

The prediction of the student's tendency to computer games based on the brain- behavioral functions, cognitive flexibility and sensation seeking

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Summary

Aims: Research about the student's Tendency to Computer Games has increased over the last decade, but little investigation has examined the relationship between Tendency to Computer Games, Brain-Behavioral Functions, Cognitive Flexibility, and Sensation Seeking. The present study was designed to predict the student's Tendency to Computer Games based on the Brain-Behavioral Functions, Cognitive Flexibility and Sensation Seeking.

Method: Through Cluster sampling, 200 subjects were chosen for this Descriptive and correlational study. Brain-Behavioral Functions questionnaires, Cognitive Flexibility, Sensation Seeking and Tendency to Computer Games were applied to collect data. Descriptive statistics, Pearson correlation test, and multiple linear regression were used to analyze data.

Results: The findings revealed that there are significant associations between Brain-Behavioral Functions, Cognitive Flexibility, and Sensation Seeking variables on the Tendency to Computer Games. Meanwhile, Brain-Behavioral Functions, Cognitive Flexibility and Sensation Seeking predicted Tendency to Computer Games.

Discussion: The results emphasized the effect of Brain-Behavioral Functions, Cognitive Flexibility, and Sensation Seeking on the Tendency to Computer Games. The findings of this research can be applied for planning activities such as increasing students' awareness of the consequences and influences causing the inclination to computer games and their appropriate application.

student's tendency to computer games, brain-behavioral functions, cognitive flexibility, sensation seeking.

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INTRODUCTION

We live in a moment of introduction and development of technology on which each part of our life depends. Technology impacts our daily living through amusement, training, communication, businesses and lifestyle [1,4]. Computer games, which have become one of the most important recreation instruments for the youth,

were one of the huge technological advances [5]. Research on computer games on the adolescents has been important. Today's rise in computer games because of their important impact on the behavior and health of the community has led to the government's worriedness [1]. Previous studies showed that 68 percent of the teens have computer games as their weekly entertainment [6]. In the past, children were involved in playing with other kids, but today they spend most of their time on computer games, while these games cannot create a healthy emotional lifestyle, and human relationship for them [1,7,9]. However, studies reveal that the use of computer games plays a prominent role in the visual-motor coordination and individual cognitive functioning [10]. In psychological pathology, by designing the theory of brain-behavioral systems, Gary considers disturbances reflected among one of these processes. He suggested three different brain-behavioral systems on the theory of Reinforcement Sensitivity Theory (RST) that show personal differences: The Behavioral Inhibition System (BIS), the Behavioral Activation System (BAS), and the War-escape System [11]. He related the personal responses to the environmental stimuli to both the behavioral inhibition and activation system that are evaluated based on neurology: BAS is responsible for activation behaviors in response to rewards (positive affect) and BIS responsible for inhibitory behaviors in response to threats and punishment (negative effect) [12]. According to this concept, studies showed that BAS and BIS predicted the pathological activities in compulsive attitudes such as substance abuse, alcohol abuse, drug abuse, pathological gambling and internet addiction [13,14].

Nowadays, there has been an increasing focus on Cognitive Flexibility and the intellectual advantages that games may have on players. Cognitive flexibility shows the ability to solve a problem in one way and then move to fix a similar problem by a different manner [15]. Shift from one task to another needs the reconfiguration of the cognitive task set [16]. Green and Bavelier in their study showed that playing video games increases the players' visual attentional capability [17]. Another study claimed that Cognitive Flexibility was disrupted in these individuals [18]. These findings of the previous

studies seem somewhat contradictory. Therefore, it is imperative to examine the process of Cognitive Flexibility on people who play computer games to see which of these hypotheses is correct.

The tendency to Computer Games and Internet addiction is related with an increased frequency of externalizing issue attitudes and internalizing problem behaviors, which are linked to Sensation Seeking [19]. Sensation Seeking as one of a growth domains seems to be connected with maturational changes [20]. Previous investigations showed that Sensation Seeking have significant associations with online game addictions [21,22].

Thus, the increased prevalence of computer games among children and adolescents have made many researchers to determine the effects of these games on players. In Iran, there are limited number of studies on the impact of Tendency to Computer Games on players. Considering the increasing rate of Tendency to Computer Games among Iranian juveniles and youth, we conducted the present study to predict the student's Tendency to Computer Games based on The Brain-Behavioral Functions, Cognitive Flexibility and Sensation Seeking.

METHODS AND MATERIALS

Participant

This descriptive and correlational study was conducted on middle school students in Ardebil. The minimum sample size based on our goals with a 95% confidence interval, an error estimate of 5% was calculated using the Cochran formula. Among the pupils in Ardebil City, 214 students were selected through cluster sampling. Finally, 200 Students with the complete questionnaire and good cooperation enrolled in this research. The inclusion criteria were 12 to 17 years old, studying in intermediate schools, playing daily computer games over 45 minutes. This investigation authorized by Education Department of Ardabil City, Iran. We explained the research objectives, and participants were ensured that their information will remain confidential. Students who had the inclusion criteria and were willing to take part in the study completed in-

formed consent and agreement forms. Also, participants could resign from the course whenever they want, and the research were performed based on respect to the rights of the participants, anonymousness and confidentiality. In the next step, after coordinating with the Education Department of Ardebil City and Management of middle school, we administrated the study.

INSTRUMENTS

In this study, the research tool was selected based on the sample and the appropriateness of the measured values.

Brain-Behavioral Functions (BIS, BAS): this questionnaire comprises 20 self-report items created by Carver & White and is based on Gray's BIS/BAS theory which consist of one BIS scale, seven elements and three BAS scales: Reward Responsiveness, Drive and Fun Seeking. Answers based on a 4- point scale (1= disagree strongly to 4 = agree strongly). Cronbach's alpha coefficients of BAS subscales have been reported to be 74%, 73%, 76%, and 66% [23]. Abdulahi has also reported test-retest reliability for BAS scale to be 0.78% and for BIS scale to be 0.81% [24].

Cognitive Flexibility (CFI): is a short self-reported scale which includes 20 questions and designed by Dennis and Vanderwal. The method of scoring is based on a 7-point scale. In Iran, Soltani and et al revealed that the validity coefficient for retesting the total scale equals to 0.71% and Cronbach's alpha coefficient of the total scale is 0.90% [25].

Arnett Inventory of Sensation Seeking (AISS) is a self-report questionnaire that Arendt created and it consists of 20 elements divided into 2 sub-scales of 10 items, intensity and innovation. Responding based on a 4- point scale (from 1 = don't describe me at all to 4 = describes me very well). Subscale scores are derived from the entire elements and can range from 10 to 40. Six of the items are reverse keyed (innovation subscale= 3, 13, 17) and (Intensity subscale=2, 6, 10). The total score is obtained from the sum of the two subscales and higher scores showed greater levels of Sensation Seeking. Smorti & Guarnie-

ri reported that the Cronbach's alpha coefficient for the entire scale equals 70% [26].

The tendency to Computer Games: A researcher-made questionnaire was used to measure this variable. This scale included 10 questions assessing the type and rate of applying computer games on a 3-point scale (1 = disagree, 2 = I have no idea, 3 = I agree). In order to validate the questionnaire, the tendency to computer games used in the study of subject literature and experts' views and implementation of a preliminary sample. For this purpose, the questionnaire was provided to professors and professionals, after receiving the modifying ideas and adjustment of some questionnaire items, the questionnaires were presented to 18 individuals of the statistical population as a preliminary model and also according to the suggestions, this preliminary group were reassured the propriety of questions for the statistical community. The questionnaire's Cronbach's alpha coefficients obtained 74%.

Statistical Analyses

The required data were analyzed utilizing SPSS21 software. Analysis of the data was performed using descriptive statistics (mean and standard deviation), Pearson correlation coefficient with the significance level $P < 0.001$, and multiple linear regression analysis.

RESULTS

The demographic information is reported in Table 1. The descriptive indicators of the Brain-Behavioral functions, Cognitive Flexibility, and Sensation Seeking with the Tendency to Computer Games in students are reported in Table 2. In Table 3, the Correlation coefficient and in Table 4, the multilinear regression are presented.

The results in Table 1 revealed that from 200 participants, the age range were between 13-14 (62%) and 15-16 (38%). Also Education degree of the participants were first grade (31%), second grade (32%) and third grade (37%).

Table 1. Demographic characteristics of the study samples (N= 200)

Group	Levels	Frequency	Percentage
Student age	13-14	124	62
	15-16	76	38
	total	200	100
Student education	first grade	62	31
	Second grade	64	32
	Third grade	74	37
	total	200	100

The findings of Table 2 showed that the mean and standard deviation of the Behavioral Activation system, Inhibition Activation system, Cognitive Flexibility, Sensation Seeking and Tendency to Computer Games were respectively 25.67±3.9, 17.54±2.1, 84.33±5.2, 16.62±3.8 and 23.97±3.4.

Table 2. Descriptive indicators for brain- behavioral functions, cognitive flexibility, and sensation seeking with the tendency to computer games in the student's (n=200).

Variable	Min	Max	Mean, SD
Behavioral Activation System	9	34	25.67±3.9
Behavioral Inhibition System	5	26	17.54±2.1
Cognitive Flexibility	42	145	84.33±5.2
Sensation seeking	4	25	16.62±3.8
Tendency to Computer Games	7	40	23.97±3.4

The results in Table 3 revealed the existence of a significant correlation between Brain- Behavioral functions, Cognitive Flexibility, and Sensation Seeking with the student's Tendency to Computer Game. As a significant positive correlation exists between the tendency to Comput-

er Games with the BAS factor as 0.350, a significant reverse correlation about -0.224 exists between the Tendency to Computer Games with the BIS factor. A reverse correlation exists between Tendency to Computer Games and the Cognitive Flexibility factor as -0.266. A significant positive correlation about 0.311 exists between the tendency to Computer Games with Sensation Seeking.

Table 3. Correlation coefficient between the tendency to computer games and brain- behavioral functions, cognitive flexibility, and sensation seeking.

Variable	BAS	BIS	Cognitive Flexibility	sensation seeking
Tendency to Computer Games	0.350**	-0.224**	-0.266**	0.311**

**P<0.01

The results of Table 4 showed that Brain- Behavioral Functions, Cognitive Flexibility, and Sensation Seeking predict totally 0.24% of the variance in the student's Tendency to Computer Games (P< 0.01).

Table 4. The coefficients of the regression analysis of the brain- behavioral functions, cognitive flexibility, and sensation seeking with tendency to computer games.

Source	F	Beta	T	Sig	Adjusted R2
Behavioral Activation System	0.69	0.452	4.2	0.01	0.24
Behavioral Inhibition System		-0.301	-2.2	0.01	
Cognitive Flexibility		-0.327	-2.6	0.01	
Sensation seeking		0.429	3.9	0.01	

DISCUSSION

The present study examines prediction of the student's Tendency to Computer Games based on the Brain-Behavioral Functions, Cognitive Flexibility, and Sensation Seeking. Results showed significant relationships between Brain-Behavioral Functions, Cognitive Flexibility, and Sensation Seeking variables on the Tendency to Computer Games. Also, Brain-Behavioral Functions, Cognitive Flexibility and Sensation Seeking predicted Tendency to Computer Games. Based on the findings of this research, there are positive and significant associations between BAS function on the Tendency to Computer Games and negative significant associations between BIS function on the Tendency to Computer Games. BAS can be considered as a parasympathetic system in which a person tries to overcome obstacles and achieve his or her desired goals, while the BIS leads to disturbances, discomfort, negative emotions and punishment [27]. The findings of this research agree with Gray theory that says there is a positive correlation between BAS with pleasure activity, while there is a negative correlation between BIS and pleasures activities. This result aligns with the previous studies that found a high degree of BAS related to behaviors such as hope and joy, internet addiction, relief, aggression, seeking for desirable aims and high-risk factor, opposite to a large level of BIS connected with fear, disappointment, lack of motivation, physical illness and punishment [12- 14, 27, 28]. The BAS system associates with excitement, extroversion, and adventure, and because the computer games correlate with a certain excitement, we can explain the positive interaction between these two variables.

The finding of the present study indicates that, there is a significant negative relationship between Cognitive Flexibility to Computer Games tendency in students. Meanwhile, Cognitive Flexibility predicted Tendency to Computer Games. With a due attention to personal factors, those who are introverted and are less adaptive and have less communication skills are more likely to play computer games. The immediate consequence of these efforts is to get rid of the disturbing situation that the individual is experiencing at the moment, but in the long term, these harassments experiences lead to conditions

in which a person limits his life and doing anything to escape from these troublesome situations. Cognitive Flexibility is the mental processes that help individuals change their mental resources in the manner to adapt to events [18]. The result is in conformity with the findings which showed low levels of Cognitive Flexibility in the individual who plays computer games, accompanied with features and behaviors such as the denial of the problems, low emotional support, disconnected from other, daily arguments with parents, education issue, neglect of responsibilities and a physical problem [18, 29, 30]. Thus, People who have Cognitive Flexibility use alternative justifications, reconfigure their cognitive framework and accept challenging cases or stressful circumstances more than those to have lower Cognitive Flexibility.

According to the other findings, there is a significant positive relationship between Sensations Seeking on tendency the computer games in students. Also, Sensation Seeking predicted Tendency to Computer Games. The tendency to Computer Games helps to adventure and explore new phenomena in Sensation-Seeking individuals to escape the repetitive experiences of life. In another words, Sensation Seeking provides a mechanism to overcome fatigue, which is an association with the rewarding motives. In fact, these people are more adventurous and more likely to take dangerous behaviors than others. The results are in accordance with the previous findings which showed that the tendency to computer games relates to the level of Sensation Seeking [19- 22]. These individuals have most tendencies to discover unknowns through a computer game and they believe they can express their emotions in this way.

Study limitations

This investigation had limitations that should be regarded in describing the data. Participants were evaluated by self-report scale, which may not be enough appropriate to get accurate data. The present research is a cross-sectional study. The correlation between the variables studied may be due to alternative elements, which can only be controlled by their survey of the role of each in the creation of such types and further,

recognizing that the present study was carried out among the students of Ardabil Province, the discretion should be held to generalize the results. So it is suggested that this research be done in other societies.

CONCLUSION

The findings revealed that there was a significant relationship between Brain-Behavioral Functions, Cognitive Flexibility, and Sensation Seeking in the student's Tendency to Computer Games. Therefore, it is urgent to provide programs for the proper management of these variables on students by school officials and families. Despite the existence of many surveys of computer games and the factors influencing it, in Iran, where a large part of the population is adolescents and there is a high prevalence of computer games in it, there are few researches which have addressed this issue, which requires a lot of studies on this topic in the future.

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Conflict of interest

The authors have no conflict of interest.

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