# Moderating effects of general need frustration on the association between electronic screen use and adolescents' socio-emotional problems

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# **Author contributions**

Conceptualization: RV, MN, TS, PP, CL; Methodology: RV, MN, TS; Analysis: RV, MN, JC, TS; Writing - original draft preparation: RV; Writing - review and editing: RV, MN, TS, CL, PP, JC; Supervision: MN, TS, CL, PP, JC.

# Data and code availability statement

All data and code used for this study are available at the Open Science Framework (https://osf.io/vny6m/?view\_only=da04a1e281314934ad2f56ef080a5ea8).

# Acknowledgements

We would like to acknowledge Emma L. Bradshaw for her invaluable contributions during the early stages of this paper.

#### Abstract

Self-determination Theory recognises the satisfaction of three basic psychological needs-competence, relatedness and autonomy-as essential nutriments for individuals' optimal functioning and psychological wellbeing. The frustration of these needs is associated with a range of maladaptive coping mechanisms, including compulsive behaviours, often leading to poor socio-emotional outcomes. It is possible that adolescents' electronic screen use is also driven by a similar mechanism. The aim of this study was to investigate the moderating effects of general need frustration on the longitudinal relationship between electronic screen use and socio-emotional problems among adolescents. Baseline and follow-up data (6 months apart) were collected through online surveys from 877 adolescents (mean age = 21.8, 84.5% female). Moderated-mediation analyses were used to test the conditional indirect effect of 'general need frustration' on the relationship between 'need satisfaction from screens' (i.e., video games and social media) and 'socio-emotional problems' via 'problematic screen use'. Findings revealed distinct patterns of this relationship across screen types. Need satisfaction from video games was positively associated with socio-emotional wellbeing, provided that gaming did not become a compulsive behaviour. Adolescents whose unmet life needs were fulfilled through gaming interactions showed increased vulnerability to both problematic gaming behaviour ( $\beta = 0.27$ ; CI [0.05, 0.49]; p =0.018) and socio-emotional problems ( $\beta = 0.36$ ; CI [0.12, 0.61]; p < 0.004), particularly among those driven by intrinsic life aspirations ( $\beta = 0.27$ ; CI [0.19, 0.34]; p < 0.001). In contrast, adolescents from need-supportive environments who engaged in compulsive social media use were more extrinsically motivated and more likely to develop socio-emotional problems over time ( $\beta = 0.27$ ; CI [0.18, 0.36]; p < 0.001). These findings emphasise the importance of moving beyond generic screen time recommendations toward more nuanced, context-sensitive approaches when examining the relationship between screen use and

socio-emotional problems in young populations. Parents, educators, and policymakers should focus on fostering environments that support adolescents' psychological needs in real life, while also encouraging balanced and mindful digital engagement that meets these needs in a healthier, sustainable manner.

*Keywords:* video games; social media; socio-emotional wellbeing; youth; Self-determination Theory; basic psychological needs; life aspirations

#### **Theoretical Background**

One in seven (14%) of individuals aged 10 to 19 struggle with mental health disorders, but such conditions often go unnoticed and untreated (WHO, 2021). When dealing with mental health issues, adolescents might feel left out, face unfair treatment, and deal with stigma, making it harder for them to seek help. These challenges can also show up in school struggles, risky behaviours, physical health problems, and violations of human rights (WHO, 2021). Many factors have been associated with their development, including socio-demographic factors (e.g., gender, age, and SES; Fink et al., 2015), home and social environments (e.g., peer relationship problems; Patalay & Fitzsimons, 2016), and psychological problems (e.g., anxiety and depression; Baxter et al., 2014). Although mental disorders are often first detected in adults, most of them begin in early adolescence (Patel et al., 2007; WHO, 2023). Therefore, a better understanding of the risks underlying the development of socio-emotional problems among adolescents is essential for learning how to prevent their progression later on in adulthood.

Self-Determination Theory (SDT; Ryan & Deci, 2018) may help explain the development of many socio-emotional problems. SDT recognises the satisfaction of three basic psychological needs—competence, relatedness and autonomy—as essential nutriments for individuals' optimal functioning and psychological wellbeing (Martela & Sheldon, 2019). Briefly: *competence* refers to the need to experience mastery in interacting with one's environment; *relatedness* entails the need of feeling meaningfully connected to others; and *autonomy* pertains to the sense of volition and ownership of one's actions (Deci & Ryan, 2004). In contrast, the frustration of such needs is associated with maladaptive mechanisms in order to cope with these frustrations (Bartholomew et al., 2011). For example, meta-analytic evidence from 139 reports demonstrated that living in more controlling environments was associated with antisocial behaviour (Donald et al., 2021). Additionally, longitudinal evidence

showed that autonomy thwarting environments lead to compensatory behaviours, such as binge eating and alcohol abuse (Vansteenkiste & Ryan, 2013), aggressive behaviours (Joussemet et al., 2005), internalisation and oppositional defiant disorder (Vansteenkiste et al., 2014).

Importantly, frustration of needs does not imply poor need satisfaction but rather involves need thwarting (Deci & Ryan, 2000). To illustrate, a student may feel they lack meaningful social connections (low relatedness), leading to reduced enthusiasm for attending school. However, when feeling actively rejected or excluded by others (relatedness thwarting or frustration), the consequences can be more profound, manifesting as severe symptoms of stress, antisocial behaviour, and conduct problems. That is, unlike the gradual effects of unmet needs, the process of need thwarting more strongly correlates with psychosocial impairment (Vansteenkiste & Ryan, 2013). Furthermore, when people are generally need-frustrated, but a specific behaviour is need satisfying (e.g., alcohol, video games), people can become dependent on that behaviour to satisfy their needs (Ryan & Deci, 2018). Thus, it is essential to discern between the effects of low need satisfaction and the active frustration of needs on people's psychosocial wellbeing.

It is possible that people's screen use is driven by a similar mechanism. Well-designed video games have the ability to simultaneously nurture the three basic psychological needs of the gamer (Ryan et al., 2006). They are challenging enough to satisfy a player's need for competence, and afford considerable control to players, satisfying their need for autonomy. Also, modern video games often facilitate social interactions with other players, satisfying their need for relatedness (Rigby & Ryan, 2011). According to Ryan and colleagues (2006), the better the game is at satisfying the player's needs, the more enjoyable it becomes, and the larger will be its positive impact on players' wellbeing, at least short-term. For example, research has shown that adolescents who use digital technologies to regulate their emotions

experience a temporary improvement in psychological wellbeing, but these effects do not persist over the long term (Scott et al., 2024). Based on this previous research, we hypothesised that socio-emotional problems do not stem from merely finding screens to be satisfying: we predicted *there would be no longitudinal relationship between need satisfaction from screen use at time 1 and later socio-emotional problems (Hypothesis 1). Specifically, those adolescents whose needs are consistently satisfied when using screens (e.g., by giving a sense of autonomy, competence, and relatedness while playing real-time strategy games online with friends) would not be at risk of developing socio-emotional problems over time* (see Figure 5.1).

# Figure 5.1

Conditional indirect effects of need satisfaction in screens and socio-emotional problems via compulsive use of screens, moderated by general need frustration and life aspirations.



*Note.* **Predicting (independent) variable**: Need satisfaction during screen use via the Basic Psychological Need Satisfaction Scale. **Primary outcome (dependent) variable**: Socio-emotional problems via the Strengths and Difficulties Questionnaire. **Mediating variable**: Compulsive screen use (i.e., social media and video games) behaviour via the Internet Gaming Disorder Measure and Social Media Disorder Scale. **Primary moderating variable**: Need frustration in general life via the Basic Psychological Need Frustration Scale. **Secondary moderating variable**: Life aspirations via the Aspirations Index.

## When Needs are Frustrated, Screen Use Can Become a Crutch

Screen use is generally 'avoidance coping', which alleviates distress without addressing core issues (Herman-Stabl et al., 1995). Research evidence have suggested that people often use electronic screens as a coping strategy to escape from their 'bored' and 'unhappy' reality (C. Cheng et al., 2015; Lu et al., 2021; Maroney et al., 2019). Psychological impairment was found to be a predictor of video game playing in children (H. Jeong et al., 2019; Poulain et al., 2018; Prescott et al., 2018). Similarly, need thwarting in daily life experiences was identified as a risk factor for obsessive video-game playing among youth (Przybylski et al., 2009). In other words, those whose needs are thwarted in real life but are highly satisfied during interactions with electronic screens, would be more vulnerable to *overuse* screens (Ryan & Deci, 2018). This is explained by what SDT proposes as the 'need density hypothesis' (Ryan & Deci, 2018): it is risky to have most of a person's psychological needs met from one behaviour, lest that behaviour become compulsive.

Compulsive behaviours of any kind, however, are well known predictors of general psychological ill-being (Bartholomew et al., 2011; Costa et al., 2015). According to some researchers (Deci & Ryan, 2000; Ryan et al., 2006; Ryan & Deci, 2018; Vansteenkiste & Ryan, 2013), behaviours are more likely to become compulsive when (a) the behaviour satisfies psychological needs *and* (b) psychological needs are not well met in other areas of the person's life. This 'need density' phenomena has been found in some domains (e.g., alcohol use; Bradshaw et al., 2018). Few researchers have looked at how it explains screen use and socioemotional problems. Interestingly, compulsive gaming behaviour was linked to lower wellbeing only when players were obsessively passionate about the game (Przybylski et al., 2009). Additionally, online games allow players to create personalized avatars, a virtual representations of themselves in the game (Bender et al., 2020). When players perceive these avatars as extensions of their own identity and use them to fulfil unmet real-life needs—such as lack of physical strength, attractiveness, or social status—gaming interactions can pose a significant risk to their socio-emotional wellbeing (Green et al., 2020). Findings like these, and the need density hypothesis, underpin our next hypotheses:

Hypothesis 2. There will be an interaction between basic need frustration and need satisfaction from screens that will significantly increase compulsive screen use. Specifically, those adolescents whose needs were satisfied when using screens (e.g., by giving a sense of autonomy, competence, and relatedness while playing real-time strategy games online with

friends)—but whose basic needs were highly frustrated in general life—will be most likely to overuse electronic screens and become compulsive users. In contrast, those low in both general need frustration and screen-related need satisfaction would be the least likely to become compulsive screen users (see Figure 5.1).

*Hypothesis 3. Basic need frustration will lead to socio-emotional problems regardless of their screen use.* 

*Hypothesis 4. Compulsive screen use will predict socio-emotional problems.* 

While games often support basic psychological needs, other types of screens may thwart a user's psychological needs. For example, Mishra and Dash (2019) argued that social media promotes social comparison, potentially making adolescents feel inadequate or inferior compared to other social media users. These harmful effects of peer comparison on social media seem to be especially pronounced among girls (Haidt, 2024). Adolescents do not report enjoying social media (Rideout et al. 2022). One explanation for why they nevertheless use it may be that their needs are otherwise being thwarted. For example, lonely adolescents are more likely to use social media, perhaps as a coping strategy to deal with their loneliness (Cauberghe et al., 2021). It is plausible that non-satisfying screen use may become attractive when people find the rest of their life need-thwarting. For instance, compared to frustration of needs in a 'virtual reality', frustration of needs in the 'real world life' was found to have a larger negative impact on individuals' wellbeing (Allen & Anderson, 2018). Based upon these findings, we hypothesised that:

Hypothesis 5. Among compulsive screen users who do not find screens need-supportive (e.g., by feeling physically inadequate or inferior compared to others in social media), those whose basic needs were highly frustrated in general life would be at greater risk of socio-emotional problems.

Despite finding social media use unsatisfying, young individuals may be compelled to

continue using it due to other contextual factors, such as pre-existing mental health issues, traumas, or underlying motivations. In this context, evidence shows that frustration of psychological needs can lead individuals to adopt need substitutes, referred to as extrinsic aspirations (i.e., wealth, fame, and image; Ryan & Deci, 2016; Vansteenkiste et al., 2020). For instance, it was found that adolescents exposed to a need-thwarting maternal style, characterised by cold or controlling behaviour, were more likely to pursue extrinsic life goals (Kasser et al., 1995). Extrinsic life goals include materialism, popularity, fame, and physical appearance (Kasser & Ryan, 1996). These goals tend to have detrimental effects on psychological wellbeing (Kasser & Ryan, 1996). However, given the way social media may support these life goals (e.g., by posting on different platforms to seek popularity in their social circle), adolescents may use social media even if finding it ultimately unsatisfying.

So, even if screen use hinders adolescents' needs, those who prioritise extrinsic goals in life may still be inclined to use screens, especially if they perceive their environment as thwarting their needs. Our study therefore tests these final hypotheses.

Hypothesis 6. Those who did not find screens need-supportive but were still compulsive screen users would be the adolescents with more extrinsic life aspirations (e.g., those who feel inadequate, but consistently use social media to seek popularity) and exhibit greater levels of socio-emotional problems (see Figure 5.1).

Hypothesis 7. Among adolescents who were compulsive screen users even not finding screens need-supportive, those more extrinsically oriented and whose general needs were highly thwarted in real life, would be at the greatest risk of socio-emotional problems.

Research employing the dual-process model/need deficit model may help researchers to understand this complex relationship and to develop effective health promotion and preventive strategies. For example, if extrinsic life aspirations left adolescents at risk of socio-emotional problems from screen use, interventions could nurture intrinsic life aspirations and need-supportive environments. The need deficit model could help parents to support their teenagers crossing over this complex life period to the best of their socio-emotional capabilities. To answer these questions, the overall aim of this study was to investigate the moderating effects of general need frustration on the relationship between electronic screen use and socio-emotional problems among adolescents. Specifically, this study aimed to investigate the interaction between general need frustration and need satisfaction when using screens on predicting socio-emotional problems among this population.

#### Methods

# **Study Design**

This study was a 6-month longitudinal online survey. The study protocol was approved by the Australian Catholic University Ethics Committee (Approval #2022-2753E; Appendix C - File C1) and registered with Open Science Framework prior to assessing the data (Vasconcellos et al., 2024).

# **Participants**

Participants were recruited by a panel data company—Dynata Insight Solutions—using three qualifying questions defined as eligibility criteria: (1) an age range between 16 and 24 years at baseline; (2) electronic media usage at any level; and (3) absence of neurological disorders. This age range was defined based on three criteria: (a) most mental health disorders begin in adolescence (Patel et al., 2007); (b) for ethical reasons, as parental consent is not a requirement for conducting research in participants aged  $\geq$  16 years; and (c) a new definition proposed by Sawyer and colleagues (2018), which expanded the adolescence period to 24 years to be more inclusive of a typical developmental trajectory. Eligible participants who expressed interest in participating in the study were required to sign the e-consent form to participate.

#### **Measurement Procedures**

Baseline data was collected using an online survey. To ensure the quality of the data, we used validity checks do identify and filter out respondents who might not be taking the survey seriously. Validity checks comprised five attention-check questions embedded in the survey (e.g., *"I feel like I need to eat cement but I have never brushed my teeth"*), and a minimum completion time of 6 minutes (i.e., 6 seconds per item on average). Participants who completed the survey in less than six minutes and/or failed on three or more of these attention checks were excluded from the sample, as it was unlikely they could have completed it with the necessary care and attention. After a 6-month period (between September 2023 and March 2024), participants were recontacted by Dynata using a Unique Identifier Number (UIN). Participants were asked to respond to the same online survey at baseline and follow-up assessment, with a time commitment of about 20 minutes at each timepoint. Unique identifier numbers were used to link participants' data from the two timepoints.

#### **Internet Gaming Disorder Measure**

To assess Internet Gaming Disorder according to the nine DSM-IV diagnostic core criteria (APA, 2013), we used a short version of the Internet Gaming Disorder Scale (IGDS9-SF; Pontes & Griffiths, 2015). The scale consists of 9 items and each question is rated using a 5-point Likert scale of (1) 'Never', (2) 'Rarely', (3) 'Sometimes', (4) 'Often', and (5) 'Very Often'. We calculated the scores—ranging between 9 and 45—by summing participants' answers. As per Pontes and Griffiths, scores lower than 36 indicated non-disordered gamers, while scores of 36 or more were considered disordered gamers. This scale is valid, reliable, and demonstrated to be suitable for measuring internet gaming disorder (Pontes & Griffiths, 2015).

#### Social Media Disorder Measure

To assess social media disorder we used a short-form of the Social Media Disorder

Scale (SMDS; van den Eijnden et al., 2016). This scale consists of nine dichotomous items—yes (1) and no (0)—corresponding to all nine criteria used to diagnose internet gaming disorder: (1) preoccupation, (2) tolerance, (3) withdrawal, (4) persistence, (5) escape, (6) problems, (7) deception, (8) displacement, and (9) conflict. Scores ranged from 0 to 9 points, and total scores were obtained by summing up yes-answers given to the 9 items of the scale. Higher scores were indicative of a higher degree of Social Media Disorder. Five or more (out of nine) criteria needed to be met in order to differentiate disordered social media users from non-disordered social media users (van den Eijnden et al., 2016). The SMDS presents good psychometric properties, and is recommended for research on problematic social media use among adolescents (Boer et al., 2021).

#### **Need Satisfaction and Frustration Measurement**

We used the Basic Psychological Need Satisfaction and Frustration Scale (Chen et al., 2015) to assess adolescents' need frustration in reference to their general life experiences and need satisfaction when using electronic screens (i.e., video games and social media). The original 24-item scale evaluates the satisfaction and frustration of needs, separately, with eight related items—four measuring satisfaction, and four measuring frustration—for each of the three basic psychological needs: competence, autonomy, and relatedness. This scale is currently the most validated and used scale to assess need satisfaction in several contexts (Martela & Ryan, 2021).

For the purpose of this study, we used nine need frustration items to assess adolescents' need frustration in reference to their general life experiences, and 12 need satisfaction items to assess need satisfaction in two screen use domains: (a) electronic gaming, and (b) social media; 6 items each. These two domains were selected based on the Common Sense Media report (Rideout et al. 2022). Adolescents spend most of their average daily screen time (8:39 hours per day) watching online videos (77%), using social media (62%), watching TV (49%),

and playing video games (40%). Interestingly, enjoyment rates differed notably from usage frequency. While 62% of adolescents reported daily use of social media, only 34% indicated that they enjoy it. In contrast, 26% reported daily gaming, but 39% expressed high enjoyment of gaming. It may suggest that these two domains of screen use can satisfy user's needs differently, by fulfilling or not their needs for autonomy, competence, and relatedness. Participants completed the 21-item questionnaire in a randomised order, using a 5-point Likert scale ranging from 1 (*Not true at all*) to 5 (*Completely true*).

#### Life Aspirations Measurement

We used a short version of the Aspirations Index (Kasser & Ryan, 1996) to access participants' life aspirations. The original scale consists of a total of 105 items representing seven categories of life aspirations. These categories include the extrinsic aspirations of wealth, fame, and image; the intrinsic aspirations of personal growth, meaningful relationships, and community contributions; and the aspiration of good health, which is considered a neutral aspiration. Because the 'health' category is not clearly either extrinsic or intrinsic, its related-items were not included in this study. Participants were only asked to rate the importance of each life aspiration to themselves. The second and third sub-items, which relate to (a) their beliefs about the likelihood of attaining each aspiration, and (b) the degree to which participants have already attained each of the life aspirations. Participants rated the six items from (1) 'not at all important' to (5) 'very important'. To calculate the intrinsic and extrinsic aspirations, we averaged the scores of the three intrinsic and the three extrinsic scale items separately.

#### **Socio-emotional Problems Measure**

We used a modified version of the self-reported Strengths and Difficulties Questionnaire (SDQ; Goodman et al., 1998) to identify the incidence of socio-emotional problems among the participants. The original 25-item SDQ consists of five subscales (i.e., emotional symptoms, conduct problems, hyperactivity or inattention problems, peer relationship problems, and prosocial behaviour). Since this study focuses solely on negative socio-emotional outcomes, and the absence of prosocial behaviour is conceptually different from the presence of antisocial behaviour (Cheng et al., 2010), the scores for the prosocial items were not assessed. Thus, for the purpose of this study, we used only four subscales of the questionnaire. Each subscale consisted of 5 items (20 items in total), and each item was rated on a 3-point Likert scale of (0) if they were 'not true', (1) 'somewhat true', or (2) 'certainly true'. Subtotal scores on relevant subscales ranged from 0 to 10. We calculated the SDQ total score by summing the scores on the emotional symptoms, conduct problems, hyperactivity-inattention, and peer problems subscales (range 0–40). Lower total difficulties scores indicated normal socio-emotional wellbeing, while medium scores indicated a borderline for socio-emotional problems, and higher scores indicated increased socio-emotional problems (Goodman et al., 1998). Previous research suggests that this instrument is suitable and invariant across age and sex (de Vries et al., 2018; Yao et al., 2009).

# **Additional Measures**

We collected demographic data for sample description (i.e., participants' age, gender, language spoken at home, and family socio-economic status). Family socio-economic status was measured using the youth version of the MacArthur Scales of Subjective Social Status (Goodman et al., 2001). This measure has demonstrated excellent reliability, with intraclass correlation coefficients of 0.73 and 0.79 for the society and community ladders, respectively. Higher numerical scores indicated higher subjective perceived social status, while a lower score suggests a lower perceived social status.

# **Analytical Strategy**

We performed all statistical analyses using R version 4.3.2 (R Core Team, 2020). A

p-value < 0.05 was defined to indicate statistical significance. To account for deviations to the normal distribution of variables, we tested all models using maximum likelihood estimation with robust standard errors to accommodate unmodeled heterogeneity (Hox et al., 2010). To ensure comparability across measurements and improve interpretability, we standardised all continuous variables. Scaling the variables allows for direct comparison of effect sizes across different measures and time points, particularly in studies with varying metrics or measurement scales (Lalla, 2017). We conducted the analyses in three steps:

- Descriptive statistics (i.e., means, standard deviations and frequencies) of participants' outcomes at baseline and follow-up assessments.
- 2. A mediation analysis. Mediation tests a hypothetical causal chain where the effect of one variable (X) on another variable (Y) is mediated, or explained, by a third variable (M). We performed a mediation analysis to test the relationship between 'screen use need satisfaction' at time 1 (predictor) and 'socio-emotional problems' at time 2 (outcome) through 'compulsive screen use' (mediating variable). Because this was a 2-wave study, we tested the association between 'need satisfaction from screens' and 'compulsive screen use' (path a) by controlling for prior levels of compulsive screen use to account for changes over time. Also, the association between 'changes in compulsive screen use' and 'socio-emotional problems' at time 2 (path b), as well as the direct association between 'need satisfaction from screens' at time 1 and 'socio-emotional problems' at time 2 (path c), were controlled by accounting for socio-emotional problems at time 1.
- 3. Moderated mediation analyses. Moderated mediation occurs when the strength of an indirect effect (mediated relationship via variable M) between two variables X and Y depends on the level of a moderator variable Z (Preacher et al., 2007). In this study, we performed a moderated mediation analysis to test the conditional indirect effect of

'general need frustration' (moderating variable) on the relationship between 'screen use need satisfaction' (predictor) and 'socio-emotional problems' (outcome) via 'changes in compulsive use of screens' (mediating variable). Additionally, we tested the predictive effects of different levels of need satisfaction from screens (± 2 standard deviations) on the moderated mediation analyses. Next, we tested the concurrent effects of 'general need frustration' and 'life aspirations', using the latter as a secondary moderating variable on the relationship between 'need satisfaction from screens' and 'socio-emotional problems'.

For all analyses, we examined the moderating effects of different types of interactions with screens (i.e., social media use and video gaming), separately. Additionally, all analyses were conducted controlling for 'prior compulsive screen use' in path a', and for pre-existing socio-emotional problems in paths b' and c'. To handle missing data, we employed Full Information Maximum Likelihood (FIML). This technique is recommended for latent moderated structural equations as it accurately manages sample distributions and yields unbiased parameter estimates, standard error estimates, and valid statistical inferences (Cham et al., 2017). Cham and colleagues (2017) also suggest that FIML is suitable when the indicators are missing completely at random (MCAR; Little, 1988). MCAR assumes that the likelihood of missingness is independent of any observed or missing values (Enders, 2022).

Both analyses (i.e., mediation analysis and moderated-mediation analysis) were conducted using bootstrapping procedures. Bootstrapping is a resampling technique where the sample is conceptualised as a pseudo-population representing the larger population from which the sample was derived (Preacher et al., 2007). By generating multiple resamples of the dataset, the sampling distribution of any statistic can be calculated. This approach eliminates the need for assumptions about the shape of the sampling distribution when performing inferential tests, providing a more robust and reliable analysis. We used 5,000 bootstrap samples for the mediation analyses. For moderated-mediation analyses, due to model complexity, we used 1,000 bootstrap samples.

To describe effect sizes, Schäfer and Schwars (2019) recommend using benchmarks derived from within disciplines. They argue that global benchmarks (e.g., Cohen's benchmarks) may not be suitable for all areas of behavioural sciences. This is especially important in longitudinal studies, where very high correlations (i.e., r = 0.40 or greater) are often unreliable and may significantly overestimate the actual effect size (Funder & Ozer, 2019). Reflecting this insight, we classified effect sizes using the updated benchmarks by Funder and Ozer (2019): very small (0.05), small (0.10), medium (0.20), large (0.30), and very large ( $\geq 0.40$ ). All analyses were performed using 95% confidence intervals and the significance threshold was set at alpha < 0.05.

#### Results

#### **Sample Characteristics**

At baseline, we collected data from 1,473 participants. From these, 877 participants provided valid responses and were included in the study sample. At the follow-up, 186 participants completed the survey, of which 142 provided valid responses. To handle missing data from participants who did not complete follow-up measures, we used Full Information Maximum Likelihood and bootstrapping procedures. Thus the sample size for all statistical analyses remained at 877 participants (84.5% female;  $M_{age} = 21.8 \pm 2.0$  years). In terms of screen use, 570 participants reported using both video games and social media. Of the remaining participants, 289 participants exclusively used social media (e.g., Instagram, TikTok, SnapChat, and Facebook), while 18 participants reported only playing video games and did not use social media at all. The majority of participants (74.3%) reported that English was the primary language spoken at home. All descriptive statistics and correlations among variables investigated are provided in Table C1 - Appendix C.

#### **Simple Mediation Analysis**

For mediation analyses, need-satisfaction and socio-emotional problems were treated continuously (i.e., scored from 0 to 40 on socio-emotional problems). Compulsive screen use was dichotomised using the aforementioned cut-offs. For interpretation, we defined 'high' and 'low' need satisfaction as participants 2 standard deviations (SD) above or below the mean, with 'moderate need satisfaction' describing participants between +2SD and -2SD. Model fit statistics across simple mediation models suggested a good fit to the data, with Comparative Fit Index (CFI; Bentler, 1990) varying from 0.97 to 0.99; Tucker-Lewis Index (TLI; Tucker & Lewis, 1973) from 0.83 to 0.94; Root Mean Square Error of Approximation (RMSEA; Browne & Cudeck, 1992) from 0.04 to 0.07; and Standardised Root Mean Square Residual (SRMR) from 0.06 to 0.08. Thus, it is reasonable to conclude that these models adequately reproduce the observed data in the form of a variance-covariance matrix. Full model fit results are presented in Table C2 - Appendix C.

As hypothesised, '*high* need satisfaction' from screens at Time 1 did not directly predict socio-emotional problems at Time 2 ( $\beta_{c'} = -0.13$ ; 95% CI [-0.35, 0.18]; see Figure 5.2). While high dropout meant statistical power was low, the trend in effect sizes suggested that higher need satisfaction predicted fewer problems than moderate need satisfaction ( $\beta_{c'} =$ -0.04; 95% CI [-0.17, 0.10]) or lower need satisfaction ( $\beta_{c'} = 0.04$ ; 95% CI [-0.18, 0.35]). Additionally, we anticipated that adolescents exhibiting compulsive screen use would be at greater risk of developing socio-emotional problems (Hypothesis 4). The results of the mediation analysis combined for both screen types support this hypothesis (Figure 5.2). Compulsive screen use was significantly associated with later socio-emotional problems, with effects increasing from high need satisfaction ( $\beta_b = 0.17$ ; 95% CI [-0.21, 0.54]), to moderate ( $\beta_b = 0.25$ ; 95% CI [0.06, 0.44]), and low need satisfaction from screens ( $\beta_b = 0.33$ ; 95% CI [-0.03, 0.68]). Although the wide confidence intervals indicate some uncertainty, the relatively large effect at low need satisfaction is noteworthy and approaches statistical significance. Despite this, indirect effects were very small across all levels of need satisfaction, suggesting that compulsive screen use only weakly mediated this relationship. Meanwhile, the total effect of screen use on adolescents' socio-emotional problems ranged from a small positive association at low need satisfaction ( $\beta = 0.04$ ; 95% CI [-0.22, 0.31]) to a small negative association at high need satisfaction ( $\beta = -0.13$ ; 95% CI [-0.40, 0.14]).

# Figure 5.2

Indirect Effects of Need Satisfaction from Screens on Socio-emotional Problems via

# Compulsive Screen Use



Notes. Bootstrap samples = 5,000; n = 877; Levels of need satisfaction from screens:

moderate, high and low ( $\pm 2$  SD)

A similar pattern was observed when analysing this relationship for video games only. As shown in Figure 5.3, the negative direct effects of video games on socio-emotional problems decreased as need satisfaction increased, from low ( $\beta = 0.08$ ; 95% CI [-0.17, 0.34]) to higher levels ( $\beta = -0.25$ ; 95% CI [-0.51, 0.01]; Figure 5.3). Additionally, the negative impact of compulsive gaming on socio-emotional problems was weakened, shifting from lower levels ( $\beta_b = 0.37$ ; 95% CI [-0.06, 0.81]) to higher levels of need satisfaction ( $\beta_b = 0.04$ ; 95% CI [-0.40, 0.47]; Figure 5.3). Again, wide confidence intervals indicate some uncertainty whether the effect of compulsive gaming is significantly moderated by the degree of need satisfaction derived from gaming interactions. However, the effect at low need satisfaction were quite large and nearly statistically significant, suggesting a potentially meaningful moderation. The indirect effects remained marginally null across all levels of need satisfaction from video games, indicating that changes in compulsive gaming did not mediate this relationship (Appendix C - Figure C1). Conversely, the total effect of need satisfaction from video gaming shifted from a small positive association at low levels ( $\beta = 0.08$ ; 95% CI [-0.17, 0.63]) to a moderate negative association at higher levels of need satisfaction ( $\beta = -0.25$ ; 95%) CI [-0.51, 0.35]; Figure 5.3). Specifically, adolescents who experience moderate to high need satisfaction during their gaming interactions tend to exhibit fewer socio-emotional problems compared to those whose needs are not fulfilled through gaming interactions.

# Figure 5.3

Effects of Different Levels of Need Satisfaction from Video Games and Social Media on Socio-emotional Problems through Compulsive Use



Notes. Bootstrap samples = 5,000; n = 877; Levels of need satisfaction from screens: moderate, high and low (± 2 SD).

For social media, the predictive analysis revealed a distinct relationship between need satisfaction at Time 1 and socio-emotional problems at Time 2. For example, direct effects of need satisfaction on socio-emotional problems were minimal across all levels of need satisfaction (see Figure 5.3). Also, the results indicated an interaction effect of  $\pm 0.10$  on the relationship between need satisfaction and compulsive social media use. This association shifted from negative at *low* need satisfaction ( $\beta = -0.04$ ; 95% CI [-0.37, 0.28]), to positive at *moderate* levels ( $\beta = 0.04$ ; 95% CI [-0.12, 0.21]), and *higher* levels of need satisfaction ( $\beta =$ 0.13; 95% CI [-0.19, 0.46]). However, the associations between compulsive use and socio-emotional problems remained comparable and non-significant across all levels of need satisfaction. Consequently, the indirect effect of need satisfaction on socio-emotional problems via compulsive social media use was minimal, with slightly larger effects at high need satisfaction ( $\beta = 0.03$ ) compared to low levels ( $\beta = -0.01$ ; Figure C2 in Appendix C). The total effects of need satisfaction on socio-emotional problems were also similar across different levels of need satisfaction from social media use. Thus, while high need satisfaction more strongly predicts compulsive social media use, compulsive use does not appear to mediate the relationship between need satisfaction and socio-emotional problems.

# **Moderated Mediation Analysis**

To test the hypotheses 2 through 5, we explored the conditional effect of 'general need frustration' on the relationship between need satisfaction from screens on adolescents' socio-emotional wellbeing. First, to test our second hypothesis, we examined how the interaction between need satisfaction and need frustration influences the first mediation pathway (i.e., path a). We hypothesised an interaction between high need satisfaction from screens and high general need frustration that would significantly increase compulsive screen use (Hypothesis 2). Alternatively, an interaction between low need satisfaction from screens and low general need frustration would not lead to problematic screen use. As presented in

Figure 5.3, the mediation analyses revealed distinct patterns of association for video games and social media. Therefore, we conducted separate moderated mediation analyses for each screen use type. The results for video games and social media are presented below.

Across all moderated-mediation models, the results of the Comparative Fit Index (CFI; Bentler, 1990) demonstrated a good fit to the data ( $CFI_{lowest} = 0.86$ ;  $CFI_{highest} = 0.89$ ). The results of the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973) also indicated acceptable model fit measures:  $TLI_{lowest} = 0.84$ ;  $TLI_{highest} = 0.87$ . TLI has been shown to be very sensitive to model complexity (Shi et al., 2019), and in complex models such as a longitudinal moderated-mediation model, the TLI can be significantly downwardly biassed even if the model was correctly specified. The Root Mean Square Error of Approximation (RMSEA) results varied from acceptable (RMSEA<sub>lowest</sub> = 0.09) to suboptimal model fit (RMSEA<sub>highest</sub> = 0.12). RMSEA values exceeding 0.10 could suggest a poor model fit (Browne & Cudeck, 1992). However, according to Lai and Green (2016), the RMSEA index evaluates the magnitude of a model's fit function value from a different perspective. Therefore, discrepancies between RMSEA and CFI qualitative results do not necessarily indicate problems with the data-model relationship. Moreover, discrepancies between RMSEA and CFI tend to be less problematic if a 'good CFI' and a 'poor RMSEA' are found, rather than the other way around (2016), which aligns with our findings. The Standardised Root Mean Square Residual values were slightly elevated (SRMR<sub>lowest</sub> = 0.16; SRMR<sub>highest</sub> = 0.21), suggesting poor model fit (Verma & Verma, 2023). However, in models with a large number of variables or parameters, achieving lower SRMR values can be challenging. Higher SRMR values may still be deemed acceptable if other fit indices, such as CFI and TLI, indicate good model fit (Hu & Bentler, 1999). Therefore, given the exemptions, moderated-mediation models appear to adequately replicate the variance-covariance matrices of the observed data (see Table C2 in Appendix C).

#### Video Games

#### Need Satisfaction and General Need Frustration Predicting Problematic Gaming

The moderated mediation analysis confirmed the second hypothesis. As shown in Figure 5.4 (path a), there was a significant interaction between '*high* need satisfaction' and '*high* need frustration', which substantially increased the risk of compulsive gaming behaviour ( $\beta = 0.27$ ; CI [0.05, 0.49]). In contrast, the interaction between '*low* need satisfaction' and '*low* need frustration' resulted in a small, non-significant effect ( $\beta = 0.01$ ; CI [-0.14, 0.17]). These findings indicate that adolescents who experience high general need frustration but also derive high satisfaction from gaming interactions are at increased risk of engaging in problematic gaming behaviour. In contrast, those who live in need-supportive environments and do find gaming need-fulfilling are less likely to become compulsive gamers. See Table C3 in Appendix C for full results.

# Figure 5.4

Moderating Effects of General Need Frustration on the Relationship between Need

Satisfaction from Video Games and Socio-emotional Problems through Compulsive Gaming



Notes. Bootstrap samples = 1,000; n = 877; Condition levels: moderate, high and low (± 2 Standard Deviations)

#### Compulsive Gaming and General Need Frustration Predicting Socio-emotional Problems

We hypothesised that high levels of general need frustration would strengthen the association between problematic gaming and socio-emotional problems, regardless the degree of need satisfaction from video games (H3). This hypothesis was partially supported by the moderated-mediation analysis (Figure 5.4; path b). Specifically, for those with high general need frustration, *high*, but not low satisfaction from video games was linked to socio-emotional problems ( $\beta = 0.36$ ; CI [0.12, 0.61]). While this path was non-significant for those with low need satisfaction from video games ( $\beta = 0.17$ ; CI [-0.08, 0.41]), the estimate was still substantive, but with high variability. This high variability suggests possible factors,

external to the model, which can modify this relationship further. However, compulsive gaming was also significantly associated with increased socio-emotional problems among adolescents who reported '*low* need frustration' in real life environments: effects were comparable at *low* need satisfaction ( $\beta = 0.29$ ; CI [0.10, 0.48]) and *high* need satisfaction ( $\beta = 0.27$ ; CI [0.08, 0.46]) from video games. These findings suggest that compulsive gaming is a risk factor for socio-emotional problems, with adolescents whose needs are chronically frustrated in real life but met through gaming being the most vulnerable group.

# Adolescents from High Need-thwarting Environments Face Greater Risk of

#### Socio-emotional Problems Linked to Gaming Behaviour

The direct association between need satisfaction from video games and socio-emotional problems was minimal and non-signifcant across all conditions, even under the influence of '*high* general need frustration' (see Figure 5.5). However, the indirect effect was notably influenced by the moderating role of '*high* need frustration'. Specifically, for adolescents whose needs were satisfied through gaming, '*high* general need frustration' significantly increased the risk of socio-emotional problems via heightened problematic gaming behaviour ( $\beta = 0.10$ ; CI [0.08, 0.12]). Among those with '*low* need satisfaction' during gaming, the indirect effect through compulsive gaming was also significant but negatively linked to socio-emotional problems ( $\beta = -0.03$ ; CI [-0.05, -0.01]).

# Figure 5.5

Direct, Indirect, and Total Effects of Interactions Between Need Satisfaction from Video



Games and General Need Frustration

Notes. Bootstrap samples = 1,000; n = 877; Condition levels: moderate, high and low need satisfaction from screens and general need frustration (± 2 Standard Deviations)

The total effect was statistically significant only when '*high* need satisfaction' was paired with '*high* need frustration' ( $\beta = 0.09$ ; CI [0.04, 0.14]). At low levels of general need frustration, neither the indirect nor total effects of need satisfaction from video games were meaningful (Table C3 - Appendix C). These findings support the hypothesis that a need-thwarting environment has a substantial impact—through compulsive gaming—on the socio-emotional wellbeing of adolescents, particularly when they find games satisfying. Furthermore, adolescents who did not find gaming interactions need-supportive but were still compulsive gamers, were at greater risk of socio-emotional problems if coming from a need-thwarting environment—confirming the fifth hypothesis of this study.

Intrinsic Life Aspirations Increase the Risk of Socio-emotional Problems among Adolescents who live in Need-thwarting Environments We expected that life aspirations would influence the relationship between need satisfaction from screens and socio-emotional problems. Specifically, we hypothesised that *adolescents exhibiting problematic gaming behaviour—despite finding video games unsupportive of their needs—would be mostly driven by extrinsic life aspirations and would be at greater risk of socio-emotional problems (H6).* Additionally, we anticipated that *among these people, those living in highly need-thwarting environments would be particularly vulnerable to socio-emotional issues (H7).* To test these hypotheses, we performed a moderated-mediation analysis, using life aspirations (i.e., extrinsic and intrinsic orientation) as a secondary moderating variable.

The results did not support these hypotheses (see Figure 5.6). Among compulsive gamers reporting '*low* need satisfaction' from gaming and '*low* general need frustration', the total effects were comparable, both without ( $\beta = 0.00$ ; CI [-0.06, 0.05]) and with the influence of intrinsic ( $\beta = 0.01$ ; CI [-0.06, 0.08]) and extrinsic ( $\beta = 0.00$ ; CI [-0.08, 0.07]) life aspirations. In contrast, life aspirations significantly moderated the relationship among adolescents from need-thwarting environments whose needs were fulfilled through gaming interactions. Among these people, compulsive gamers with a stronger intrinsic orientation were at greater risk of socio-emotional problems ( $\beta = 0.27$ ; CI [0.19, 0.34]) compared to more extrinsically oriented players ( $\beta = 0.10$ ; CI [0.03, 0.18]). Full results are presented in Appendix C - Table C4.

# Figure 5.6

Direct, Indirect and Total Effects of the Interaction between General Need Frustration and Life Aspirations on the Mediated Relationship between Need Satisfaction from Video Games and Socio-emotional Problems



Notes. Bootstrap samples = 1,000; n = 877; Reference: moderate need satisfaction from video games and moderate general need frustration; Intrinsic: people two standard deviations above the mean for intrinsic values; Extrinsic: people two standard deviations above the mean for extrinsic values.

#### **Social Media**

#### Need Satisfaction and General Need Frustration Predicting Problematic Social Media Use

The moderated-mediation analysis did not support the hypothesis that the interaction between '*high* need satisfaction' and '*high* need frustration' would be the strongest predictor of problematic social media use (see Figure 5.7; path a). Although a moderate, non-significant association was observed for this condition ( $\beta = 0.18$ ; CI [-0.22, 0.57]), the strongest association came from the interaction between '*low* need satisfaction' and '*low* need frustration' ( $\beta = 0.33$ ; CI [-0.02, 0.68]). While neither of these associations reached statistical significance, the effect sizes indicate a potential relationship. These findings suggest that adolescents with low levels of both need satisfaction and frustration may be more vulnerable to problematic use. However, those with high levels of both are not entirely protected. Additionally, the interaction between '*high* need satisfaction' and '*low* need frustration' was inversely and significantly associated with problematic social media use ( $\beta = -0.38$ ; CI [-0.73, -0.03]), suggesting that high need satisfaction without significant need frustration in real life may reduce the risk of excessive social media engagement.

# Figure 5.7

Moderating Effects of General Need Frustration on the Relationship between Need Satisfaction from Social Media and Socio-emotional Problems through Compulsive Gaming



Notes. Bootstrap samples = 1,000; n = 877; Condition levels: moderate, high and low (± 2 Standard Deviations)

# Compulsive Social Media Use and General Need Frustration Predicting Socio-emotional Problems

In our third hypothesis, we predicted that general need frustration would strengthen the relationship between compulsive social media use and socio-emotional problems, regardless of the level of need satisfaction from social media use. The moderated-mediation analysis provided partial support for this hypothesis. As shown in Figure 5.7 (path b), compulsive social media use was not significantly associated with social emotional problems at both low levels ( $\beta = 0.08$ ; CI [-0.14, 0.31]) and high levels of need satisfaction ( $\beta = 0.15$ ; CI [-0.08, 0.38]). However, a stronger effect was found in the interaction between '*low* need satisfaction' and '*low* need frustration' ( $\beta = 0.30$ ; CI [0.08, 0.52]). These findings indicate that adolescents with low levels of need satisfaction from social media and low levels of general need frustration are more likely to develop socio-emotional problems if they engage in problematic social media use.

# Adolescents from Low Need-thwarting Environments, Whose Needs are Unmet From Social Media—but Still Exhibit Problematic Social Media Use—are Most Vulnerable to Socio-emotional Problems

As shown in Figure 5.8, moderated-mediation analysis for social media revealed a significant direct association between need satisfaction and socio-emotional problems among adolescents who experienced 'high need satisfaction' from social media but '*low* general need frustration' ( $\beta = 0.06$ ; CI [0.01, 0.11]). For all other conditions, direct effects were not significant. The indirect effects, however, were statistically significant for two key interactions: '*low* need satisfaction and *low* need frustration' ( $\beta = 0.10$ ; CI [0.07, 0.13]), and '*high* need satisfaction and *low* need frustration' ( $\beta = 0.06$ ; 0.00]). In both cases, problematic social media use was the primary driver of the total effects of need satisfaction, though in opposite directions. Consequently, total effects were statistically significant only for the interaction between 'low need satisfaction' and 'low need frustration' ( $\beta = 0.07$ ; CI [0.01, 0.12]), suggesting that adolescents with *low* need satisfaction from social media and *low* general need frustration are particularly susceptible to socio-emotional problems through problematic social media use (Figure 5.8). This contradicts the hypothesis that 'among adolescents who do not find social media need-supportive but are still compulsive users, those from a need-thwarting environment would be at greater risk of socio-emotional problems'.

# Figure 5.8

Direct, Indirect, and Total Effects of Interactions Between Need Satisfaction from Social Media and General Need Frustration on Socio-emotional Problems



Notes. Bootstrap samples = 995; n = 877; Condition levels: moderate, high and low need satisfaction from screens and general need frustration (± 2 Standard Deviations)

Additionally, findings challenge predictions by revealing an interaction between *high* need satisfaction from social media and *high* general need frustration (see Figure 5.8). Specifically, among adolescents from need-thwarting environments, the direct effect of need satisfaction on their socio-emotional wellbeing was minimal ( $\beta = -0.01$ ; CI [-0.06, 0.03]). However, when need satisfaction led to problematic social media use, the indirect effect intensified, approaching statistical significance ( $\beta = 0.03$ ; CI [0.00, 0.05]). Despite this, adolescents in this condition (i.e., *high* need satisfaction and *high* need frustration) were not at greater risk of socio-emotional problems over time (total effect:  $\beta = 0.01$ ; CI [-0.04, 0.07]). Thus, these findings suggest a pattern where adolescents in need-thwarting environments may turn to social media to meet real-life unmet needs through virtual connections. Detailed results are available in Appendix C - Table C5.

# Being Extrinsically Motivated Increases the Risk of Socio-emotional Problems in Adolescents who live in Need-supportive Environments

We hypothesised that adolescents who compulsively use social media—despite not having their psychological needs met during these interactions—would be primarily motivated by extrinsic life aspirations and, as result, would experience greater socio-emotional problems (H6). Additionally, we predicted that among these adolescents, those whose needs were consistently frustrated in life would be particularly vulnerable to socio-emotional problems over time (H7). The moderated-mediation analysis using life aspirations as a secondary moderating variable supports these hypotheses (see Figure 5.9). Among problematic social media users with '*low* need satisfaction' from social media and '*low* general need frustration', total effects were statistically significant for those driven more by extrinsic ( $\beta = 0.10$ ; CI [0.01, 0.19]) than intrinsic life aspirations ( $\beta = 0.05$ ; CI [-0.03, 0.13]).

# Figure 5.9

Direct, Indirect and Total Effects of the Interaction between General Need Frustration and Life Aspirations on the Mediated Relationship between Need Satisfaction from Social Media and Socio-emotional Problems



Notes. Bootstrap samples = 991; n = 877; Reference: moderate need satisfaction from video games and moderate general need frustration; Intrinsic: people two standard deviations above the mean for intrinsic values; Extrinsic: people two standard deviations above the mean for extrinsic values.

Life aspirations also played a significant role in the moderated relationship (i.e., with general need frustration as a primary moderating variable) between need satisfaction from

social media and socio-emotional problems (refer to Table C6 in Appendix C). Specifically, among adolescents whose needs were fulfilled through social media interactions: (a) those living in need-supportive environments who were more extrinsically oriented were at significantly higher risk of socio-emotional problems ( $\beta = 0.27$ ; CI [0.18, 0.36]); (b) those from need-thwarting environments with a stronger intrinsic orientation had a significantly lower risk of socio-emotional problems ( $\beta = -0.08$ ; CI [-0.16, -0.01]). These findings indicate that, in need-supportive environments, pursuing extrinsic aspirations intensifies the negative impact of social media on adolescents' socio-emotional wellbeing. Conversely, in need-thwarting environments, an intrinsic orientation seems to protect adolescents' social-emotional health.

#### Discussion

The primary aim of this study was to examine how general need frustration moderates the relationship between need satisfaction from screen use and socio-emotional problems in adolescents. The findings largely support the proposed hypotheses and revealed distinct patterns for video games and social media. For video games—contrary to prevalent concerns about its detrimental effects—adolescents whose basic psychological needs were fulfilled through gaming showed better socio-emotional wellbeing. This is consistent with previous research indicating that in-game satisfaction of needs can foster positive socio-emotional wellbeing of players (Granic et al., 2014; Przybylski et al., 2009; Rigby & Ryan, 2011; Ryan et al., 2006). However, those exhibiting problematic gaming behaviour were more likely to experience socio-emotional problems over time. In other words, need satisfaction from gaming appears to benefit adolescents' socio-emotional wellbeing, as long as it does not escalate to compulsive gaming. These findings are consistent with earlier studies showing that compulsive gaming only negatively affects wellbeing when players are driven by obsessive passion for the game (Przybylski et al., 2009). For social media, the direct effects of high need satisfaction on socio-emotional outcomes were minimal. However, adolescents who experienced greater need satisfaction through their social media interactions were more likely to develop problematic attachment to social media. Once this problematic behaviour emerged, its negative impact on socio-emotional wellbeing remained consistent, regardless of the level of need satisfaction. These findings highlight the notable mediating role of problematic social media use in this relationship. Thus, compared to video games, high need satisfaction from social media appears to be a stronger predictor of socio-emotional problems in adolescents.

When considering broader psychological contexts in adolescents' lives (i.e., general need frustration and life aspirations), further nuances emerged between video games and social media. For video games, the impact of *high* need satisfaction on adolescents' socio-emotional wellbeing depended greatly on whether their life environments were need-supportive or need-thwarting. Adolescents in highly need-thwarting environments who felt need-fulfilment through gaming interactions were more likely to develop problematic gaming behaviours. These adolescents appear to turn to games to satiate psychological needs being thwarted elsewhere. These results align with the need density hypothesis, which posits that individuals who lack need satisfaction in broader aspects of their lives may intensify their engagement with specific activities to compensate for unmet psychological needs. Specifically, these adolescents seem to use gaming as a substitute for the need support absent in their daily lives. While gaming may temporarily fulfil these needs, the excessive reliance on it can foster compulsive behaviours, reinforcing problematic gaming patterns. Over time, these patterns tend to increase vulnerability to socio-emotional issues, as the reliance on gaming fails to address the root causes of need frustration in their broader environment.

The nuanced differences between adolescents in need-supportive versus need-thwarting environments underscore the importance of considering environmental factors when interpreting the effects of need satisfaction from gaming. For instance, findings from a systematic review in adolescents revealed that poor parent-child relationships were strongly linked to greater severity of problematic gaming (Schneider et al., 2017). Longitudinal research has also shown that factors such as greater parental hostility, lower parental affection (Kwon et al., 2011), lower-quality parenting (Kim & Kim, 2015), reduced time socialising with parents, and negative parental attitudes towards gaming (Jeong & Kim, 2011) predict problematic gaming over time. Additionally, social vulnerability and dissatisfaction with life appear to increase the risk of problematic gaming behaviour in adolescents (Peeters et al., 2018). In contrast, greater parent-child connectedness and warm, positive family environments were found to be protective against problematic gaming behaviours (Choo et al., 2015; Liau et al., 2015). Moreover, the relationship between poor parent-child relationships and problematic gaming was mediated by reduced school connectedness and increased social interaction with deviant peers (Zhu et al., 2015).

Essentially, problematic gaming behaviour seems to emerge primarily when gaming becomes a substitute for unmet needs in a frustrating environment, rather than just an enjoyable activity within an otherwise supportive context. This aligns with the 'need density hypothesis' (Ryan & Deci, 2018), which suggests that people may seek satisfaction in alternative contexts when their real-life needs are unmet. In this scenario, gaming becomes a primary outlet for fulfilling those unmet needs, serving as a coping mechanism (Kaimara et al., 2021; Reinecke, 2009). For example, evidence shows that adolescents with family-related challenges tend to engage in gaming not only to escape from threatening family environments, but also to seek out more comfortable or supportive relationships (Caplan, 2010; Paulus et al., 2018). Also, the sense of control, achievement, and social connection experienced in gaming may provide temporary relief from frustrations in other parts of life (Scott et al., 2024). For instance, skill-based games with online rankings may fulfil players' need for recognition and achievement when such validation is lacking in their family environment (Schneider et al.,

2017). However, *relying* on gaming in this way can develop into an unhealthy coping strategy. Online games, for example, allow players to create avatars that represent them in-game (Bender et al., 2020). When players see these avatars as extensions of themselves, they may start depending on them to fulfil unmet needs in their real-life environments (Green et al., 2020). Gaming may offer temporary relief from negative feelings and emotions (Liao et al., 2022). However, gaming does not address the root causes of their psychological distress (Herman-Stabl et al., 1995). Instead, extended gaming time and a gradual disconnection from their real identity can pose a significant risk to their socio-emotional wellbeing (Green et al., 2020). Therefore, focusing solely on adolescents' gaming behaviours may overlook critical underlying factors that contribute to the development of problematic gaming behaviour and related socio-emotional problems (Schneider et al., 2017).

Alternatively, problematic gaming may displace other *healthier* behaviours that could more sustainably meet adolescents' needs (e.g., friendships, school engagement, physical activity; Rigby & Ryan, 2011). For instance, systematic reviews have linked problematic gaming behaviour to lower levels of physical activity (Chan et al., 2022), reduced sleep quality and duration (Hale & Guan, 2015; Hysing et al., 2021; Kaimara et al., 2021), and fewer in-person social interactions (Twenge, Martin, et al., 2018). The nature of online games may reinforce these risks: as games do not stop when players log out, they may feel compelled to stay connected for extended periods (Kaimara et al., 2021; Schneider et al., 2017). This pressure can be exacerbated by desires for social approval, status, and affiliation within gaming communities (Kaye et al., 2017), reflecting motivations that are largely extrinsic (Kasser & Ryan, 1996). In these contexts, the 'fear of missing out' can lead adolescents to prioritise gaming over important real-life experiences such as outdoor leisure and physical activities, proper sleep, and face-to-face interactions. Over time, this behaviour may intensify into compulsive gaming, deepening socio-emotional struggles and creating a harmful cycle.

Furthermore, adolescents whose unmet general needs were fulfilled through gaming experiences were particularly at risk of socio-emotional problems if they were both compulsive gamers and highly intrinsically motivated. In contrast, intrinsically motivated adolescents who did not engage in compulsive gaming were not at risk. Although this finding did not support the study hypothesis, it supports prior research (Bányai et al., 2019; Maroney et al., 2019; Przybylski et al., 2012). Przybylski and colleagues (2012) noted that video games are mostly intrinsically motivating, partly because they allow players to embody idealised versions of themselves. Gaming fosters a strong sense of autonomy, enabling players to set their own in-game goals and make independent choices within virtual environments (Ryan et al., 2006). Skill-based progression and challenging gameplay can enhance self-worth and confidence in handling real-life challenges (Liao et al., 2022; Rigby & Ryan, 2011; Ryan et al., 2006). For instance, gaming has been shown to improve problem-solving skills and indirectly boost academic performance (Adachi & Willoughby, 2013; Blumberg et al., 2008). This sense of mastery and control is particularly appealing to intrinsically motivated players, who value the gaming experience itself over external rewards (Przybylski et al., 2012). Additionally, cooperative games can foster interpersonal empathy, supporting relationship building and maintenance (Greitemeyer et al., 2010). Such abilities may help intrinsically motivated adolescents address their real-world frustrations (Blumberg et al., 2008).

Thus, nurturing positive gaming experiences can serve as a constructive outlet for intrinsically motivated adolescents to cope with unmet needs. However, when paired with compulsive gaming, the combination of high real-life need frustration, high gaming-related need satisfaction, and strong intrinsic motivation can be harmful. Compulsive gaming often displaces other meaningful activities, such as spending time with family, socialising with friends, or participating in community programs—opportunities that might more sustainably fulfil their general needs. The resulting opportunity costs can lead to feelings of sadness or

regret. In contrast, adolescents driven by extrinsic values may be less affected by such opportunity costs. For these individuals, gaming might satisfy needs like status (e.g., through leaderboards), and the missed opportunities hold less significance (e.g., spending less time on personal appearance may not feel like a meaningful loss). This difference highlights the nuanced impact of gaming motivations on adolescents' socio-emotional wellbeing.

For social media, the direct effect of need satisfaction on adolescents' socio-emotional wellbeing was minimal, suggesting that simply feeling fulfilled through social media does not directly predict socio-emotional problems over time. However, higher levels of perceived need fulfilment increased the likelihood of problematic attachment to social media. Compulsive use was also moderately associated with socio-emotional difficulties, regardless of how satisfying the social media interactions were. Despite this, the total effects remained small and did not differ between low and high levels of need satisfaction, indicating that compulsive use substantially mediates this relationship. These findings are consistent with previous research showing that the harmful effects of social media often stem from displacing healthier behaviours that more sustainably support adolescents' wellbeing. For instance, smartphone use at bed time (e.g., text messaging and phone call after lights out), has been associated with poor sleep quality (Cain & Gradisar, 2010; Hysing et al., 2015, 2021), and excessive daytime sleepiness (Munezawa et al., 2011), which are linked to poorer socio-emotional health (Baum et al., 2014). These behaviours are likely more common when social media use is compulsive. Likewise, excessive social media use is linked to reduced face-to-face interactions, correlating with a decline in psychological wellbeing in adolescents (Nie, 2001; Stepanikova et al., 2010; Twenge et al., 2018). Indeed, adolescents who predominantly rely on virtual over in-person social interactions have been found to report more loneliness (Twenge et al., 2019). Loneliness, in its turn, leads them to increase social media use to alleviate feelings of isolation, ultimately worsening it (Kim et al., 2009).

The interactions between need satisfaction from social media and general need frustration appear to have a particularly strong impact on adolescents' socio-emotional wellbeing. Adolescents from need-thwarting environments who reported high need satisfaction through social media use seemed to rely on their online interactions to compensate for frustrated feelings in their offline lives. This behaviour aligns with prior findings that underscore the influence of family dynamics, particularly parental behaviour, on adolescents' socio-emotional health. For example, frequent parental distraction by mobile phones, or "parental phubbing" (phone snubbing), can erode adolescents' sense of belonging, undermining their need for relatedness (Deci & Ryan, 2000). Parental phubbing not only reduces adolescents' feelings of connection but also inhibits face-to-face interaction, stunting their sense of autonomy by limiting opportunities for open communication (Shoshani & Krauskopf, 2021). When adolescents' basic psychological needs are hindered by poor parent-child relationships, many turn to social media to fulfil unmet needs. This compensatory use aligns with the 'need density hypothesis', suggesting that adolescents who gain a sense of satisfaction through a specific behaviour—such as engaging in virtual connections—are more likely to use it compulsively as a coping mechanism (Ryan & Deci, 2018). However, when online interactions become their primary or only source of need satisfaction, this reliance can easily become a maladaptive coping strategy. Over time, adolescents may enter a cycle where frustrated needs drive them to increase their social media use. This may offer a temporary relief but ultimately amplifies their socio-emotional challenges, perpetuating a cycle of dependency and heightened emotional distress.

Also unexpectedly, adolescents in need-supportive environments with low need satisfaction from social media—but who still used it compulsively—showed elevated socio-emotional issues. Conversely, those whose needs were fulfilled during virtual social interactions showed reduced vulnerability to socio-emotional problems with increased social media use. This suggests that problematic social media use seems to mediate these relationships, with its impact—positive or negative—shaped by the degree of need support provided by social media interactions. When virtual interactions satisfy core psychological needs of autonomy, competence and relatedness, problematic use may sometimes be tempered by positive social reinforcement, potentially moderating the adverse effects on mental health (Sheldon & Gunz, 2009). In contrast, when social media interactions lack this need fulfilment, problematic use tends to worsen socio-emotional challenges, consistent with research on maladaptive coping mechanisms (Bartholomew et al., 2011). These findings suggest that—particularly in these circumstances—the relationship between need satisfaction from social media and socio-emotional problems may transcend the supportiveness or thwarting nature of their offline environments.

Moderated-mediation analysis underscored a notable role of life aspirations within this dynamic: among adolescents in need-supportive environments, extrinsic aspirations emerged as stronger predictors of both problematic social media use and socio-emotional problems over time, regardless of whether their social media experiences were satisfying or dissatisfying. This finding implies that problematic social media behaviour may be more common among adolescents who, rather than compensating for daily frustrations, are focused on pursuing extrinsic goals. For instance, fear-of-missing-out (FoMO) has been linked to problematic social media and behaviour like phubbing among youth (Ansari et al., 2024; Franchina et al., 2018; Groenestein et al., 2024; Przybylski et al., 2013). Fear-of-missing-out is defined as an intra-personal trait that compels people to stay updated of what their peers are doing and achieving in life (Franchina et al., 2018). It is reflected in feelings of anxiety that emerge when they perceive themselves missing out on rewarding experiences that others are having (Franchina et al., 2018; Groenestein et al., 2024). A recent scoping review highlighted that fear-of-missing-out mediates the relationship between problematic social media and

psychological wellbeing in a bidirectional pattern (Groenestein et al., 2024). Specifically, problematic social media users, by fearing-of-missing-out, are more likely to experience psychological impairment. On the other hand, social media users experiencing psychological distress due to their fear-of-missing-out, are more likely to overuse social media to alleviate their anxiety (Groenestein et al., 2024). Experimental evidence reviewed by Groenestein et al. (2024) even suggested that severely restricting social media use increases FoMO. This underscores the importance of collaborative and respectful boundary-setting between parents and adolescents to effectively reduce both problematic screen use and improve adolescents' socio-emotional wellbeing.

External factors like social pressure, social comparison, appearance concerns, and peer influence can also lead to problematic social media use, affecting adolescents' mental health in various ways. Many adolescents compare themselves to the idealised images they see on social media, often feeling inadequate or inferior compared to others. Such social comparisons impact their self-esteem, leading to psychological distress (Burnette et al., 2017). Adolescents who are particularly concerned with their physical appearance-and who may already struggle with low self-esteem-often feel they do not measure up to others online. Such feelings may drive maladaptive behaviours, such as body dissatisfaction and a heightened desire to change their appearance, ultimately leading to unhealthy social media habits (Burnette et al., 2017). Research further suggests that adolescents with lower popularity or self-esteem are more inclined to post content that reflects negativity and receive less positive feedback on their profiles, reinforcing feelings of social rejection and isolation (Forest & Wood, 2012; Mikami et al., 2010). This creates a cycle where the need for external validation, such as receiving 'likes' and positive feedback, becomes central to feeling accepted and valued among peers (Andreassen et al., 2017). This reliance on external approval is especially common among adolescents with narcissistic tendencies, who are often motivated by a strong need for

admiration and social validation (Andreassen et al., 2017; Casale & Fioravanti, 2018).

Alternatively, some may be driven by peer influences: adolescents often feel pressured to mirror the behaviours they observe in their social circles, especially on social media, where visibility and peer validation are amplified. Research suggests that teens who frequently see their peers engaged online may feel compelled to increase their own social media activity, not just to remain part of the social loop but to avoid feelings of exclusion or missing out on important social interactions (Nesi & Prinstein, 2015). Adolescents who receive direct encouragement from their peers to be active online—such as tagging each other in posts or encouraging group participation—are even more likely to feel the need to engage in similar online activities to foster a sense of community and connection (Valkenburg et al., 2017). Moreover, adolescents who feel socially insecure or less popular are particularly susceptible to peer influence online, often spending more time on social media as a way to enhance their social presence and feel included (Oberst et al., 2017; Valkenburg & Peter, 2011). This desire to connect and seek validation can, however, lead to problematic social media habits and overattachment, as they become dependent on these online interactions for their self-worth and social identity (Nesi & Prinstein, 2015; Oberst et al., 2017).

Furthermore, adolescents from need-supportive environments who experience high levels of need satisfaction from social media do not seem to rely on social media in the same way. They are less likely to engage in compulsive use, possibly because their broader environment provides sufficient fulfilment of their psychological needs. For these adolescents, social media serves as an additional—rather than a primary—source of satisfaction, lowering the risk of dependency or excessive use. This aligns with findings from Kelly and Leung (2021), who found that social media use can enhance self-regulation through virtual rank and status, satisfy otherwise deficient—but not frustrated—social needs, and promote friendships and social groups. These findings suggest that social media enhances social connectedness among well-adjusted people by enabling individuals to extend and to maintain social relations (Ahn & Shin, 2013; Valkenburg & Peter, 2009). Despite that, it is noteworthy that the time spent on social media possibly consumes the time supposed to be spent on other valuable activities, such as in-person social interactions, without generating its benefits such as emotional support (Ahn & Shin, 2013).

Overall, these findings highlight a complex relationship between need satisfaction through screen use (i.e., video games and social media) and socio-emotional health in adolescents. The interactions among screen-based need satisfaction, need-support from broader life environments, and aspirational life goals warrant careful consideration when evaluating the impact of video games and social media on adolescents' socio-emotional health. To advance this field, research should shift beyond examining the consequences of problematic screen use and focus on understanding the underlying drivers of screen overattachment, including environmental and individual differences that inherently shape each adolescent's responses to digital media (Nesi & Prinstein, 2015; Orben, 2020).

# Strengths and Limitations, and Recommendations for Future Research

This study has several key strengths. First, it is anchored in a robust theoretical framework based on the Self-determination Theory (SDT; Ryan & Deci, 2018), offering valuable insights into how basic psychological needs interact with screen use and socio-emotional problems in adolescents. Second, by focusing on both need satisfaction derived from screen use and general need frustration, the study goes beyond surface-level screen use, allowing for a nuanced understanding of how compulsive screen use relates to adolescents' socio-emotional wellbeing. Additionally, by considering aspirational goals, this study enhances our understanding of the psychological and environmental mechanisms shaping the relationship between screen use and socio-emotional outcomes. This comprehensive perspective allows for a more detailed exploration of how internal motivations

and external influences jointly impact adolescents' screen use and socio-emotional development. Future research should incorporate a broader assessment of family factors to better capture the role of family dynamics and environments in these relationships.

The longitudinal design is another strength of this study, as it enables a more comprehensive analysis of causal relationships over time, which is crucial for identifying long-term impacts of screen use on adolescents' socio-emotional wellbeing. Finally, the incorporation of attention checks throughout the online survey helped minimise potential biases introduced by inattentive or malicious participations (Meade & Craig, 2012). Careless responses can introduce noise and undermine the reliability of the findings. By filtering out participant's responses, this methodological approach enhanced data quality, ensuring more accurate and reliable conclusions.

Despite these strengths, the complexity of the moderated-mediation models presented challenges in achieving ideal model fit measures. Root Mean Square Error of Approximation (RMSEA) and Standardised Root Mean Square Residual (SRMR) values were slightly above recommended thresholds in models that included two moderating variables, which may suggest a potential misfit between the model and the data. However, the Comparative Fit Index (CFI; Bentler, 1990) and Tucker-Lewis Index (TLI; Tucker & Lewis, 1973) remained within the acceptable range for highly complex structural equation models, indicating that while some fit indices were not optimal, the overall model performance was still adequate, reflecting the intricate nature of the analysis and the difficulty of balancing fit with model complexity. These findings highlight the trade-offs in model fit when working with sophisticated moderated-mediation frameworks.

While the baseline sample size was reasonable, a substantial portion of participants either did not provide follow-up data, or submitted untrustworthy responses and were not included in the analysis. While this response validation process improved data quality, it also increased the amount of missing data at time 2. To address this issue without reducing the baseline sample size, Full Information Maximum Likelihood (FIML) was used to input missing data. To further strengthen the reliability of the results, a bootstrap sampling technique was applied to enhance the reliability of the results by accounting for any uncertainty introduced by the imputation process. Together, these methods helped preserve the robustness and reliability of the study's findings.

The nuances observed between the effects of video games and social media underscores the importance of considering contextual factors when evaluating the psychological impact of screen use. For example, boys and girls often exhibit distinct psychological and behavioural responses to their environments and social interactions (Zahn-Waxler et al., 2008). Also, internet gaming disorders have been found to be more prevalent in boys than girls (Mihara & Higuchi, 2017). So, it is reasonable to anticipate that the impact of screens on adolescents' socio-emotional wellbeing may vary based on gender. However, the current study's sample was predominantly female, limiting the generalisability of the findings to boys. Future research should apply a similar methodological approach—such as examining the role of general need frustration as aspirational goals—to explore these dynamics across different gender groups and socio-demographic backgrounds, ensuring a more comprehensive understanding of how screen use affects diverse populations.

#### Conclusion

Self-determination Theory highlights the importance of fulfilling three basic psychological needs—competence, relatedness and autonomy—as vital for individuals' optimal functioning and psychological wellbeing. The frustration of these needs is associated with a range of maladaptive coping mechanisms, including compulsive behaviours, and often lead to poor socio-emotional outcomes. Adolescents' screen use may be driven by similar mechanisms. This study contributes to the understanding of how and under what circumstances video games and social media impact adolescents' socio-emotional wellbeing. These findings emphasise the need to consider several factors when examining the relationship between screen use and socio-emotional problems: (a) the role of screen interactions in fulfilling adolescent's basic psychological needs, (b) the broader psychosocial context, including how need thwarting their environments are, and (c) the aspirations of these adolescents. While gaming and social media offer unique opportunities to fulfil psychological needs, these findings suggest that both types of screen use may incur potential risks for their socio-emotional wellbeing. For video games, the risks arise when adolescents use games as substitutes for 'unsupportive' real-life environments, being particularly strong among those with intrinsic life aspirations. On the other hand, the negative impact of problematic social media engagement seems driven by more extrinsic life aspirations (e.g., seeking social validation or popularity). Additionally, the different patterns of effect between video games and social media reinforce the importance of moving beyond general screen time recommendations to a more nuanced, context-sensitive approach. In light of these, parents, educators, and clinicians should be attentive to the underlying motivations behind adolescents' video gaming and social media use, encouraging healthier real-life alternatives that can meet their psychological needs in more sustainable ways.

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