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Effect of piano education on the attention skills of 7-12 year old children

Elnara Huseynova, Hatice Onuray Egilmez* and Doruk Engur

Department of Music Education, Faculty of Education, Uludag University, Gorukle, Nilufer, Bursa, Turkey.

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This research is aimed to determine the effects of piano education on the attention skills of 7-12-year-old children. In the research, pretest-posttest control group design is used, and attention skills of both of the groups are measured before and after the experiment. Unlike the control group (n=53), the experimental group (n=46) had private piano education an hour a week for 14 weeks with a tutor, and as a result of the cooperation with the parents, the students practised the piano on their own at home. For collecting data, 4 stage Stroop Colour-Word Test is used. In analysing the data, SPSS 23.0 packaged software and 2x2 mixed ANOVA's are used. Independent factors are determined as group (piano lesson group and control group) and time (pretest-posttest). Dependent variables are reading black and white (RBW), name the colour of the square patches (NCS), reading the coloured words (RCW) and saying the colours of the coloured words (SCCW). Different ANOVA's are used for each dependent variable. In the study, in all the applied sections, it was seen that the reading time of the children who have been having piano education has shortened and their attention skills have been improved. Nevertheless, especially in 'Name the Colour of Square Patches' and 'Reading the Coloured Word' tests results it was seen that, children having piano education have improved their attention skills statistically more than the children who are not having piano education. Children having piano education are considered to be more careful about the aliasing effect and their perception to be improved.

Key words: Piano education, attention skills, Stroop colour-word test.

INTRODUCTION

Education is the most significant phenomenon used to have individuals equipped with desired behaviours and qualities and develop the temperamental hereditary factors. It is believed that societies transfer their distinctive elements to new generations in accordance with traditions and conventions and ensure that they are learnt. During this learning process, attention is the basic element and one of the first phases of learning. Attention is a basic component of the human data processing system (Caglar and Koruc, 2006). While according to the Turkish Linguistic Society Dictionary (2005), attention is defined as focusing the thoughts and feelings on something. Vigilance, in the dictionary of psychology is defined as the ability to ignore some of the perceptional functions, thoughts, sensual entries, cognitive stimuli while choosing some of these and focusing on them, thus

*Corresponding author. E-mail: haticeegilmez@gmail.com.

to perceive chosen stimulants more clearly and to control and direct all of these processes voluntarily (Budak, 2000), attention and perception are necessary in order to notice stimuli received by sense organs during sensual registry and transfer them to short term memory (Kurtuldu, 2012). According to Anderson (2002), attention control arises in babyhood and develops rapidly in early childhood. However, cognitive flexibility, targeting and data processing develop at the age of 7-9 and fully develop at the age of 12. According to Piaget (as cited in Ulugbay (2013)) the intelligence development of children is accelerated especially between 2-7 years and 7-12 years of age. This situation took effect in choosing 7-12-year-old children for the sample and the belief that music education might have a significant position in the development of children's attention level, and skills were determinant in deciding the subject.

This is because music education allows development of children's skills such as analysis, synthesis, coordination to develop, and tends towards creativity by developing a deliberate thought. Today, music education experts emphasise that musical instrument training, which is an important aspect of music education, is of capital importance for the personality development, development of emotions and skills in children and their learning to be self-confident, patient and self-disciplined along with having sustainable attention skills. Also, according to Hallam (2015), active engagement with music has a significant impact on brain structure and function. Hallam (2015) suggests that correlation studies prove that there are relationships between musical activities and the various skills related to literacy including verbal and auditory working memory, spatial reasoning and mathematical performance, intellectual development, creativity, emotional intelligence etc. Early piano education gained importance after 1950's. There were not a consensus between musicians and child development experts on the correct time to start piano education and the schedule that should be followed, since musicians did not master on child development and child development experts did not master on music education; and these were interdependent. However, by time it is understood that the earlier the child starts music education the better the result is, and philosophy of music education is formed. As a result of this the effect of playing piano on the development of child started to be investigated (Minina, 2012).

While playing the piano, which is an instrument played widely in Turkey, melodies with several rhythms written in two staves in different clefs (treble clef – bass clef) have to be performed correctly and precisely. Performing these complicated tasks requires a perfect eye, hand and foot cooperation. Besides these psychomotor skills, many activities such as polyphonic hearing can be done together while playing the piano. Given complex activities are known to benefit the development of data processing in children's brains. Playing the piano is also believed to require continuous attention and focusing.

In a study of Shaw and Rauscher (as cited in Ulugbay (2013)), it is argued that the most functional way to improve cognitive structure that affects preschool children's demonstrating high skills in mathematics and science is playing piano; and that music education, particularly piano education until the age of 12 is an activity requiring functions which mathematics and chess entail, such as high brain functions.

Studies of Pavlov (2008) are focused on the importance of instrument education. In one of his researches, there were 41 children who played an instrument (n= 14 playing flute, n=27 playing piano) and 25 children who did not play any instrument. All children were between the ages of 6 and 7, their characteristics and cognitive abilities were equal. After 7-8 months of education, all of the children had 6 different neuropsychological tests measuring their attention skills and cognitive abilities. Children who played an instrument were shown to have higher improvement than the children who did not play. Children who played flute had higher perception of space when compared to the others. Children who played piano had higher acceleration as well as improvement in verbal reasoning, verbal memory, logical intelligence, cognitive and psychomotor skills. Permiakova and Tkachenko (2016) conducted a study on children who recently have started to play piano and had similar results. Their study, which was made in Ekaterinburg consisted of 50 children; 26 of them did not play any instrument, while 24 of them have started to take piano lessons. After a period of one year, these children had required tests at the Neuropsychology Laboratory of Moscow State University. The children who played piano were shown to have higher improvements in cognitive and psychological skills; and 1.5 times higher acceleration especially in motor development. In the second part of this study, Permiakova and Tkachenko (2016) made a second experiment on 10 male children who have hyperactivity and attention deficit disorder. 5 of them played piano and 5 of them did not play any instrument. Both of the groups had similar tests as the previous groups, such as attention, memory and cognitive ability. After a period of one year, children playing piano had significantly better results than the children who did not play piano. Piano education is recommended especially for children diagnosed with hyperactivity and attention deficit disorder.

The studies mentioned above show the benefits of music and piano education for brain development. One of other rare studies showing the benefits of piano education for attention skills is Demirova's (2008) research. Demirova (2008) presented in her study that piano education affects the attention skills of elementary school children positively. Also, Kuscu (2010) stated that the attention skills of preschool children improve significantly because of musical activities including Orff Schulwerk approach. In accordance with the international

and national studies mentioned above, it can be stated that studies show the significant effect of music education, particularly piano education on children's development.

Attentive study and long-term concentration are two important factors of playing piano, which is among the instruments that are suitable to begin at an early age. Attention has the same importance in every school, education system and curriculum. In this context, the relationship between playing the piano and attention that is defined as a bridge or a tool between the students' musical improvement and their performing this on the piano by Demirova (2008) is detected.

PROBLEM SITUATION

During the education of a child, school success is one of the most concerned issues by the parents and teachers. There are many factors playing a role in school success, and a child not being able to focus on a subject plays a negative role in his/her school life as well. This problem occurs when the child starts elementary school, and he/she is expected to focus on a subject. However, focusing on a subject can be taught by an education starting at an early age (Ozdogan, 2001). Attention, as it is seen, is an ability that can be improved. The researchers stated that in order for children to be able to concentrate and to improve their attention span, music education could be an effective tool. However, piano education having effect on children's attention skills has not been a subject except for a few research. Accordingly, the problem sentence of this research has been determined as: Is piano education effective on the attention skills of 7-12-year-old children? Research questions have been considered to provide an opportunity to solve the problem of the research.

Research questions

1. Is there a significant interaction effect between group (experimental and control) and test (pretest and posttest) factors on reading black and white (RBW)?
2. Is there a significant interaction effect between group and test factors on naming the colour of square patches (NCS)?
3. Is there a significant interaction effect between group and test factors on reading the coloured words (RCW)?
4. Is there a significant interaction effect between group and test (pretest and posttest) factors on saying the colours of the coloured words (SCCW)?
5. Is there a significant interaction effect between group and test factors on time difference between SCCW and RCW?
6. Is there a significant interaction effect between group and test factors on wrong answers?
7. Is there a significant interaction effect between group and test factors on spontaneous recovery numbers?

Research objective

In this research, the aim is to determine the effects of piano education on the attention skills of 7-12-year-old children.

Importance

This research is considered important for the following reasons;
1. Being one of the first studies on determining the effects of piano education on the attention skills of children.
2. By stating the effect of piano education on the attention skills of 7-12-year-old children.
3. By being beneficial and being a resource for the institutions giving piano education, teachers and students and the researches on this subject.

Assumptions

In this research it is assumed that;
1. Children have responded to the instructions sincerely, caringly and carefully during the Stroop Test applications;
2. Stroop test is an effective tool for measuring attention.

Limitations

Research is limited by:

1. 46 students taking piano education and 53 students who do not take piano education at the age of 7-12 in Bursa province.
2. An application period of fourteen weeks on piano education.
3. Stroop Colour-Word Test which is used in order to determine the attention skills of students and personal information form.
4. Statistical analyses on Stroop Colour-Word Test.

METHODS

In this chapter, model, population and sample of the research; data collection tools used in the research; and collection and analyses of data are studied.

Model of the research

This study is conducted using a mixed factorial design. According to Fraenkel et al. (2012), factorial designs are experimental designs

Table 1. Age Distribution of experimental and control groups.

Age	Experimental group						Control group					
	Female		Male		Total		Female		Male		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
7	8	17,4	2	4,3	10	21,7	7	13,2	4	7,5	11	20,8
8	2	4,3	1	2,2	3	6,5	3	5,7	1	1,9	4	7,5
9	6	13,0	4	8,7	10	21,7	6	11,3	5	9,4	11	20,8
10	4	8,7	2	4,3	6	13,0	6	11,3	1	1,9	7	13,2
11	5	10,9	0	0,0	5	10,9	6	11,3	0	0,0	6	11,3
12	9	19,6	3	6,5	12	26,1	12	22,6	2	3,8	14	26,4
Total	34	73,9	12	26,1	46	100	40	75,5	13	24,5	53	100

that involve two or more independent variables, at least one of which are manipulated. Field (2013) classifies the factorial designs according to whether the independent variables are measured using different or the same entities. If the independent variables are measured using different entities the design is called independent factorial design, and if they are measured using the same entities the design is called repeated-measures factorial design. If some independent variables are measured with different entities, whereas others used the same entities the design is called a mixed design.

In this study, we have two independent variables; the first one is the group factor which has two levels (experimental group – control group), while the second one is the test factor which also has two levels (pretest-posttest).

The attention skills of both groups are measured before the experiment. The experimental group had private piano lesson an hour a week for 14 weeks with one of the researcher who is a piano tutor. As a result of the cooperation with the parents, the pianist researchers also controlled the students practising piano on their own at home. Each lesson has been planned by researchers with a curriculum including musical content such as technical studies (scales, arpeggios etc.) pieces, and sight reading practices. After the test, both of the experimental and control groups are measured again.

Study group

Study group of this research consists of 99 7-12-year-old elementary school students in Bursa, some of whom have had piano education (experimental group n= 46) and who have not had piano education (control group n=53) in the 2017-2018 spring term. The research was originally planned to be done with 110 students, 55 of them in the experimental group and 55 in control group; however, students who could not take the posttest due to private reasons have not been evaluated, and data of 99 students, 53 in control group and 46 in experimental group, was used. In determining the sample group, homogeneous sampling among purposive sampling types was used.

Purposive (purposeful) sampling is a non-probability and selective sampling approach. The purposive approach allows selecting and studying highly informative situations deeply according to the purpose of the study (Buyukozturk et al., 2010). On the other hand, homogeneous sampling is selecting a homogeneous subgroup or situation related with the problem of the research among the population and studying on it (Buyukozturk et al., 2010). The experimental group consists of 46 students (34 female and 12 male) between the ages of 7-12 who are studying in elementary private schools in Bursa and have private piano lessons. The control group is formed by the students (n=53) that are also studying in a private school (Private Nilufer Yonder Elementary and Secondary School) in the same city to ensure that the economical statue of the families are nearly same with the students' families of experimental group. The students on the control group do not have any private lesson of piano or another instrument and do not do any activity that is believed to be improving attention. In the control group, the number of female and male students and their age distribution were specially paid attention to. Table 1 represents the age distribution of the students.

Criteria for being selected for experimental group

Selected children should:
i. Be at the ages of 7-12.
ii. Have no psychological (attention deficit, hyperactivity problems, specific learning disability etc) and physical complaints.
iii. Have started piano education at least 2 months ago.

Criteria for being selected for control group

Children being selected should:
i. Not be playing the piano or any other instruments or doing any activities that are believed to improve attention.
ii. Be between ages 7-12.
iii. Not have any psychological (lack of attention, hyperactivity problems, specific learning disorder etc.) or physical (visual or auditive etc.) complaints.

Data collection tools

Information about people's attention span are obtained from neuroimaging studies, zoological experiments, electrophysiologic and neuropsychologic data (Kilic, 2002). In this study it was prefferred to use neuropsychological test. The piano is a polyphonic instrument having a wide sound range. Thus piano, unlike most of the other music instruments lets treble clef (G clef) notes and bass clef (C clef) notes be played at the same time. Playing the notes which differ according to the clefs on both staves (for instance in treble clef on the first line is note E while in bass clef it is G) makes the student affected by the interference effect of attention. That is why the data about students attention levels were collected by the Stroop Colour-Word Test. Stroop test is a neuropsychological test capturing the frontal lobe activity. McKeen Cattell (as cited in Karakas et al. (1999) discovered that telling names of objects or colours takes more time than reading words about them while improving this test; and Stroop showed that it was simply a colour–word interference effect in 1935. According to Glaser and Glaser (as cited in Karakas et al. (1999)) Stroop test reflects three basic

Table 2. Descriptive statistics of the RBW response times.

Test	Group	M	SD	N
Pretest	Control	41.99	18.276	53
	Experimental	42.27	20.437	46
Posttest	Control	34.87	9.360	53
	Experimental	30.46	8.572	46

courses; selective attention, reading and saying colours. Likewise, it works as a critical experimental job used frequently for studying data processing speed and parallel processing models. According to MacLeod (as cited in Karakaset al. (1999)) not only is this test used for evaluating regular persons' cognitive processes but also evaluating several psychiatric and neurological disorders.

In accordance with the literature review, the cognitive processes which Stroop test measures are stated as focused attention, selective attention, reaction inhibition, resistance to interference effect and data processing speed (Karakas and Dincer, 2011). The phenomenon known as Stroop interference effect is not being able to inhibit, and occurs when naming the colours take more time than reading actual words of colours (Karakas and Dincer, 2011). There are several Stroop tests applied individually and formed on the basis of naming the colours which are printed in different colours than they actually are. These are 3 card original Stroop test which is arranged in 10 columns with 5 items each; 3 card Nehemkis and Lewinsohn form which consists of 100 items; single card Dodrilform consisting of 178 items; and 3 card Victoria form consisting of 6 lines with 4 items each (Karakas and Dincer, 2011). There is a version of this test which has musical notes instead of word and colour elements as well (the musical Stroop effect) (Gregoire et al., 2013).

In the current research, a registration form is generated for gathering personal information and demographic qualifications of children, 4 stage Stroop Colour-Word test which was confirmed to be valid in the age of 7-12 by Elmastas (2000) was used for collecting data. Aforesaid stages are explained below as presented in Appendix 1.

1. Card - "Reading Black & White' (RBW)
Name colours which are printed black on a white background is a quality of the original Stroop Test. This stage has the characteristics of a control stage which determines the fundamental level of reading and data processing speed.

2. Card - "Naming the Colour of Square Patches" (*NCS*)
This is a control stage determining the fundamental level of speed of data processing and naming colours by naming red, blue and green squares printed on white background.

3. Cart- "Reading the Coloured Words" (RCW)
Different colours printed on a white background are expected to be named. Each word is printed in a different colour than its actual colour, and this is the main stimulant of Stroop Tests. Naming the Coloured Words are related to interference effect.

4. Card - "Saying the Colours of the Coloured Words" (SCCW)
Saying the colours of the different coloured words printed on a white background is expected. Stroop effect occurs when the colour used in printing the word and actual colour of the word is different from each other. On this stage, Stroop interference effect occurs when the person focuses on saying the colour of the word but also has a tendency to read the coloured word. Being able to say the colour despite this tendency requires flexibility, perceptive configuration, and shifting attention and behaviour. Stroop Tests are stated to measure attention other than naming colours and reading (focused attention) (Karakas and Dincer, 2011; Kilic et al., 2002; Karakas et al., 1999).

Collecting and analysing data

Before collecting data, permission was taken from the ethics committee of Uludag University. Data was collected via Stroop Colour-Word Test and analysed statistically. Before the test was given, students in the experimental and control groups had been informed; required permissions had been taken from the parents for the experimental group and from the Ministry of National Education for the control group. The environment had been set and needed material had been put on the table before the Stroop Colour-Word Test was given. External factors which would distract students such as noise and light were taken under control. Before starting, instructions of Stroop Colour-Word Test were read to the students and explanations were made about how to answer the test. Afterwards, the cards were given to the students in the order mentioned above, and time span and number of wrong answers for each test were recorded. The assessment was completed in approximately 10 min.

As this test was given to healthy individuals, neuropsychological results of the test stages were ignored, and the differences between the children who take and do not take piano lessons were emphasised. In analysing the data, SPSS 23.0 packaged software and 2x2 mixed ANOVA's were used. Independent factors were determined as group (experimental group and control group) and time (pretest-posttest). Dependent variables are response time for RBW, response time for NCS, response time for RCW, response time for SCCW, time difference between RCW and SCCW, number of wrong answers, and spontaneous recovery numbers. Different ANOVA's were used for each dependent variable.

FINDINGS AND DISCUSSION

First research question

Table 2 shows RBW response time means and standard deviations in seconds, while Table 3 represents the ANOVA results for RBW response times.

In Table 3 when RBW time spans are examined, it can be seen that the main effect of the test factor was significant: F (1, 97) = 49.384, p = <.001. This case shows that when response time is examined (evaluating two groups as one), answers of the posttest (M = 32.82) were given faster than the pretest (M = 42.12). Main effect of the group variable was not significant, F (1, 97) = 0.576, p = 0.450. This case shows (evaluating pre and posttests as one), response time of the control group (M

Table 3. Analyses of RBW response times.

Source of variance		SS	Df	MS	F	p
Within groups	Test	4414.7	1	4414.67	49.384	<.001
	Test * group	271.1	1	271.07	3.032	0.085
	Residual	8671.2	97	89.39	-	-
Between groups	Group	209.9	1	209.9	0.576	0.450
	Residual	35353.7	97	364.5	-	-

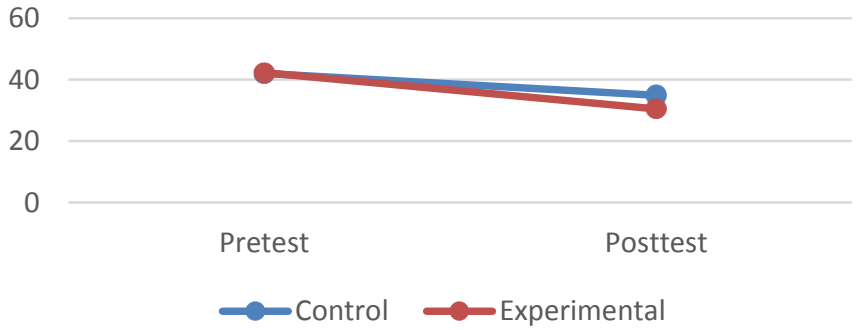

Chart 1. Change in the RBW time of the groups.

Table 4. Descriptive statistics of the NCS response times.

Test	Group	M	SD	N
Pretest	Control	51.27	13.87	53
	Experimental	50.23	13.54	46
Control	Control	47.72	12.54	53
	Experimental	42.27	12.05	46

= 38.43) and the experimental group (*M* = 36,37) were not significantly different. Interaction was not significant, *F* (1, 97) = 3.032, *p* = 0.085. This situation shows that the acceleration in the experimental group (pretest = 42.27, posttest = 30.46), was not significantly more than the acceleration in control group (pretest = 41.99, posttest = 34.87). As seen in Chart 1, both of the groups have shorter response time in the posttest. Although the experimental group is seen to have accelerated more than the control group, the difference was not significant.

Second research question

Table 4 shows NCS response time means and standard deviations in seconds, while Table 5 represents the ANOVA results for NCS response times.

When NCS time spans are examined, effects of the test factor were significant, *F* (1, 97) = 88.66, *p* = <.001. This situation shows that responses of the posttest (*M* = 45.19) were faster than the pretest (*M* = 50.78). Main effect of group factor was not found significant, *F* (1, 97) = 1.613, *p* = 0.207. This case shows that there was not a significant difference between response times of the control group (*M* = 49.50) and experimental group (*M* = 46.25). Test * Group interaction was found to be significant, *F* (1, 97) = 13.06, *p* = <.001. This situation shows that acceleration of the experimental group (pretest= 50,23, posttest= 42,27) was more than the acceleration of control group (pretest = 51,27, posttest = 47,72). As seen on Chart 2, experimental group has accelerated significantly more than the control group.

Third research question

Table 6 shows RCW response time means and standard deviations in seconds, while Table 7 represents the ANOVA results for RCW response times.

When RCW time spans were examined, it is seen that

Table 5. Analysis of the NCS response times.

Source of variance		SS	df	MS	F	p
Within groups	Test	1630.1	1	1630.09	88.66	< .001
	Test * group	240.1	1	240.05	13.06	< .001
	Residual	1783.5	97	18.39	-	-
Between groups	Group	518.3	1	518.3	1.613	0.207
	Residual	31174.8	97	321.4	-	-

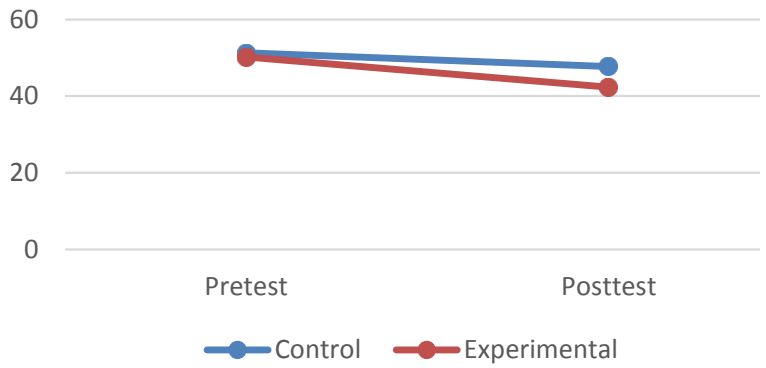

Chart 2. Change in the NCS times of the groups.

Table 6. Descriptive statistics of the RCW response times.

Test	Group	M	SD	N
Pretest	Control	43.37	18.204	53
	Experimental	43.80	21.596	46
Control	Control	38.09	12.689	53
	Experimental	33.44	9.833	46

Table 7. Analysis of RCW response times.

Source of variance		SS	df	MS	F	p
Within groups	Test	3012.1	1	3012.13	43.969	< .001
	Test * group	318.4	1	318.39	4.648	0.034
	Residual	6645.1	97	68.51	-	-
Between groups	Group	218.9	1	218.9	0.479	0.490
	Residual	456.7	97	456.7	-	-

the effect of the test factor was significant, F (1, 97) = 43.969, p = <.001. This situation shows that response times on posttest (M = 35.93) were shorter than the response times of the pretest (M = 43.57). Main effect of the group factor was not significant, F (1, 97) = 0.476, p = 0.490. This situation shows that there was not a significant difference between the response times of the control group (M = 40.73) and experimental group (M = 38.62). Test * Group interaction was significant, F (1, 97) = 4.648, p = 0.034. This case shows that acceleration of the experimental group (pretest = 43.80, posttest = 33.44) was significantly higher than the control group (pretest = 43.37, posttest = 38.09). As seen in Chart 3, the experimental group has accelerated significantly

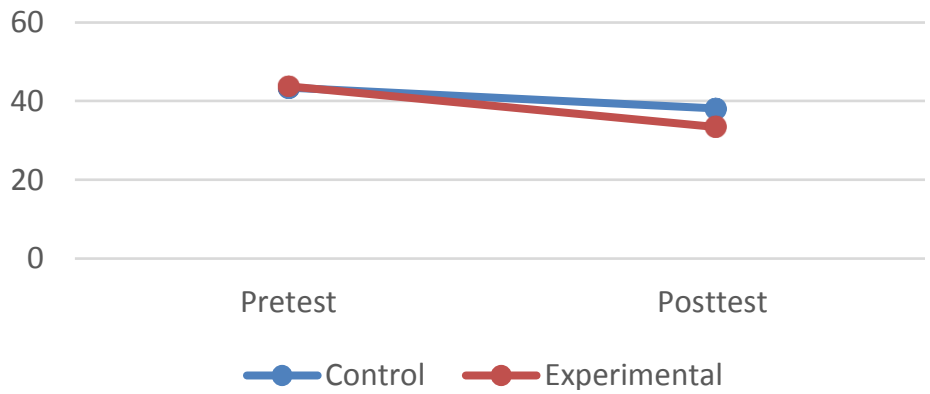

Chart 3. Change in the RCW times of the groups.

Table 8. Descriptive statistics of the SCCW response times.

Test	Group	M	SD	N
Pretest	Control	105.04	43.42	53
	Experimental	100.09	34.14	46
Posttest	Control	94.58	43.14	53
	Experimental	81.54	30.68	46

Table 9. Analysis of the SCCW response times.

Source of variance		SS	df	MS	F	p
Within groups	Test	10360.2	1	10360.2	44.165	< .001
	Test * group	805.3	1	805.3	3.433	0.067
	Residual	22754.3	97	234.6	-	-
Between groups	Group	3986	1	3986	1.449	0.232
	Residual	266879	97	2751	-	-

higher than the control group.

Fourth research question

Table 8 shows SCCW response time means and standard deviations in seconds, while Table 9 represents the ANOVA results for SCCW response times.

When SCCW time spans are examined, the main effect of the test factor is seen to be significant, F (1, 97) = 44.165, p = <.001. This case shows that response times in the posttest were (M = 88.52) shorter than the response time in the pretest (M = 102.74). Effect of the group factor is not found significant, F(1, 97) = 1.449, p = 0.232. This situation shows that response times of the control group (M = 99.81) and the experimental group (M = 90.82) were not significantly different. Test * Group interaction was not significant, F(1, 97) = 3.433, p = 0.067. This situation shows the acceleration of the experimental group (pretest = 100.09, posttest = 81.54) was not significantly higher than the acceleration of the control group (pretest = 105.04, posttest = 94.58). As seen on Chart 4, response times of both groups were shortened. Although the experimental group is seen to be accelerated higher, this was not found statistically significant.

Fifth research question

Table 10 shows SCCW-RCW time difference means and standard deviations in seconds, while Table 11 represents

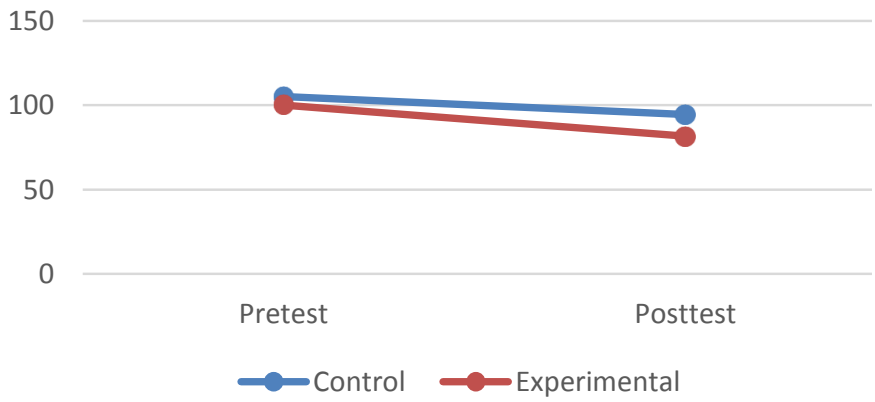

Chart 4. Change in the SCCW times of the groups.

Table 10. Descriptive statistics of time differences between SCCW and RCW.

Test	Group	M	SD	N
Pretest	Control	61.67	36.80	53
	Experimental	56.28	31.12	46
Posttest	Control	56.49	35.96	53
	Experimental	48.10	24.20	46

Table 11. Analysis of time difference between SCCW and RCW.

Source of variance		SS	df	MS	F	p
Within groups	Test	2199.8	1	2199.8	5.481	0.021
	Test * group	111.0	1	111.0	0.276	0.600
	Residual	38930.1	97	401.3		
Between groups	Group	2337	1	2337	1.344	0.249
	Residual	168674	97	1739		

the ANOVA results for SCCW-RCW time differences.

When time differences are examined, it is seen that the main effect of test variable was significant, F (1, 97) = 5.481, p = 0.021. This situation shows that time differences were less in the posttest (M = 52.59) than the pretest (M = 59.17). Main effect of the group factor was not found significant, F (1, 97) = 1.344, p = 0.249. This situation shows that there was not a significant difference between the control group (M = 59.08) and experimental group (M = 52.19). Test * Group interaction was not found significant, F(1, 97) = 0.276, p = 0.600. This situation shows that the decrease in the time differences of the experimental group (pretest = 56.28, posttest = 48.10) was not significantly higher than the control group (pretest = 61.67, posttest = 59.49). As seen on Chart 5, time differences decreased in both groups. As much the difference in the experimental group looks higher, this case was not found statistically meaningful.

Sixth research question

Table 12 shows the wrong number means and standard deviations, while Table 13 represents the ANOVA results for wrong numbers.

When the number of wrong answers is examined, it is seen that the main effect of the test factor is not significant, F (1, 97) = 1.689, p = 0.197. This situation shows that the number of wrong answers in the posttest (M = 0.909) is close to the number of wrong answers in the pretest (M = 1.394). Main effect of the group variable is not found significant, F (1, 97) = 0.062, p = 0.803. This situation shows that there was not a significant difference group (M = 1.264) and experimental group (M = 1.174).

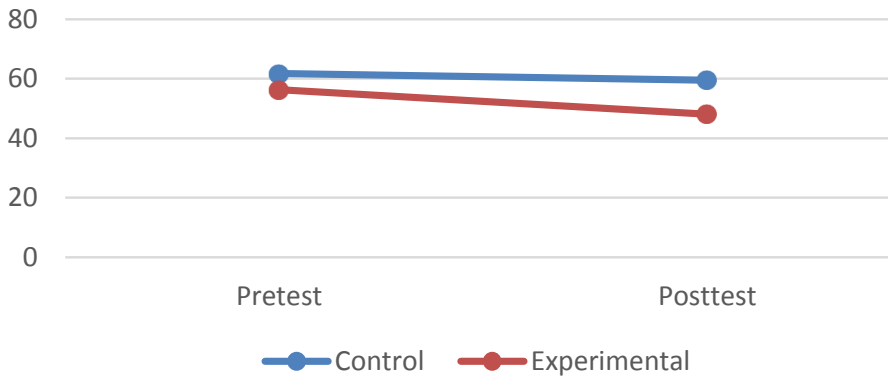

Chart 5. Change in the time differences of the groups.

Table 12. Descriptive statistics of number of wrong answers.

Test	Group	M	SD	N
Pretest	Control	1.302	2.407	53
	Experimental	1.500	1.835	46
Posttest	Control	1.226	2.407	53
	Experimental	0.848	2.328	46

Table 13. Analysis of the number of wrong answers.

Source of variance		SS	df	MS	F	p
Within groups	Test	6.519	1	6.519	1.686	0.197
	Test * group	4.095	1	4.095	1.059	0.306
	Residual	375.066	97	3.867	-	-
Between groups	Group	0.401	1	0.401	0.062	0.803
	Residual	622.821	97	6.421	-	-

Test * Group Interaction was not found significant, F (1, 97) = 1.059, p = 0.306. This situation shows that the decrease in the number of the wrong answers of experimental group (pretest = 1,500, posttest=0,846) was not significantly higher than the decrease in the control group (pretest = 1,302, posttest = 1,226). As seen in Chart 6, there is a decrease in the number of wrong answers in both of the groups. Even though the decrease in the number of wrong answers in the experimental group looks higher than the control group, this case was not found statistically meaningful.

Seventh research question

Table 14 shows spontaneous recovery number means and standard deviations, while Table 15 represents the ANOVA results for spontaneous recovery numbers.

When spontaneous recovery numbers are examined, the main effect of the test factor is seen to be significant, F (1, 97) = 17.14, p = <.001. This situation shows that spontaneous recovery numbers in the posttest (M = 1.051) were less than the recoveries in the pretest (M = 1.818). Main effect of the group variable was not found significant, F (1, 97) = 0.826, p = 0.366. This situation shows that there was not a significant difference between the spontaneous recovery numbers of the control group (M = 1.529) and the experimental group (M = 1.326). Test * Group interaction was found significant, F (1, 97) = 10.10, p = 0.002. This case shows that the decrease in the spontaneous recovery numbers in the experimental group (pretest = 2.043, posttest = 0.609) was significantly higher than the decrease in the control group (pretest = 1.623, posttest = 1.434). As seen in Chart 7, the decrease in the spontaneous recovery numbers of the experimental group is significantly higher than the decrease in the

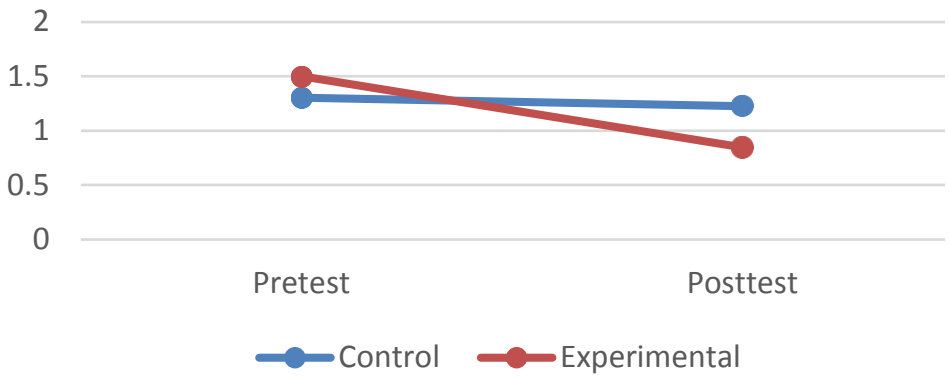

Chart 6. Change in the number of wrong answers in the group.

Table 14. Descriptive statistics of spontaneous recovery numbers.

Test	Group	M	SD	N
Pretest	Control	1.623	1.584	53
	Experimental	2.043	1.788	46
Posttest	Control	1.434	1.448	53
	Experimental	0.609	0.906	46

Table 15. Analysis of spontaneous recovery numbers.

Source of variance		SS	df	MS	F	p
Within groups	Test	32.45	1	32.453	17.14	< .001
	Test * Group	19.12	1	19.120	10.10	0.002
	Residual	183.71	97	1.894	-	-
Between groups	Group	2.014	1	2.014	0.826	0.366
	Residual	236.632	97	2.440	-	-

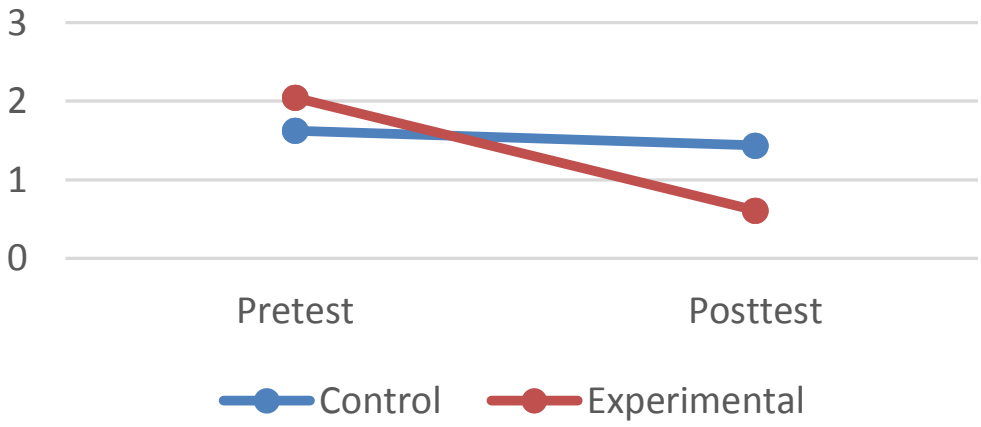

Chart 7. Change in the spontaneous recovery numbers in the groups.

control group.

Conclusion

In the research, the effects of piano education given to 7-12-year-old children on attention skills are shown. The level of the effects of piano education on attention skills of children is measured by the Stroop Colour-Word Test consisting of 4 parts. Experimental group and control group are stated to have different levels of success in 4 parts of Stroop Colour-Word Test. Accordingly, in the *black and white reading* part, two groups are seen to get shorter reading time and no significant difference has occurred. This part of the test serves as quality of control, determining the basic level of reading and data processing speed. Thus, this result states that children in both groups show similar qualities and have similar differences in their data processing speed. In *name the colour of square patches* part of the test, which is for controlling the basic level of data processing speed; reading time of two groups in the posttest is shorter than the pretest. However, an increase in the speed of the experimental group is seen to be considerably more than the control group. In the RCW section, reading time of both groups in the posttest were shorter than the ones in the pretest. However, in the experimental group, which consists of children having piano education, the acceleration is seen to be significantly more than the control group of children who do not have piano education. In the *saying the colours of coloured words* section, the reading time of both groups got shorter similarly, and there was not a significant difference between the groups. In the study, in all the applied sections, the *coloured word* tests results, it was seen that children having piano education have improved their attention skills statistically more than the children who are not having piano education. Children having piano education are considered to be more careful about the aliasing effect and their perception to be improved.

Stroop test is usually used on determining the attention skills of children having neurologically or psychiatric disorders. In literature, it is seen than the aforesaid test has not been used widely in music education. In the literature review, researches on several sports branches such as chess (Kaynar, 2014), skiing (Goktepe et al., 2016), golf (Tunc, 2013), orienteering (Atakurt et al., 2017) were found, whereas there is a limited number of researches found on the effects of piano education which would be compared to the findings of current researches. One of these few researches is of Yesil and Unal (2017). In the mentioned research, Stroop test is given to 1st and 4th-grade children in order to determine the effect of music education on the attention and working memory of adults. It was stated that long term systematic music education has no significant effect on attention skills; however, in some test requiring active use of working memory, improvements were found. Systematic and intensive music practice in adults is thought to have positive effects on cognition (Yesil and Unal, 2017).

Another research stating the effect of piano education on attention (Ciftci and Ozelma, 2017) has corresponding results with our current results. In the research, 4th-grade students have been given half an hour piano education two times a week for 6 months; consequently, a significant improvement on their attention and concentration, general learning skills, school success, psychomotor skills and mental development was found. According to Demirova (2008), results showing that piano lessons have a positive effect on children who are examined in the research are also corresponding with current research results.

Recommendation

1. It is recommended to make new and various researches showing the effect of piano education on attention skills of children using various measurement tools and methods.
2. The current study is limited by 14 weeks. Piano education is a long term education and its benefits on mental skills increase is directly proportional to the time spent. Thus, it is recommended to make longer-term researches to measure the effects of piano education on attention skills.
3. The experimental group of the current research consists of students having private piano lessons 1 hour a week. Major students in conservatories of music spend more time with their instruments during a day. Researches made with these students might provide different results on the effects of piano on attention. Improvement of a sample group chosen among conservatory students in their attention skills as from the first year of their instrument training can be seen.
4. Research is made on 46 students who have private piano education. Similar research can be made increasing the number of students.
5. Attention skills of sample group consisting of private piano students are measured via Stroop test. Data taken via Stroop Test can be used as an ‘enriched pattern’ and that can be supported by the parent, student and teacher opinions.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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