

Social Networks Use and Executive Functions: The Mediating Role of Social Cognition in University Students

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Abstract

Introduction: This study aimed to examine the relationship between the extent of social network use and executive functions, with the mediating role of social cognition.

Method: The research is fundamental in nature and employs a descriptive-correlational design using Structural Equation Modeling (SEM) for data analysis. The population consisted of all students at Imam Khomeini International University in Qazvin across all academic levels during the 2023–2024 academic year. A sample of 250 students was selected through cluster random sampling. Data were collected using the Social Networks Usage Questionnaire (SNUQ), the Barkley Deficits in Executive Functioning Scale (BDEFS), and the Social Cognition Questionnaire (SCQ). Structural equation modeling (SEM) was conducted using AMOS 24.

Results: The proposed model demonstrated good fit indices. Social network use showed a significant positive effect on executive dysfunction ($\beta = 0.27, p = .001$) and a negative effect on social cognition ($\beta = -0.51, p = .001$). Social cognition negatively predicted executive dysfunction ($\beta = -0.58, p = .001$), mediating the relationship between social network use and executive functions (indirect effect = 0.31, 95%).

Conclusion: Excessive social network use may impair social cognition and executive functioning both directly and indirectly. These findings highlight the importance of fostering digital literacy to mitigate the cognitive consequences of problematic social media use.

Keywords: Social Networks, Executive Functions, Social Cognition, University Students

Introduction

The rapid advancement of internet technologies, fueled by the widespread adoption of smartphones and digital devices, has transformed the way individuals communicate and access information. Among these technologies, social networking and online communication platforms have become integral to daily life, enabling users to connect, share, and interact globally [1, 2]. While extensive research has explored the psychological and behavioral impacts of social network use, its influence on brain and cognitive functions remains less clearly understood [3]. Previous studies have predominantly emphasized the negative emotional and psychological consequences of social networks—such as anxiety, depression, and loneliness—whereas their potential effects on higher-order cognitive processes, particularly executive functions, have received comparatively little attention [1, 4, 5]. Executive functions are a set of cognitive abilities associated with the prefrontal cortex, encompassing skills such as problem-solving, working memory, decision-making, planning, and organization [6]. Emerging evidence suggests that excessive use of social networks may contribute to cognitive overload, emotional dysregulation, and reduced executive functioning, especially among adolescents and young adults [7]. From the perspective of Cognitive Load Theory, the constant influx of online information can overwhelm cognitive

resources, impairing attention and executive control [8, 9]. Moreover, Social Comparison Theory posits that frequent exposure to idealized representations of others on social networks can elicit negative self-evaluations, anxiety, and diminished cognitive performance [10].

Social cognition—defined as the mental processes involved in perceiving, interpreting, and responding to social information—is another cognitive domain that may be affected by extensive social network use [11, 12]. It encompasses the ability to recognize others' emotions, infer intentions, and adjust behavior according to social contexts [13, 14]. The rapid growth of digital communication, particularly during the COVID-19 pandemic, has amplified reliance on online interactions. While such platforms facilitate social connection, they may also reduce the depth and quality of interpersonal communication, potentially impairing empathy, theory of mind, and emotional perception [15, 16].

Recent research indicates a strong interdependence between social cognition and executive functions, both of which rely on overlapping neural networks within the prefrontal cortex [17]. According to the Social-Cognitive Resource Framework, executive functions and cognitive reserve jointly support the processing of complex social information, thereby influencing the effectiveness of social cognition [13, 18, 19]. Consequently, chronic or excessive engagement with social networks may simultaneously disrupt both cognitive domains, leading to

broader impairments in psychological functioning over time.

Despite the increasing interest in the cognitive impacts of social networks, significant research gaps persist, particularly concerning the specific mediating role of social cognition. While it is well established that executive functions and social cognition are interrelated and essential for social adaptation [20], the current literature does not explicitly identify social cognition as a mediator in the relationship between social network use and executive functions. Most studies examining mediation have concentrated on factors such as emotional disturbance, sleep quality, affective state, stress, or physiological measures like blood pressure [1, 21]. The lack of comprehensive models that integrate social network use, specific components of social cognition, and executive functions represents a significant deficiency. This gap indicates an underexplored pathway through which social networks may influence cognitive abilities, underscoring the necessity for research that directly investigates whether alterations in social cognitive processes, induced by social network engagement, subsequently affect executive functions. Therefore, the present study aims to investigate the mediating role of social cognition in the relationship between social network use and executive functions among university students. Figure 1 illustrates the proposed conceptual model guiding this research.

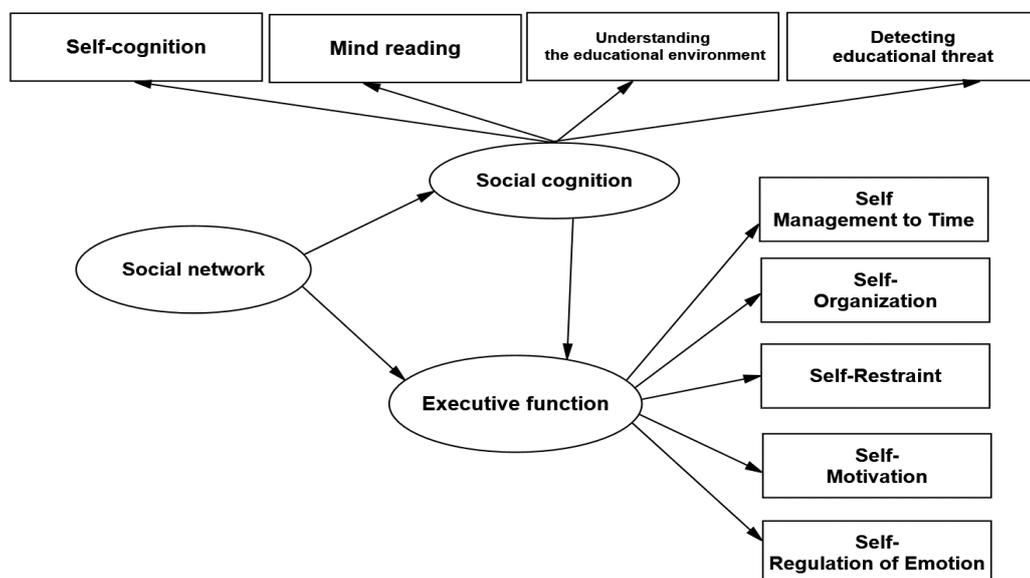


Figure 1. Structural equation model of social network use, social cognition, and executive functions.

Method

This applied study employed a descriptive–correlational design analyzed through Structural Equation Modeling (SEM). The population included all undergraduate, master's, and doctoral students at Imam Khomeini International University (IKIU) in Qazvin during the 2023–2024 academic year. A cluster random sampling method was used. From the seven university faculties, five (Social Sciences, Humanities, Basic Sciences, Engineering, and Islamic Studies) were randomly selected. Within each

faculty, two to three classes were chosen proportionally to faculty size, with class sizes ranging from 15 to 35 students, yielding 260 distributed questionnaires. Following Tabachnick and Fidell's (2007)[22] guideline that samples exceeding 200 are adequate for SEM, the final sample met this requirement. Inclusion criteria were willingness to participate, informed consent, membership in at least one social network, and proficiency in Persian. Participants who did not meet these criteria or provided incomplete data were excluded, resulting in 250 valid

responses for analysis. Data were gathered through standardized self-report questionnaires. Confirmatory Factor Analysis (CFA) confirmed acceptable construct validity, and Cronbach's alpha coefficients above 0.70 indicated satisfactory reliability. Ethical approval was obtained from the Research Ethics Committee. After explaining the study objectives and ensuring confidentiality, questionnaires were administered and collected in person during class sessions. Finally, the collected data were analyzed using SPSS version 27 for descriptive and preliminary analyses and AMOS version 24 for structural equation modeling.

The tools used in this study were as follows:

Social Networks Usage Questionnaire (SNUQ): The Social Networks Usage Questionnaire, developed and validated by Rasoulabadi (2015), is a 13-item instrument designed to assess social networks usage among university students. Items are answered using a five-point Likert scale (e.g., from "Strongly Disagree" to "Strongly Agree"). Two methods of analysis are possible: (a) analysis of individual items and (b) analysis of the total score. Content validity was assessed through expert review, and construct validity was investigated using factor analysis. The questionnaire demonstrated strong internal consistency, with a Cronbach's alpha coefficient of .85. Cronbach's alpha coefficient was employed to determine the reliability of the questionnaire. The results of Rasoulabadi's study (2015) demonstrated that Cronbach's alpha for the total test score (0.78) and for individual items exceeded the standard threshold, confirming the instrument's reliability [23]. CFA confirmed a unidimensional structure ($\chi^2/df = 2.1$, CFI = 0.92, RMSEA = 0.06), with AVE = 0.54 and CR = 0.78. In the present study, the reliability of this tool was also estimated using Cronbach's alpha, yielding a coefficient of 0.83, indicating strong reliability.

Barkley's Deficits in Executive Functioning Questionnaire (BDEFQ): The 89-item self-report instrument applies to individuals aged 18 to 81 and uses a four-point Likert scale ranging from "Never" to "Always." Scoring follows a Likert scale. Individual scores are derived from the sum of each subscale. A high score in each subscale may indicate a deficiency in that area of executive functioning. The scale comprises five subscales, which measure deficits in five executive functions: Time Management (21 items), Self-Organization/Problem-Solving (24 items), Self-Restraint (19 items), Self-Motivation (12 items), and Self-Regulation of Emotion (13 items). The psychometric properties of this scale have also been investigated for use within the Iranian population. The Cronbach's alpha coefficient for the whole test was 0.97, and the correlation coefficients of the total score with the subscales of time self-management, self-organization/problem-solving, self-control/inhibition, self-motivation, and self-regulation of emotion were 0.89, 0.90, 0.84, and 0.83, respectively. The results of confirmatory factor analysis also showed that the five-factor model of Barkley's deficits in executive functioning scale (time self-management, self-motivation, self-control, inhibition, problem-solving, and self-regulation of emotion) has a good fit in the Iranian population [24].

Also, in the present study, the reliability coefficient of the total score of this instrument was estimated to be 0.95 by the Cronbach's alpha method, and the Cronbach's alpha coefficient for each of the subscales of time management was 0.78, organization was 0.93, self-control was 0.67, motivation was 0.71, and self-regulation was 0.91. CFA supported the five-factor structure ($\chi^2/df = 2.3$, CFI = 0.90, RMSEA = 0.07), with AVE ranging from 0.52 to 0.65 and CR above 0.7.

Social Cognition Questionnaire (SCQ): This questionnaire was designed to assess the social cognition status of students and university students. The subscales include self-awareness, theory of mind, threat detection, and self-regulation. The questionnaire consists of 19 items, measured on a five-point Likert scale ranging from "almost never" (1) to "almost always" (5). Thus, the total score ranges from a minimum of 17 to a maximum of 85. The Kaiser-Meyer-Olkin (KMO) measure for this scale was 0.84, and Bartlett's test of sphericity yielded a chi-square value of 2491.28 with 171 degrees of freedom, which was statistically significant at $p < 0.0001$ [25]. These results indicate the adequacy of the sample for factor analysis. In the study by Reihani et al., internal consistency analyses provided evidence for the convergent validity of the SCQ. Moreover, the reliability coefficients for the subscales of this questionnaire were as follows: Self-Cognition: 0.73, Mind Reading: 0.72, Detecting Educational Threat: 0.71, and Understanding the Educational Environment: 0.74. The overall reliability of the Social Cognition Scale was reported as 0.84. Furthermore, in the present study, the Cronbach's alpha coefficient for the total score of this instrument was estimated at 0.93. The Cronbach's alpha values for each subscale were as follows: Self-Cognition: 0.83, Mind Reading: 0.82, Detecting Educational Threat: 0.85, and Understanding the Educational Environment: 0.78. CFA confirmed the four-factor structure ($\chi^2/df = 2.0$, CFI = 0.93, RMSEA = 0.06), with AVE = 0.58 and CR = 0.80.

Results

The present study's sample consisted of 250 university students, of whom 59.2% were female and 40.8% were male. The majority of participants (88%) fell within the 18–25 age range. Regarding educational level, the highest proportion of students was undergraduates (52%), while the lowest proportion belonged to doctoral students (16%). Additionally, 93.6% of the students were single, and 6.4% were married. Descriptive statistics, skewness, and kurtosis indices have been presented in Table 1. A univariate normality checks Table 1 indicated that none of the skewness or kurtosis values exceeded the acceptable range of (-2, +2), suggesting that the data were approximately normally distributed. In the present study, Mardia's coefficient was 3.12, confirming that the data followed a multivariate normal distribution. The tolerance values for predictor variables were found to be greater than 0.1, and the VIF values were less than 10. Furthermore, since the Durbin-Watson statistic (1.82) falls within the acceptable range of 1.5 to 2.5, it can be concluded that the independence of the residuals assumption was met. Before conducting

structural equation modeling, the correlation coefficients among study variables were examined using Pearson's correlation coefficient, with results presented in Table 1. Accordingly, given that the significance level was below 0.05, all relationships between the variables were found to be statistically significant.

In this section, the proposed model was evaluated using structural equation modeling. The final model output from AMOS software is shown in Figure 2. An analysis of fit indices was conducted to evaluate the model fit. The fit indices for the research model have been presented in Table 2. The results, show that the final research model achieved an adequate fit.

Table 1. Descriptive Statistics and Correlations of the Variables of Study

Variable	1	2	3.	4.	5.	6.	7.	8.	mean	S.D	S	K
1.Social networks	1								25.52	6.61	-0.23	0.15
2. Executive Function	0.44**	1							188.20	30.06	-0.36	0.18
3. Self- Management of Time	0.32**	0.39**	1						46.3	6.69	-0.23	0.08
4. Self- Organization	0.40**	0.49**	0.66**	1					48.09	11.06	-0.26	0.02
5. Self-Restraint	0.39**	0.45**	0.56**	0.7**	1				41.09	5.29	-0.26	0.01
6. Self-Motivation	0.42**	0.47**	0.64**	0.68**	0.68**	1			25.56	6.92	-0.22	0.01
7. Self-Regulation of Emotion	0.41**	0.41**	0.52**	0.66**	0.73**	0.66**	1		36.14	4.23	-0.33	0.04
8. Social Cognition	-0.46**	-0.58**	-0.50**	-0.59**	-0.52**	-0.50**	-0.48**	1	66.05	12.16	-0.24	0.04

N = 250; M Mean; SD Standard deviation; S Skewness; K Kurtosis; **= p<0.05

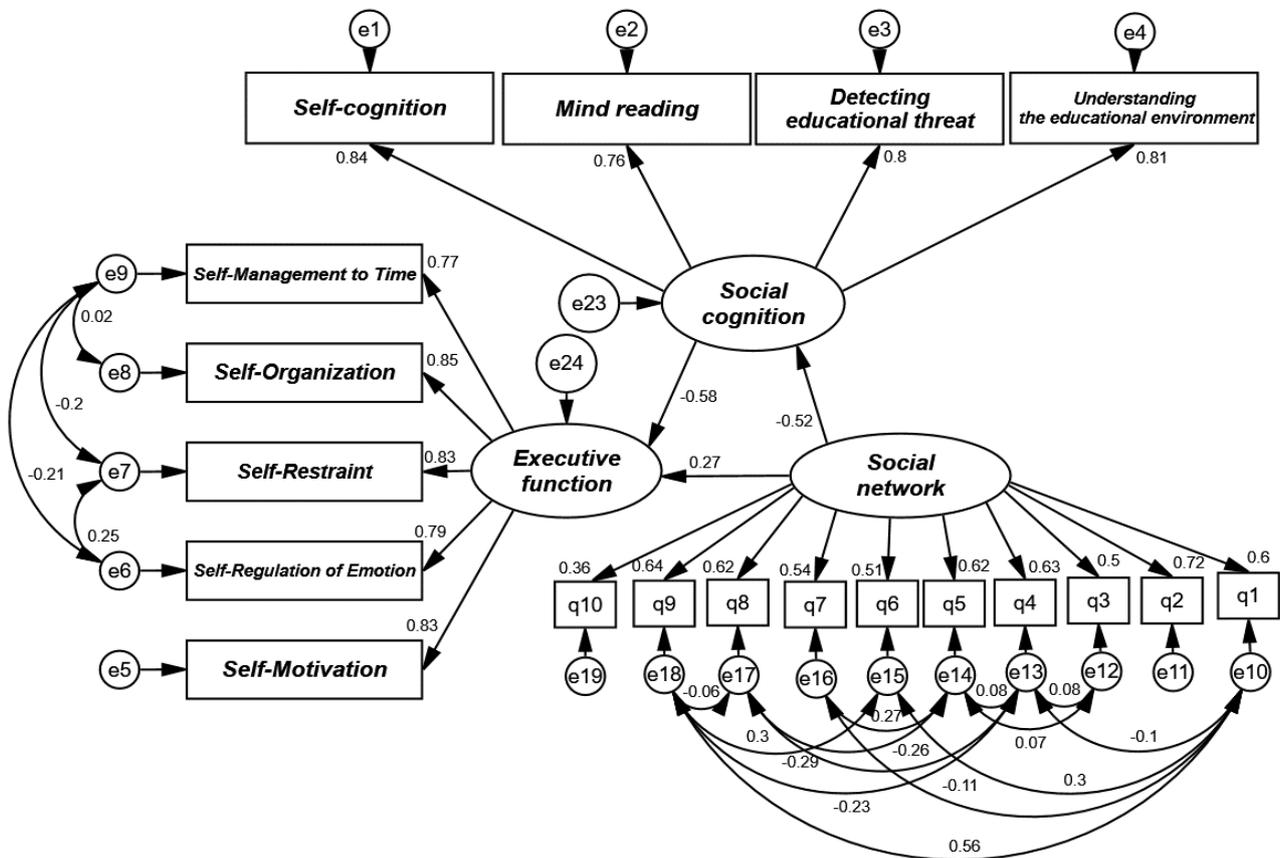


Figure 2. Final research model in standardized coefficient form model fit assessment.

Table 2. Overall Model Fit Indices

Fit indices	PNFI	PCFI	AGFI	IFI	TLI	CFI	RMSEA	CMIN/df
Final research model	0.67	0.71	0.82	0.90	0.90	0.92	0.07	2.40
Normal	> 0.50	> 0.50	> 0.80	> 0.90	> 0.90	> 0.90	< 0.08	< 3.0

After confirming the model fit, hypothesis testing was conducted using two key statistical indices: the Critical Ratio [CR or t-value] and p-value. At a significance level of 0.05, the CR must exceed 1.97 to indicate statistical significance. According to the SEM results in Table 3, the standardized path coefficient from social networks to

executive functions was estimated at 0.27. The CR value for this relationship was 3.93, which exceeds 1.97. The findings in Table 3 indicate that social networks exert a direct effect on all subcomponents of executive function and the CR value for their relationship, which exceeds 1.97. Consequently, there is a significant positive correlation

between social networks usage and the following executive function subcomponents. Additionally, the standardized path coefficient from social networks to social cognition was estimated at -0.51. The CR value was 3.76, exceeding 1.97, indicating a negative and significant correlation. Similarly, the standardized path coefficient from social cognition to executive functions was -0.58, with a CR value of 3.85 (greater than 1.97), demonstrating a negative and significant correlation. The Bootstrap method was employed to test the

significance of the indirect effect of the independent variable on the dependent variable via the mediator (Table 4). According to Table 4, the lower bound of the confidence interval for social cognition as a mediator in the relationship between social networks usage and executive functions is 0.19, and the upper bound is 0.48. The confidence level is 95%, and the number of bootstrap samples is 500. This effect is considered statistically significant since zero is not within this confidence interval and the p-value is 0.001.

Table 3. Coefficients and Significance of Direct Effects of Social Networks and Executive Functions

Criterion Variable	Predictor Variable	t-value	Unstandardized Coefficient (β)	Standardized Coefficient (β)	P
Executive Function	Social networks	3.93	0.35	0.27	0.001
Self-Management of Time	Social networks	2.44	0.84	0.77	0.001
Self-Organization	Social networks	5.36	0.91	0.85	0.001
Self-Restraint	Social networks	4.65	0.94	0.83	0.001
Self-Motivation	Social networks	3.71	0.92	0.83	0.001
Self-Regulation of Emotion	Social networks	2.70	0.81	0.79	0.001
Social Cognition	Social networks	-3.76	-0.60	-0.51	0.001
Executive Function	Social Cognition	-3.85	-0.61	-0.58	0.001

Table 4. Coefficients and Significance of the Indirect Effect of Social Networks and Executive Functions

Criterion Variable	Predictor Variable	Type of Effect	Data	Boot	Bias	SE	Lower Bound	Upper Bound	P
Executive Function	Social networks	Indirect (via Social Cognition)	0.36	0.37	0.001	0.06	0.48	0.19	0.001

Discussion

The findings of this study indicate that social networks usage has a direct and significant relationship with executive functions. Specifically, as social networks usage increases, deficits in executive functions also increase. Among the five subscales of executive function, all were positively and significantly correlated with the amount of social networks use. In other words, as social networks usage increased, deficits in organization, time management, self-restraint, self-motivation, and self-regulation also increased. These results are consistent with the findings of previous studies [1, 6, 7, 9, 26]. Frequent use of social networks, which involves constant switching between various contents and multiple relationships, can increase cognitive load and impair information processing, ultimately leading to deficits in executive functions [27]. In addition, according to attention theory, attention is a limited resource, and frequent use of social networks can lead to divided attention and reduced focus on important tasks. Research has shown that people who spend more time on social networks have difficulty maintaining attention and concentration [28]. Based on these findings, it can be interpreted that social networks use may have significant negative effects on executive functions, including reduced attention, working memory impairment, and weakened social skills. These effects may arise due to high cognitive load, divided attention, and dependency on technology resulting from virtual interactions. Social networks can have a significant impact on various components of executive functions, such as organization, time management, self-restraint, self-motivation, and self-regulation of emotion, which will be discussed in the following section.

According to the findings, there is a significant negative relationship between the amount of social network use and social cognition. Specifically, as social network usage increases, social cognition declines. These findings are consistent with previous research [1, 15, 29]. The negative effect of social networks on social cognition aligns with the Social Information Processing Model [16], as reduced face-to-face interactions impair social cue processing. These findings extend prior work by identifying social cognition as a key mediator [1]. Based on these findings, it can be explained that excessive social network use can have significant negative effects on social cognition. In other words, constant presence in the digital space reduces face-to-face interactions, which are essential for developing social and cognitive skills. The absence of these interactions can weaken communication abilities and social cognition. Instead of engaging in real-world interactions, individuals may solely rely on online relationships. Since online interactions tend to be more superficial than face-to-face communication, people may become distanced from experiencing genuine emotions and reactions from others. This detachment can reduce empathy and impact emotional understanding. Furthermore, online relationships typically lack nonverbal cues such as body language and tone of voice, which are crucial for accurately interpreting others' emotions. The findings of this study indicate a significant negative relationship between social cognition and executive functions. Specifically, as social cognition increases, deficits in executive functioning decrease. These results are consistent with previous research [12, 14, 17, 18, 30]. Based on these findings, it can be concluded that executive functions and social cognition are interrelated.

Executive functions provide a fertile foundation for social cognition and actively support its development [12]. Therefore, the relationship between social cognition and executive functions can be understood as complex and multifaceted. Given previous research findings that highlight the reciprocal relationship between social cognition and executive functions, it can be argued that the ability to understand others' emotions and intentions, as a component of social cognition, influences decision-making and problem-solving. For instance, an individual who can accurately recognize others' emotions is more likely to navigate social situations effectively and make appropriate decisions. Conversely, executive functions support better performance in complex social contexts. For example, planning and anticipating others' behavior enable individuals to respond appropriately in social interactions.

Conclusion

The results of this study indicated that social network usage has an indirect effect on executive functions through social cognition. According to the researcher's review, no prior studies have specifically examined this relationship, highlighting a research gap in this area. According to the Social Information Processing Model [16], reduced face-to-face interactions on digital platforms may impair the ability to process social cues, such as facial expressions and tone, thereby weakening social cognition. This impairment may indirectly affect executive functions, like decision-making and working memory, due to shared neural pathways. The reduction in face-to-face interactions limits opportunities for individuals to practice social skills, potentially leading to difficulties in managing relationships and resolving conflicts, thereby weakening social cognition. Impairments in social cognition can contribute to difficulties in problem-solving, as individuals may struggle to collaborate effectively with others or consider diverse perspectives. Additionally, the inability to recognize and understand others' emotions may disrupt emotional regulation, further affecting executive functions. This dynamic can create a vicious cycle in which frequent social network use leads to diminished social cognitive skills, making it harder for individuals to establish meaningful connections. Given social network use potential impact on mental health and quality of life, this issue warrants special attention. Universities could implement workshops to teach students strategies for managing social network use, such as setting screen time limits and practicing mindfulness to enhance social cognition. Policymakers should consider guidelines promoting responsible digital engagement to mitigate cognitive and social impairments. Future research should employ longitudinal designs to examine the causal effects of social network use on social cognition and executive functions. Incorporating objective measures, such as neuropsychological tasks, could further validate these findings. This study faced some limitations. One of the main challenges was the length of the questionnaire, which discouraged many students from completing it,

thus slowing down the research process. Another limitation was the exclusive reliance on self-report questionnaires to assess the variables. Future studies should consider incorporating additional assessment tools to obtain more comprehensive data.

Conflict of Interest

The authors declare no conflicts of interest.

Ethical Approval

The present study has been registered with the Ethics Committee of Biological Research of Qazvin Faculty of Medical Sciences under the code: IR.QUMS.REC.1403.168

Declaration of Generative AI and AI-Assisted Technologies

During the preparation of this work, the authors used EditGPT (OpenAI) in order to edit and proofread the language of the manuscript. After using this tool, the authors reviewed and revised the content as needed and take full responsibility for the content of the publication.

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