The Effect of Mental Exercise and Repetition Studies on the Mental Performance of 7th Class Students of Primary Schools

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Abstract

The purpose of this experimental study is, taking into consideration variables such as gender and school type, to investigate mental development of 7th grade primary school students through having the students do mental exercise and repetition studies. While the experimental group has been applied a mental development program with mental exercise and repetition studies for a 6-week time, the other group has not received the same application. In this study data related to students mental development is collected throug[4]h Cattell's mental test, developed by Cattell (1957) and adapted by Togrol (1974), and the achieved crude points are turned into points related to mental parts. In this study T-test and ANOVA are applied to analyse whether there's a meaningful differentiation between pre-test and post test scores. At the end of this study these findings have been obtained: A meaningful differentiation cannot be seen between the pre-test and post-test point averages related to mental parts of girls and boys according to their gender. In terms of being a private school or states school there is not a meaningful differentiation in mental parts between the pre-test points averages, however there is a meaningful differentiation in the post test points averages in the favour of private schools. There is not a meaningful differentiation between the experimental group and control group in mental parts pre-test point averages, however there is a meaningful differentiation in the favour of experimental group in mental parts between the point averages in post-test. Generally there's a meaningful relation in a positive way in the favour of post-test points between the pre-test and post-test point averages related to mental parts.

Key words: Mental exercise and repetition, Mental performance.

Introduction

Developing students' characteristics (personal, social, pedagogical and professional), accommodating a convenient classroom environment for students' development and creating a positive teaching and learning environment is the basis of the developmental counseling program applied in schools. In this way, the purpose is to increase the students' academic success and to develop students' characteristics in every way (Yeşilyaprak, 2007). The studies carried on schools to develop the students in every aspect are called teaching and learning activity. These activities include elements such as curriculum, teaching methods, examinations, transition to an upper grade and evaluation of academic works. Today, the meaning of the academic activities has been changed and aesthetically, socially and scientifically valuable education has come into prominence in. In this sense, it has become important that students should *learn thinking* in sophisticated, discrete, critical, creative, constructive, independent, reasonable and analytical way; *use their current knowledge* to produce new information, *solve problems* about recognition and diagnostic; *do individual work* for their interest; *develop a healthy self-concept* and *gain communication skills* to interact with their environment (Özden, 2003). The most important dimension of this new concept is mental process, activities and learning strategies. An organism encountering any stimuli carries out the processes such as:

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attention by heading to stimuli or stimulus response, *perception* by interpreting or comprehending the sensual information, *permanent repetition* by activating the knowledge to use current knowledge in the memory, *grouping* by degrading complicated and extended information units to a limited number, *open and implicit repetition* to pass on the information from the short-term memory to long-term memory, *encoding* by transferring and associating the information both in the long-term and short-term memory (Koptagel, 1984, Eggen and Kauchak, 1992; Senemoğlu, 1997; Ulusoy, Güngör, Akyol, Subaşı, Ünver and Koç, 2007).

Intelligence, the basic factor in mental process, has a traditional role in explaining learning and comprehension. Intelligence is the ability to learn, to make use of what is learned, to adopt new situations and to create new solutions (Yörükoğlu, 1996). It is seen that the close relationship between the intelligence shaping the mental processes and learning strategies is inevitable. Practice and repetition strategies which are the subject of this paper are also seen closely related to intelligence and mental processes. Practice and repetition has an important function in transferring the information from the short-term memory which is scant particularly in storing and time to long-term memory and thus in making the information permanent. Mental practice and repetition studies provide a basis in cognitive processes such as organising and jointing which enrich the encoding process to raise the permanency of information in memory. Thereby, an increase in intelligence and mental exercise is seen (Tomporowski, Davis, Miller and Naglieri, 2008). In this paper, the effect on primary school students' intelligence performance is examined experimentally by preparing a program related to mental exercise and repetition explained above.

The purpose of this study is, taking into consideration variables such as gender and school type, to investigate mental development of 7^{th} grade primary school students through having the students do mental exercise and repetition studies

Method

In this section, research design, characteristics of the experimental group and control groups, the procedures applied on experimental and control groups, data collection tools, data collection process, data analysis techniques and limitations of the research are explained.

Research Design

Pre-test and post-test with control group experimental pattern is used for the purpose of the research. Experimental patterns are the research patterns which aim to explore the cause and effect relations between the variables. In this pattern, the groups which are examined are split into two groups as control group and experimental group. At the beginning of the research pre-test is applied and at the end of the research post-test is applied to these groups and results are concluded by looking through the differentiations between them.

Control and Experimental Groups

Actual sample of the research is formed with 50 students in 7 C-D classes from Şeker Primary School and to 41 students in 7 B-D from Private İstiklal Primary School. 'Group mapping' technique is used to determine the study groups. In this technique, two groups are determined with regard to the group averages which belong to the relevant variables (Büyüköztürk, 2001). In this sense, at the beginning of the study, the groups are divided

into two groups as control and experimental group. In the process of determining the control and experimental groups, Cattell Intelligence Test (pre-test) is applied to the groups. Then, the results related to the intelligence score obtained from control and experimental groups are inserted to SPSS program and 't' test is applied to the independent groups. With the results of the analysis conducted, it has been seen that there is not a meaningful statistic differentiation between the groups. The table concerned with these results can be seen below.

Table 1. *The t Test Values Related to Pre-test Points of Experimental and Control Groups*

Factor (Pre-test)	**Groups**	**N**	**Mean**	**Sd**	**t**	**p**
	The experimental group	20	137.50	34.28	0.041	.968
	The control group	20	137.14	18.48		

The Procedures Applied to Experimental Group

Mental Exercise and Repetition Program

Mental exercise and repetition program include a six-week study. It is sorted as below:

First Week

1. Students are made to play chess, king and Sudoku.
2. Students are made to do exercises to improve their memory related to numbers.

3. The number chains below are given to the students and students are made to repeat them until they did not do mistakes.

Exercise: 0 3 8 5 0 4 7
Exercise: 1 6 4 9 5 6 8 3
Exercise: 6 2 3 8 4 9 3 2 4

4. Students are made to repeat the number chains from the opposite.

Exercise: 1 3 4 9
Exercise: 9 6 8 3 5
Exercise: 7 5 5 3 9 0 6

5. Students are asked to review the statistic data given to them in a critical way.
6. Before using any measurement instrument, students are provided to see 'how much' the thing to be measured is with their mental eye using only their emotions.

Exercise: Students are made to estimate their friends' height and weight.

The results are tested to be true.

Exercise: Students are made to estimate the width and height of the materials such as the blackboard, bookcase and clipboard in the classroom.

Exercise: Students are made to estimate how big the school garden is.

Second Week

1. Students are made to play chess, king and Sudoku.
2. Students are made to do exercises to improve their memory related to syntax. Students are given sentences and made to repeat the sentences word for word. The sentences below are repeated word for word.

Exercise: The superior man does not set his mind either for anything, or against anything. (Confucius)

Exercise: Anybody accepts the boundaries of their viewpoint as the boundaries of the world. (Schopenhauer)

Exercise: A man is not idle because he is absorbed in thought. There is visible labour and there is invisible labour. (Victor Hugo)

Exercise: Nobody loves freedom from the heart except good people; as for the others, they love what is allowed, not freedom. (Milton)

3. Students are asked to review the statistic data given to them in a critical way.

4. Before using any measurement instrument, students are provided to see 'how much' the thing to be measured is with their mental eye using only their emotions.

Exercise: Students are made to estimate their friends' height and weight.

The results are tested to be true.

Exercise: Students are made to estimate the width and height of the materials such as the blackboard, bookcase and clipboard in the classroom.

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Third Week

1. Students are made to play chess, king and Sudoku.

2. Students are made to do exercises to improve their memory related to paragraphs. Students are given paragraphs and are provided to recall the whole paragraph by using the important words as key words.

Exercise: People are always blaming their circumstances for what they are. I don't believe in circumstances. The people who get on in this world are the people who get up and look for the circumstances they want, and, if they can't find them, make them. (George Bernard Shaw).

Exercise: We are most likely to get angry and excited in our opposition to some idea when we ourselves are not quite certain of our own position, and are inwardly tempted to take the other side. (Thomas Mann)

Exercise: Not only does one not retain all at once the truly rare works, but even within such works it is the least precious parts that one perceives first. Less deceptive than life, these great masterpieces do not give us their best at the beginning. (Marcel Proust)

3. Students are made to solve maths problems.

4. Before using any measurement instrument, students are provided to see 'how much' the thing to be measured is with their mental eye using only their emotions.

Exercise: Students are made to estimate their friends' height and weight.

The results are tested to be true.

Exercise: Students are made to estimate the width and height of the materials such as the blackboard, bookcase and clipboard in the classroom.

Exercise: Students are made to estimate how big the school garden is.

Fourth Week

1. Students are made to play chess, king and Sudoku.

2. Students are made to solve the number chains given to them.

Exercise: 4 9 25 49 81 ?

True solution is 121, that is, 11*11

Exercise: 2 9 28 65 126 ?

Exercise: 5 25 61 113 181 ?

3. Students are made to solve maths problems.

4. Before using any measurement instrument, students are provided to see 'how much' the thing to be measured is with their mental eye using only their emotions.

Exercise: Students are made to estimate their friends' height and weight.

The results are tested to be true.

Exercise: Students are made to estimate the width and height of the materials such as the blackboard, bookcase and clipboard in the classroom.

Exercise: Students are made to estimate how big the school garden is.

Fifth Week

1. Students are made to play chess, king and Sudoku.

2. Students are asked to solve the codes and mind flexors with a specific order given to the students.

Exercise: nrabin dedul secisw cihwe srohe care ekils iemoh tadedu lcess iohw suin gena.
Solution: a genius who is secluded at home is like a race horse which is secluded in barn.
3. Students are made to solve math problems.
4. Students are asked to consider themselves as if they are in that problematic situation.
Exercise: A man says by looking at the portrait on the wall: "I have neither a sister nor a brother, but this man's father is my father's son." So who is in the portrait he is looking at?
Solution: The man is looking at his son's portrait. While solving the problem, we should follow: If John is the only child and Mr X's father is John's father's son, then Mr X's father should be John and if Mr X's father is John, we should think that Mr X is John's son.

Sixth Week
1. Students are made to play chess, king and Sudoku.
2. Students are made to solve maths problems.
Exercise (solution time: 1 minute): Information: 2 stars + 1 moon = 10, 1 moon + 1 sun + 1 star = 9, 1 star + 2 moon = 8, 1 star + 1 flower + 1 sun = 12. Find each symbol's mathematical equivalent.

Solution: star = 4, sun= 3, flower = 5, moon = 2
Exercise (solution time: 2 minutes): Three men decide to share a hotel room for economic reasons. The receptionist tells them the room fee is 30 $ and each of them pays 10 $. Then, the receptionist realizes that there is a mistake. The room fee is not 30 $, it is 25 $. He gives 5 $ to the housekeeper and asks him to return it to three men. The housekeeper gives 1 $ to each of them and keeps 2 $ for the charity box. In this case, each man pays 9 $. 9 $ * 3 = 27 $. The housekeeper keeps 2 $, so it counts 29 $. What about 1 $?
Solution: The room fee is 25 $. Three men give 27 $, that is, they pay extra 2 $, this 2 $ is kept for the charity box.
Exercise (solution time: 3 minutes): Two men sell ties. One sells two ties for 10 $, the other sells three ties for 10 $. Instead of competition, they decide to become partners. So each man brings thirty ties in this partnership and they have a 60-tie stock. Then they decide to sell five ties for 20 $. If the first man sold thirty ties for 10 $ for two of them, he would save 150 $. If the second man sold 30 ties for 10 $ for three of them, he would save 100 $. When counting these two sales, it is 250 $. But after they become partner, their sale results 240 $. What about 10 $?
Solution: There is no trick here; there is only the mathematical logic. When collected 10 $ for two ties and 10 $ for three ties, until "10 $ for three ties" is sold out, 5 ties is sold for 20 $ for a limited time, this is obviously quicker than the sold of the ties for 10 $. Then, some of the rest of the ties will be sold as 10 $ for three ties, but in this case instead of selling the two ties left for 10 $, there will be confusion as they sell in a complicated way.

The Procedures Applied to Control Group

A special procedure concerned with mental exercise and repetition is applied to control group cooperating family, the school management and teachers.

Data Collection Tools

Cattell Intelligence Test 2A-2B: Cattell Intelligence test was developed by Cattell (1957) and adaptation works are done by Toğrol (1974). Test is used for intelligence measurement in individuals whose age is between 7-6 or 14-20. Cattell Intelligence Test is applied in twenty five minutes. It consists of four sections and the application time of each section is different. There are separate explanations and examples for each section. Explanations are verbally made. The test can be applied on either individuals or groups. Grading the test is made according to the answer key. Each correct answer is '1' point. The total point obtained from the test shows the mental age of the individual. Intelligence section of the individual is estimated with the 'mental age/chronological age x 100' formula. No special education is needed to apply the test.

Reliability

Two Half-Test Reliability: In a number of studies, reliability factor of the test estimated with the two half-test reliability is averagely 0.80.

Parallel Form Reliability: Correlation factor of the test between 2A and 2B Forms is found above 0.50.

Validity

Criterion-Dependent Validity: The correlation between Porteus Labyrinth Test and Cattell Intelligence Test applied to 1300 children is below 0.50. The test has criterion-dependent validity (Öner, 1997).

Data Collection Process

In this paper, as explained before, data is collected depending on the experimental pattern. It has been noted that the obtained data facilitates to compare the results of the control and experimental groups and to help see the effects of the mental exercise and repetition on mental performance of the primary school children.

First, equalized 20 children for experimental group and 20 children for control group are chosen by applying Cattell Intelligence Test on 91 students from both schools. Then, experimental group is made to do mental exercise and repetition studies regularly. At the end of the sixth week, Cattell Intelligence Test is re-applied for post-test, the obtained data is ready to analyze including variables such as gender, school type, etc.

Data Analysis Techniques

The data obtained through the research is inserted into the SPSS 16.0 statistic program and it is analysed. Different statistical techniques are used in analysing the obtained data.

First of all, Independent Samples T-Test technique is used to determine if there is a meaningful differentiation in the pre-test scores of the experimental group and control group. Two-way ANOVA for Mixed Measures technique is used to see simultaneously the variation differentiations between the groups to test if there is a meaningful differentiation in point average of pre-test and post-test according to gender, school type, control group and experimental group. Besides, Pearson Moments Correlation Technique is used to determine if there is a relationship between the point average of pre-test and post-test.

The Constraints of the Research

The findings of this research are limited to the primary school students in the study groups; the effort and intimacy of the supporting teachers to apply the mental exercise and repetition studies on the children joined to control and experimental groups; the content of the program of the mental exercise and repetition studies used in this research; data related to the IQ scores measured with Cattell Intelligence Test which is used as the data collecting tool in the research.

Findings

Students' pre-test and post-test average points and standard deviation values obtained from the intelligence test according to their gender are indicated in Table 2.

Table 2. *Standard Deviation Values and Intelligence Test Points of Students' Pre-test and Post-test According to Gender*

	Pre-test			Post-test		
Groups	**N**	**Mean**	**Sd**	**N**	**Mean**	**Sd**
Male	22	139.29	4.46	22	159.74	4.32
Female	18	134.92	3.05	18	150.79	4.36
Total	40	137.32	2.71	40	155.71	4.31

As seen in Table 2, the male students' average points from the intelligence test are 139.29 before the experiment, and they are 159.74 after the experiment. The female students' average points from the intelligence test are 134.92 before the experiment, and they are 150.79 after the experiment. In total, the average points from the intelligence test are 137.32 before the experiment, and they are 155.71 after the experiment.

The multiple comparison of students' pre-test and post-test average points obtained from the intelligence test according to gender is indicated in Table 3.

Table 3. *ANOVA Table of the Averages of Student's Pre-test and Post-Test Points According to Gender*

Factor	Source	SS	df	MS	F	p
Gender (Pre-test)	Between Groups	188.634	1	188.634	.250	.620
	Within Groups	28636.621	38	753.595		
	Total	28825.255	39			
Gender (Post-test)	Between Groups	792.414	1	792.414		
	Within Groups	71676.974	38	1886.236	.420	.521
	Total	72469.388	39			

There is not a meaningful differentiation between the average points of the students' pre-test and post-test according to their gender ($F_{(1, 38)}$=0.250, p=.620 and $F_{(1, 38)}$=0.420, p=.521). This result shows that there is not a meaningful differentiation between the mental performance points according to gender.

Students' pre-test and post-test average points and standard deviation values obtained from the intelligence test according to the school type in which the students are educated are indicated in Table 4.

Table 4. *Students' Pre-Test and Post-Test Average Points and Standard Deviation Values Obtained From The Intelligence Test According to The School Type*

	Pre-test			Post-test		
Groups	**N**	**Mean**	**Sd**	**N**	**Mean**	**Sd**
State School	30	133.57	2.61	30	145.48	3.84
Private School	10	148.57	2.85	10	186.43	4.34
Total	40	137.32	2.71	40	155.71	4.31

As seen in Table 4, average points of the students who are educated in state schools from the intelligence test are 133.57 before the experiment, and they are 145.48 after the experiment. Average points of the students who are educated in private schools from the intelligence test are 148.57 before the experiment, and they are 186.43 after the experiment. In total, the average points from the intelligence test are 137.32 before the experiment, and they are 155.71 after the experiment.

The multiple comparison of students' pre-test and post-test average points obtained from the intelligence test according to the school type in which the students are educated is indicated in Table 5.

Table 5. *The ANOVA Table of Students' Pre-Test And Post-Test Average Points obtained From The Intelligence Test According to The School Type In Which The Students Are educated*

Factor	Source	SS	df	MS	F	p
School Type (Pre-test)	Between Groups	1687.500	1	1687.500	2.363	.133
	Within Groups	27137.755	38	714.151		
	Total	28825.255	39			
School Type (Post-test)	Between Groups	12578.231	1	12578.231	7.981	.007
	Within Groups	59891.156	38	1576.083		
	Total	72469.388	39			

As seen in Table 5, there is not a meaningful differentiation in the average points of the students' pre-test according to the school type ($F_{(1, 38)}$=2.363 p=.133).There is a meaningful differentiation in the average points of the students' post-test in favour of the private school ($F_{(1, 38)}$=7.981, p=.007).

Pre-test and post-test average points and standard deviation values of experimental group and control group obtained from the intelligence test are indicated in Table 6.

Table 6. *Pre-Test and Post-Test Average Points and Standard Deviation Values of experimental Group and Control Group Obtained From The Intelligence Test*

	Pre-test			Post-test		
Groups	**N**	**Mean**	**Sd**	**N**	**Mean**	**Sd**
The experimental group	20	137.50	3.42	20	178.21	4.35
The control group	20	137.14	1.84	20	133.21	2.91
Total	40	137.32	2.71	40	155.71	4.31

As seen in Table 6, the average points of the experimental group from the intelligence test are 137.50 before the experiment, and they are 178.21 after the experiment. The average points of the control group from the intelligence test are 133.21 before the experiment, and they are 137.14 after the experiment. In total, the average points from the intelligence test are 137.32 before the experiment, and they are 155.71 after the experiment.

The multiple comparison of pre-test and post-test average points of the experimental group and control group obtained from the intelligence test is indicated in Table 7.

Table 7. *The ANOVA Table of Students' Pre-Test And Post-Test Average Points and Standard Deviation Values Obtained From The Intelligence Test*

Factor	Source	SS	df	MS	F	p
Experimental-Control Group (Pre-test)	Between Groups	1.276	1	1.276	0.002	.968
	Within Groups	28823.980	38	758.526		
	Total	28825.255	39			
Experimental-Control Group (Post-test)	Between Groups	20250.000	1	20250.000	14.736	.000
	Within Groups	52219.388	38	1374.194		
	Total	72469.388	39			

There is not a meaningful differentiation in the average points of the students' pre-test ($F_{(1, 38)}$=0.002 p=.968). As expected, there is a meaningful differentiation in the average points of the students' post-test in favor of the experimental group ($F_{(1,38)}$=14.736, p=.000).

Results and Discussion

According to their gender, there is not a meaningful differentiation between the pre-test and post-test average points of the male and female students related to their mental performance. Many research results which have investigated the relations between the intelligence and gender exist in literature. Some studies suggest that gender is an important factor in evaluating the intelligence which is described as general ability (Murphy, Hall and Colvin 2003; Furnham and Thomas, 2004). There also exist research results which suggest intelligence does not differ according to gender (Kaufman, Kaufman, Liu and Johnson, 2009) as well as those research findings which suggest that in the performance of intelligence males (Rammstedt and Rammsayer, 2001) or females (Pascualvaca, Anthony, Arnold, Rebok, Ahearn, Kellam and Mirsky, 1997) are more advantageous. From a different perspective, Raty and Snellman, 1992; Rammstedt and Rammsayer, 2002; Rammstedt and Rammsayer, 2002; Guastello and Guastello, 2003; Petrides and Furnham, 2004; Furnham and Buchanan, 2005; Extremera, Fernandez-Berrocal and Salovey, 2006 have found that intelligence is a multiple factor; males are more talented in mental areas such as logic-maths, reasoning, numerical transactions, shape perception and problem solving; and females are more talented in mental areas such as verbal, inner, social and artistic. Besides, Konter and Yurdabakan, 2010 have found that features of nonverbal intelligence do not differ according to gender.

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According to students' being educated in state or private schools, there is a meaningful differentiation in the average points of the post-test in favour of the private school while there is not a meaningful differentiation in the average points of the pre-test related to students' mental performances. This result can be based on many reasons such as; the mental exercise and repetition studies are applied in a more relevant situation in terms of education in private schools, the attitudes of the private schools which support the students' personal development, private schools include more individual and group works and they are accustomed to this, the students in private schools have the opportunity to do mental exercise and repetition better and relatively the parents are more qualitative, etc. Students' socio-economic status and parents' qualifications affect their mental

performances (Hovels-Gurich, Konrad, Skorzenski, Nacken, Minkenberg, Messmer and Seghaye, 2006; Gomez-Sanchiz, Canete, Rodero, Baeza and Gonzalez, 2004; Ramey, Bryant, Wasık, Sparling, Fendt and Lavange, 1992).

There is not a meaningful differentiation between the average points of pre-test and post-test related to the mental performance of experimental group and control group; but, as expected, there is a meaningful differentiation in the average points of the post-test related to mental performance in favour of experimental group. This result can be explained with the positive effect of the mental exercise and repetition program applied to experimental group on the mental performance points of the primary school students. There are research results which support this result in literature (Dickens, 2005; Falk, Lidor, Lander and Lang, 2004; Tomporowski and others, 2008).

According to these results, mental exercise and repetition should be taken into consideration while designing teaching and learning activities. Practices can be done by preparing classroom activities, materials and more comprehensive programs related to mental exercise and repetition. Educational programs on mental exercise and repetition can be organized for parents and teachers.

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