

Cognitive Control and Judicial Bias of Adolescents with and without Internet Addiction: A Comparative Study

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Abstract

Cognitive control is the intrapersonal conflicts between logic and lust, cognition and incentive, planning and internal action, which results in the dominance of the first part of each pair over the second part. A cognitive bias refers to a type of cognitive vulnerability in information processing. Today, the Internet has tied with human life, but addiction to the internet has adverse effects on people especially adolescents who have no skill in cognitive control. This study aimed to determine the difference between cognitive control and judicial bias in two groups of adolescents with and without internet addiction. The population consisted of male and female second-grade high school students in district 2 of Tehran in 2020-2021. The sample size was 16000 students. 18 schools were selected using the random clustering sampling method. The research tools were the Young internet addiction test (1999), Grasmic et al (1993) self-control scale, and Foa et al (1996) negative social probability scale. The data were analyzed by SPSS 26 using multivariate analysis of variance (MANOVA) and the Mann-Whitney U test. Results showed that the total mean score of cognitive control in the groups of adolescents with internet addiction was lower than adolescents without internet addiction. The comparison of subscales indicated that, except for the subscale of Preferences for physical activities, there were significant differences in the subscales of impulsiveness, convenience, risk-taking, self-centeredness, and expressing anger ($P \leq 0.01$). The mean scores of these variables were higher in the group of adolescents with internet addiction. Regarding the variable of judicial bias, the Mann-Whitney U test showed that the mean scores of the adolescents with internet addiction were higher than those of the adolescents without internet addiction, and the addicted adolescents showed more judicial biases ($P \leq 0.01$). The results revealed the requirement to perform strategies to prevent and cope with internet addiction.

Keywords: internet addiction; cognitive control; judicial bias.

Introduction

In many complicated and dual situations, one has to choose, the person needs to use cognitive control. Cognitive control is the intrapersonal conflicts between logic and lust, cognition and incentive, planning and internal action, which results in the dominance of the first part of each pair over the second part [1]. Cognitive control is not a single process but a regulation of a package of cognitive processes. Cognitive control failure is associated with the concept of impulsivity, indicating an inability to think about the outcomes of behavior. Thinking about the outcomes but acting based on immediate happiness results in unpredicted behavior [3]. People use their cognitive control when they are going to achieve a long-term goal. Humphrey divided the dimensions and constructs of cognitive control into three parts and believed that these three dimensions have a

positive mutual relationship so that investment in each part can predict the development of other parts. He introduced the dimensions as individual cognitive control, interpersonal cognitive control, and self-assessment or self-knowledge. Self-control refers to the person's ability to limit himself/herself. In their general theory of crime, Gottfredson and Hirschi used the concept of weak self-control to explain the commission of all similar and criminal behaviors. To assess the variable of self-control, six dimensions have been considered: impulsiveness, convenience, risk-taking, preferences for physical activity, self-centeredness, and expression of anger and volatile temper [4].

Comparing cognitive control with external supervision is the best way to show the need for cognitive control. The individuals with an external source of control, who believe that their behavior and attitude do not

affect the boosters they receive do not value making efforts to improve their conditions. In contrast, the individuals with an internal source of control have control over their conditions and behave under the source [5]. Gelasser (2011) as the founder of the approach of selection theory and reality therapy argued the conceptual role of external control in human relations, which is the root of numerous mental-social problems [6]. External control is the most precise and the shortest term for seven harmful habits: blaming (criticizing), complaining, threatening, nagging, punishing, bribing, and controlling others. These habits are considered as the external source of control because you can control others by using these habits [7]. It can be argued that cognitive control can be much more effective than external supervision if it is created and reinforced because there is always a concern about the external supervision if they are valid and authentic or malicious intentions are involved.

People with poor cognitive control are more vulnerable to facing severe stress because they can regulate unexpected cognitions [8]. Although adolescents' performance is gradually developed, they have limitations in cognitive control especially cognitive flexibility until the early 20s. Addiction not only threatens individuals' physical and mental but also their social and psychological health. However, mental, social, and cognitive dysfunctions can also direct the person towards addiction [9]. A cognitive bias refers to a type of cognitive vulnerability in information processing (attention, judgment, interpretation, and memory); that is, special conditions directing cognitive processes are disrupted toward a special direction. In other words, it is a defect in the perception of evaluation, judgment, and interpretation of events, which is resulted from disregard or negligence of some aspects to the benefit of others [10]. Human beings usually cannot see the new decisions from a neutral reference point. They usually involve their previous judgments about the previous decisions in their new decisions. In this regard, Biserman believes that people should be educated to consider each decision independently of previous decisions [11]. Judicial bias refers to the extreme estimation of outcomes or the probability of negative events occurrence. Many studies have investigated the judicial biases in socially anxious people as compared to the subjects in the control group [12]. The results showed that socially anxious people have judicial biases that are content-based content. Recent studies have revealed two types of judicial biases, which can be important in understanding social anxiety. They are the extreme estimation of the occurrence probability of social negative events (for example, how likely you are to feel embarrassed and ashamed among people?), and the extreme estimation of the outcomes of social negative events occurrence (for example, how bad it will be if you feel ashamed and embarrassed among people) [12]. Biases are normally applied unconsciously and automatically and occur without people being aware of their outcomes and existence. Biases occur in all aspects of life. People's judgment in life more relies on their cognitive biases than the conventional methods of analysis [13]. Extreme estimations of the occurrence probability and outcomes of social negative events may be the result of people's cognitive biases [14].

According to the cognitive theory, internet addiction disorder is due to defective cognitions or defective cognitive processing. Therefore, treatment should be planned based on the correction of cognitive processes [15]. Excessive use of the internet leads to mental disorders and threatens the person's mental health [16]. The internet provides most of the basic human needs. But such an increasing reliance on and exposure to the internet increases the likelihood of internet addiction [17]. Many people use the internet to manage and get rid of unwanted emotions such as stress loneliness, depression, and get out of these emotions, which is the starting point of internet addiction [18]. Pathological use of the internet or internet addiction is the internet use with poor user control, which can result in impulse control disorders characterized by signs such as tolerance (the need for more time to reach the same level of initial desirability) and withdrawal symptoms [19]. The internet acts like a two-

edged sword, which can be extensively used through appropriate education and culture. Otherwise, improper use, inappropriate education, and lack of culture in using the internet destroy the human's social and individual identity [19]. The increasing development of the internet and its more adverse effects on internet addiction has led to consider this type of addiction as the most important behavioral addiction [20]. Given the increasing number of adolescent internet users and concerns about internet addiction as well as its mental and behavioral harmful effects on behaviors and biases and since there has been conducted no similar study on this issue in adolescents, the present study aimed to find an answer to the question if the cognitive control and judicial biases are different in two groups of the adolescents with and without internet addiction.

Objectives

This study aimed to determine the difference between cognitive control and judicial bias in two groups of adolescents with and without internet addiction.

Patients and Methods

This study was a comparative-causal research. The population consisted of male and female second-grade high school students in district 2 of Tehran in 2020-2021. The sample size was 16000 students. 18 schools were selected using the random clustering sampling method. A total number of 349 questionnaires were expected to be filled. A score of 50 was considered to be the cut point (in the Young internet addiction test). 43 students were placed in the group of internet addiction (the mean higher than 50) and 178 adolescents were placed in the group of the non-addicted. To balance the number of samples in the two groups, the adolescents in the group of the non-addicted, whose mean scores were the minimum (lower than 25), were selected. Finally, the two groups of 42 were prepared for analysis (in each group, one subject was excluded due to inappropriate answers to the tools of judicial biases and cognitive control).

Instruments

To meet the purposes of the study, three questionnaires were used: IAT internet addiction test, Grasmick et al (1993) self-control test, and negative social probability questionnaire (1999).

Young internet addiction test (IAT): it was developed in 1999 by Kimberly Young. The questionnaire has 20 items and determines if excessive use of the internet has affected the person's different aspects of life. It is scored based on a 5-option Likert scale ranging from rarely to always (rarely=0, always=5). To calculate the total score, the scores of different parts of the questionnaire are added. It ranges between 20 and 100. The higher total score indicates higher addiction to the internet. This questionnaire is standard and its validity and reliability were reported in previous studies using Cronbach's alpha 0.90. The Persian version of this scale has been used in Iran and Nastozaei and Ghasemzade determined its reliability by the Cronbach's alpha as 0.81 and 0.88, respectively (quoted by Bahri et al, 2011). Hamidi et al (2015) also reported its Cronbach's alpha as 0.94. The reliability of the questionnaire in this study was 0.95 [19].

Grasmick et al (1993) self-control test: contains 24 items assessing the person's self-control status. This questionnaire has 6 subscales of impulsiveness, convenience, risk-taking, preferences of physical activities, self-centeredness, and expressing anger. Impulsiveness included the items 1 to 4; convenience (seeking comfort, leisure, and being lazy) included the items 5 to 8; risk-taking (uncertainty and unawareness about the outcomes of an action) included the items 9 to 12; preferences of physical activities (exercising or any activity indicating dynamism and vitality) included the items 13 to 16; self-centeredness (lack of ability to distinguish between self and others) included the items

17 to 20; expressing anger (a psychological state ranging from slight annoyance to severe anger) included the items 21 to 24. The answers were scales based on a 4-option Likert scale (1=totally agree to 4=totally disagree). The low score on this scale shows low self-control. The validity and reliability of the tool were calculated by Li SD (2004) using the Cronbach's alpha coefficient as 0.92 [21].

Foa et al (1996) probability/ outcome questionnaire for children: each questionnaire consisted of 20 similar items including 10 negative social events and 10 negative non-social events that measure people's judgment of probability/outcome of negative social events and negative non-social events. Foa et al (1996) made changes in the items of the questionnaire based on the adolescents' social experiences to be applied for adolescents. In the probability questionnaire, the subject ranks the probability of negative social events and negative non-social events based on a 9-point scale (it is not possible=0 to completely possible=8). This questionnaire contained two subscales: social probability. In the questionnaire of the outcome, the subject ranks the possibility of negative social events and negative non-social events based on a 9-point scale (not bad at all=0 to completely bad=8). This questionnaire also contained two subscales: social outcomes and non-social outcomes. The alpha coefficients ranged from 0.85 to 0.97 [12]. Considering the purpose, the social probability questionnaire was used in the present study. The reliability of the social probability questionnaire was calculated as 0.84 by Ostavar and Kheyr (2008). The reliability of the questionnaire was 0.87 in the present study.

Ethical Considerations

Questionnaires were given to the samples anonymously. The participants were assured that the data from the questionnaire would be used in line with the objectives and hypotheses of the present study. Responding to the questionnaires was completely voluntary and free, so that people would quit if they did not want to participate in the research.

Hypotheses

1. The cognitive control in the two groups of adolescents with and without internet addiction is significantly different.
2. The judicial biases in the two groups of adolescents with and without internet addiction are significantly different.

Results

The normality of the demographic variable is investigated based on the skewness and stretching and the parametric independent t-test was used to compare the variables. There was no significant difference between the two groups in demographic characteristics, and the two groups were homogenous in terms of demographic variables ($P>0.05$).

Table 1 shows the mean and standard deviation of the research variables including judicial biases, cognitive control, and its dimensions in the two groups of adolescents with and without internet addiction.

Indicator		The group of adolescents				Total	
		Without internet addiction (n=42) Number (percentage)		With internet addiction (n= 42) Number (percentage)			
Variable							
Control	Impulsiveness	12.90	2.79	10.26	2.61	11.58	2.99
	Convenience	12.54	2.75	9.80	3.03	11.17	3.18
	Risk-taking	12.80	3.24	11.04	3.13	11.92	3.29
	Preferences for physical activity	10.09	2.82	9.14	3.12	9.61	3.01
	Self-centeredness	12.61	2.69	11.02	2.57	11.82	2.73
	Expressing anger	12.07	3.14	9.66	3.10	10.86	3.33
The total score of cognitive control		73.04	11.52	60.95	9.78	67	12.24
The total score of judicial biases		9.45	6.70	28.45	17.08	18.95	16.05

Table 1: The descriptive statistics of judicial biases, cognitive control, and its dimensions for both groups

The results of Table 1 shows that the mean score of judicial biases in the adolescents with internet addiction was higher than that of the group of adolescents without internet addiction. But the mean score of cognitive control and its dimensions in the group of adolescents without internet addiction was higher than that of the group with internet addiction.

Hypothesis 1: there is a difference in cognitive control and its dimensions between the two groups of adolescents with and without internet addiction.

MANOVA was used to investigate the dimensions and an independent t-test was used to examine the total score. Assumptions are required to be

met to use these tests before implementing the test. The most important assumptions were normal distribution of data, homogeneity of variances, homogeneity of the covariance matrix, lack of outlier data, and lack of alignment of dependent variables.

According to the results of Table 2, the total effect of the group was significant because F of the four tests (with the value of 5.507 and freedom degrees of 6 and 77) was significant at $P<0.001$. Therefore, there was a significant difference between the two groups of adolescents with and without internet addiction in at least one of the dimensions of cognitive control.

Test	Value	F	Df	Df _E	P	Partial Eta squared (Δ^2)
Pillay effect	0.300	5.507	6	77	<0.001	0.300
Wilks' Lambda	0.700	5.507	6	77	<0.001	0.300

Hoteling effect	0.429	5.507	6	77	<0.001	0.300
Roy's largest root	0.429	5.507	6	77	<0.001	0.300

Table 2: Significance test for multivariate analysis of variance for the dimensions of cognitive control

As seen, the multivariate analysis of variance for the variable of cognitive control was significant. To investigate what dimension was affected by the total effect, the results of the multivariate analysis of variance are presented in Table 3.

Variable	Sum of squares	DF	Squares mean	F	Significance	Partial eta squared (Δ^2)
Impulsiveness	146.679	1	146.679	20.055	<0.001	0.197
Convenience	157.440	1	157.440	18.795	<0.001	0.186
Risk-taking	65.190	1	65.190	6.391	0.013	0.072
Preference for physical activity	19.048	1	19.048	2.143	0.147	0.025
Self-centeredness	53.440	1	53.440	7.703	0.007	0.086
Expressing anger	121.440	1	121.440	12.446	<0.001	0.132

Table 3: The results of multivariate analysis of variance to determine the intergroup difference in the dimensions of cognitive control

Table 3 shows that all the subscales, except for the subscale of preference physical activity, had a significant difference. According to the results of Table 3, it is inferred that the difference between the means of the two groups under study was significant in subscales of impulsiveness (F=20.055), convenience (F=18.795), risk-taking (F=6.391), self-centeredness (F=7.703), and expressing anger (F=12.446) at P<0.05. There could be found no significant difference in the subscale of preference of physical activity between the two groups of adolescents with and without internet addiction. Considering the means of the two groups, the results showed that the dimensions of cognitive control in the

adolescents with internet addiction were in lower degrees than those of the adolescents without internet addiction.

The independent t-test was used to determine the difference between cognitive control between the adolescents with and without internet addiction. To perform the test, the assumptions of normality and homogeneity of variances were investigated. According to the results, the normality of cognitive control was confirmed based on the indicators of skewness and stretching. Also, the lack of significance of Levin test results (F=2.588, P=0.112) indicated that the homogeneity of variances was established. The results of the t-test with the assumption of the equality of the variances are presented in Table 4.

Statistic t	Df	Sig.	Mean difference	Effect size	Confidence interval	
					Up	Down
5.183	82	<0.001	12.095	1.121	16.737	7.452

Table 4. The results of the t-test to investigate the difference between the groups of adolescents with and without internet addiction in the variable of cognitive control.

As indicated in the table, the independent t-test shows a significant difference in the total score of cognitive control. According to Table 4, the mean score of cognitive control in the group of adolescents with internet addiction was lower than the other group (p<0.001). Therefore, this part of the hypothesis is accepted that there is a significant difference between the two groups of adolescents with and without internet addiction in cognitive control. According to Hedges' effect size of cognitive control (1.121), the difference was high in the population.

in judicial biases.

An independent t-test was used to measure the difference in judicial biases between the two groups under study. To this end, the assumptions of normality and homogeneity of variances were investigated. According to results, the variable of judicial bias was confirmed due to the indicators of skewness and stretching, but according to the significance of the Levin test (F=34.503, P<0.001), the assumption of variances homogeneity was not established. Therefore, the results of the t-test with the assumption of the equality of variances are presented in Table 5.

The second hypothesis: There is a difference between the groups of adolescents with and without internet addiction

Statistic t	Df	Sig.	Mean difference	Effect size (Hedges' g)	Confidence interval	
					Up	Down
-6.10	53.335	<0.001	-19	1.451	-13.321	-24.678

Table 5: The results of independent t-test to investigate the difference in groups of adolescents with and without internet addiction in judicial biases

As observed in this table, the two groups under study had a significant difference in the variable of judicial bias. According to Table 5, the mean score of judicial bias in the group of adolescents with internet addiction was higher than the other group ($P < 0.001$). Therefore, this part of the hypothesis is accepted that there is a significant difference in judicial

biases between the two groups of adolescents with and without internet addiction. According to Hedges' effect size of judicial bias (1.451), the difference was high in the population.

Table 6 showed the results of the Mann-Whitney U test to investigate the difference between the adolescents with and without internet addiction.

Group	(Third quarter-first quarter) middle	Statistic value	Significance level
Without internet addiction	7.500 (4-15)	Mann-Whitney U=283.500	<0.001
With internet addiction	26 (14.75-42.25)		

Table 6: The results of the Mann-Whitney U test in judicial bias between the two groups under study

As indicated in this table, the middle score of judicial bias in the group of adolescents with internet addiction was higher than the other group. The results of the Mann-Whitney U test in Table 6 showed that the middle score of judicial bias in adolescents with internet addiction was higher than the other group ($P < 0.001$). Therefore, the hypothesis was accepted that there is a significant difference between the two groups under study in judicial biases.

Discussion

Cognitive control and judicial biases are significantly different in the two groups of adolescents with and without internet addiction. The results of the independent t-test showed that the mean score of cognitive control in adolescents with internet addiction was lower than the other group; therefore, the hypothesis was accepted that there is a significant difference between the two groups of adolescents with and without internet addiction in cognitive control. That is, the adolescents with internet addiction had lower cognitive control than the adolescents without internet addiction. According to Hedges' effect size of cognitive control, it was indicated that the difference was high in the population. Using multivariate analysis of variance, Akbari Charmhini et al (2018) in an article entitled "Cognitive Control in Two Groups of Adolescents with High and Low Interest in the Internet" showed that the two groups under study had no significant difference in cognitive inhibition but the significant difference in London Tower Test indicated a significant difference in their cognitive planning; in other words, the group of adolescents with low interest in the internet had better performance in London Tower Test. According to the results of the research, it seems that cognitive functions including planning are important factors that must be considered in controlling and preventing addiction in adolescence. The results of this study are in line with those found in the present study.

The results of multivariate analysis of variance for measuring the significance of each subscale of cognitive control showed that the differences in the subscales of impulsiveness, convenience, risk-taking, self-centeredness, and expressing anger between the two groups under study were significant. There was no significant difference between the groups of adolescents with and without internet addiction in the subscale of preference of physical activity, and the adolescents with internet addiction had higher scores than the other group in impulsiveness, convenience, risk-taking, self-centeredness, and expressing anger. Since there could be found no study on the subscales of cognitive control, it was not possible to compare the present study with the previous studies. The results of the Mann-Whitney U test showed that the middle score of judicial bias was higher in adolescents with internet addiction; therefore, internet-addicted adolescents are more influenced by judicial biases in their decisions.

Conclusions

The hypothesis was confirmed that the difference between the two groups of adolescents with and without internet addiction was significant in judicial bias. Thus, all the secondary hypotheses were accepted except for the subscale of preference for physical activity. According to Hedges' effect size of judicial bias, the difference was high in the population. The results were not possible to be compared with the results of the previous studies since there was no related study. Regarding the purpose, the present study used the subscale of negative social events probability. In this study, it was not possible to control some of the factors affecting the variables under study, including family conditions, economic conditions, and home quarantine due to the prevalence of COVID-19, and stress for the entrance exam. For further and more precise investigation, it is suggested to researchers to conduct studies with emphasis on the duration of internet addiction in students and research on the effect of other types of addiction on normal groups.

Footnotes

Authors' Contribution:

Study concept and design: Farideh Hamidi and Farnaz Iman Shoar; acquisition of data and intervention: Farnaz Iman Shoar; statistical analysis and interpretation: Farideh Hamidi and Farnaz Iman Shoar; study supervision: Farideh Hamidi.

Conflict of Interests: Authors declare that they have no conflict of interest.

Ethical Approval: All ethical principles were considered in this research. The research extracted from the MSc dissertation of educational psychology in Electronic Azad Islamic University (Ref.no.2698633).

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Patient Consent: Informed consent was obtained from all individual participants included in the study.

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