inclusion or exclusion

criterion during the final data analysis, taking into account the results of 26 respondents, which we previously divided into four age groups:

1. The first group of participants is a group of children aged 6 and 7 – 5 respondents (five boys). Children with the etiology of deafness genetics are included in this group.
2. The second group consists of children aged 9 and 10 – 7 respondents (seven boys). Children with the etiology of deafness genetics are included in this group.
3. The third group consists of children aged 11 and 12 – 7 respondents (seven girls). This group includes children with the etiology of deafness genetics and three respondents who are engaged in some extracurricular sports activities.
4. The fourth group consists of children aged 13 and 15 – 7 respondents (seven girls). This group included children with deaf etiology unknown and with 100% deafness. Also, this group consists of three subjects who have a cochlear implant.

Table 1.

Paired Samples Test of selected motor abilities of dependent variables in hearing impaired children aged six and seven (boys)

		Paired Differences			**T**	**df**	**Sig. (2-tailed)**
		AS	**SD**	**SEM**			
Pair 1	MCYS – MCYSF	12.17333	4.67163	2.69717	4.513	4	.046
Pair 2	ICCS – ICCF	10.28667	6.41157	3.70172	2.779	4	.109
Pair 3	MKKT – MKKSF	68.69667	2.99183	1.72733	39.770	4	.001
Pair 4	MKS3M – MKS3MF	5.63667	.56722	.32748	17.212	4	.003
Pair 5	МКСУУ – МКСУУФ	-5.81667	1.26081	.72793	-7.991	4	.015

Legend: AS – Arithmetic mean, SD – Standard deviation, SEM – Standard error, T – value of t statistics, df – difference, number of degrees of freedom, Sig – significance of the test [3].

The results shown in Table 1, except for the ICCS (Step to the Side) test, show a statistically significant difference in the significance level $p < 0.05$, with a significance level of less than 5%. The highest statistical significance is shown by MKKT ($p = 0.001$, $t = 39.770$), followed by MKS3M ($p = 0.001$, $t = 17.212$), MKSUU ($p = 0.015$, $t = -7.991$) and MCYS ($p = 0.046$, $t = 4.513$).). The ICCS test (Steps aside) did not show statistically significant results ($p = 0.109$, $t = 2.799$).

[3] The same labels are in the following tables.

Table 2.

Paired Samples Test of selected motor abilities of dependent variables in hearing-impaired children aged nine and ten (boys)

		Paired Differences			T	Df	Sig. (2-tailed)
		AS	SD	SEM			
Pair 1	MCYS – MCYSF	9.80667	3.38210	1.95266	5.022	6	.037
Pair 2	ICCS – ICCF	7.41000	.64374	.37166	19.937	6	.003
Pair 3	MKKT – MKKTF	21.34667	1.50533	.86911	24.562	6	.002
Pair 4	MKS3M – MKS3MF	16.75667	4.04166	2.33345	7.181	6	.019
Pair 5	МКСУУ – МКСУУФ	-16.46667	1.56312	.90247	-18.246	6	.003

The results from Table 2 show a statistically significant difference at the significance level $p < 0.05$ with a significance level of less than 5%. The highest statistical significance is shown by MKKT ($p = 0.002$, $t = 24.562$), followed by MKKS ($p = 0.003$, $t = 19.937$) and MKSUU ($p = 0.003$, $t = -18.246$), MKS3M ($p = 0.019$, $t = 7.181$) and MCYS ($p = 0.037$, $t = 5.022$).

Table 3.

Paired Samples Test of selected motor abilities of dependent variables in children with hearing impairment aged eleven and twelve years (girls)

		Paired Differences			t	Df	Sig. (2-tailed)
		AS	SD	SEM			
Pair 1	MCYS – MCYSF	3.66333	.88093	.50860	7.203	6	.019
Pair 2	ICCS – ICCF	1.67000	2.33167	1,34619	1.241	6	.341
Pair 3	MKKT – MKKTF	11.53000	3.08385	1.78046	6.476	6	.023

Pair 4	MKS3M – MKS3MF	10.50667	.88189	.50916	20.635	6	.002
Pair 5	МКСУУ – МКСУУФ	-16.16000	5.96105	3.44161	-4.695	6	.042

In Table 3, all results, except for the ICCS (Step to the Side test), show a statistically significant difference in the significance level p <0.05, with a significance level of less than 5%. The highest statistical significance is shown by MKS3M (p = 0.002, t = 20.635), followed by MCYS (p = 0.019, t = 7.203), MKKT (p = 0.023, t = 1.78046) and MKSUU (p = 0.042, t = -4,695). The ICCS (Steps to the Side) test does not show statistically significant results (p = 0.341, t = 1.241).

Table 4.

Paired Samples Test of selected motor skills of children with hearing impairment between the ages of thirteen and fifteen (girls with cochlear implants)

		Paired Differences			**t**	**Df**	**Sig. (2-tailed)**
		AS	**SD**	**SEM**			
Pair 1	MCYS – MCYSF	4.50000	1.54380	.58350	7.712	6	.000
Pair 2	ICCS – ICCF	4.18571	1.71506	.64823	6.457	6	.001
Pair 3	MKKT – MKKTF	8.40000	6.62193	2.50286	3.356	6	.015
Pair 4	MKS3M – MKS3MF	5.24286	4.87301	1.84182	2.847	6	.029
Pair 5	МКСУУ – МКСУУФ	-14.02857	3.13726	1.18577	-11.831	6	.000

In the last table (Table 4) all results show a statistically significant difference at the significance level p <0.05, with a significance level less than 5%. The most significant statistical difference is shown by the MCYS and ICTY tests with p = 0.000 st = -11.831 (ICTY) and = 7.712 (MCYS), followed by ICCI (p = 0.001, t = 6.457), MCTT (p = 0.015, t = 3.356). and MKS3M (p = 0.029, t = 2.847).

Initial measurements through all five tests showed that motor skills were selected – body coordination and speed of movement below the age level. These results are consistent with other results

showing that the motor abilities of children with hearing impairment are delayed in development compared to hearing children (Rine et al., 2000; Schlumberger, Narbona & Manrique, 2004). The reason for this state of motor skills in children with hearing impairment is not sensory impairment, but their focus on speech and hearing development while neglecting physical activity (Kaltsatou et al., 2013; Tzanetakos et al., 2017). Vuljanić (2015) proved that children with hearing impairment have a deficit in the ability to coordinate movement, and speed deficit as well. 80 children participated in her research, where coordination skills were measured through the Steps Away test (ICPS).

The following graphs (Graphs 1, 2, 3, 4) show us the results of the initial and final measurements through all five tests. The results show progress in the performance of the tests, but it is important to note that the result of the final test in the first four tests was measured in time units of seconds, so the speed was performed, while in the last test (long jump backwards) units of length, in centimeters. Accordingly, the difference between the initial and final measurements is such that the second measurement shows a lower value of the arithmetic mean, which indicates an improvement in coordination skills and speed of execution, while the last test has a higher arithmetic mean of the final measurement than the initial it also points us to improved results after the music and dance program.

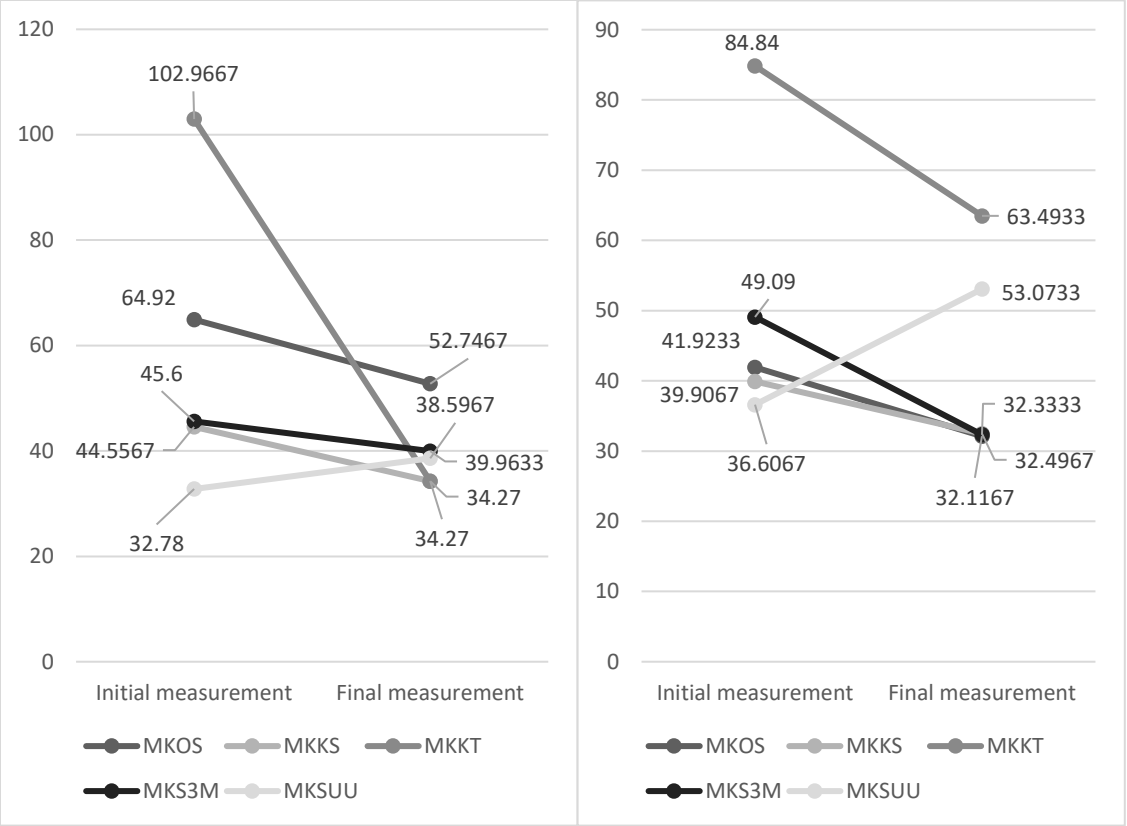
A comparative presentation of the initial and final measurement results in the graphs clearly indicates the situation from the beginning and end of the program of music and dance workshops in which children of different ages and etiologies of hearing difficulties practiced the development of certain motor tracks.

Graph 1.

Joint presentation of the influence of music and dance program on selected motor skills in hearing impaired children aged six and seven

Graph 2.

Joint presentation of the influence of the music and dance program on selected motor skills in hearing-impaired children aged nine and ten

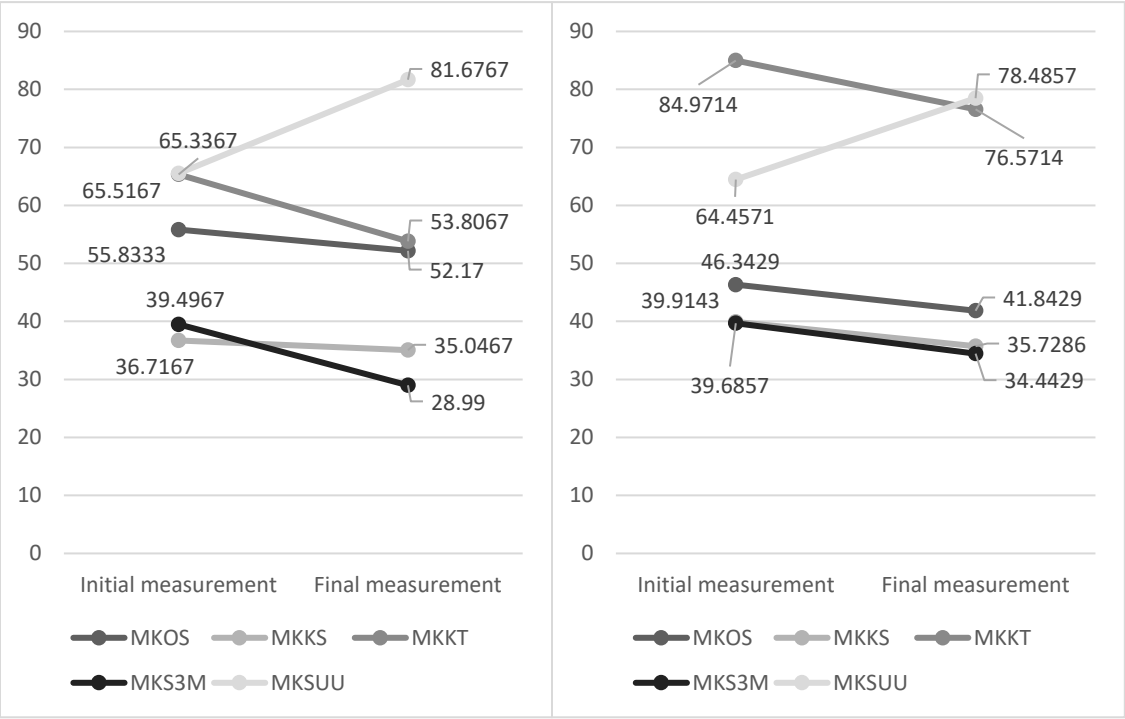

120
100
80
60
40
20
0
102.9667
64.92
52.7467
45.6
38.5967
44.5567
39.9633
34.27
32.78
34.27
Initial measurement
Final measurement
MKOS
MKKS
MKKT
MKS3M
MKSUU
90
80
70
60
50
40
30
20
10
0
84.84
63.4933
49.09
53.0733
41.9233
39.9067
32.3333
36.6067
32.4967
32.1167
Initial measurement
Final measurement
MKOS
MKKS
MKKT
MKS3M
MKSUU

Graph 3.

Joint presentation of the influence of the music and dance program on selected motor skills in hearing impaired children aged eleven and twelve

Graph 4.

Joint presentation of the influence of the music and dance program on selected motor skills in hearing impaired children aged thirteen and fifteen



Considering that music has been shown to support the development of motor skills (Anshel, 1987; Vassiliki et al., 2001), especially when it comes to rhythm that is directly related to the motor cortex of the brain and which shows activity on rhythmic stimulation, we can conclude that musical-dance program of workshops has a special role in the development of motor skills in children with hearing impairment. These results show that the music and dance program has a positive impact on the development of body coordination and speed of movement in children with hearing impairment. Vassiliki and colleagues explore and describe joint action, a combination of music and physical education, and emphasize the importance of rhythmic ability in the realization of motor activities. "Rhythmic abilities refer to comprehension, memory and movements during the performance of data obtained from a temporally dynamic structure, and adjusts

the performance of movements and thus becomes a very important factor in the development, performance and learning of motor skills" (Vassiliki et al., 2001, page 17).

CONCLUSION

Issues of quality of motor abilities of children and people with hearing impairment are increasingly occupying the scientific and professional public in various fields of research: education and rehabilitation, deafness, kinesiology, music pedagogy and psychology, dance pedagogy, music therapy. In addition, an increasing number of examples of successful people with hearing impairments in the field of musical and dance expression and creation raise new research questions about the music-dance and motor abilities of these people in general. On certain issues of support for the development of motor and overall abilities and the possibility of achieving greater and more significant learning outcomes and work of children with hearing impairment through music, dance and sports activities, school or extracurricular, there is some research that opens the way for new research. The presented research aimed to determine what and how many effects musical-rhythmic stimulations have on the coordination of the body and the speed of movement of children 6 to 15 years of age with hearing impairment. The results of the initial measurement showed that the selected motor skills of children 6 to 15 years of age with hearing impairment are below the average age, which is consistent with other studies. The final measurement showed that there was a statistically significant difference and that body coordination and movement speed were improved. We can conclude that musical-rhythmic stimulations had a positive impact on the development of selected motor skills in children 6 to 15 years of age with hearing impairment after a dedicated educational program of music and dance workshops lasting four and a half months.

The research results and new knowledge about the possibilities of developing motor skills of children with hearing impairment are of great importance primarily for children and people with these disabilities, and then for the competent educational institutions that should monitor scientific achievements. Adequate information of all levels of education authorities, both in Bosnia and Herzegovina and beyond, includes changes and improvements in education and inclusive policies, revision of curricula in the direction of creating adequate curricula at all levels of education and better and more complete training of experts in general and music education, rehabilitation and related socio-humanistic fields with the aim of improving the educational, social, economic status of children and people with hearing impairments for the benefit of every society.

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