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## THE COMPARISON OF EXECUTIVE FUNCTIONS IN PRIMARY SCHOOL STUDENTS DEPENDENT AND NON-DEPENDENT ON COMPUTER GAMES

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### ABSTRACT

The aim of present study is to compare executive functions (reverse digit memory, corsi span, numeration span, and sun & moon strop) in primary school students dependent and non-dependent on computer games. The present study is a descriptive with causal-comparative type research in data collecting. The participants for this study were 30 students of 9 to 11 years old in hamedan who having been selected by accessible sampling method. The questionnaires consisted of straight digit span test, corsi digit span, reverse digit span, numeration span, and sun & moon strop. Descriptive and inferential statistics indices such as multiple tests of multivariate variance analysis with spss-19 software been used for data analysis. The results of present study showed that there is no significant difference between five variables of reverse digit memory, corsi digit span, numeration span, and sun & moon strop in dependent and non-dependent students on computer games.

**Keywords:** Executive Functions, Computer Games, Students.

### INTRODUCTION

Today, there are abundant new entertainments in several mass media whose popularities are increasing day by day and have induced public concerns due to being very attractive to many people. Computer games are most popular mass media (Durkin & Barber, 2002). Nowadays, Internet becomes an integral part of modern life and its development in undeniable. Whilst most of people use Internet without any negative effect, some people are who misuse it, and Internet causes some problems in their lives (Aminifar, Sedghpoor, & Dabbaghzadeh, 2012). Since Internet draws many addressees' attention due to a wide range of topics, a variety of subjects, updated information, being anonymous in it, and audio-visual attractions, dependence on Internet is one of the propounded phenomena and is, in fact, the consequence of its inopportune use (Khosravi & Alizadeh, 2011).

Computer games phenomenon, like many new types of entertainment, which become widely popular, raises concern about its possible impact on extremist players (Aminifar, Sedghpoor, & Dabbaghzadeh, 2012). Whereas children and teenagers play computer

games at the expense of ignoring their other educational, social and recreational activities, these games potentially considered being harmful (Cheshmi & Zamani, 2011). Excessive paying attention to computer games not only results from the content of these games, but also individual traits have important roles in teenagers' tendency toward the games so that individuals' personal and psychological traits partially orient their desires towards playing these types of games. With respect to dissemination and wonderful effects of computer games, which due to their influence on changing life style, they referred to as "computer games revolution", they cannot be just looked as tools for spending leisure time but they may be an effective or affected factor of psychological and behavioral traits of individuals. This is why many researchers have dealt with this area (Khodabakhsh & Maher, 2008). Wei (2007), for example, in his case study, examined the probable causes of dependence on and playing computer games. The results of his study showed that addiction-like proceeding these games is mostly due to the lack of skill in controlling behaviors and time

managing as well as running away from life problems and stresses, so that one opts to proceed the games as a way of being free from stresses. Griffiths et al (2007) showed in their research that dependence on and addiction to computer games does not depend upon the hours of playing these games. Results of Roth's study in Taiwan showed that the degree of addiction to computer games in children and teenagers relates to their boldness level, social skills and educational successes.

Positive and negative effects of computer games have been demonstrated in several studies. For example, Anderson & Dill (2000; quoted by Poormohseni et al, 2004) suggested that negative effects of computer games include increase in aggression level and hostile behavior, decrease in patience for defeat, addiction and dependency, decrease in social relations, and weakness in educational functions. Improvement of self-imagination learning, problem-solving thought, development of spatial reasoning, and children-specific cognitive abilities are some of their positive effects. One of the most important psychological components is executive function, which comprises of several aspects. Executive function is an excellent cognitive and metacognitive function, which consists of a set of magnificent capabilities such as inhibition, self-initiation, strategic planning, cognitive flexibility, and mover controlling (Ghamari Givi et al, 2010). In fact, functions such as organizing, decision-making, working memory, maintenance and shift of dynamic control, time sensation and perception, future anticipation, inner language, and problem-solving are the most important neurological executive functions that assist human in life and implementation of learning tasks and mental actions (Barkley, 1998; quoted by Soltani, Alizadeh, Hashemi, Serami, & Soltani, 2013).

Given that playing computer games may leads to enhancement of individuals' skills, and it has been shown in various studies on the relationship between executive functions and children's skills that executive functions are good anticipators for performance (Bull & Screrif, 2001), it is very important to carry out further studies in this connection. In addition, environmental and cognitive factors effect on inhibition factor and working memory and contribute to person's function (Barkley, 1998; quoted by Soltani, Alizadeh, Hashemi, Serami, & Soltani, 2013). Although computer games sometimes consider as difficulties in educational affairs, the roles of them in children's development remain unclear. Consequently, the aim of the present

study is to compare executive functions in students dependent and non-dependent on computer games.

## **METHODOLOGY**

The present study is a descriptive with causal-comparative type research in data collecting. The participants for this study were all 9-11 years old primary school students in educational years of 2014-2015. Sample size consisted of 30 students from Azadi and Al-Zahra primary schools in Hamedan (15 normal and 15 dependent students on computer games) who having been selected by accessible sampling method. For matching subjects, the attempt was to select 9-11 years old students. In terms of economic and social status, it was also tried to select subjects from the same school. Students, who were studying in these schools, were commonly of the same economic and social status. The tools for the present study consisted of straight digit span, corsi span, reverse digit span, numeration span, and sun & moon strop test.

### **Straight digit span test**

The tester read a set of singular digits and the testee should sequentially repeat the digits as the tester read them. Firstly, the set of digit consists of two digits and then after each repetition, the tester adds one digit to the chain until the chain has a maximum of 7 digits. When the child incorrectly repeats a chain on two successive times, the test will be stopped. The function is scored as the number of total correctly reminding the series. Gattercool et al (2004) have reported that test reliability-retest of digit span is 81%. This task has been widely used for evaluating phonetic circuit of working memory (Gathercole & Pickering, 2000; quoted by Abrahimi, Firoozi, & Dortaj, 2011).

### **Corsi digit span test**

The tester gives each taste a paper, on which nine similar dark dots were drawn, and it is said to child that these dots are stones in a marsh and our fingers are frogs that jump from one stone to the other. After my frog jumps on some stones, your frog should jump on the same stones and as the same sequence as me on your own paper. The tester touches some stones in a completely random sequence, and the chain consists of two dots at first and then one dot adds until the chain contains six dots. The test stops when the child incorrectly repeats representation of a chain twice. Test reliability-retest of this task is 53%, and usually uses for evaluating visual-spatial design component of working memory (Gathercole et al,

2004; quoted by Soltani, Alizadeh, Hashemi, Serami, & Soltani, 2013).

#### Reverse digit span test

The implementation of this task is the same as straight digit span test, except that child should repeats digits reversely. This task is scored according to the total number of correct reminding. Test reliability-retest is 62% (Gathercole et al, 2004; quoted by Abrahimi, Firoozi, & Dortaj, 2011).

#### Numeration span test

It uses for measuring the short time storage capacity and manipulating information of central executor component of working memory. A card, on which there are a number of red and blue dots, is shown to the child and asked him/her to count red dots. Then another card is presented for counting its red dots. Finally, it is asked the child to mention representations of red dots, respectively. The test stops when the child incorrectly responds to all three trials of a test. Test Reliability-retest of this task is 62% (Gathercole et al, 2004; quoted by Soltani, Alizadeh, Hashemi, Serami, & Soltani, 2013).

#### Sun & moon strop test

Archibald & Kerens made this test (1999; quoted by Abrahimi, Firoozi, & Dortaj, 2011). It consists of two pages with rows of sun and moon pictures, which arranged randomly. In first situation, children should move on rows and say sun when they see sun's picture and do the same about moon. In second situation, they should say moon when they see sun's picture, and vice versa. In both situations, it is asked children to go ahead as fast as possible during 45 seconds, and whenever they make a mistake, stop and correct it. Interference score is calculated by deducting the numbers of correct cases of first

situation from those of the second one and dividing the result into the numbers of correct cases of first situation. The larger negative digit, the more interference will be. Test reliability-retest is 86%, it uses for inhibition of central executor component (Soltani, Alizadeh, Hashemi, Serami, & Soltani, 2013).

The method of selecting dependent students on computer games was in such a way that firstly it asked students how long do they computer games in one day, on the average? The category of students who play computer games more than three hours recognize as dependent on computer games.

Finally, normality of descriptive statistics indices such as mean, standard deviation, frequency, and frequency percentage and of inferential statistics indices such as kolmogoroff-smirnov test was measured by means of spss-19 software, and if data distribution was normal, then multivariate variance analysis was used.

## RESULTS

Table 1 represents means scores of straight digit memory, reverse digit memory and sun & moon strop tests, and corsi and numeration span tests.

As observed in table 1, means scores of straight digit memory, reverse digit memory and sun & moon strop tests of dependent students on computer games are lower than non-dependent ones.

However, means scores of Corsi and numeration span test are higher in non-dependent students on computer games.

Before using multivariate variance analysis, kolmogoroff-smirnov test was used for measuring data normality. For this purpose, relative scores to each group and each test were separately calculated. The results are shown in table 2.

**Table: 1. Descriptive statistics of tests' scores of dependent and non-dependent groups on computer games**

| Type of test          | Dependency    | Mean  | Variance | Standard deviation |
|-----------------------|---------------|-------|----------|--------------------|
| Straight digit memory | Dependent     | 5.73  | 2.49     | 1.57               |
| Test                  | Non-dependent | 5.53  | 1.98     | 1.40               |
| Reverse digit memory  | Dependent     | 3.93  | 2.06     | 1.43               |
| Test                  | Non-dependent | 3.80  | 0.743    | 0.861              |
| Corsi span test       | Dependent     | 9.73  | 0.210    | 0.457              |
|                       | Non-dependent | 9.40  | 0.543    | 0.736              |
| Numeration span       | Dependent     | 6.26  | 5.35     | 2.31               |
| test                  | Non-dependent | 6.73  | 5.06     | 2.25               |
| Sun & moon strop      | Dependent     | 0.130 | 0.008    | 0.092              |
| test                  | Non-dependent | 0.102 | 0.011    | 0.103              |

**Table: 2. Kolmogoroff-smirnoff test for evaluation of data distribution normality**

| Type of test               | Dependency    | Z coefficient | Significance level (P-value) |
|----------------------------|---------------|---------------|------------------------------|
| Straight digit memory Test | Dependent     | 0.647         | 0.797                        |
|                            | Non-dependent | 1.14          | 0.143                        |
| Reverse digit memory Test  | Dependent     | 0.808         | 0.532                        |
|                            | Non-dependent | 1.00          | 0.269                        |
| Corsi span test            | Dependent     | 1.75          | 0.401                        |
|                            | Non-dependent | 1.26          | 0.083                        |
| Numeration span test       | Dependent     | 0.680         | 0.744                        |
|                            | Non-dependent | 0.695         | 0.720                        |
| Sun & moon stop test       | Dependent     | 0.684         | 0.738                        |
|                            | Non-dependent | 0.999         | 0.272                        |

As shown in table 2, the significance level of all components of both above groups is 0.05, which

indicates that the test is not meaningful, and that data distribution is normal in this research.

Also, box test used for examining homogeneity assumption of variance-covariance matrices. Table 3 represents box test for equation of covariance matrices.

**Table: 3. Box test for equation of covariance matrices**

|                       |       |
|-----------------------|-------|
| Box M                 | 15.69 |
| F                     | 0.842 |
| First freedom degree  | 15    |
| Second freedom degree | 0.003 |
| Significance level    | 0.631 |

As shown in table 3, not meaningfulness of box test indicates that homogeneity assumption of variance-covariance matrices has proved ( $P=0.631$ ). Finally, multivariate variance analysis used after evaluating presupposed tests, and its results presented in table 4.

**Table: 4. Multiple tests of multivariate variance analysis**

|       | Trace                     | Value | F     | Freedom level of hypothesis | Freedom level error | Significance level | Squares of $\eta$ -values |
|-------|---------------------------|-------|-------|-----------------------------|---------------------|--------------------|---------------------------|
| Group | <b>Pillai Trace</b>       | 0.121 | 0.663 | 5                           | 24                  | 0.655              | 0.121                     |
|       | <b>Wilkes Lambda</b>      | 0.879 | 0.663 | 5                           | 24                  | 0.655              | 0.121                     |
|       | <b>Hotellings trace</b>   | 0.138 | 0.663 | 5                           | 24                  | 0.655              | 0.121                     |
|       | <b>Roy's largest root</b> | 0.138 | 0.663 | 5                           | 24                  | 0.655              | 0.121                     |

As shown in table 4, the obtained squares of  $\eta$ -nominal values is 0.121 that indicates degree of average effect of five variables, named straight digit memory, reverse digit memory, Corsi span, numeration span, and sun & moon stop, on separation of two groups of students dependent and non-dependent on computer games. So the research hypotheses did not confirmed due to not meaningfulness of test. In addition, because there was no significant difference between groups, executing follow-up tests ignored.

## DISCUSSION

Based on the purpose of present study, which focused on the comparison of executive functions in primary school students dependent and non-dependent on computer games, the obtained results from multivariate variance analysis showed that there is no significant difference between straight digit memory, reverse digit memory, Corsi span, numeration span, and sun & moon stop, on separation of these two groups. The results of this study are inconsistent with the findings of Soltani, Alizadeh, Hashemi, Serami, & Soltani (2013) study. They examined the efficiency of computer-assistance teaching program

of working memory on executive functions of students with difficulties in mathematics and showed that there is a significant difference in executive functions of normal students and those of students with difficulties in mathematics. In such a way computer-assistance teaching of working memory meaningfully affected executive functions of students with difficulties in mathematics.

Soltani, Alizadeh, Hashemi, Serami, & Soltani (2013) in explanation of their findings suggested that regarding there is so much stress on working memory in computer-assistance teaching and most of computer games as well as working memory is the major and underlying skill in learning mathematics, therefore computer-assistance teaching or computer games can thereby increase working memory capacity. However why difference between students dependent and non-dependent on computer games is not meaningful may results from the qualities of these games, but not their extents. In other words, after computer games affect improvement of working memory, the extents of them (duration of playing) may have not much effect on it. In addition, the results of present study are inconsistency with the findings of Poormohseni, Vafaei, & Azadfalsh

(2004). They assessed the effects of computer games on teenagers' mental rotation abilities, and show that use of computer games increases teenagers' mental rotation abilities.

Firoozzi, Abrahimi, & Dortaj, in a research titled comparison of executive functions based on examination anxiety in fifth grade primary school students, suggested that neural-cognitive executive functions of goal directed processes are neurological that are responsible to control and coordinate behavior, and relate to psychological processes responsible for control, consciousness, thought, & acting. Nevertheless, many computer games help coordinating cognitive and behavioral processes to each other. However, intensity and extent of computer games play no role in this case. In fact, the extent of computer games tends to have no effect on the manner and performance of executive functions. So the effects of computer games may be on individuals' other psychological and cognitive areas. Therefore, further studies need for evaluation and comparison of other psychological and cognitive aspects of individuals dependent and non-dependent on Internet.

Limitations of this study included limitation of sample size, not collaborating of students' Families with researcher, lengthy being of research questions, and limiting of participants to students in Hamedan, among others. Therefore, it is suggested that similar studies with larger sample size and other age groups be conducted in future researches and the results be compared with the findings of present study.

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