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COMPUTER AND STRATEGIC SKILLS

Roman Yavich, Lior Heffetz, Hodaya Dareli, Yafa (Amaretz) Yhakove
Ariel University

ABSTRACT: *Our senses receive stimuli from the environment and retain them consciously for a few seconds in order to give our brain the opportunity to process the information. If the brain gives an order to process this information we use processing strategies for optimal storage of information. Some people are capable of using these strategies more frequently than others. These people have more rapid retrieval skills than those who do not use such strategies or use them less often. In our study we sought to explore the frequency in which these strategies are used among 8-10 year old children. The study is a correlational quantitative empirical study that operationally examined the correlation between the use of various types of electronic media and computer games and the memory skills of children of these ages. In the first part of the study 30 children aged 8-10, selected at random, were asked how much time they spend at the computer every day and about their types of usage. In the second part of the experiment, they were read a story, and in the third part they were asked questions about the story. The results of the study showed a significant correlation between respondents' use of memory strategies and the amount of time they spent at the computer as well as their type of computer use.*

KEYWORDS: Computer Games, Children's Cognition, Strategic Skills

INTRODUCTION

The use of memory strategies is a mechanism that enables better storage of sensory information received from the environment through our senses. Every moment we are absorbing all the information around us through our senses, of which the strongest are the senses of hearing and sight. When we receive information through vision, for example, the incoming information continues to be presented to us even after it is removed, namely our sensory system retains it as visual information for several seconds in order to let the brain store it. If the brain does not store this information – it disappears. We use learning strategies in order to better process the material that we wish to rapidly retrieve.

Former studies have divided learning strategies into "externally-based strategies" and "internally-based strategies" (Blumberg, Fran & Sokol, 2003). Externally-based strategies are our use of external factors for the purpose of remembering, for example: asking the examiner, using the assistance of other people in order to reach understanding, etc. In contrast, using internally-based strategies implies that one learns from personal knowledge and does not use external factors in order to establish learning and encode the information.

Previous research shows that there is indeed some correlation between use of computer games and better memory. "Confidence or sense of self-efficacy could have been based on their status as frequent players" (Bloomberg, Fran & Sokol, 2004). This is mainly true of the connection between computer games and memory and less in the context of using memory strategies. Some studies mention the ability to use electronic media at a young age as a tool for enhancing cognitive actions. It is indeed possible to develop the cognitive activity of young children by

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using adult-mediated computer programs (Nir-Gal, 2006). The research suggests that gaming improves creativity, decision making, and perception (Hots, 2012). People who play action-based video and computer games made decisions 25% faster than others without sacrificing accuracy, according to a study (Guerts, Duke & Vermeulen, 2007).

Existing research has proven the correlation between chronic computer games and electronic media and neuronal (brain) and behavioral development. Video game enthusiasts spend many hours at play, and this intense activity has the potential to alter both brain and behavior (Spens & Feng, 2012). Use of electronic media and computer games leads to improved skills of vision, attention, and certain aspects of cognition. And these skills are not just gaming skills, but real-world skills (Trudeau, 2010). Research of memory strategies and memory per se, however, is not sufficiently developed, and therefore in our study we try to explain this relationship.

RESEARCH METHOD

Participants

The research population consisted of 30 randomly-selected children aged 8-10 from various towns in Israel. All the children chosen to participate in the research use computers in their daily life, but their exposure varies.

Research Tools

The research tools used in the current study were questionnaires constructed with Google Docs. This method was used in order to construct two questionnaires for purposes of the study.

The first questionnaire was – Background information on computer use. This questionnaire consists of three demographic questions (see figure 1a), such as: age and place of residence, and five multi-choice questions that provide background on the child's computer use (see figure 1b), such as: how many hours a day do you spend on the computer? The options were 0-1, 2-3, and 4 or more

The second questionnaire was – Memory questionnaire on the story read, consisting of 9 multi-choice questions. This questionnaire explored children's memory of the story (see figure 2). For example: How many objects did the professor have on his table? Possible responses were: 3 objects, 2 objects, or 4 objects.

The questionnaires were sent to the personal e-mail addresses of the respondents' parents. Construction of the questionnaires and sending them through the electronic media contributed to our study but we also encountered difficulties.

The advantages:

- Participation in the study requires respondents' consent, as well as parents' consent for their children's participation. Completion of the questionnaires and their return through the parents' e-mail signaled their consent for their child's participation in the experiment.
- Construction of the questionnaires on Google Docs aroused no difficulties and no special editing was required.

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- Sending the questionnaires by e-mail was carried out easily at a click.
- Sending the questionnaires through the electronic media saved us resources, such as time and money.

The disadvantages:

- Nonetheless, sending the e-mail to parents via the electronic media required us to write clear and detailed instructions in order to avoid problems with questionnaire completion and sending.
- Several parents had no e-mail address and this required us to find alternate methods, such as coming to the child's home in person, asking for the help of relatives, etc.

Procedure

The experiment took about 30 minutes to complete and was conducted with randomly-selected children aged 8-10 selected from various towns. The research procedure was identical for all respondents and they received clear and detailed instructions on questionnaire completion.

The study was conducted in three stages:

In the first stage – Respondents were asked to answer a background questionnaire on computer use, and were required to answer all the questions.

In the second stage – The **encoding stage -** the story "Paper, ink, and pen" was read to respondents (see figure 3).

In the third stage – **The retrival stage -** respondents were asked to answer a memory questionnaire on the story read. Here too they were requested to answer all the questions.

The questionnaires were sent to each of the participants by e-mail and when completed were returned to the researchers by e-mail. Respondents' answers were entered in a Google Docs table and then the data was transferred to the SPSS program for processing and analysis of the results.

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Figure 1a. Demographic questions from the background questionnaire on computer use.	**Figure 2a. Questions examining the child's background of computer use**
Please fill the following questionnaire: * Gender (male/female) נקבה * Age * Address	* Do you have a computer at the home? (yes/no) כן * How many hours do you spend on using Computer? (0-1/2-3/4+) 0-1 2-3 4 ומעלה * For which purpose do you use the computer? (Fighting / memory/ Internet לחימה זיכרון גלישה באינטרנט

RESULTS

In the current study we hypothesized that children aged 8-10 who spend many hours playing computer games that require thinking strategies (combat and memory) will have better memory of details from the story than children of the same age who do not play at all or who play computer games that do not require thinking strategies (surfing the web for fun) for shorter lengths of time.

The Variables:

Dependent variable: The number of details the child remembers from the story.

Independent variables: Variable 1 – Number of daily hours of computer use (0-1; 2-3; 4 or more); Variable 2 – Type of computer use (combat; memory; surfing the web).

Explanation of our specific choice of these types of computer use:

- Combat games: We chose combat games since those who play this type of games usually use thinking and memory strategies and therefore would be more inclined to remember details from the encoding stage.
- Memory games such as: Solitaire, Poker, etc. This type of game also engages higher parts of the brain responsible for rapid solutions and is based on better memory and quicker retrieval skills.
- Surfing the web: Facebook, Twitter, Messenger, etc., have almost no effect on memory and retrieval skills.

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As stated, we claimed that greater exposure to strategy games on the computer raise one's chance of having swifter and better retrieval capabilities. This claim was examined in a two-tailed test on the SPSS program.

Report of results

Table 1: Dependent variable: Number of items that the child remembered them.

How many hours do you spend on using computer?	For which purpose do you use the computer?	Mean	Std. Deviation	N
0-1 hours	Fighting	4.00	0.000	2
	Memory	3.33	1.155	3
	Internet surfing	3.25	1.035	8
	Total	3.38	0.961	13
2-3 hours	Fighting	8.00	1.000	5
	Memory	6.60	1.140	5
	Internet surfing	3.00		1
	Total	6.91	1.758	11
4+	Fighting	7.60	1.517	5
	Internet surfing	6.00		1
	Total	7.33	1.506	6
Total	Fighting	7.17	1.850	12
	Memory	5.38	1.996	8
	Internet surfing	3.50	1.269	10
	Total	5.47	2.300	30

In table 1 we see that the higher the number of hours spent on computer games the higher the mean number of details remembered by respondents. Respondents who play computer games for 0-1 hours a day have a mean of 3.38. Respondents who play 2-3 hours a day have a mean of 6.91. The mean of respondents who play combat and memory games 2-3 hours a day is in the range of 6-8, while the mean of respondents who play the same number of hours but surf the web is 3. Respondents who play 4 or more hours a day have a mean of 7.33.

Close observation of the data shows that the mean of respondents who surf the web 4 or more hours a day is 6. Although these respondents do not play memory-developing strategy games they attained a high mean, since they spend 4 or more hours a day on the computer, a significant time span.

Table 2. **Tests of Between-Subjects Effects**

Dependent Variable: מספר הפריטים שהילד זכר

Sig.	F	Mean Square	df	Type III Sum of Squares	Source
0.000	13.741	17.843	7	124.900a	Corrected Model
0.000	385.751	500.891	1	500.891	Intercept
0.000	14.787	19.201	2	38.402	Hours
0.005	6.910	8.973		17.946	Purpose
0.065	2.777	3.606		10.817	Hour-Purpose
		1.298	22	28.567	Error
			30	1050.000	Total
			29	153.467	Corrected Total

Table 2 presents the significance of the variables. Each of the independent variables reached significance (p<0.01). The interaction between the variables, however, is not significant. The reason for the lack of significance is one respondent who surfs the web for more than 4 hours who raised the mean of the group that surfs the web for more than 4 hours a day.

Next was the Scheffe test, a post-hoc test that examines the significance between the different levels of each of the independent variables.

Table 3.

95% Confidence Interval						
Upper Bound	Lower Bound	Sig.	Std. Error	Mean Difference (i-j)	How many hours do you spend on using Computer? (j)	How many hours do you spend on using Computer? (i)
-2.30	-4.75	0.000	0.467	-3.52	2-3	0-1
-2.47	-5.42	0.000	0.562	-3.95	+ 4	
4.75	2.30	0.000	0.467	-3.52	0-1	2-3
1.09	-1.94	0.767	0.578	-0.42	+ 4	
5.42	2.47	0.000	0.562	3.95	0-1	+ 4
1.94	-1.09	0.767	0.578	0.42	2-3	

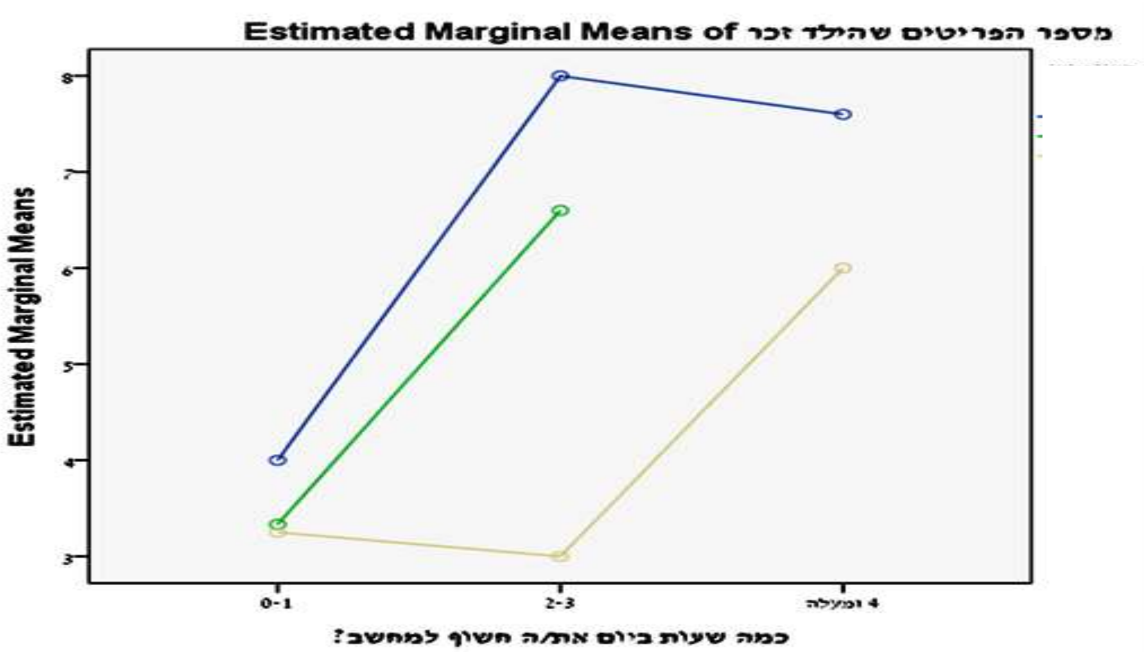
Post-hoc analysis of the variable of number of computer use hours a day showed a significant difference between children who play computer games 0-1 hours a day and those who play 2-3 hours a day. A significant difference was also found between children who play 0-1 hours a day and those who play 4 hours or more a day. In contrast, no significant difference was found between those who play 2-3 hours a day and those who play 4 or more hours a day. These data show that children who play two hours or more a day remember more details than children who play computer games for less than two hours a day.

Table 4.

95% Confidence Interval						
Upper Bound	Lower Bound	Sig.	Std. Error	Mean Difference (i-j)	For which purpose do you use the computer?(j)	For which purpose do you use the computer? (i)
3.16	0.43	0.009	0.520	1.79	memory	fighting
4.95	2.39	0.000	0.488	3.67	Internet surfing	
-0.43	-3.16	0.009	0.520	-1.79	fighting	memory
3.29	0.46	0.008	0.541	1.88	Internet surfing	
-2.39	-4.95	0.000	0.488	-3.67	fighting	Internet surfing
-0.46	-3.29	0.008	0.541	-1.88	memory	

Post-hoc analysis of the variable of type of computer use found a significant difference between all levels, namely between combat games and memory games, between combat games and surfing the web, and between memory games and surfing the web.

Figure 1.



How many hours do you spend on using Computer?

The blue line in the graph denotes combat games. We can see that the more hours a child was exposed to computers, the higher the number of details remembered. The green line denotes memory games. It is clear that the more hours the child was exposed to computers the higher the number of details remembered. The yellow line denotes surfing the web. We can see that the more hours a child spent surfing the web the lower the number of items remembered. In addition, we can see that respondents who surfed the web for more than three hours

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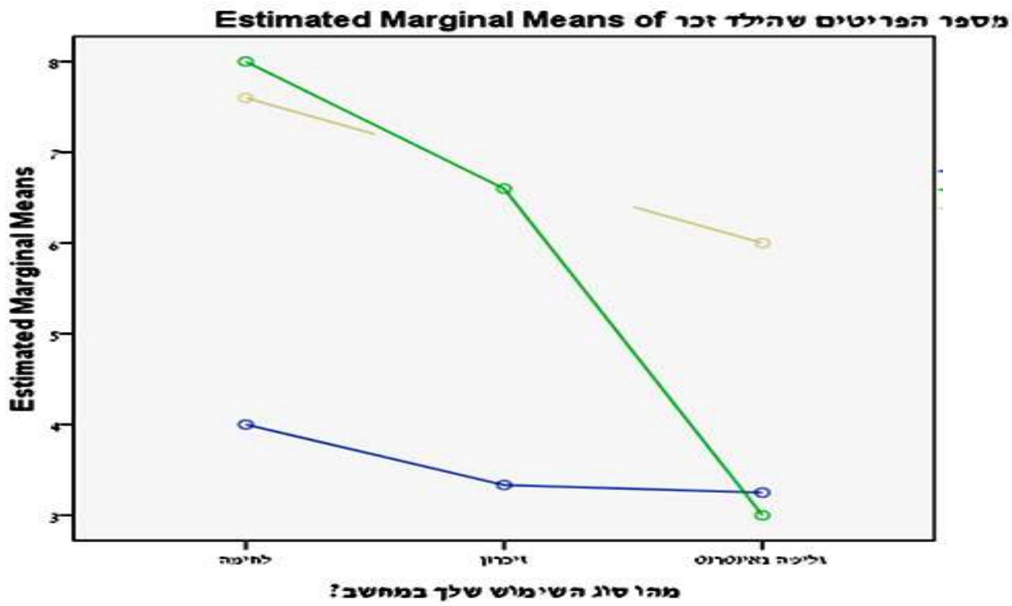
remembered more details. Close observation of the data shows that only one respondent had an impact on this result (as stated in table 1).

Figure 2.



For which purpose do you use the computer?

In general, we can see that children who played combat games remembered more details than children who played memory games, and that children who played memory games remembered more details than children who surf the web, unrelated to the extent of their computer use.

DISCUSSION AND CONCLUSIONS

In the current study we examined the correlation between the two independent variables of number of hours spent on the computer and type of computer use and between the dependent variable of level of memory among 30 children aged 8-10 through a 2-tailed ANOVA test. We found a significant correlation between the number of hours children spend at the computer and memory. Namely, the more time children spend at the computer the more time they have to acquire skills, enabling better memory of details. Therefore, we hypothesize that this result will let us reach the same prediction regarding the second variable, as children who play more strategy games and spend more time at the computer hone their capabilities and consequently new learning memories are created in the hippocampus. The reason we expected to find significance is based on the simple neurological explanation derived from the brain sciences, that the more we hone a certain area of the brain the more we hone neuronal connections in that area, and the more neuronal connections the more neural communication, indicating the development of skills in that area. For example the AC1 area of the hippocampus, responsible for creating new memories and for short-term memory, the memory we tried to achieve in the

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current experiment. (The entire process took 3 minutes for each child, for the simple reason that we wanted to check memories in the short-term memory – processed by the AC1 area of the hippocampus and stored in the correct place).

In order to achieve such results it is necessary to hone our ability to use storage strategies. Therefore we expected those children who honed those skills through strategy games to show significant correlations with better quality memory as proven in the experiment. Indeed, we saw that the research results show a tendency that matches our hypothesis, although not significantly, as when the two variables of number of hours and type of use were combined the result was not significant on a $p>0.05$ level. This result might derive from other aspects not included in the study that could have had an effect, such as age differences between the children. Maybe the encoding abilities of an 8 year old are not compatible with those of a 9 year old, and so on.

Another factor we did not take into consideration in this study was the effect of the environment and other factors on the child. Maybe a child who played strategy games daily but answered only few of the questions correctly had dyslexia problems or attention and concentration disorders. Maybe the child was raised in a home that did not encourage computer usage and therefore the computer was not used after school. Each of these factors and others might bias the research results and explain the lack of significance of interaction between the two variables.

Further studies can investigate the topic among a larger spectrum of participants with a wider age range. It would be interesting to examine the results of children in different ages. In addition, the study could be limited to children who do not have certain concentration disorders, thus examining whether this was an interfering variable in the current study.

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