The Relationship Between Utilization of Computer Games and Spatial Abilities Among High School Students

Vahid Motamedi [1], Razeyah Mohagheghyan Yaghoubi [2]

[1] Department of Educational Technology Faculty of Psychology and Education Kharazmi University Tehran, Iran
motamedivahid@ymail.com
vmotamedi@khu,ac.ir

[2] Faculty of Psychology and Education
Kharazmi University
Tehran, Iran

ABSTRACT

This study aimed at investigating the relationship between computer game use and spatial abilities among high school students. The sample consisted of 300 high school male students selected through multi-stage cluster sampling. Data gathering tools consisted of a researcher made questionnaire (to collect information on computer game usage) and the Newton and Bristol spatial ability questionnaire with reliability value of .85. Data were analyzed using Pearson's correlation coefficient. Results showed that there was a meaningful relationship between the use of computer games and spatial ability (r = .59 and p = 00.00), there was a meaningful relationship between the use of computer games and the spatial perceived ability (r = .60 and p = .00), there was a meaningful relationship between the use of computer games and mental rotation ability (r = .48 and p = .00) and there was a meaningful relationship between computer game use and spatial visualization ability (r = .48 and p = .00). In general, the findings showed there was a positive and a significant relationship between the use of computer games and spatial abilities in students.

Keywords: *Computer games, Spatial ability*

INTRODUCTION

NOWADAYS computer games are not just a tool for entertainment and fun, but also are one of the biggest products of Information and Communications Technology. In the past two decades this industry has had an enormous impact on the hardware and software used in the world. Because of the limited knowledge of this industry in Iran, most people consider computer games for children and consider it as a hobby for leisure time while in most other countries it is considered as a major specialty.

Computer games are cultural products and play a major role in creativity of children and it is the first step for most children to enter the world of technology and communications using computers. The games attract children's attention because of their visual attractiveness, structured content, quick feedback, possibility of direction and speed. On the other hand, a society such as Iran loves to see the growth and successful integration of students and technology but also expect children to be successful in various other aspects of learning and growth such as cognitive dimensions, emotional, gain of skills and abilities. Intelligence is viewed and considered as one of the basic features to achieve such skills. According to Strobach and Schubert (2014) "Recent research has shown that brain organization and cognitive functioning can be influenced by continuous practice and experience. That is, daily participation, practice or training in particular actions, activities or professions may modify the functioning of specific brain structure, mental processes, and behavior" (p. 1).

This mental activity sometimes may be influenced by environmental and genetic factors. Therefore,

the concept of intelligence especially multiple intelligences can be important in its various dimensions. Gardner (1999) defined intelligence as "bio-psychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture" (p. 33). Theory of Intelligence in various dimensions does not believe that there is only one way for training, encouraging and motivating students to learn. Spatial intelligence is one of Gardner's multiple intelligences. Gardner's spatial intelligence is associated with spatial ability. He defined spatial intelligence as mental ability to perceive the objects in space and move them to different apparent locations.

Space perception is a major component of human intelligence; the ability to access spatial information and use it for problem solving plays an important role in human life. Those with strong spatial intelligence are able to accurately see the world around them. They can visualize and deal with visuals graphically. This strong internal imagery makes their creativity and imagination workable.

Thus, spatial intelligence can be developed in students' learning, activities and learning experiences in the field of action. This can be possible with the help of new technology. Computer games are one of the tools that put the user in a position corresponding to real-life situations and test the user's intelligence and ability. Analysis of computer games show that games can be a tool to foster spatial skills. According to Granic, Lobel, and Engels (2014), "play contexts allow children to experiment with social experiences and simulate alternative emotional consequences which can then bring about feelings of resolution outside the play context" (p. 67). They further state, "play provides children opportunities to reproduce real-life conflicts, to work out ideal resolutions for their own pleasure, and to ameliorate negative feelings" (p. 67).

David (2012) conducted research on training of spatial abilities through computer games. The result indicated that special abilities increase when educational tasks and complex spatial abilities such as spatial visualization are exercised.

Quaiser-Pohl, Geiser, and Lehmann (2006) in their research examined how computer-game preference relates to mental-rotation test performance and to gender differences. The result showed large gender differences with respect to class assignment. More females were found in the "logic-and-skill-training game player" class and in the class of "non-players". Males were overrepresented in the class of "action-and-simulation game players." Males on average outperformed females in mental-rotation test performance. Squire (2006) in his research suggested that players develop new identities both through game play and through the gaming communities in which these identities are enacted. In fact, as Anderson, Gentile, Brown, and Swing (2014) explained, research has revealed a number of other positive consequences of video game play such as beneficial effects of pro-social games on helping (Greitemeyer & Osswald, 2010) and positive effects of action games on visual-spatial skills (Green & Bavelier, 2007). Squire (2006), believed that games can communicate powerful ideas and open new identity trajectories for learners.

The purpose of this study was to investigate the relationship between utilization of computer games and spatial abilities among high school students. There were four hypotheses tested:

1. there is a significant relationship between the use of computer games and spatial ability,
2. there is a significant relationship between the use of computer games and spatial perception,
3. there is a significant relationship between the use of computer games and mental rotation, and
4. there is a significant relationship between the use of computer games and image of space.

METHODOLOGY

This study was conducted at a high school in city of Shahreyar. The sample for this study consisted of 300 first grade high school male students in 2013-14 who were selected through multi-stage cluster sampling. The population consisted of 30 high schools among which three were chosen. Among these three schools eight classes were chosen which included 300 students. The data collection instrument selected for this study consisted of two questionnaires. One was to collect information about computer game use. In this questionnaire two questions were asked which include four choices: first, how often do you play computer games: a. every day, b. once a week, c. a number of times in a mouth, and d. not at all. And the second

question was what kind of games you play: a. educational, b. sports, c, adventure, and 4. action. And the other questionnaire was the Newton and Bristol "spatial ability questionnaire" with 45 questions ranging from 1 for the correct answer to zero for wrong and blank answers. For this study descriptive and inferential statistical analyses were used. Newton and Bristol spatial ability was used to test the reliability 0.85. Using SPSS software, data were analyzed using Pearson's correlation coefficient. Results showed that there was a meaningful relationship between the use of computer games and spatial ability as well as between the uses of computer games and spatial ability sub-factors, namely spatial perception, mental rotation and spatial visualization.

DATA ANALYSIS AND RESULTS

First hypothesis

There is a significant relationship between the use of computer games and spatial ability.

The following Table 1 displays the results of Pearson correlation test for the relationship between the game and spatial ability.

Table 1 Pearson Correlation Coefficient for Relationship Between Game Paly and Spatial Ability

Significance Level	Correlation Coefficient	Standard Deviation	Average	Count	Criterion Variables	Variable
0.000	.597	7.54555	31.9667	300	Spatial Ability	Game

Table 1 shows the results obtained from the use of computer games and spatial ability of students with a correlation coefficient of .597 and a significance level of .000. There is a significant and positive correlation between the two variables; increasing the use of computer games is expected to increase spatial ability. Therefore, the first hypothesis that there is a relationship between computer games and spatial ability is confirmed.

Second hypothesis

There is a significant relationship between the use of computer games and spatial perception.

Table 2 Pearson correlation coefficient for the relationship between game play and perception of space

Significance Level	Correlation Coefficient	Standard Deviation	Average	Count	Criterion Variables	Variable
0.000	.601	2.91229	10.3467	300	Space Perception	Game

Table 2 shows the results between the use of computer games and spatial perception of students with a correlation coefficient of .601 and a significance level of .000. There is significant and positive relationship between the two variables; increased use of computer games is related to increase in spatial perception. Therefore, the second hypothesis that there is a relationship between the use of computer games and spatial perception is also confirmed.

Third hypothesis

There is a significant relationship between the use of computer games and mental rotation.

Table 3 Pearson correlation coefficient for the relationship between game play and mental rotation

Signifi-cance level	Correlation Coefficient	Standard Deviation	Average	Count	Criterion Variables	Variable
0.000	.487	2.59979	11.1833	300	Mental Rotation	Game

Table 3 shows the results obtained from the use of computer games and mental rotation of students with correlation coefficient of .487 and a significance level of 0.000. There is significant and positive relationship between the two variables; increasing the use of computer games is associated with increase in mental rotation. Therefore, the third hypothesis that there is a relationship between the use of computer games and mental rotation is confirmed as well.

Fourth hypothesis

There is a significant relationship between the use of computer games and image of space.

Table 4 Pearson correlation coefficient for the relationship between the game and image of space

Significance Level	Correlation Coefficient	Standard Deviation	Average	Count	Criterion Variables	Variable
0.000	.488	3.05348	10.4367	300	Image of space	Game

Table 4 shows the results obtained from the use of computer games and image of space of students with correlation coefficient of .488 and a significance level of .000. There is significant and positive relationship between computer game use and image of space; increasing the use of computer games is related to increase in image of space. Therefore, the fourth hypothesis that there is a relationship between the use of computer games and image of space is also confirmed.

DISCUSSION AND CONCLUSION

In this study, the relationship between computer game use and spatial abilities among students was examined. For the first hypothesis, the results showed that there is a significant and positive relationship between computer games and spatial ability. There was a meaningful relationship between computer game use and spatial ability as well as between the uses of computer games and spatial ability sub factors, namely spatial perception, mental rotation and spatial visualization. The results of this study are consistent with the findings of Bavelier and Green (2004), David (2012), Squire (2006), De Lisi and Wolford (2002) and confirm the hypothesis.

The second hypothesis showed that there is a positive relationship for the use of computer games and the ability in spatial perception. Perhaps we can interpret the third hypothesis that action-based video games have a lot more effect on improving mental rotation. Action-based video games tend to increase the ability of students' mental rotation and as Anderson et al. point out this kind of game is associated with performance superiority and improvement on many visual and spatial tasks. Strobach and Schubert (2014) also believe that action video gaming enhances the "spatial distribution, spatial selectivity, capacity, temporal resolution, efficiency, and top-down guidance of attention" (p. 3). Caplovitz and Kastner (2009), in their study showed that playing action-based video games improved attentional processing. What we can say about the fourth hypothesis is that computer games can reinforce the ability of rapid perception and visual memory whereas action video based games reinforce high speed ability in players.

Granic, Lobel, and Engels (2014), explained that the most essential distinguishing feature of computer

games is interactivity. They state "players cannot passively surrender to a game's storyline. Instead, video games are designed for players to actively engage with their system and for these systems to, in turn, react to players' agentive behaviors" (p. 67). According to Anderson, Gentile, Brown and Swing (2014), playing video games has been associated with improvement on many visual and spatial tasks. They state specific-spatial skills and tasks that incorporate those skills can be improved through games requiring players to practice these skills. Positive effects of video game on visual-spatial skills have been found both in correlational studies (Green & Bavelier, 2003) and experimental studies (Okagaki & Frensch, 1994). In an experimental study by Feng, Spence, and Pratt (2007), only 10 hours of video game play can improve spatial attention and mental rotation.

Many scientists and psychologists find that video games can have many benefits such as making children smart. In fact, video games can teach children high-level thinking skills that might be good for their future. It is recommended that children not spend more than one to two hours per day in front of all electronic screens including television. It is interesting to note that children who play video games for up to an hour are happier, more sociable and less hyperactive than those who do not play at all. We suggest that it is important to recognize the potential capacity of computer games in relation to their cognitive effects. Also, we suggest to those responsible in education that it is good for children to use computer games. Computer games improve children's creative ability, as well as self-confidence and self-esteem.

REFERENCES

Bavelier, D., & Green, C.S. (2004). Effects of video game playing on visual functions. *Journal of Vision, 4*(11), 23.

Caplovitz, G. P., & Kastner, S. (2009). Carrot sticks or joysticks: Video games improve vision. *Nature Neuroscience, 12*(5), 527-528.

David, L. T. (2012). Training of spatial abilities through computer games – results on the relation between game's task and psychological measures that are used. *Procedia – Social and Behavioral Sciences, 33,* 323-327.

De Lisi, R., & Wolford, J. L. (2002). Improving children's mental rotation accuracy with computer game playing. *Journal of Genetics Psychology*, *163*(3), 272-82.

Feng, J., Spence, I., & Pratt, J. (2007). Playing an action video game reduces gender differences in spatial cognition. *Psychological Science, 18,* 850-855.

Gardner, H. (1999). *Intelligence reframed: Multiple intelligences for the 21st cent*ury. New York, NY: Basic Books.

Granic, I., Lobel, A., & Engels, R. C. M. E. (2014). The benefits of playing video games. *American Psychologist, 69*(1), 66-78.

Green, C. S., & Bavelier, D. (2003). Action video game modifies visual selective attention. *Nature, 423,* 534-537.

Green, C. S., & Bavelier, D. (2006). Effect of action video games on the spatial distribution of visuospatial attention. *Journal of Experimental Psychology: Human Perception and Performance, 32*(6), 1465-1478.

Green, C. S., & Bavelier, D. (2007). Action video game experience alters the spatial resolution of attention. *Psychological Science, 18*(1), 88-94.

Greitemeyer, T., & Osswald, S. (2010). Effects of pro-social video games on pro-social behavior. *Journal of Personality and Social Psychology, 98,* 211-221.

Okagaki, L., & Frensch, P.A. (1994). Effects of interactive entertainment technologies on development. *Journal of Applied Developmental Psychology, 15,* 33-58.

Quaiser-Pohl, C., Geiser, C., & Lehmann, W. (2006). The relationship between computer-game preference, gender, and mental-rotation ability. *Personality and Individual Differences*, *40*(3), 609-619.

Squire, K. (2006). From content to context: Videogames as designed experience. *Educational Researcher, 35*(8), 19-29.

Strobach, T., & Schubert, T. (2014). *Positive consequences of action-video game experience on human*. OMICS Publishing Group.