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Effect of Neuroplasticity-based BrainFit® Mind Exercises on Attention Skills of Primary School Students[1]

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Abstract
The purpose of this study is to investigate the effect of BrainFit® mind exercises based on neuroplasticity on the affective characteristics of primary school students, such as impulsivity, auditory - visual attention periods and focussing skills. Quasi-experimental design was used in the study. In practice, BrainFit® mind exercises were performed for a period of four months to 32 students, as an experimental group, selected from various elementary schools in İzmir. For the control group of 28 students, no exercise program was applied. It has been deemed appropriate for elementary school students who have gained literacy skills and who are studying at the 3rd and 4th grade levels, who have developed characteristics such as perception, memory, reasoning and reasoning, to participate in the study. "IVA + PLUS (Integrated Visual and Auditory Continuous Performance Test) (CPT)" was applied to both groups before and after the implementation. At the end of the research, it is found that, the experimental group's impulse and hyperactivity controls, the auditory and visual attention levels and speeds increased significantly.
Keywords: neuroplasticity, mental development, attention skills

1. Introduction

It is known that learning occurs consciously or unconsciously after the interaction with the environment and that the person has cognitive, emotional, and deviant changes after learning. The way in which the learning concept has been studied by many educational scientists, and many different theories are being put forward by the theorists. Neuropsychology, also known as brain-based learning is one of them (Aşkın Tekkol, Başar, Şen, & Turan, 2017). Neurophysiological (brain-based) learning theory is defined as a biochemical change, an increase in the number of synapses, a combination of synaptic connections to form new neural networks, an increase in the number of dendrites, and the formation of new synapses (Keleş & Çepni, 2006; Özden, 2014; Paliç & Akdeniz, 2012; Yaman & Emir, 2017). Brain-based learning builds upon the structure and functions of the brain and is inferences for teaching. This theory relates learning to the way the brain and brain work, and to mention the positive effects of improving brain characteristics and work performance on learning. It is therefore mainly concerned with brain development (Gözüyeşil & Dikici, 2014).

The data indicating that neuroscience has been lacking in the relationship between the brain and nervous system and cognitive behavior has been described as the newest achievement in education. Neuroscience has now begun to take place in education, and many researches have been carried out in this field (Keleş & Çepni, 2006). Especially with the development of MRI, PET and MEG scanners; in researches, the state of the neurons in the brain can be displayed in color by systems such as positron emission tomography and Nuclear Magnetic Resonance Imager (NMRI), so that many variables such as memory, emotion, attention, pattern and their effects on learning are examined (Gözüyeşil & Dikici, 2014; Keleş & Çepni, 2006; Soylu, 2004).

It is thought that the brain will not change after a certain age until 20 years ago, and the intelligence will remain constant. Scientists have assumed that the human brain has undergone very little change throughout life, and that the connections between neurons remain constant. However, over the past two decades, it has been determined that the use of the above-mentioned techniques has made the human brain constantly evolve and adapt to innovations (Chudler, 2005).

Research findings that the brain is active in building new nerve cells and having a new neural network have led to major changes in the world of neuroscience. This change in recent years has also opened up the developmental and educational implications of neural processing for research and discussion. It is seen that this situation is related with the concept of neuroplasticity, which is especially important in terms of education and development (Turhan & Özbay, 2016). In general terms, the concept of plasticity is defined as "adaptability" and "variability according to the situation". Neuroplasticity, on the other hand, is the change in the structural properties and functions of neurons in the brain and of the synapses that these neurons form depending especially on exercise and experience and environmental stimuli (Kalia, 2008; Mundkur, 2005). These changes play an important role in the development of important central functions such as learning and in the recovery of illnesses

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(Mundkur, 2005; Uzbay, 2004). Nevertheless, the concept of neuroplasticity refers more to brain's ability to learn, remember and forget. Therefore, this concept has a special importance for education.

Along with learning in the brain, it is suggested that there are two forms of change. These; (a) changes in the internal structure of neurons, especially in synapses, and (b) increase in the number of synapses between neurons (Turhan & Özbay, 2016). Especially with the increase of the connections between the brain hemispheres, visuospatial and visual-sensory-motor skills develop at the age of 1-2 years and significant dendritic bifurcations are formed in the speech areas, between the ages of 2-12 years. It is known that such bifurcations and connections are present between the two brain hemispheres. This anatomical connection that provides communication between the two hemispheres is called "corpus callosum". It is thought by researchs that behavioral disorders, learning difficulties and cognitive deficits can also be caused by structural disorders in these fibers (Czéh et al., 2001; Gürpınar, Erol, & Mete, 2007; Knickmeyer et al., 2008; Özmert, 2005).

Thanks to neuroplasticity, increased dendritic bifurcations, elongation in length, new synapse formation and alteration of the activity of existing ones, as well as new neuron formation, survival and resistance to stress under stress can be increased (Uzbay, 2004). According to the researchs, a minimum of 400 repetitions per day have to be done for constructing a new synaptic connection, that is in order to be able to learning a new skill. In similar studies, the importance of not only in repetition but also in diversified repetition is defined. It is known that the main anatomic regions in which neuroplastic changes in the brain are intensively observed are cortex, septum, amygdala and especially hippocampus. Additionally, the formation of new neurons can be called neurogenesis. Neurogenesis is more common in the hippocampus and smell center. Hippocampus neuroplasticity is one of the highest brain regions. While all kinds of mind exercises increase hippocampal volume and neurogenesis, continuous stress conditions cause decrease in hippocampal volume and neurogenesis of hippocampal neurons (Czéh et al., 2001; Stahl, 2000). Physical and intellectual activities, education, social interaction and all kinds of cognitive improvement affect neuroplasticity positively. Especially hippocampus volume and neurogenesis can be increased with mind exercises (Turhan & Özbay, 2016).

A healthy brain; It is expected that it will be able to develop cognitive functions such as learning and memory adequately, to develop strategies to overcome the obstacles encountered during daily life, to create space for individuals in society and to form the basis for emotional well-being. It is necessary to pay attention to improving physical activity, establishing social relations, doing mind exercises, coping with stress, sleep hygiene and diet contents for the protection and improvement of the health of this organ which is based on the in-body organization and makes our existence cognitively and socially meaningful (Esen, 2016). The most important factor that positively affects neuroplasticity is to go out of monotonous or routine life or behavior. Going out of activities or routines that have not been done before is one of the most important factors that trigger reconstruction in neurons (Stiles & Jernigan, 2010).

There are different formations in Turkey that offer various exercises to provide brain development for individuals, especially for children. One of these formations is BrainFit® Studio, which is based on neuroplasticity based on scientific sub-structure and applies the mind exercises according to the levels of individuals. As a trusted brain fitness specialist since 2001, BrainFit® Studio aims to transform lives by improving learning capabilities, boosting performance, shaping behaviors and increasing intelligence through high-quality evidence-based neuroscientific cognitive training programs. At this point, through its partnership with Scientific Learning Corporation, BrainFit® Studio has been able to access the work of four internationally-renowned neuroscientists who are also the founding members of Scientific Learning Corporation Dr. Michael Merzenich, Dr. William Jenkins, Dr. Paula Tallal, and Dr. Steven Miller, whose expertise is based on more than 30 years of scientific research into how the brain learns. In addition, BrainFit® Studio is also cooperating with Dr. Martha Burns, Senior Clinical Specialist and Director of Professional Relations at Scientific Learning Corporation. As a Professor in Speech-Language Pathology, she is a passionate educator who offers cutting-edge information that is essential to everyone who seeks to improve the lives of students by improving their ability to learn and read.

It has been determined that neuroplasticity occurring in brain in childhood is mainly related to the vision, auditory, motor skills and language skills of the brain (Rapoport & Gogtay, 2008). Thus, BrainFit® Studio's whole-brain methodology targets training in all five "brain muscles" of vision, auditory, sensory-motor, focus and emotional processing. It aims to develop cognitive skills such as speed, memory, attention, reasoning, timing, coordination, emotional regulation, social skills and tenacity in this way.

In BrainFit® Studio's Web Site there are different research summaries are given on the effectiveness of its brain fitness training programs, including proven studies from Stanford, Harvard and MIT Universities. At the same time, various finds are shared on the site. In this context, this study is unique in that BrainFit® mind exercises based on neuroplasticity determine the effect of children on brain development and various cognitive skills.

1.1 Purpose
The purpose of this study is; BrainFit® mind exercises based on neuroplasticity examines the effect of primary school students on cognitive characteristics such as impulsivity, auditory-visual attention periods, hyperactivity control and focus skills. The research of BrainFit® mind exercises applied within the scope of the research is important to understand the effectiveness of these exercises on students and to provide recommendations to educators and their families.

1.2 Problem Sentence
What is the effect of BrainFit® mind exercises based on neuroplasticity on the affective characteristics of primary school students, such as impulsivity, auditory-visual attention periods, hyperactivity controls and focus skills?

1.3 Hypotheses
In the study, the effect of BrainFit® mind exercises on the affective characteristics of primary school students was examined in terms of various variables by examining pre-test and post-test performance scores of experimental and control groups. Hypotheses for these variables are given below.

Between the experimental group in which BrainFit® mind exercises were performed and the control group in which these exercises were not performed;
1. There is a significant difference in favor of the experimental group in terms of the impulse control scores.
2. There is a significant difference in favor of the experimental group in terms of attention scores.
3. There is a significant difference in favor of the experimental group in terms of hyperactivity scores.
4. There is a significant difference in favor of the experimental group in terms of auditory speed scores.
5. There is a significant difference in favor of the experimental group in terms of visual speed scores.

2. Method
2.1 Research Model
Experimental design was used in the study. Since it is not possible to collect each individual in a pool; 32 students who participated in the exercises at BrainFit® Centers at the third and fourth grade level and 28 students who never participated in these exercises were assigned quasi-experimental pattern by assigning control group (Ekiz, 2009, p. 102). In the study, an experimental study was carried out using pre-test / post-test unbalanced control group model from the quasi-experimental models.

Table 1. Experimental design

Groups	Pre-test	Implementation	Post-test
EXPERIMENT	IVA+PLUS	BME	IVA+PLUS
CONTROL	IVA+PLUS	ELE	IVA+PLUS

IVA+PLUS: Integrated Visual and Auditory Continuous Performance Test
BME: BrainFit® Mind Exercises, ELE: Existing Living Environment

BrainFit® mind exercises begin with Mind Check-Up. This process involves a multimodal approach consisting of an analysis of 5 domains and 31 subheadings as a whole Students' levels of mind exercises are determined by standardized tests that are proven internationally valid. Standardized tests are applied all over the world in the same and consistently, scored and healthy statistical results are achieved. These results make comparisons. The CognitiveMAP™ (Cognitive Map Test) measures the competence of a student by comparing it to scores falling within the field of his or her age in an international database. According to the result of the Mind Check-Up report, personal programs are created in areas that the individual needs. These programs, called SMART programs, are cognitive; As well as educational mental exercises on sensory-motor, visual, auditory, attention and focus skills; Behavioral and academic exercises, family counseling, and home exercises to maintain success. The development is followed by continuous feedback to the family. The cognitive mind exercises appropriate to the condition of the student's mind exercises program are being adjusted. During a 50-minute mind-work session at BrainFit®, when a student repeats a cognitive task between 500 and 1000, a new structuring occurs in his brain. Frequency and intensity are very important at the level required to achieve maximum results. If these steps are followed, it is expected that the brain will have faster and sharper learning and performance networks, students will learn more permanently, focus longer, think faster and remember more. All students are reapplied to the CognitiveMAP™ (Cognitive Map Test) at the end of the SMART programs to see their achievements and follow their progress, and the results are shared with the parents.

In the experimental group BrainFit® mind exercises were performed in 32 sessions for four months. In the control group, these exercises were not implemented and the participants continued their current life processes. The implementation lasted approximately four months, and cognitive and affective changes between both groups were attempted.

Dependent Variables: Impulsivity, auditory-visual attention periods, hyperactivity controls and focus skills

Independent Variables: Experimental and Control Groups

2.2 Study Group

Since experimental design is used in the research, it is necessary to be constantly involved with the student community to which the research will be applied during the research. In the experimental studies, the effect of the changes observed in the dependent variables and the internal validity of the explanatory variables are of great importance (Büyüköztürk, Çakmak Kılıç, Akgün, Karadeniz, & Demirel, 2011). Hence, by using the reasoning of the sample, the study group was selected in an unselected manner and a convenient sample was selected from the students participating in the exercises in BrainFit® Centers in İzmir Province. The study group consists of 60 primary school students, 32 of which are participating in the exercises at BrainFit® Centers in İzmir and 28 of which are control groups.

It has been deemed appropriate for elementary school students who have gained literacy skills and who are studying at the 3rd and 4th grade levels, who have advanced features such as perception, memory, reasoning, reasoning, to participate in the study.

2.3 Instrument

The "IVA + PLUS (Integrated Visual and Auditory Continuous Performance Test) (CPT)" developed by Sandford and Turner (2004) was used as the data collection tool in the study. IVA + PLUS is a 13-minute auditory and visual performance test that measures variables such as impulsivity, attention, focus, auditory and visual response speed, correctness and consistency.

IVA + PLUS developers have implemented a wide geographical backend, applied to 1,700 people aged 6 years and over, with ethnic diversity and sex specific norms. Many studies have evaluated the convergent and discriminant validity of the test, especially with children (Arble, Kuentzel, & Barnett, 2014; Corbett & Constantine, 2006; Nichols & Waschbusch, 2004; Sandford & Turner, 2004; Tinius, 2003).

IVA + PLUS is widely used by researchers and clinicians especially in neuropsychological or cognitive rehabilitation studies. However, it is also used to distinguish Attention Deficit Hyperactivity Disorder (ADHD) from individuals with behavioral disabilities and no behavioral problems.

IVA + PLUS is a computer based test that is based on clicking on the mouse when the number "1" is heard on the computer and when it is heard and when the "2" is heard. The test is designed to be boring at mild, demanding constant attention, and producing inaccuracies and impulsivity. The test consists of 500 stimuli that need to be reacted and avoided. Each stimulus is presented in 1.5 second intervals.

2.4 Data Analysis Techniques

In the study, it was determined that the groups were normal distribution in the Levene analysis performed on the data obtained from the experiment and control group, so the comparison of the groups was performed by independent sample t-test.

3. Findings

When the findings and interpretations were given, a proper order was followed, taking into account the order of dispensing.

3.1 Findings Related to the 1st Hypothesis

The first hypothesis of the study was expressed as "There is a significant difference in favor of the experimental group in terms of impulse control scores between the experimental group in which BrainFit® mind exercises were performed and the control group in which these exercises were not conducted." For this, pre-test and post-test point averages obtained from IVA + PLUS test applied to experimental and control groups were compared by performing t-test analysis with normal distributions.

Pre-test and post-test averages and t-test analysis of experimental and control groups are given in Table 2.

Table 2. Analysis of t-test according to results of pre-test and post-test impulse control scores of experimental and control groups

Assessment	Groups	n	Average	Standard Deviation	t	p
Pre-test	Experiment	32	91,09	17,938	-1,392	,169
	Control	28	96,64	11,842		
Post-test	Experiment	32	102,38	14,804	2,283	,025*
	Control	28	94,14	12,869		

*p<0.05

In quasi-experimental design studies, it is desirable that the students in the experimental and control groups should be at the same level before the implementation to ensure that the research is healthy. When the pre-test averages in Table 2 are examined, it is seen that the averages are 91,09 in the experimental group and 96,64 in the control group. Although the impulse control level is favored by the control group, it can be said that both groups are initially similar because the "p" significance level is greater than 0.05.

BrainFit® mind exercises were applied to the experimental group throughout the implementation. The control group continued the current life process. There is a significant difference in the impulse control between the experimental group of BrainFit® mind exercises students expected to be enrolled and the control group students continuing to the current life process.

When Table 2 is examined, unlike the pre-test averages, the average of the post-test is 102,38 in the experimental group and this average is larger than control group's average (94,14). This suggests that the experimental group performed better impulse control than the control group at the end of the study. When the "p" value, meaning the significance of the differences between the groups, is examined by considering the significance level of 0.05, it is seen that there is a significant difference between the groups' pro-test results. This confirms that the BrainFit® mind exercises practiced to the experimental group improve the impulse control of the students and confirm their validity.

The t-test analyses within themselves of the experimental and control groups according to pre-test and post-test averages in terms of impulse control scores are given in Table 3.

Table 3. T-test analysis of the experimental and control groups within themselves according to pre-test post-test impulse control results

Groups	Assessment	n	Average	Standard Deviation	t	p
Experiment	Pre-test	32	91,09	17,938	-2,744	,008*
	Post-test	32	102,38	14,804		
Control	Pre-test	28	96,64	11,842	,756	,453
	Post-test	28	94,14	12,869		

*p<0.05

When Table 3 is examined, it is seen that the pre-test average of the experimental group is 91,09, the post-test average is 102,38, and in the control group, the pre-test average is 96,64 and the post-test average is 94,14. There is a significant difference between pre-test and post-test impulse control scores only at the significance level of "p" value of 0.05 in the experimental group. Given the increase in the average, the difference between the experimental and control groups is evident. In this case, it can be said that BrainFit® mind exercises increased the impulse control of the experimental group.

3.2 Findings Related to 2nd Hypothesis

The second hypothesis of the study was expressed as "There is a significant difference in favor of the experimental group in terms of attention scores between the experimental group in which BrainFit® mind exercises were performed and the control group in which these exercises were not conducted." For this, pre-test, post-test attention score averages of experimental and control groups were compared with t-test analysis.

Pre-test and post-test averages and t-test analysis of experimental and control groups are given in Table 4.

Table 4. Analysis of t-test according to results of pre-test and post-test attention scores of experimental and control groups

Assessment	Groups	n	Average	Standard Deviation	t	p
Pre-test	Experiment	32	86,69	24,731	-,538	,593
	Control	28	89,75	18,376		
Post-test	Experiment	32	101,31	16,079	2,468	,017*
	Control	28	87,96	25,334		

*p<0.05

When Table 4 is examined, it is seen that the pre-test attention score averages of experiment and control groups are very close to each other and the "p" importance level is larger than 0.05. At this point, there is no significant difference between pre-test attention scores of experimental and control groups. In the second hypothesis, it is expected that there are significant differences in attention scores between the experimental group in which BrainFit® mind exercises were performed and the control group in which these exercises were not performed. As seen in Table 4, there is a significant difference between the two groups after the implementation because the "p" significance level is less than 0.05 between the attention scores. This suggests that BrainFit® mind exercises have a positive effect on students' attention levels.

Within the scope of the study, the experimental group and control group was also compared sub-dimension in terms of visual attention and auditory attention. Similarly to the general attention comparison, at the beginning it is no significant difference in terms of visual attention and auditory attention between groups. While in the post-test application, in terms of both visual attention (p =.031) and auditory attention (p=.047) scores, it is seen that there is a significant difference between the two groups in favor of the experimental group.

A t-test analysis was performed to determine whether the pre-test and post-test attention scores of both groups showed a significant difference within themselves, as in impulse control. The t-test analyzes performed within the experimental and control groups according to pre-test and post-test attention results are given in Table 5.

Table 5. T-test analysis of the experimental and control groups within themselves according to pre-test post-test attention results

Groups	Assessment	n	Average	Standard Deviation	t	p
Experiment	Pre-test	32	86,69	24,731	-2,805	,007*
	Post-test	32	101,31	16,079		
Control	Pre-test	28	89,75	18,376	,302	,764
	Post-test	28	87,96	25,334		

*p<0.05

When Table 5 is examined, BrainFit® mind exercises applied for about four months seem to increase the attention levels of the experimental group students. While the attention averages of the control group showed little change according to the pre-test and post-test attention comparison results of the students in both groups, the average of the experimental group increased and the "p" value between the pre-test and post-test attention scores was significant at the significance level of 0.05 difference emerged. A similar situation is evident in the development of visual and auditory attention levels examined in the sub-dimension.

3.3 Findings Related to 3rd Hypothesis

The third hypothesis of the study was expressed as "There is a significant difference in favor of the experimental group in terms of hyperactivity scores between the experimental group in which BrainFit® mind exercises were conducted and the control group in which these exercises were not performed." Pre-test and post-test averages and t-test analysis of experimental and control groups are given in Table 6.

Table 6. Analysis of t-test according to pre-test and post-test hyperactivity results of experimental and control groups

Assessment	Groups	n	Average	Standard Deviation	t	p
Pre-test	Experiment	32	85,88	27,782	-,994	,325
	Control	28	91,93	17,446		
Post-test	Experiment	32	95,09	26,509	1,822	,047*
	Control	28	82,29	27,894		

*p<0.05

As it is seen in Table 6, it is seen that the average of the control group is higher than the average of the experimental group before the implementation. While the experimental group's hyperactivity control scores increased with BrainFit® mind exercises, the control group scores decreased. Significant differences were found at this point as the post-test averages were smaller than 0.05 for significance level "p" in favor of the test group. This indicates that there is hyperactivity control in the experimental group, just as it is in the impulse control.

3.4 Findings Related to 4th Hypothesis

The fourth hypothesis of the study was expressed as "There is a significant difference in favor of the experimental group in terms of auditory speed scores between the test group in which BrainFit® mind exercises are performed and the control group in which these exercises are not conducted." Pre-test and post-test averages and t-test analysis of experimental and control groups are given in Table 7.

Table 7. Analysis of t-test according to results of pre-test and post-test auditory speed scores of experimental and control groups

Assessment	Groups	n	Average	Standard Deviation	t	p
Pre-test	Experiment	32	105,66	12,793	-,303	,763
	Control	28	106,79	16,019		
Post-test	Experiment	32	119,88	12,778	1,244	,018*
	Control	28	104,29	21,442		

*p<0.05

When Table 7 is examined, it is seen that the experimental and control groups have pre-test auditory speed average values very close to each other and "p" significance level is greater than 0.05. At this point there is no significant difference between pre-test auditory speed scores of the experimental and control groups. In the fourth hypothesis, it is expected that there are significant differences in auditory speed scores between the experimental group in which BrainFit® mind exercises were performed and the control group in which these exercises were not performed. As seen in Table 7, there is a significant difference between the two groups after the implementation because the "p" significance level is less than 0.05 between the auditory speed scores. This suggests that BrainFit® mind exercises have a positive effect on the auditory speed of the students.

The t-test analyzes performed by the experimental and control groups according to pre-test and post-test auditory speed results are given in Table 8.

Table 8. T-test analysis of the experimental and control groups within themselves according to pre-test post-test auditory speed results

Groups	Assessment	n	Average	Standard Deviation	t	p
Experiment	Pre-test	32	105,66	12,793	-1,320	,042*
	Post-test	32	119,88	12,778		
Control	Pre-test	28	106,79	16,019	,494	,623
	Post-test	28	104,29	21,442		

*p<0.05

When Table 8 is examined, it is seen that the auditory speed scores of the experimental group increased with BrainFit® mind exercises and the difference between the scores was significant. The scores of the control group showed a decline.

3.5 Findings Related to 5th Hypothesis

The fifth hypothesis of the study was expressed as "There is a significant difference in favor of the test group in terms of visual speed scores between the experimental group in which BrainFit® mind exercises were conducted and the control group in which these exercises were not conducted." Pre-test and post-test averages and t-test analysis of experiment and control groups are given in Table 9.

Table 9. Analysis of t-test according to results of pre-test and post-test visual speed scores of experimental and control groups

Assessment	Groups	n	Average	Standard Deviation	t	p
Pre-test	Experiment	32	98,22	15,801	1,279	,206
	Control	28	93,39	13,048		
Post-test	Experiment	32	101,38	14,828	1,164	,249
	Control	28	96,86	15,187		

According to the results of the t-test analysis given in Table 9, it is understood that there is no significant difference between the groups. In spite of the results, it can be said that the visual speed levels of the students did not change according to BrainFit® mind exercises.

4. Conclusion, Discussion and Recommendations

This study was conducted with the aim of investigating the effect of BrainFit® mind exercises based on neuroplasticity on cognitive characteristics of primary school students, such as impulsivity, auditory-visual attention periods, hyperactivity controls and focus skills. The study is designed experimentally and at the end of the study according to the scores obtained from the IVA + PLUS test there is a significant difference between the experimental group in which mind exercises are performed and the control group in which these exercises are not performed, in favor of the experimental group.

The results showed that depending on BrainFit® exercises;

-The impulse control of the experimental group increased and the reasoning skills developed significantly (Table 2-3).

-It was seen that the experimental group showed a significant increase especially in visual impulse control.

-The auditory and visual attention levels of the experimental group increased significantly (Table 4-5).

-Likewise, the hyperactivity scores of the experimental group also showed a significant increase. This indicates that there is hyperactivity control in the experimental group as well as in the same impulse control (Table 6).

- The auditory and visual speeds of the experimental group increased. As a result, the experimental group's processing (receiving and reacting) speeds have improved (Table 7-8).

The American Psychological Association today reports that one in five young people is experiencing mental health problems. The World Health Organization predicts that in 2020, neuropsychiatric disorders in children will increase by 50% compared to other health problems and that they will be among the top five in terms of disability and death reasons. In Turkey in 2013, 600,000 attention deficit hyperactivity disorder prescriptions were written. However, 10% of the students who are in school are experiencing problems in the lessons due to learning disorders and 80% of the remaining students cannot use their strengths because they do not know their cognitive capacities.

About 20 years ago, while problems related to attention and impulsivity were identified in the summer as a disturbance of genetic-based mother or father to the child, it has been added to the environmental influence that today, digital natives exist, depending on the developing technology, and in the generational classification, especially the children in the small age group, who are called the Z zone. The investigations reveal that stimuli, which are responsible for attention, reasoning, decision-making, decrease in prefrontal lobe activity during the use of technology by individuals, are taken by the occipital and hearing responsible temporal lobe and sent to the basal ganglia without sending the prefrontal lobe. Impulsivity in this case results in a decrease and attenuation of the prefrontal lobe activity, which is responsible for the decision-making process. However, attention is paid to the fact that human nature is social and that academic achievement and sense of accomplishment are important, and prefrontal lobe function has a critical prescription in order for impulsivity skills to be effective.

Neurocognitive research conducted in recent years has shown that exercise enhances the functioning and effectiveness of neurobiological mechanisms that are vital to the learning process. Episodic exercise and a certain habit-based way of life have a positive effect on cognitive functions and learning processes, the function of BDNF (brain derived neurotrophic factor), a molecule that plays an important role in neural regeneration and plasticity it increases. Sedanter or a static way of life delayed the synthesis of the molecule in question, and the lack of exercise was caused by various investigations leading to negative effects on academic skills and learning. Recently, one of the greatest causes of academic success and weakness among students in different age groups has been stated to be sedentary life, and one of the biggest problems of the 21st century is physical inactivity, or stable life (Demir et al., 2016). Individuals who are constantly interacting with technology need to be rescued from physical inactivity and neuroplasticity must be achieved through exercises in which motor skills will be employed. The "SMART™ Moves" exercises included in the SMART programs used in BrainFit® mind exercises include exercises designed to improve motor skills.

Studies in which the exercises performing neuroplasticity increase attention, impulse control, motor skills, visual and auditory speeds, and even perform these neuroplasticities even in disadvantaged groups, especially in younger age groups, take place in the article. Hornickel, Zecker, Bradlow, and Kraus (2012) conducted an experimental study with 38 children with normal hearing ability, aged 8-14 years and diagnosed with dyslexia. The students in the experimental group and the assistant listening devices (Class FM systems) conducted exercises for one year and observed that at the end of a year, children using these devices had speech-related auditory brainstem structures. In parallel with this study, Fisher, Holland, Merzenich, and Vinogradov (2009) conducted a similar application with 55 schizophrenic patients by using computer technology with 50 hours of auditory training. As a result of the verbal memory development of these patients, reached.

Similarly, Schlaug et al. (2009) in their experimental study with 31 children between the ages of 5 and 7, they reached the conclusion that instrumental musical exercises applied to the experimental group for 29 months developed the corpus callosum region, which provided communication between the two hemispheres in the brains of children in this group.

Kraus, Hornickel, Strait, Slater, and Thompson trained 26 children between the ages of 6 and 9 from low-disadvantaged and disadvantaged regions in the context of the Harmoni Project they conducted in 2014, using music exercises for two years, Found that children with stronger neuro-coding had better response consistency in speech harmony. In parallel with these studies, Shahin, Roberts, and Trainor (2004) and Hyde et al. (2009) have achieved similar results in their study.

One of the SMART programs used in BrainFit® mind exercises used in the study is called "SMART™ Listening" and includes many auditory exercises. The experiment group repeatedly repeated these exercises with the support of the increase of the auditory speed during the four months during which the students practiced. Thanks to these repetitions, auditory velocities were observed to develop in a way that would make a meaningful difference compared to the control group.

Early childhood is the period when the rate of neuroplasticity is highest. At the same time, this period is the period when the work towards a certain target gives important results in terms of different fields. It has been proven that certain critical periods (periods when the brain is more susceptible to stimuli) lead to more periods of plasticity in acquiring certain functions at certain ages (Hensch, 2016). Through motor activities, new connections are formed between neurons in the brain and these connections can become links that are also used for cognitive activities (Turhan & Özbay, 2016).

In recent years, it has become necessary to carry research findings and findings related to the brain and nervous system into educational settings. For this reason, it is a necessity to study the educational programs developed especially for childhood in brain based new developments and information. In this developmental period, the above mentioned and similar studies are presented in the brain of the child in terms of physical coordination, perception, attention, memory, language functions, logical thinking and imagination. Attention and impulse control are considered as high-level cognitive skills. It is thought that the development of these skills depends on the development of basic cognitive skills. The basic cognitive skills should be given more importance to the development of the children in this period since they have skills developing between 0-6 years. Taking into consideration the studies carried out in this framework, it is necessary to reconsider the teaching methods in the contents of childhood education programs and the regulation of the applications in the light of information about neuroplasticity. Before beginning schooling, it is necessary to measure the attentiveness of the students in the school guidance services and to take necessary precautions by sharing them with the teachers and their families. Attention and impulse control concepts of reasoning, consistency, readiness are intermingled with each other. Seminars can be organized for parents and trainers about attention and impulse control to avoid concept clutter.

In this study, it was revealed that coordination-based BrainFit® mind exercises developed attentional skills, stimulated impulsivity and hyperactivity control, and visual and auditory progress. For this, it is recommended that students be given BrainFit® based exercises to support their cognitive skills.

References

Arble, E., Kuentzel, J., & Barnett, D. (2014). Convergent validity of the Integrated Visual and Auditory Continuous Performance Test (IVA+ Plus): associations with working memory, processing speed, and behavioral ratings. *Archives of Clinical Neuropsychology, 29*(3), 300-312.

Aşkın Tekkol, İ., Başar, T., Şen, Z., & Turan, S. (2017). Öğrenmede insanı odağa almak: Beyin araştırmaları doğrultusunda bir tartışma. *Kastamonu Eğitim Dergisi, 25*(3), 1187-1202.

Büyüköztürk, Ş., Çakmak Kılıç, E., Akgün, Ö., E., Karadeniz, Ş., & Demirel, F. (2011). *Bilimsel araştırma yöntemleri* (8. Baskı ed.). Ankara: Pegem Akademi.

Chudler, E. H. (2005). Brain Plasticity: What Is It? Learning and Memory. Retrieved from http://faculty.washington.edu/chudler/plast.html (02.06.2017)

Corbett, B. A., & Constantine, L. J. (2006). Autism and attention deficit hyperactivity disorder: Assessing attention and response control with the integrated visual and auditory continuous performance test. *Child Neuropsychology, 12*(4-5), 335-348.

Czéh, B., Michaelis, T., Watanabe, T., Frahm, J., de Biurrun, G., van Kampen, M., . . . Fuchs, E. (2001). Stress-induced changes in cerebral metabolites, hippocampal volume, and cell proliferation are prevented by antidepressant treatment with tianeptine. *Proceedings of the National Academy of Sciences, 98*(22), 12796-12801.

Demir, M. Ş., Usta, M. E., Yayla, A., Taşkın, N., Hastunç, Y., & Alav, Ö. (2016). Çeşitli nöro-bilişsel & nöro-pedagojik ygulama ve modalitelerin bilişsel becerilerin gelişimi üzerindeki etkisi. *Journal of Kirsehir Education Faculty, 17*(2), 679-696.

Ekiz, D. (2009). *Bilimsel araştırma yöntemleri* (2. Baskı ed.). Ankara: Anı Yayıncılık.

Esen, E. (2016). Beynimizi zinde tutmak. *Osmangazi Tıp Dergisi, 38 (Özel Sayı 1)*, 13-16. doi:10.20515/otd.70974

Fisher, M., Holland, C., Merzenich, M. M., & Vinogradov, S. (2009). Using neuroplasticity-based auditory training to improve verbal memory in schizophrenia. *American Journal of Psychiatry, 166*(7), 805-811. doi:10.1176/appi.ajp.2009.08050757

Gözüyeşil, E., & Dikici, A. (2014). Beyin temelli öğrenmenin akademik başarıya etkisi: Bir meta-analiz çalışması. *Kuram ve Uygulamada Eğitim Bilimleri Dergisi, 14*(2), 629-648. doi:10.12738/estp.2014.2.2103

Gürpınar, D., Erol, A., & Mete, L. (2007). Depresyon ve Nöroplastisite. *Klinik Psikofarmakoloji Bulteni, 17*(2), 100-110.

Hensch, T. K. (2016). The power of the infant brain. *Scientific American, 314*(2), 64-69.

Hornickel, J., Zecker, S. G., Bradlow, A. R., & Kraus, N. (2012). Assistive listening devices drive neuroplasticity in children with dyslexia. *Proceedings of the National Academy of Sciences, 109*(41), 16731-16736. doi:10.1073/pnas.1206628109

Hyde, K. L., Lerch, J., Norton, A., Forgeard, M., Winner, E., Evans, A. C., & Schlaug, G. (2009). Musical training shapes structural brain development. *Journal of Neuroscience, 29*(10), 3019-3025. doi:10.1523/JNEUROSCI.5118-08.2009

Kalia, M. (2008). Brain development: anatomy, connectivity, adaptive plasticity, and toxicity. *Metabolism, 57*, S2-S5. doi:10.1016/j.metabol.2008.07.009

Keleş, E., & Çepni, S. (2006). Beyin ve öğrenme. *Türk Fen Eğitimi Dergisi, 3*(2), 66-82.

Knickmeyer, R. C., Gouttard, S., Kang, C., Evans, D., Wilber, K., Smith, J. K., . . . Gilmore, J. H. (2008). A structural MRI study of human brain development from birth to 2 years. *Journal of Neuroscience, 28*(47), 12176-12182.

Mundkur, N. (2005). Neuroplasticity in children. *Indian journal of pediatrics, 72*(10), 855-857.

Nichols, S. L., & Waschbusch, D. A. (2004). A review of the validity of laboratory cognitive tasks used to assess symptoms of ADHD. *Child Psychiatry and Human Development, 34*(4), 297-315.

Özden, Y. (2014). *Öğrenme ve Öğretme* (12. Baskı ed.). Ankara: Pegem Akademi.

Özmert, E. N. (2005). Erken çocukluk gelişiminin desteklenmesi-II: Çevre. *Çocuk Sağlığı ve Hastalıkları Dergisi, 48*, 337-354.

Paliç, G., & Akdeniz, A. R. (2012). Designing and evaluating a Web supported instructional material based on brain based learning. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 6*(1), 67-93.

Rapoport, J. L., & Gogtay, N. (2008). Brain neuroplasticity in healthy, hyperactive and psychotic children: insights from neuroimaging. *Neuropsychopharmacology, 33*(1), 181-197.

Sandford, J., & Turner, A. (2004). IVA+ plus: Integrated visual and Auditory Continuous Performance Test administration manual. *Richmond, VA: Brain Train*.

Schlaug, G., Forgeard, M., Zhu, L., Norton, A., Norton, A., & Winner, E. (2009). Training‐induced neuroplasticity in young children. *Annals of the New York Academy of Sciences, 1169*(1), 205-208.

Shahin, A., Roberts, L. E., & Trainor, L. J. (2004). Enhancement of auditory cortical development by musical experience in children. *Neuroreport, 15*(12), 1917-1921.

Soylu, H. (2004). *Fen Öğretiminde Yeni Yaklaşımlar*. Ankara: Nobel Yayın Dağıtım.

Stahl, S. M. (2000). *Essential psychopharmacology: Neuroscientific basis and practical applications* (2. Baskı ed.). Cambridge: Cambridge university press.

Stiles, J., & Jernigan, T. L. (2010). The basics of brain development. *Neuropsychology review, 20*(4), 327-348.

Tinius, T. P. (2003). The integrated visual and auditory continuous performance test as a neuropsychological measure. *Archives of Clinical Neuropsychology, 18*(5), 439-454.

Turhan, B., & Özbay, Y. (2016). Erken çocukluk eğitimi ve nöroplastisite *Uluslararası Erken Çocukluk Eğitimi Çalışmaları Dergisi, 1*(2), 58-68.

Uzbay, T. (2004). Anksiyete ve depresyonun nörobiyolojisi. *Klinik Psikiyatri Dergisi, 4*(3), 1-11.

Yaman, Y., & Emir, S. (2017). Beyin Temelli Öğrenme. In B. Akçay (Ed.), *Fen Bilimleri Eğitimi Alanındaki Öğretme ve Öğrenme Yaklaşımları* (pp. 89-105). Ankara: Pegem Akademi.