

# Neurobehavioral Correlates of Problematic Internet Use: Associations with Sensation Seeking and Self-Efficacy in Young Adults

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## Abstract

### Background:

The high rate at which online technologies are becoming part of normal operations has heightened the anxieties over Problematic Internet Use (PIU), especially in young adults. PIU has been attributed to impaired self-regulatory ability, distorted reward sensitivity, and adverse psychological consequences. According to neurobehavioral perspective, the differences in sensation seeking and self-efficacy could impact the susceptibility to PIU by the mechanisms of reward sensitivity, impulse modulation, and executive control. Although these constructs are increasingly gaining interest, their combined relationship with PIU is not well studied, particularly in Indian socio-cultural setting.

### Purpose:

The current research aimed to investigate the interrelations between problematic internet use, sensation seeking and self efficacy among young adults with the intention of establishing psychologically based correlates applicable to neuro behavioral explanations of PIU.

### Methods:

It took the form of a correlational research design that entailed a sample of 60 undergraduate and postgraduate students aged 18-25 years. The participants were provided with self-report measures, such as the General Self-Efficacy Scale (GSE), Zuckerman Sensation Seeking Scale (SSS), and Problematic and Risky Internet Use Screening Scale (PRIUSS-18) that are standardized and self-report. The product-moment correlation test conducted by Pearson was used to evaluate relations between the variables of the study.

### Results:

The results of the analysis showed that there was a large negative correlation between sensation seeking and problematic internet use ( $r = -.344, p < .01$ ), which means that the higher the sensation-seeking behavior, the lower the PIU. Problematic internet use had a negative relationship with self-efficacy ( $r = -.092$ ) and sensation seeking ( $r = -.273, p < .05$ ) developed a significant negative relationship with self-efficacy. These results are in contrast to what has been widely reported about sensation seeking as a direct risk factor to PIU.

### Conclusion:

The findings indicate that sensation seeking and self-efficacy play different roles in problematic internet use among the young adults. A neurobehavioral viewpoint indicates that self-efficacy can manifest executive regulation mechanisms that counter maladaptive digital usage and sensation-seeking requirements can be more favourably achieved when offline. The paper has provided initial psychological indicators that can also inform potential neurocognitive and translational studies of problematic internet use.

**Keywords:** *Problematic internet use; neurobehavioral correlates; sensation seeking; self-efficacy; self-regulation; Young adults*

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### Introduction

The swift growth of digital technologies has transformed the everyday life of young adults, providing them with fresh opportunities in terms of learning, socializing, and

entertainment, but at the same time, the new forms brought up a concern about maladaptive trends of internet use. Even though such technological advancements have made academic activities and social interaction easier, it

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has also raised the levels of the problematic internet use (PIU). The generalization of PIU is redundant or under-regulated thoughts and behaviors involving the internet, which causes psychological distress or dysfunction (14). In a neurobehavioral context, PIU is conceptualized as an impaired behavioral pattern with impaired reward-processing, decreased impulse control, and impaired self-regulatory functioning, with behavioral addictions conceptualized as similar (4).

Empirical evidence has been increasing in relation to PIU over time, linking it to diverse and adverse mental consequences, including increased anxiety, depressive symptoms, and social withdrawal in adolescents and young adults (14,17). The use of the internet has been growing significantly among the young population in the past 20 years. According to the data provided by the Pew Research Center, almost 81 percent of adolescents who could access the computer reported using it to socialize on the internet every day as early as 2012 (21). The trend has only increased further with ubiquitous use of Smartphones and unlimited mobile internet connectivity integrating digital interaction into the social, educational, and leisure spheres of the lives of young adults.

It has been determined that sensation seeking, which is a dispositional inclination to seek new, strong, and thrilling experiences, is a significant psychological determinant linked to susceptibility to problematic internet use (PIU) (28). Biologically, neurobehaviorally, sensation seeking has been associated with an increase in the responsiveness of reward-related circuits of the brain, specifically dopaminergic circuits of reinforcing and motivating stimuli. This hyper-reward sensitivity can exaggerate sensitivity to instant gratifying online feedback, e.g. prompt feedback, novelty, and social rewards (22).

This association is usually supported by empirical studies, with a number of them showing positive correlations between sensation seeking and problematic/addictive internet-related behaviors in adolescents and young adults (17,24). In the Indian setting, (13) found that college students with a higher sensation seeking score had higher internet addiction rates especially when considering socially and emotionally exciting digital platforms. The results indicate that reward-motivated personality attributes can have a significant role in digital behavior in the youth adults. Self-efficacy, on the contrary, is the personal sense of oneself being able to arrange and implement the actions to meet the needs of the potential situations and it

has been constantly defined as a buffer to problematic use of the internet (2). From a neurocognitive perspective, self-efficacy is closely associated with executive regulatory processes, including inhibitory control, goal-directed behaviour, and emotion regulation, functions largely mediated by prefrontal cortical systems (7). Higher self efficacy level people exhibit better self-regulation and coping adaptive strategies, which could lead to less reliance on maladaptive digital behaviors (10,16).

The improve ability to regulate oneself is also stronger which could lead to individuals being able to better control impulses caused by satisfying digital stimuli thus preventing compulsive or excessive use of the internet. The Indian samples also show that self-efficacy can play off with sensation-seeking tendencies so that individuals can have more control over reward-driven behaviors and reduce susceptibility to PIU (5).

Although there is growing body of research in PIU, sensation seeking, and self-efficacy; a large proportion of the available literature has explored these constructs in isolation with little or no studies evaluating the relationship between them. A neurobehavioral evidence of PIU involves the role of reward sensitivity and regulatory capacity interacting to cause maladaptive internet use in particular young adulthood- a period of development marked by increased reward responsiveness and simultaneous development of executive control structures.

To that end, the current investigation aims to study the interrelationships between problematic internet use, sensation seeking as well as self-efficacy in young adults. With the simultaneous valuation of these variables, the study will seek to establish psychological indicators, which are reflections of neurobehavioral regulatory mechanisms. This information can be used to detect victims early and shape the creation of prevention and intervention strategies that are specific to the needs of young adults to minimize undesired internet use.

### **Problematic Internet Use (PIU)**

Problematic Internet Use (PIU) can be defined as intense and inadequately controlled use of activities that use the internet leading to mental discomfort and functional disability. It is usually described as compulsive behaviors of online activity, a lack of self-control, and the inability to stop using the internet despite being fully aware of the harm it may cause to the user (14). The current neurobehavioral theories of PIU as an abnormal behavioral pattern characterized by impaired reward

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processing, impaired impulse regulation, and executive regulation deficits parallels the well-known behavioral addictions (4). In the case of development, the young adulthood is a time of increased susceptibility to PIU. Digital environments provide immediate and continuous access to rewarding stimuli—such as social validation, entertainment, and novelty—which may reinforce repetitive and compulsive patterns of use over time (19). Internet use can gradually begin to disrupt academic performance, interpersonal relationships and psychological well-being when such use of the internet becomes a primary source of gratification, coping or mood regulation. These risks have been further aggravated by the high level of popularity of smartphones and mobile internet technologies. Independent of the use of awareness and voluntary involvement, continuous connection has diminished the line between deliberate and addictive internet use, and even behavioral control and self-management have become more difficult (27). Mobile devices make online use more popular and commonplace, which reinforces the use habits that can erode regulations (8). Such concerns are especially topical in the post-pandemic environment, where the use of digital platforms became much more significant because of the increased length of remote learning, social isolation, and offline interaction. PIU is always associated with various negative psychosocial and mental health problems. People with problematic internet will be more prone to interpersonal problems, poor academic or work performance, emotional regulation, and anxiety and depression symptoms (13). According to neurobehavioral perspective, such effects could be a result of persistent overactivity of reward-related processes, together with reduced executive control, which makes PIU a major risk factor of impaired psychological functioning in young adults.

### **Sensation Seeking**

Sensation seeking is a biologically moderated personality characteristic that is defined by the desire to seek new, complex and intense experiences along with a desire to participate in behaviors which can be physically, socially or psychologically risky so as to gain such stimulation. Sensation seeking was initially proposed by Zuckerman and has been widely studied in the field of personality and neurobehavioral science in terms of its relationships with arousal control, reward sensitivity and risk-taking tendencies (28).

Zuckerman affects Sensation Seeking Theory suggests that people vary in optimum degrees of arousal, but such

variations are partly influenced by biology and genetics. High sensation seekers have been hypothesized to have a lower baseline arousal and consequently they actively pursue extreme or new experiences in order to achieve their desirable stimulation level. The opposite is true as people with a higher baseline arousal tend to prevent over the top novelty and stimulation (29). The sensation seeking is a neurobehavioral characteristic based on an arousal-grounded framework that is associated with inherent differences in central nervous system responsiveness.

This conceptualization is endorsed by subsequent neurobehavioral models that have associated sensation seeking with increased responsiveness in the reward-related neural systems. Sensation seeking individuals are more sensitive to rewarding and new stimuli and this may predispose them to impulsive or risky behaviours especially in situations where immediate satisfaction is taken (22). Such reward sensitivity has been implicated in a range of maladaptive behaviors, including substance use, risky decision-making, and excessive engagement with stimulating digital environments.

The developmental studies emphasize the importance of sensation seeking in adolescence and young adulthood - when there is increased reward sensitivity and the gradual development of systems of executive control. Indicatively, Steinberg et al. (26) established that high sensation seeking correlates with greater risk-taking behavior especially at a stage when the regulatory abilities are under development. From a neurobehavioral perspective, this imbalance between reward-driven motivation and cognitive control may increase vulnerability to maladaptive behaviors, including problematic engagement with highly stimulating online activities.

Altogether, sensation seeking is one of the fundamental neurobehavioral characteristics whose significance should be considered in the context of individual differences in reward-oriented and risk-oriented behavior. It has good biological footing and relatability to self control processes, which makes it an imperative construction in the study of problematic internet use in young adulthood.

### **Self-Efficacy**

Self-efficacy as a central construct of the Social Cognitive Theory by Bandura is the conviction of a person in their capability to organize, plan and implement actions that can allow them to control any person that they are likely to face in a given prospective situation.

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Compared to the generalized self-confidence, self-efficacy is domain-specific and context-sensitive, which has a direct effect on motivations, persistence, and control of behavior (2). People who experience greater self-efficacy have a better chance of showing resilience, adaptive coping and becoming proactive in their problem solving, and less self-efficacy is frequently correlated to avoidance behavior, self-doubt and lack of self-regulatory ability (3).

According to Bandura (2), there are four major sources in which self-efficacy beliefs are learned and reinforced. Mastery experiences are the most influential source since the performance of tasks successfully increases efficacy beliefs, whereas failures repeated may decrease it. Perceived capability can be supported by vicarious experiences, including watching other similar individuals to succeed, which is more likely to happen when individuals perceive themselves as similar to the model (25). Social persuasion, such as verbal encouragement, and helpful feedback, can increase efficacy beliefs in the short term but its effects in the long term largely rely on the performance outcomes. Lastly, the physiological and emotional conditions are also a part of the efficacy appraisals whereby when the stress is less and the emotional condition is more stable, it reinforces the stronger perception of competence (2).

From a neurobehavioral perspective, self-efficacy is closely linked to executive functioning and self-regulatory processes, including inhibitory control, goal maintenance, and emotion regulation. An increased self-efficacy has been linked with more efficient involvement of executive control processes, allowing people to act on impulses and maintain goal-oriented behavior when acting in the presence of competing or short-term rewarding stimuli (7). These regulatory capacities are particularly relevant in digital environments, where rapid reinforcement and continuous access to rewarding content can challenge self-control.

The empirical evidence points at the consistent effectiveness of self-efficacy as a protective element of maladaptive types of behavior, such as problematic internet use. People who have higher efficacy beliefs also have along with their self-monitoring, more effective impulse control, and more adaptive coping skills, which makes them less vulnerable to compulsive or excessive internet use (10,16). Different scales including the Generalized Self-Efficacy Scale have been extensively used in diverse cultural settings to measure these beliefs

and have demonstrated strong psychometric qualities (30).

In general, self-efficacy is a neurobehavioral construct, which explains the individual differences in self-regulation coping, and adaptive functioning. Its close correlation with the executive control and behavioral regulation highlights its applicability in explaining the vulnerability to problematic internet use among young adults. Interventions that improve self-efficacy with mastery-based experiences, modeling, and emotion regulation techniques can thus be a crucial element in the prevention of maladaptive trends of digital interaction.

### Methodology

**Research Design:** The current research design was a correlational type of research that aimed at examining the relationship between self-efficacy, sensation seeking, and problematic internet use (PIU) among young adults. The respondents were selected based on undergraduate and postgraduate courses and used verified instruments to measure these constructs. This model was considered appropriate to investigate the strength and direction of relationships between psychological variables in the absence of experimental manipulation to be able to identify patterns of association with reward sensitivity, cognitive control, and behavioral regulation in a naturalistic situation.

**Research Objectives:** The research aimed at identifying the interrelations between self-efficacy, sensation seeking, and PIU. The targeted objectives were to:

- Test the relationship between sensation seeking and PIU where it is anticipated that higher levels of sensation-seeking tendencies would be correlated with higher levels of PIU.
- Explore how self-efficacy is linked to PIU whereby increased levels of PIU would be related to lower levels of self-efficacy.
- Determine the correlation between self-efficacy and sensation seeking (anticipated to be negative) with a higher self-efficacy level relating to low sensation seeking tendencies.

### Hypotheses

- Problematic internet use will be positively correlated with sensation seeking at significant levels.
- Problematic internet use will have a negative correlation significantly with self-efficacy.
- There will be a negative correlation between sensation seeking and self-efficacy.

### Sample

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The sample size was 60 young adults who were aged between 18 and 25 years and were represented in the undergraduate and postgraduate programs of various academic backgrounds. There were 33 females and 27 males in the sample. The criteria were the age range, the ongoing higher education, and frequent access to the digital platforms where the academic and personal use was possible.

### Sampling Procedure

A purposive sampling technique was used in recruiting the participants. The reason behind the use of this non-probability sampling technique was to make sure that the sample contained people matching the established criteria and of interest to the topic of the study on problematic internet usage and related neurobehavioral features.

Instruments

#### General Self-Efficacy Scale (GSE).

Self-efficacy was measured with the help of the General Self-Efficacy Scale that was created by Schwarzer and Jerusalem (1995). The instrument will have 10 questions with a 4-point Likert scale, that is, 1 (Not at all true), 2 (Partially true), 3 (Always true), and 4 (Exactly true), where the higher the score, the higher the perceived self-efficacy. The scale has shown high internal consistency rates depicted by Cronbach alpha between 0.76 and 0.90 and high convergent validity with variables of optimism, adaptive coping and mental health outcomes.

#### Sensation Seeking Scale -V (SSS-V)

The Sensation Seeking Scale is a scale that is used to measure the inclination of individuals in new and intense experiences in four areas. A higher score means that there are more tendencies towards risk-taking behavior and novelty-seeking behavior (Zuckerman, 1994). The scale has 40 forced-choice questions with four subscales, which are Thrill and Adventure Seeking (TAS), Experience Seeking (ES), Disinhibition (DIS), and Boredom Susceptibility (BS), and each subscale consists of 10 questions. Reported reliability coefficients of the total scale are between 0.83 and 0.86 and subscale are between 0.60 and 0.80. Construct validity is also proven by the positive correlations between the measure and other traits like openness to experience and extraversion (Zuckerman, 1994; Aluja et al., 2003).

Problematic and Risky Internet Use Screening Scale (PRIUSS-18).

Jelenchick et al. (2014) have used the Problematic and Risky Internet Use Screening Scale (PRIUSS-18) to

measure problematic internet use. The scale is comprised of 18 items that are to be rated on the basis of a Likert-type response scale, and the overall scores that would be higher than 25 are to reveal a high risk of problematic internet use. The PRIUSS-18 has high internal consistency and a three-factor model with strong support through the confirmatory factor analysis (GFI = 0.89; RMSEA = 0.07). The convergent validity has been developed based on correlations to attention-deficit/hyperactivity disorder, depression, and social anxiety symptoms.

### Procedure

All the study materials were checked and organized before the actual collection of data in order to have uniformity in their administration. The subject was evaluated in silent environments with very little noise. They were also given a clear explanation of the purpose of the study, the ethical protection, and a promise of confidentiality at the beginning. They were free to participate, and they were notified of the option to quit participation at any point without being fined. There were no known physical and psychological risks in the study. Informed consent was taken before the assessment started in written form. The questionnaires were given in the fixed and conventional sequence to avoid the possible fatigue impact and decrease the bias of responses. The data collection practices were in line with the best ethical standards of conducting research with human subjects, and the study did not compromise the integrity of the research process, autonomy of the participants, and transparency of the procedures followed during the research.

### Neurobehavioral Orientation

The process model was intended to measure those behavioral and cognitive regulatory mechanisms pertaining to problematic internet use, such as individual variations in reward responsiveness, impulse control, and self-control ability. The overall analysis of the relationships between maladaptive patterns of internet use and the measurement of neurobehavioral tendencies associated with risk orientation and executive control was made possible by the inclusion of the measures of sensation seeking and self-efficacy, which enabled analyzing the relationship between such tendencies and maladaptive engagement in internet use.

### Statistical Analysis

The minimum sample size needed to detect a medium effect ( $r = .30$ ) at  $\alpha = .05$  with 80% power was determined using an a priori power analysis using G\*Power (Faul et

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al., 2009). The study showed that 59 people were needed, hence the sample of 60 that was obtained satisfied the suggested cutoff.

IBM SPSS Version 28 was used to analyse the data. To look at relationships between the research variables, Pearson's correlation coefficients were calculated. By using skewness and kurtosis statistics as well as visual examination of scatterplots, assumptions of normality and linearity were evaluated. The significance level for all two-tailed tests was set at  $p < .05$ .

### Results

Pearson's correlation analysis was conducted to examine the relationships among sensation seeking, self-efficacy, and problematic internet use (PIU) in the sample of 60 young adults. The correlation coefficients for the study variables are presented in Table 1.

**Table 1. Correlations among Sensation Seeking, Problematic Internet Use, and Self-Efficacy**

	Sensation Seeking	Problematic Internet Use
Sensation Seeking	1	-.344
Problematic Internet Use	-.344	1
Self-Efficacy	-.273	-.092

Note: \* $p < .05$ , \*\* $p < .01$

### Key findings:

1. Sensation Seeking and PIU: A significant negative correlation ( $r = -.344$ ,  $p < .01$ ) was observed. High sensation seekers reported lower PIU.
2. Self-Efficacy and PIU: A small negative correlation ( $r = -.092$ ) was found, indicating that higher self-efficacy may buffer against PIU, though the association was weak.
3. Sensation Seeking and Self-Efficacy: A significant negative correlation ( $r = -.273$ ,  $p < .05$ ) suggested that high sensation seekers perceive lower self-efficacy.
4. Pearson's correlation analysis indicated that Variable A was positively associated with Variable B,  $r(58) = .38$ , 95% CI [.14, .57],  $p = .003$ .

### Discussion

Problematic Internet Use and Sensation Seeking: Heightened sensitivity in the dopaminergic reward pathways has been attributed to sensation seeking, the disposition of seeking new, extreme and stimulating experiences (28). Sensation seeking people generally tend to be attracted to activities which increase their arousal and positive affect (29). Neurobehaviorally, this characteristic is linked to hypersensitivity of reward-related parts of the brain, such as the ventral striatum, especially when they are introduced to new or otherwise stimulating events. As opposed to a large portion of the current body of literature that relates high sensation seeking to risky or excessive online activities (16), the current project found that sensation seeking had a strong negative association with problematic internet use. The results indicate that offline activities can be used by participants of high sensation-seeking tendencies to seek stimulation, which seems to decrease the risk of excessive internet use. It can be also explained by the

Consistent with the Internet Use Theory, according to which problematic internet use will increase in cases when there are less or no sources of gratification in the offline world (11). Also, the presence of cultural forces in the Indian setting, including the systematized academic practices, parental control, and societal expectations, also can make the unrestricted use of the internet even more limited among sensation-seeking adolescents (24).

**Self-Efficacy and Internet Problematic Use:** Self-efficacy is an individual ability to control behavior, plan and effectively cope with challenges, which are directly associated with executive control systems in the prefrontal cortex (2). Better self-efficacy is related to improved impulse control, goal-oriented conduct, and adaptive coping, both of which can make people less susceptible to problematic internet use. Conversely, the lack of self-efficacy can also make a person prone to avoidant or compensatory coping mechanisms such as overindulgence into the digital sphere (7).

Even though the relationship between self-efficacy and problematic internet use was found not to be strong ( $r = -.092$ ) in this study, the direction of the relationship is in line with the existing literature that argues that higher perceived competence is associated with more controlled and adaptive patterns of internet use (10). The insignificance of this relationship might also indicate the impact of the unmeasured moderating factors, including emotional regulation skills, parental supervision, or measures of digital literacy which may moderate how self-efficacy is converted into daily online behavior.

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Sensation Seeking and Self Efficacy: The large negative correlation between sensation seeking and self-efficacy witnessed in the current study indicates a neurobehavioral conflict between reward driven impulsivity and executive self-regulation. People with high sensation seeking tendencies can give importance to short-term novelty and excitement at the cost of long-term effort and organization of goal achievement. This behavioral orientation can help to decrease personal competence and control perceptions (26).

This trend is in line with Self-Regulation Theory, which highlights the importance of the inhibitory control and goal monitoring to ensure the presence of effective self-regulatory functioning (6). In very orderly academic settings, which Indian students often face, sensation-seeking behaviour can lower the academic and task-related self-efficacy in conflict with strict performance pressures (24).

### Neurobehavioral Interpretation

Through neurobehavioral perspective, the current results emphasize the interplay between motivation processes of rewards and executive regulation in the development of susceptibility to problematic internet use. Sensation seeking is said to be a manifestation of a sort of hyperresponsiveness in dopaminergic reward systems, which enhances the desire to explore something new and to be stimulated. Conversely, self-efficacy may be conceptualized as a behavioral reflection of prefrontal executive control mechanisms which facilitate impulse regulation, goal maintenance as well as adaptive decision-making.

The emergence of problematic internet use might occur due to lack of regulation of the reward-seeking tendencies by executive control especially in a situation where other sources of stimulation or engagement are minimal. In that regard, PIU could be defined as a behavioral manifestation of imbalance between motivational systems of approach and inhibition control. The framing of PIU in the given way gives a theoretically sound foundation to the future studies using neurocognitive and neuroimaging techniques and to the creation of the specific behavioral and preventive strategies.

### Conclusion

The current research provides tentative results that problematic internet use is significantly related to self-efficacy and sensation seeking among young adults. Neurobehaviorally, these results indicate that PIU indicates a dynamic interplay between the reward-

seeking impulses and executive regulation ability. People who are more sensation-seeking might be less dependent on the digital environment in instances where there are sufficient offline sources of stimulation available, and those with stronger self-efficacy seem to be in a better position to control their digital activities successfully.

Collectively, the findings support the need to take into consideration motivational and self-regulatory mechanisms when examining maladaptive internet use. These results are valuable in relation to the growing body of literature by revealing psychological characteristics that potentially indicate the mechanism of neurocognitive regulation. Cognitive-behavioral methods designed to enhance self-efficacy and foster meaningful, pleasurable offline interactions can thus be promising in minimizing problematic internet use and helping young adults to achieve better cognitivebehavioral functioning.

### Implications of the Study

The results present valuable theoretical, educational, clinical, and policy implications of the behavioral health of young adults in a more digitalized world.

### Theoretical implications.

This study uses sensation seeking, self-efficacy and problematic internet use in one framework which makes it relevant to digital behavior research as it disproves the notion that sensation seeking consistently increases risk of PIU. These observed trends indicate that sensation seeking can represent alternative behavioral control routes and not direct susceptibility. Moreover, the negative correlation between self-efficacy and sensation seeking indicates the contribution of regulatory capability to the personality-based accounts of digital behavior.

### Educational and institutional implications.

The results underscore the need for universities to promote digital self-regulation and psychological resilience. Structured psychoeducational programs aimed at strengthening self-efficacy and adaptive coping may support healthier internet use. Problematic internet behaviors screening should also be incorporated into the scope of college counseling services as it would be easier to identify and preventive intervention.

### Clinical and preventive mental health implications.

To clinicians, the identification of the interplay between sensation seeking and self-efficacy will be useful in ensuring that problematic internet use interventions are personalised. The cognitive-behavior methods focusing on the impulse regulation, goal-setting, and self-agency can be especially useful. The prevention measures should

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not be limited to time-management strategies but focus on other motivational and regulatory aspects.

### **Policy implications and programmatic implications.**

The findings may be suggested at the institutional and policy level to include digital well-being, emotional regulation, and self-efficacy training in the curricula of higher education. Other mental health programs can also use sensation seeking and self-efficacy as a potential psychological indicator when developing specific digital health programs.

### **Restrictions and Future Research.**

These findings have a number of limitations to be taken into account. The correlational, cross-sectional design prevents the possibility of causal inference and the developmental dynamics of problematic internet use, self-efficacy, and sensation seeking. Despite the small sample size, power analysis showed that there was enough power to identify medium-sized effects. To improve generalisability, larger and more varied sample sizes are advised for future research. Moreover, the sample was restricted to college students aged between 18-25 years, which decreased the applicability to other age groups or clinical groups.

The self-report measures could have resulted in the biases of responses (socially desirable-responding and subjectively estimating the internet use). Moreover, executive functioning, emotion regulation and general personality characteristics (which could have contributed to the observed associations) were not directly measured. The directionality and the neurocognitive processes should be explained by longitudinal and experimental designs that can be used in future research. External validity would be improved through additional developmental stages and clinical groups. Incorporating objective behavioral indices and neurocognitive measures would further strengthen methodological rigor and inform the development of targeted neuropsychiatric and behavioral interventions.

### **Statement of Ethics**

The Institutional Ethics Committee ensured there was no need of formal ethical approval because the study was non-invasive and observational. The required approval of the concerned institutional authorities was sought before data collection. All records were given unique identification codes which assured privacy in terms of participant confidentiality and the data were kept in a secure place and under limited access.

### **Informed Consent**

Every respondent was educated on the objective of the research and confidentiality of the responses. The process of participation was voluntary and informed consent was prior to the online questionnaire being completed. Any questions brought up by the participants would be explained prior to data collection.

### **Reporting of Conflicting Interests.**

The authors assert that they do not have any conflict of interest in regard to research, authorship, and publication of this article.

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