

Musical Education and Rhythm Understanding

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ABSTRACT Previous researches have proved that music education ignites brain activity. The paper shows the relation between musical education taken before and rhythm comprehending performance as a brain activity, the research was made on Turkish Folk Dancers. In the present research, -total ten participants (8 participants from *Hoy-Tur Folk Dance Ensemble* and 2 participants from *Karagöz Folk Dance Ensemble*)- five participants who have not been musical-trained and five dancers who have been musical trained were included. Each participant was asked to repeat the sample rhythm that had been recorded before. The developed software that is based on beat tracking on energy flux of audio signals algorithm compared participants' rhythms and sample rhythm with respect to their energy and timing rate and informed that musical-trained dancers are more successful than non-trained ones with about 84% (percent) and 82% (percent) rates respectively.

INTRODUCTION

Previous researches on children show that music increases brain activity. In the study of Schellenberg (2004), children are compared with respect to their lessons that they took (music and drama lessons or none of them as control group) and results of this research display that musical educated children have greater increase on full-scale IQ than non-educated children. Research of Fitzpatrick (2006) compared the results of the students in Columbus Public Schools with respect to which were instrumental and which were not. Results show that musical trained students have higher test scores in all academic categories instead of non-trained ones. Another research that has been done by Piro and Ortiz (2009) points out that children who are musical trained over three years have higher verbal and vocabulary skills than non-trained ones. After applying 'Structure of Intellect' measurement, results of research confirm that piano-trained groups have better verbal and vocabulary skills than non-musical-interested group. The study of Moreno et al. (2009) was performed with working over 9 months on 32 non-musician 8-year-old children. Results of this study investigated that after 6 months with musical training, functional organization of children's brain is improved. The correlational work of Degé et al. (2014) was done to manifest that music education increases academic achievements. In the present research, 92 persons who are 12 to 14 years old children having varied musical back-

grounds and different demographic backgrounds are included and results of the work support that musical education affects children's academic achievements and academic self-concepts. Another work which was performed by Sharma (2014) was done with 20 children that were backward. During 2 months, for 45 minute long music therapy was applied to every working day and after test sessions, results informed that musical therapy improved academic functions of backward children. In another study, that was performed by Roden et al. (2014) was done with 50 children studying in primary school. In this study, 45 minutes instrumental music training was applied to half of participants weekly during 18 months and after test sessions, results of this study explored that musical training have direct effects on cognitive performance of children. The research done by Skoe and Kraus (2012) on adults present that, the adults who had been trained in music in their childhood have more strong brain activity responses to demonstrate during their adulthood.

Further, the advantage of musical training in children evolution is that musical education improves brain activity also for young and adults. In the study of Franklin et al. (2008) musicians and non-musicians are compared with verbal memory tasks. After comparison, results show that musical training increases long-term verbal memory. Another study that was done by Özçelik and Hardalaç (2011) examined that students of Faculty of Education are classified with neural networks with respect to their sensing of hear-

ing ability in different sound frequencies. Results of this work brought forward that Musical Education Department students are more successful in musical hearing and sensing than other Education Department students in Faculty of Education. In the study of Posedel et al. (2012), students whose native-language was English were tested with pitch perception, memory and pronunciation tests on Spanish language and musical trained students discharged better performances than non-trained ones. In another study that was done by Hansen et al. (2012), non-musicians, amateur and expert musicians were tested with musical ear test and results of this study explained that musicians have better visual memory instead of non-musicians. In addition, a study conducted by Thornton (2013) with almost 7000 students in 5, 8 and 11 grades, pointed that musical trained students had better academic scores than those of non-trained.

Software has been developed for tracking and comparing beats of reference and participant's rhythm sample signals with each other by taking inspiration from the study of Yuan Liu and Hong-Yun Liu (2012). During development, beat tracking algorithm energy fluxes of signals were determined as like as Laroche (2003) firstly. Secondly, beat detection using PLP algorithm on energy flux signal was used with offerings of Aylon and Wack (2010) who were inspired Grosche and Müller's study (2009). And finally, peaks were picked for beat tracking like as using the method offered by Böck et al. (2010).

Objective of the Study

The objective of the empirical study is showing the relation between musical-education and evolution rhythm ear with testing musical-educated and non-educated participants on the subject of the rhythm comprehending.

METHODOLOGY

The present paper was done by experimental method based on measuring performances of participants and determining their statistics.

Participants of the present research were selected among Turkish folk dancers between 16 and 28 years old and those were also high-school and university students. These selected 10 participants were 5 to 5 musical-trained and non-trained respectively. These participants were evaluated during a week and their performances were recorded with statistical analysis.

To determine statistical performance of the participants, firstly, a sample rhythm was recorded and participants were asked to repeat this sample. Secondly, sample rhythm and participant's recorded rhythms were compared with each other. And finally, comparison results were noted in the result table.

The mentioned sample rhythm was also created and recorded in 2/4 meter, 95 BPM tempo and in free form as shown in Figure 1.

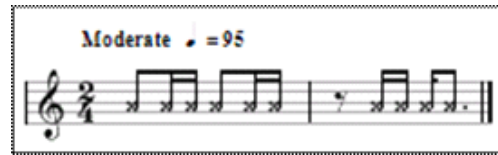


Fig. 1. Sample rhythm

Data Analysis

Data analyzing method is used for determination of success (repeating sample rhythm as possible as original) is based on comparison of participants and reference rhythm samples with each other. This comparison consists of three main steps and MATLAB® software was used in all these steps for analyzing digitalized rhythm samples.

At the first step, also named as pre-processing step, all the processes were done for both of reference and participant's rhythm samples. This step starts with taking sample with 44100 Hz sampling frequency and selecting single channel of this sample. There are same sound features of these channels, so any channel can be selected. Both samples are normalized for eliminating the errors occurred from different recording conditions. To eliminate noises also, low values of samples in amplitude domain are filtered, if they are below of threshold value determined before.

During analyzing experiments, windowing audio sample with respect to divide one second into 12 parts provides analyzing easily. In this case, all the samples are windowed for 1/12 second long. At the last part of this step, the energies of windows were determined as in the work of Aylon and Wack (2010) and a new data was created with energies of this windows. Finally, new energy sample data was normalized for the next step.

At the next step, peak detection was aimed. Peaks and their positions were detected in energy sample data. Hereby energy rate of peaks,

number of peaks, time rate between two serial peaks and full length time rate can be found here.

Last step was the main analyzing step with values that had been determined in previous steps. Here, the samples of reference and participants were compared with each other. Firstly, the numbers of peaks were compared and if these numbers remained equal, main analysis was initiated. Three success parameters were determined here and their names and descriptions are shown in Table 1. *Total Timing Success Rate* was determined with proportion of distances between first and last peaks in both of reference energy sample and participant energy sample. *Instantaneous Timing Success Rate* was determined with proportion of distances between serial peaks. *Energy Success Rate* was determined with proportion of normalized energies of energy sample one by one with energy sample of reference and participant each other.

RESULTS AND DISCUSSION

Results of Study

At the beginning of analyzing process a second long sample is divided into 12 frames and each frame is used as window. By reason of this process, success rates which includes only time are existed almost or completely equals to each other. In this case, results may have 8 % (HH1/12) error rate and these error rates are disregarded in this paper.

After measurements, performances of participants are noted as seen in Table 1 and descriptions of parameters are noted in Table 2.

In Figure 2, N1, N2, N3, N4, N5 are the performances of non-educated participants and MN

Table 2: Descriptions of parameters

TSR % :	Total Success Rate
TTSR % :	Total Timing Success Rate
ITSR % :	Instantaneous Timing Success Rate
ESR % :	Energy Success Rate
E :	Educated Participant
N :	Non-Educated Participant
ME :	Mean Perform of Educated Participants
MN :	Mean Perform of Non- Educated Partic.

is mean performance of these participants with respect to reference rhythm sample. Here, TTSR and ITSR are not highly different from each other. But ESR provides characteristic difference and the difference occurred from ESR affects TSR directly.

In Figure 3, E1, E2, E3, E4, E5 are the performances of educated participants and ME is mean performance of these participants with respect to reference rhythm sample. Here three decisive parameters affect TSR. ESR is determinative parameter here again. Also TTSR and especially ITSR affect TSR together.

The first result that is shown here is for educated participants all the parameters affect TSR together but for non-educated participants, ESR significantly determines TSR.

Importance of ESR is also reflected in Figure 4. At the left side, mean of non-educated participant's performances and at the right side mean of educated participant's performances are shown. Here TTSR and ITSR parameters are almost equal. But ESR parameter is significantly different and again it affects TSR directly.

Discussion

TSR reflects *Total Success Rate* of participants so this is the determinative parameter for the test results. With respect to TSR parameter,

Table 1: Performs of participants

#	TTSR %	ITSR %	ESR %	TSR %
N1	96	89.8148	72.2242	86.013
N2	96	89.8148	48.4358	78.0835
N3	96	88.8889	49.2843	78.0577
N4	96	89.8146	62.8646	82.8931
N5	92.5926	86.111	71.0982	83.2673
MN	95.31852	88.88882	60.78142	81.66292
E1	96.1538	83.8889	76.5667	85.5365
E2	92	92.5926	78.0548	87.5491
E3	96	90.3704	63.0098	83.1267
E4	92	87.037	66.247	81.7613
E5	96.1538	91.2963	66.0091	84.4864
ME	94.46152	89.03704	69.97748	84.492

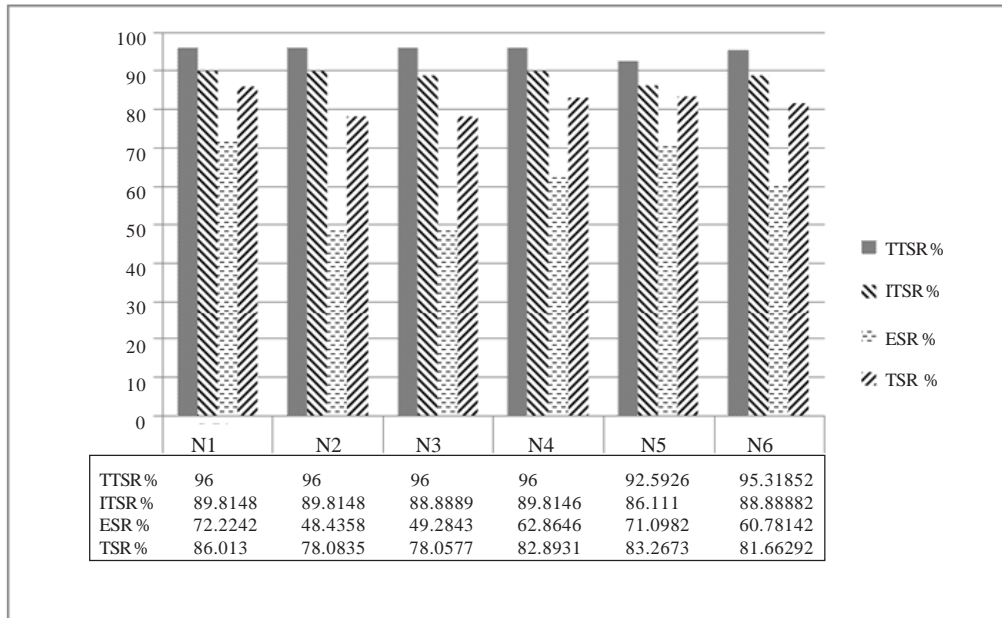


Fig. 2. Performs of Non-Educated Participants

test results show that musical educated participants have better performances than non-educated participants. Like Özçelik and Hardalaç (2011) said before, musical education provides

better musical sensing skills and effects of this sensing skill is seen in performances of musical-educated participants in this paper. If musical sensing and also rhythm understanding skills are

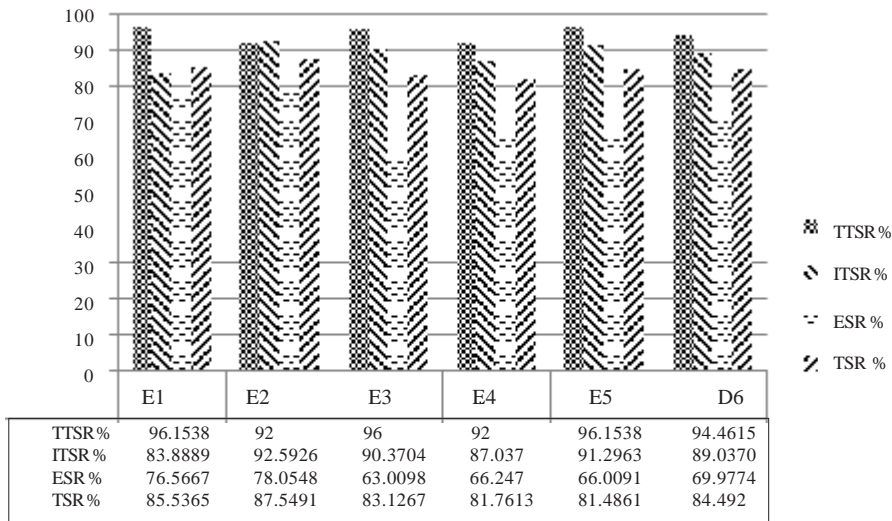


Fig. 3. Performs of Educated Participants

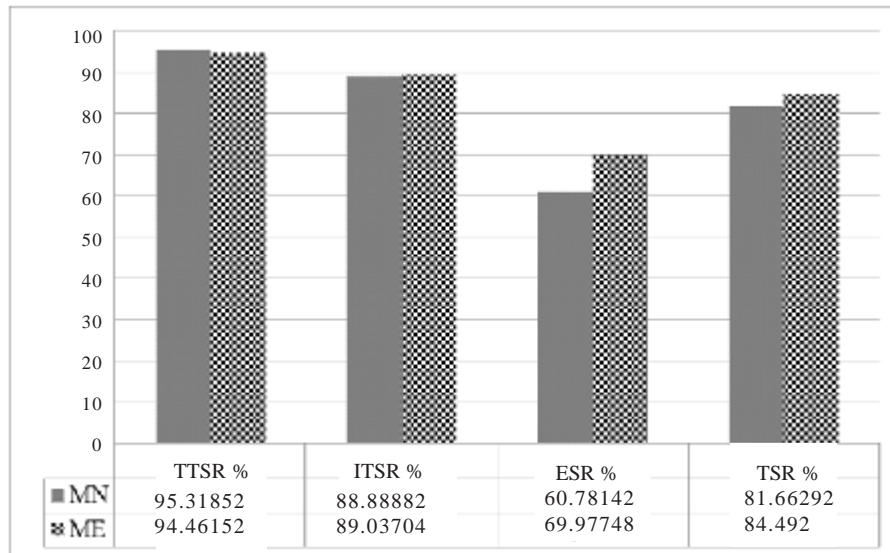


Fig. 4. Mean Performances

investigated as a brain activity, as seen in previous researches (Moreno et al. 2009; Skoe and Kraus 2012; Roden et al. 2014), results of this study confirms that musical education improves brain activity.

CONCLUSION

The results of the paper explore that musical educated persons are more successful than non-educated ones in repeating the rhythm which is listened before with 84% (percent) and 82% (percent) rates respectively. And also during performance measurement, ESR (which represent successful repeating of loudness for each beats) of non-educated participants is significantly determinative parameter for their general success. But for educated participants, all the parameters are important for determining their general success.

RECOMMENDATION

Positive effect of musical training on brain activity was recorded earlier by many researchers and also with this paper. As shown in these researches, providing musical education for young and children in early times affects their brain leading to achievements directly. Therefore, musical education is necessary for improving success rate of humans.

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