

Predicting Digital Emotional Dependence From Loneliness, Attachment Anxiety, and Perceived Social Support Among Adolescents: A Hierarchical Multiple Regression Study

Andre. McKenzie¹, James. O'Connor^{2*}, Camila. Espinoza³

¹ Department of Applied Psychology, University of the West Indies, Mona, Jamaica

² Department of Health Psychology, University of Manitoba, Winnipeg, Canada

³ Department of Educational Psychology, Universidad de Guayaquil, Guayaquil, Ecuador

* Corresponding author email address: james.oconnor@umanitoba.ca

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ABSTRACT

Objective: This study aimed to determine whether loneliness, attachment anxiety, and perceived social support predict digital emotional dependence among Canadian adolescents beyond the effects of age, gender, and daily social media use.

Methods and Materials: A cross-sectional descriptive-correlational design was conducted with 412 adolescents aged 13–18 years enrolled in secondary schools in Canada. Digital emotional dependence was assessed using the Social Integration and Emotional Connection dimension of the Social Media Use Integration Scale, loneliness was measured with the UCLA Loneliness Scale Version 3, attachment anxiety was assessed using the anxiety dimension of the Experiences in Close Relationships–Relationship Structures Questionnaire, and perceived social support was measured with the Multidimensional Scale of Perceived Social Support. Data were analyzed in SPSS 29 using Pearson correlations and hierarchical multiple regression. Age, gender, and daily social media use were entered in the first block, followed sequentially by loneliness, attachment anxiety, and perceived social support.

Findings: The final hierarchical regression model was significant, $F(6, 405) = 72.54$, $p < .001$, and explained 51.8% of the variance in digital emotional dependence, $R^2 = .518$, adjusted $R^2 = .511$. Loneliness produced the largest incremental contribution, $\Delta R^2 = .225$, $p < .001$, followed by attachment anxiety, $\Delta R^2 = .080$, $p < .001$, and perceived social support, $\Delta R^2 = .046$, $p < .001$. In the final model, loneliness was the strongest positive predictor, $\beta = .31$, $p < .001$, followed by attachment anxiety, $\beta = .25$, $p < .001$, and daily social media use, $\beta = .22$, $p < .001$. Perceived social support was a significant negative predictor, $\beta = -.23$, $p < .001$. Age and gender were not significant predictors.

Conclusion: Digital emotional dependence among adolescents appears to be shaped more strongly by interpersonal and emotional factors than by demographic characteristics alone, with loneliness and attachment anxiety increasing vulnerability and perceived social support functioning as a protective factor.

Keywords: digital emotional dependence; loneliness; attachment anxiety; perceived social support; adolescents; hierarchical multiple regression

1. Introduction

Digital technologies have become deeply embedded in the social and emotional lives of adolescents, transforming how young people communicate, seek reassurance, maintain relationships, regulate distress, and experience belonging. Social networking platforms, messaging applications, online gaming environments, and short-form video platforms now function not merely as communication tools but as psychologically meaningful spaces in which adolescents construct social identities, monitor peer relationships, and respond to interpersonal needs. Although digital engagement can provide opportunities for connection, self-expression, information exchange, and access to supportive communities, concern has increasingly shifted toward patterns of use characterized by emotional reliance, compulsive engagement, distress during disconnection, and difficulty maintaining a balanced relationship with online environments. Reviews of adolescent social networking have shown that the psychological consequences of digital participation depend not simply on frequency of use but on the ways in which online platforms become incorporated into emotional and relational functioning (Bottaro & Faraci, 2022). Similarly, problematic social networking has been associated with adverse mental-health outcomes and with neuropsychological processes involving reward sensitivity, reinforcement, and impaired self-regulation (Weinstein, 2023). Research on internet and social media dependence further indicates that excessive or emotionally driven use frequently overlaps with broader patterns of problematic internet behavior, although social media dependence should not be reduced to screen time alone because emotional investment, perceived necessity, and interpersonal compensation may represent distinct components of maladaptive engagement (Dong et al., 2025). Contemporary reviews have therefore emphasized the importance of examining psychological vulnerability factors underlying problematic social network use rather than conceptualizing digital behavior exclusively in terms of exposure duration (Fioravanti et al., 2025). Within this context, the concept of digital emotional dependence is particularly relevant because it captures the extent to which digital interaction becomes emotionally necessary for maintaining a sense of connection, reassurance, belonging, or psychological equilibrium.

Adolescence may represent a particularly sensitive developmental period for the emergence of such dependence

because interpersonal acceptance, peer evaluation, attachment needs, emotional regulation, and identity formation are all undergoing substantial change. During this stage, adolescents become increasingly oriented toward peers while remaining dependent on family and other attachment figures for security and support. Digital environments can therefore acquire heightened emotional salience by offering immediate interpersonal feedback, continuous access to social contacts, and opportunities to manage feelings of exclusion or insecurity. A broad literature on problematic internet use among young people has identified multiple psychological and contextual correlates, including emotional difficulties, family functioning, social stress, self-esteem, and patterns of coping (Kusnadi & Kaloeti, 2022). Studies among younger populations have further suggested that problematic internet use and problematic gaming do not emerge from identical pathways, underscoring the importance of identifying domain-specific predictors rather than treating all forms of digital overuse as a single phenomenon (Kim et al., 2023). Research on gaming disorder likewise supports a biopsychosocial perspective in which individual vulnerabilities interact with social and environmental factors to shape problematic technology use (Chang et al., 2023). Evidence from university and youth populations also indicates that behavioral patterns, psychological strain, and habitual smartphone engagement may combine to increase the likelihood of dependence-like use (Munusamy & Ghazali, 2022). Even among undergraduate populations, problematic internet use has been associated with psychosocial and behavioral risk factors that extend beyond simple access to technology (Acharya et al., 2023). These findings collectively suggest that emotionally dependent digital use among adolescents should be examined within a relational and psychosocial framework in which online behavior may function as a response to unmet interpersonal needs rather than merely as a consequence of technological availability.

Loneliness is one of the most theoretically plausible predictors of digital emotional dependence because online environments offer rapid and accessible opportunities for social contact when offline relationships feel insufficient. Loneliness is not equivalent to objective social isolation; rather, it reflects a subjective discrepancy between desired and experienced levels of interpersonal connection. This distinction is important because adolescents may be surrounded by peers yet still experience profound perceptions of exclusion, insufficient emotional intimacy, or

lack of belonging. The relationship between internet use and loneliness has been described as potentially bidirectional: digital communication may reduce loneliness by facilitating connection, but emotionally compensatory or excessive use may also intensify loneliness when online interactions replace or weaken satisfying offline relationships (Smith & Alheneidi, 2023). Empirical evidence has repeatedly linked loneliness to problematic internet-related behaviors. Among adolescents from Arab society in Israel, loneliness was identified as a significant predictor of internet addiction, suggesting that subjective social disconnection may motivate greater psychological reliance on online activity (Nibal, 2023). Among Chinese adolescents, loneliness also emerged as an important mechanism connecting adverse social experiences such as school victimization with internet addiction, indicating that online engagement may function partly as an escape from interpersonal distress (Shi & Wang, 2023). Longitudinal work among rural left-behind children has similarly demonstrated reciprocal associations between loneliness, social anxiety, and mobile phone addiction, reinforcing the possibility that loneliness is not merely correlated with digital dependence but may participate in a self-reinforcing developmental cycle (Wu et al., 2024). Research conducted during and after the COVID-19 period has further shown that trajectories of loneliness are meaningfully associated with adolescent mental-health outcomes, highlighting the broader psychological significance of sustained social disconnection (Wang et al., 2024).

Recent evidence has strengthened the interpretation of loneliness as a pathway through which adolescents and young adults may turn toward digital environments for emotional compensation. Loneliness has been found to mediate the association between feelings of insecurity and internet addiction, suggesting that internal experiences of vulnerability may increase problematic digital engagement partly because they heighten subjective social disconnection (Dey & Roy, 2025). Path-analytic research has also conceptualized loneliness as a bridge between psychological symptoms and internet addiction, supporting the idea of digital escape as an affect-regulation strategy (Bilgin et al., 2026). In hospitalized adolescents, recent theoretical work has proposed models in which emotional dysregulation and social compensation jointly contribute to internet addiction, further emphasizing the role of unmet interpersonal needs in excessive online behavior (Qi et al., 2026). The relationship extends beyond general internet use. Loneliness has been associated with gaming addiction among young men (Niazi

et al., 2024), while emerging longitudinal research on short-form video use suggests that loneliness and social anxiety may become intertwined with addictive engagement over time (Zhao et al., 2026). Loneliness may therefore create a motivational context in which digital environments become disproportionately important because they provide distraction, perceived companionship, social monitoring, and immediate opportunities for interaction. At the same time, persistent dependence on these environments may reduce tolerance for offline solitude or interpersonal uncertainty, strengthening the emotional significance of remaining digitally connected.

Attachment anxiety offers a complementary relational explanation for digital emotional dependence. Attachment anxiety is characterized by heightened concern about rejection, abandonment, inconsistent responsiveness, and the availability of important others. Individuals high in attachment anxiety tend to monitor interpersonal cues closely, seek frequent reassurance, and experience greater distress when they perceive distance or ambiguity in close relationships. Digital communication technologies may be particularly attractive under these conditions because they allow continual checking, rapid contact, observation of others' availability, and repeated reassurance-seeking. Although attachment processes have been studied less frequently than loneliness in relation to digital dependence, existing evidence indicates that insecure attachment styles are associated with problematic interpersonal technology use. Attachment style and loneliness have both been identified as predictors of phubbing, demonstrating that relational insecurity can manifest in maladaptive patterns of technology-mediated disengagement from face-to-face interaction (Büyüksakar & Çelik, 2024). More broadly, reviews of problematic social network use identify attachment-related insecurity among the psychological risk factors associated with dysregulated online engagement (Fioravanti et al., 2025). These mechanisms may be especially relevant during adolescence, when sensitivity to peer approval and fear of exclusion are developmentally heightened. In such circumstances, notifications, messaging, online-status indicators, and social-media feedback may function as continuous sources of interpersonal reassurance, potentially making digital access emotionally difficult to relinquish.

Attachment-related processes should also be considered within the family context because adolescent digital behavior develops within patterns of parental responsiveness, monitoring, communication, and emotional

availability. Systematic evidence indicates that family factors are meaningfully associated with both adolescent screen-media use and mental-health outcomes, with family functioning capable of operating as either a protective or risk context depending on the quality of relationships and regulation practices (Liu et al., 2024). Research on parental contributors to adolescent internet gaming addiction has likewise highlighted the influence of parenting characteristics and family processes on problematic digital engagement (Li et al., 2025). Parenting styles marked by excessive expectations or perfectionistic pressure may further increase vulnerability to internet gaming addiction by contributing to psychological strain and maladaptive coping (Luo & Li, 2025). Parental technoference represents another potential relational disruption because frequent parental interruption of interactions through digital device use may reduce perceived responsiveness and weaken the quality of parent-adolescent communication; this process has been linked in the literature to adolescent mental-health and behavioral difficulties (Dixon et al., 2023). These findings are important for understanding attachment anxiety because adolescents who perceive close relationships as inconsistent or emotionally unavailable may be more likely to compensate through digitally mediated contact. From this perspective, attachment anxiety and loneliness may overlap but remain conceptually distinct: loneliness concerns perceived insufficiency of social connection, whereas attachment anxiety reflects insecurity about whether important others will remain available and responsive.

Perceived social support may operate in the opposite direction by providing adolescents with interpersonal resources that reduce the need to rely excessively on digital environments for emotional regulation. Perceived social support refers to the belief that help, companionship, understanding, and emotional assistance are available from meaningful others, including family members, friends, and significant figures. Importantly, perceived support reflects subjective confidence in relational resources rather than the objective number of social contacts. Adolescents who believe that dependable support is available may be better able to tolerate social stress, regulate negative emotions, and seek assistance through adaptive interpersonal channels. Conversely, when support is perceived as inadequate, digital platforms may become a substitute source of reassurance, belonging, or validation. Research conducted during the COVID-19 pandemic indicated that perceived psychological and social factors were associated with internet addiction, illustrating how dependence on digital environments may

become stronger when ordinary support structures are disrupted (Suaaree et al., 2022). Studies of adolescents' social media use similarly indicate that the emotional impact of online engagement depends substantially on the broader quality of their interpersonal environment (Bottaro & Faraci, 2022). In addition, loneliness-related models of problematic internet use imply that adequate social resources may interrupt the pathway from distress to digital compensation (Bilgin et al., 2026). Thus, perceived social support may not simply correlate negatively with digital emotional dependence; it may represent a protective relational resource that competes with the emotional functions otherwise supplied by online interaction.

The relevance of social support also becomes clearer when considered alongside emerging research on social functioning, prosocial behavior, and risk prediction. Recent machine-learning approaches to adolescent prosocial behavior have demonstrated the value of examining combinations of psychosocial variables when identifying developmental risk or resilience patterns (Li, 2026). Although such approaches differ methodologically from conventional regression, they reinforce the broader principle that adolescent social behavior is best understood through multivariable models rather than single-factor explanations. Digital dependence likewise appears to result from multiple interacting vulnerabilities, including emotional distress, social insecurity, family conditions, reinforcement processes, and patterns of digital use. Research on smartphone addiction among youth has shown that behavioral characteristics remain important predictors alongside psychological factors (Munusamy & Ghazali, 2022), while research on problematic internet use consistently identifies heterogeneous risk profiles across populations (Acharya et al., 2023). The implication is that loneliness, attachment anxiety, and perceived social support should not be examined in isolation. Their relative contributions need to be evaluated simultaneously while controlling for demographic characteristics and actual intensity of social media use. Such an approach can distinguish whether digital emotional dependence is primarily explained by spending more time online or whether relational vulnerabilities retain predictive power after behavioral exposure is statistically accounted for.

This distinction is particularly important because high-frequency digital use does not necessarily indicate emotional dependence. An adolescent may spend several hours online for education, entertainment, peer communication, or creative activities without experiencing distress when

disconnected or relying on digital contact to maintain emotional stability. Conversely, another adolescent may spend less overall time online but experience intense preoccupation, reassurance-seeking, or emotional discomfort when unable to access social media. Research on problematic social networking has consistently emphasized that maladaptive engagement is defined more meaningfully by loss of control, psychological salience, functional impairment, and emotional consequences than by duration alone (Weinstein, 2023). Bibliometric and conceptual analyses of social media dependence and internet addiction likewise indicate substantial overlap but also meaningful distinctions between dependence-like psychological processes and general digital exposure (Dong et al., 2025). In adolescents, this distinction may be especially consequential because digital interaction has become normative. Therefore, identifying psychosocial predictors of emotional dependence requires models that account for daily social media use while examining whether loneliness, attachment anxiety, and perceived social support explain unique additional variance. Hierarchical multiple regression is well suited to this purpose because control variables can first be entered into the model, followed by theoretically important interpersonal predictors, thereby clarifying their incremental contribution.

The existing literature nevertheless leaves several important gaps. First, many studies have focused broadly on internet addiction, gaming disorder, smartphone addiction, or problematic social networking rather than specifically examining the emotional dependence component of digital engagement (Chang et al., 2023; Ciacchini et al., 2023). Retrospective and correlational research has documented clinically relevant patterns of social media addiction among adolescents, but greater attention is needed to the interpersonal mechanisms that distinguish emotionally dependent use from general frequency of engagement (Ciacchini et al., 2023). Second, loneliness has received substantial attention, whereas attachment anxiety and perceived social support are less often examined simultaneously within the same predictive model. Third, many available studies have been conducted among university students or adult samples, limiting direct generalization to adolescents whose attachment systems, peer relationships, and self-regulatory capacities are still developing (Acharya et al., 2023; Niazi et al., 2024). Fourth, digital behavior has changed rapidly, with newer forms of engagement such as short-form video, continuous messaging, and platform-based social monitoring

introducing additional opportunities for emotional reinforcement (Zhao et al., 2026). Finally, the potential consequences of loneliness-linked digital dependence extend beyond problematic technology use itself. Theoretical work has raised concern that severe loneliness in adolescents with internet addiction may be connected to broader psychological risks, including suicidal ideation, underscoring the clinical importance of understanding the relational vulnerabilities surrounding excessive digital engagement (Khatcherian et al., 2022). Together, these limitations indicate a need for adolescent-focused models that differentiate behavioral exposure from emotional reliance and assess multiple interpersonal predictors simultaneously.

A Canadian adolescent sample provides a relevant setting for examining these relationships because digital communication is deeply integrated into everyday peer interaction while adolescents continue to navigate developmental tasks involving autonomy, belonging, identity, and attachment security. A hierarchical predictive framework can clarify whether basic demographic factors and daily social media use explain digital emotional dependence sufficiently or whether relational experiences add substantial explanatory value. On theoretical grounds, loneliness would be expected to predict stronger digital emotional dependence because adolescents who perceive deficits in social connection may increasingly use online interaction as compensation. Attachment anxiety should also contribute positively because digitally mediated contact can provide immediate reassurance and opportunities to monitor interpersonal availability. In contrast, perceived social support would be expected to predict lower emotional dependence because adolescents who experience reliable support offline may have less need to depend on digital channels for emotional regulation and belonging. These expectations are consistent with broader evidence linking emotional distress and social compensation to internet addiction (Qi et al., 2026), insecurity and loneliness to problematic use (Dey & Roy, 2025), attachment-related vulnerability to maladaptive technology-mediated behavior (Büyüksakar & Çelik, 2024), and family and social contexts to adolescents' patterns of screen-media use (Liu et al., 2024). They are also compatible with findings that problematic digital engagement reflects complex psychosocial processes rather than a single behavioral cause (Kusnadi & Kaloeti, 2022). Accordingly, examining these variables within a unified model may provide a more differentiated understanding of why some adolescents

become emotionally reliant on digital interaction while others maintain comparatively balanced patterns of use.

The aim of the present study was to determine whether loneliness, attachment anxiety, and perceived social support significantly predict digital emotional dependence among Canadian adolescents and to examine their incremental contributions beyond age, gender, and daily social media use using hierarchical multiple regression.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a cross-sectional, descriptive-correlational design to examine the extent to which loneliness, attachment anxiety, and perceived social support predicted digital emotional dependence among adolescents in Canada. The study population consisted of adolescents enrolled in public secondary schools in Canada during the 2025–2026 academic year. A total of 428 adolescents were initially recruited through a multistage school-based sampling procedure. Following data screening, 16 questionnaires were excluded because of substantial missing responses, patterned responding, or failure to complete the principal study measures, resulting in a final analytical sample of 412 adolescents. Participants ranged in age from 13 to 18 years, thereby representing the developmental period of middle to late adolescence. Recruitment was conducted through participating secondary schools located in urban and suburban communities, with efforts made to include students from different grade levels and socioeconomic backgrounds. In the first stage of sampling, participating schools were selected from cooperating school districts; in the second stage, classes within the selected schools were approached, and all eligible students in those classes were invited to participate. Eligibility criteria included being between 13 and 18 years of age, being currently enrolled in a Canadian secondary school, having sufficient proficiency in English to understand the questionnaires, reporting regular use of at least one social media or digital communication platform, and providing assent together with parental or legal guardian consent when required by institutional and school-board regulations. Adolescents were excluded if they submitted substantially incomplete questionnaires or if response-pattern screening indicated that the data could not be considered reliable. Participation was voluntary, and students were informed that they could discontinue participation at any point without academic or personal consequences. Questionnaires were

administered electronically in a standardized format either during designated school periods or through a secure survey link approved by the participating schools. No identifying information was included in the analytical dataset, and participants were informed that their individual responses would remain confidential and would be used exclusively for research purposes. The study procedures were conducted in accordance with established ethical principles for research involving minors, including voluntary participation, confidentiality, minimization of potential psychological discomfort, and appropriate consent and assent procedures.

2.2. Measures

Digital emotional dependence was assessed using the Social Integration and Emotional Connection subscale of the Social Media Use Integration Scale developed by Jenkins-Guarnieri and colleagues. The Social Media Use Integration Scale was designed to assess the extent to which social media use is psychologically and socially incorporated into an individual's everyday life and contains two dimensions: Social Integration and Emotional Connection and Integration into Social Routines. The present study used the six-item Social Integration and Emotional Connection dimension as the primary measure of digital emotional dependence because this dimension specifically reflects the emotional significance assigned to social media, feelings of disconnection when access is unavailable, emotional discomfort associated with inability to use social media, preference for digitally mediated communication, and the perceived importance of digital platforms in maintaining social relationships. The wording of references to a specific platform in the original measure was adapted to refer broadly to “social media” or “social media accounts” in order to accommodate contemporary adolescents' use of multiple platforms rather than a single service. Responses were recorded on a six-point Likert-type scale ranging from 1 (strongly disagree) to 6 (strongly agree). Item scores were summed or averaged after appropriate scoring procedures, with higher scores representing greater emotional reliance on social media and stronger integration of digital communication into the participant's emotional and interpersonal functioning. The original Social Media Use Integration Scale demonstrated a two-dimensional structure and satisfactory internal consistency, with particularly strong reliability reported for the Social Integration and Emotional Connection dimension. In the present study, the internal consistency of the six-item digital emotional

dependence measure was evaluated using Cronbach's alpha before inferential analyses were conducted.

Loneliness was measured using the UCLA Loneliness Scale Version 3 developed by Russell. The scale consists of 20 items designed to assess subjective feelings of loneliness, perceived social isolation, lack of companionship, and dissatisfaction with the quality and availability of interpersonal relationships. Participants indicated how frequently they experienced each statement on a four-point response scale ranging from 1 (never) to 4 (often). The instrument contains both positively and negatively phrased items in order to reduce acquiescent response tendencies. Positively worded items were reverse-scored before calculating the total score, so that higher total scores consistently indicated greater perceived loneliness. The possible total score therefore reflected a continuum from relatively low loneliness and stronger perceived interpersonal connectedness to pronounced subjective loneliness and social isolation. The UCLA Loneliness Scale Version 3 has been widely used in psychological and social research and has demonstrated strong reliability and construct validity across different populations. In the present study, the scale was administered in its standard English-language format, and internal consistency was assessed using Cronbach's alpha.

Attachment anxiety was assessed using the anxiety dimension of the Experiences in Close Relationships–Relationship Structures Questionnaire developed by Fraley and colleagues. The ECR-RS is a brief self-report measure designed to assess individual differences in attachment-related anxiety and attachment-related avoidance across important interpersonal relationships. The instrument contains nine items for each relationship context, of which three assess attachment anxiety and six assess attachment avoidance. Because the present study specifically investigated anxiety concerning interpersonal availability, reassurance, and potential rejection or abandonment, only the attachment-anxiety items were used for the principal predictor variable. Adolescents completed the attachment-anxiety items with reference to their close relationships, with particular emphasis on emotionally significant attachment figures. The items assess concerns that important others may not care sufficiently, fears of abandonment, and worries regarding the responsiveness and availability of close others. Responses were provided on the instrument's seven-point Likert-type scale, ranging from strong disagreement to strong agreement. Scores on the anxiety items were averaged to obtain an attachment-anxiety score, with higher scores

indicating greater insecurity characterized by heightened concern regarding rejection, abandonment, and insufficient interpersonal reassurance. The ECR-RS was selected because it permits attachment representations to be assessed in relation to concrete interpersonal relationships rather than treating attachment exclusively as a generalized personality characteristic. The instrument has demonstrated an interpretable two-dimensional structure corresponding to attachment anxiety and avoidance. Internal consistency for the attachment-anxiety score was examined in the current sample before its inclusion in the regression analyses.

Perceived social support was measured using the Multidimensional Scale of Perceived Social Support developed by Zimet and colleagues. The MSPSS is a 12-item self-report questionnaire that assesses an individual's perception of the availability and adequacy of social support from three major interpersonal sources: family, friends, and a significant other. Each source of support is represented by four items. Participants rated each statement using a seven-point Likert-type response format ranging from 1 (very strongly disagree) to 7 (very strongly agree). Scores may be calculated separately for the Family, Friends, and Significant Other dimensions or combined to obtain an overall perceived social support score. Because the objective of the present study was to determine whether adolescents' general perception of available interpersonal support independently predicted digital emotional dependence, the overall MSPSS score was used in the principal analyses. Higher scores indicated stronger perceived availability, responsiveness, and adequacy of social support across important interpersonal relationships. The MSPSS has consistently demonstrated satisfactory reliability and a three-factor structure corresponding to family, friends, and significant-other support. For the present study, Cronbach's alpha was calculated for the overall scale as well as for its three subscales to verify the reliability of scores in the Canadian adolescent sample.

A brief demographic questionnaire was also administered to obtain information required to characterize the sample and identify relevant control variables. Participants reported their age, gender, school grade, approximate daily duration of social media use, and the number of years they had actively used social media. Daily social media use was defined as the approximate average amount of time spent using social networking, messaging, content-sharing, and comparable interactive digital platforms on a typical day. Age, gender, and daily social media use were included as control variables in the first block of the hierarchical

regression model so that the incremental predictive contributions of loneliness, attachment anxiety, and perceived social support could be evaluated after accounting for basic demographic and digital-use characteristics.

2.3. Data Analysis

Data were analyzed using IBM SPSS Statistics, version 29. Before conducting the primary analyses, the dataset was screened for completeness, coding accuracy, out-of-range values, univariate outliers, and multivariate outliers. Cases with substantial missing data on the principal variables were excluded from the final analytical sample. For cases containing only minimal item-level missingness, scale scores were computed only when sufficient valid responses were available according to the scoring requirements of the corresponding instrument. Descriptive statistics, including means, standard deviations, observed ranges, frequencies, and percentages, were calculated to describe participant characteristics and the distributions of digital emotional dependence, loneliness, attachment anxiety, and perceived social support. Internal consistency was examined using Cronbach's alpha, with coefficients of .70 or greater considered indicative of acceptable reliability for the purposes of the study. Preliminary relationships among continuous study variables were assessed using Pearson product-moment correlation coefficients. Prior to hierarchical multiple regression, the statistical assumptions underlying linear regression were examined. Linearity was evaluated through scatterplots and partial regression plots, normality of residuals was assessed using histograms and normal probability plots, and homoscedasticity was examined by plotting standardized residuals against standardized predicted values. Independence of residuals was evaluated using the Durbin-Watson statistic. Multicollinearity was assessed using tolerance values and variance inflation factors, with tolerance values above .10 and variance inflation factor values below 5.00 interpreted as indicating an acceptable degree of independence among predictors. Potential influential observations were evaluated using standardized residuals, leverage values, and Cook's distance. The distributions of the continuous predictors were also inspected for substantial skewness or kurtosis before construction of the regression models.

Hierarchical multiple regression analysis was performed with digital emotional dependence as the dependent variable. Predictors were entered into the regression equation in theoretically ordered blocks in order to determine whether

the principal psychosocial variables explained additional variance in digital emotional dependence beyond demographic and behavioral characteristics. In the first block, age, gender, and average daily social media use were entered as control variables. In the second block, loneliness was entered to determine whether subjective social disconnection accounted for a significant incremental proportion of variance in digital emotional dependence after adjustment for the control variables. Attachment anxiety was entered in the third block to evaluate whether insecurity regarding the availability and responsiveness of close others contributed additional explanatory power beyond loneliness. Perceived social support was entered in the fourth and final block to determine whether adolescents' perceptions of supportive interpersonal resources independently explained further variance after demographic characteristics, social media use, loneliness, and attachment anxiety had been considered. For each model, the multiple correlation coefficient, coefficient of determination, adjusted coefficient of determination, F statistic, and associated significance level were examined. Changes in R^2 and the corresponding F-change statistics were used to determine whether each successive block produced a statistically significant improvement in prediction. In the final model, unstandardized regression coefficients, standard errors, standardized beta coefficients, t statistics, 95% confidence intervals, and probability values were examined to determine the direction, magnitude, and independent contribution of each predictor. Statistical significance was established at $p < .05$ using two-tailed tests. The hierarchical analytical strategy was selected because it enabled evaluation not only of the overall predictive capacity of loneliness, attachment anxiety, and perceived social support, but also of the unique incremental variance explained by each psychosocial factor while controlling for relevant demographic and digital-use characteristics.

3. Findings and Results

The final sample consisted of 412 adolescents between 13 and 18 years of age, with a mean age of 15.61 years ($SD = 1.42$). Of the participants, 214 (51.94%) identified as female, 190 (46.12%) identified as male, and 8 (1.94%) identified as another gender or preferred not to report their gender. Regarding school grade, 101 participants (24.51%) were in Grade 9, 108 (26.21%) were in Grade 10, 104 (25.24%) were in Grade 11, and 99 (24.03%) were in Grade 12. Participants reported an average of 3.74 hours per day ($SD = 1.46$) of

social media use, indicating substantial routine engagement with social networking, messaging, content-sharing, and other interactive digital platforms. The average duration of active social media use was 5.21 years ($SD = 1.67$), suggesting that most participants had been exposed to digitally mediated social interaction for a considerable portion of their adolescence. Preliminary examination of the data showed that the distributions of the major continuous variables were suitable for parametric analysis. Absolute skewness values ranged from 0.11 to 0.48 and absolute kurtosis values ranged from 0.08 to 0.61, indicating no

substantial departures from normality. Inspection of standardized residuals, scatterplots, normal probability plots, and influence statistics further indicated that the assumptions of linearity, normality of residuals, homoscedasticity, and absence of excessively influential observations were adequately satisfied. The Durbin–Watson statistic for the final regression model was 1.96, supporting independence of residuals. Tolerance values ranged from 0.61 to 0.91 and variance inflation factor values ranged from 1.10 to 1.64, indicating that multicollinearity among the predictors was not a concern.

Table 1

Descriptive Statistics, Internal Consistency, and Correlations Among the Main Study Variables

Variable	M	SD	Cronbach's α	1	2	3	4
1. Digital emotional dependence	3.72	0.91	.88	—			
2. Loneliness	43.68	10.84	.93	.56***	—		
3. Attachment anxiety	4.11	1.29	.86	.49***	.52***	—	
4. Perceived social support	5.08	1.07	.92	-.46***	-.49***	-.42***	—

As shown in Table 1, the adolescents reported a mean digital emotional dependence score of 3.72 ($SD = 0.91$), indicating a moderate level of emotional integration with and reliance on social media and digitally mediated interaction. The mean loneliness score was 43.68 ($SD = 10.84$), while the mean attachment-anxiety score was 4.11 ($SD = 1.29$), suggesting meaningful variability in both subjective social disconnection and insecurity within close relationships. The average perceived social support score was 5.08 ($SD = 1.07$), indicating that participants generally perceived moderate to relatively high availability of support from family members, friends, and significant others. Internal consistency was satisfactory to excellent across all measures, with Cronbach's alpha coefficients ranging from .86 for attachment anxiety to .93 for loneliness. Pearson correlation analysis demonstrated that digital emotional dependence was positively and significantly associated with loneliness, $r = .56$, $p < .001$, indicating that adolescents who experienced stronger feelings of social isolation tended to report greater

emotional reliance on digital platforms. Digital emotional dependence was also positively correlated with attachment anxiety, $r = .49$, $p < .001$, showing that greater fear of rejection, abandonment, or insufficient interpersonal responsiveness was associated with stronger emotional dependence on digitally mediated interaction. In contrast, perceived social support was significantly and negatively correlated with digital emotional dependence, $r = -.46$, $p < .001$, suggesting that adolescents who perceived greater availability and adequacy of interpersonal support were less emotionally dependent on digital environments. Loneliness was positively related to attachment anxiety, $r = .52$, $p < .001$, whereas perceived social support was negatively associated with both loneliness, $r = -.49$, $p < .001$, and attachment anxiety, $r = -.42$, $p < .001$. Although these relationships were moderate in magnitude, none approached a level that would indicate problematic redundancy among predictors, supporting their simultaneous inclusion in the hierarchical regression analysis.

Table 2

Hierarchical Multiple Regression Model Summary for the Prediction of Digital Emotional Dependence

Model	Predictors Entered	R	R ²	Adjusted R ²	ΔR^2	F	ΔF	p for ΔF
1	Age, gender, daily social media use	.409	.167	.161	.167	27.27	27.27	<.001
2	Model 1 + loneliness	.626	.392	.386	.225	65.60	150.57	<.001
3	Model 2 + attachment anxiety	.687	.472	.465	.080	72.59	61.52	<.001
4	Model 3 + perceived social support	.720	.518	.511	.046	72.54	38.66	<.001

The hierarchical regression results presented in Table 2 indicated progressive improvement in the prediction of digital emotional dependence as theoretically relevant psychosocial variables were added to the model. In the first step, age, gender, and daily social media use collectively produced a significant regression model, $R = .409$, $R^2 = .167$, adjusted $R^2 = .161$, $F(3, 408) = 27.27$, $p < .001$. Thus, the demographic and behavioral control variables accounted for 16.7% of the variance in digital emotional dependence. When loneliness was entered in the second step, the multiple correlation increased substantially to $R = .626$ and the proportion of explained variance increased to 39.2%. The addition of loneliness accounted for an additional 22.5% of the variance beyond age, gender, and daily social media use, $\Delta R^2 = .225$, $\Delta F(1, 407) = 150.57$, $p < .001$. This represented the largest incremental increase across the hierarchical models and indicated that subjective social isolation constituted a particularly important explanatory factor. In the

third step, attachment anxiety was added to the model and significantly increased the explained variance from 39.2% to 47.2%, representing an additional 8.0% of variance, $\Delta R^2 = .080$, $\Delta F(1, 406) = 61.52$, $p < .001$. Finally, perceived social support was entered in the fourth step. The final model yielded $R = .720$, $R^2 = .518$, and adjusted $R^2 = .511$, indicating that the complete set of predictors explained 51.8% of the total variance in digital emotional dependence. Perceived social support accounted for a further 4.6% of unique variance after adjustment for all variables entered at the preceding stages, $\Delta F(1, 405) = 38.66$, $p < .001$. The progressive increase in R^2 across the four stages therefore supported the incremental contribution of loneliness, attachment anxiety, and perceived social support to the prediction of adolescents' digital emotional dependence beyond demographic characteristics and the amount of daily social media exposure.

Table 3

Analysis of Variance for the Hierarchical Regression Models Predicting Digital Emotional Dependence

Model	Source	Sum of Squares	df	Mean Square	F	p
1	Regression	56.81	3	18.94	27.27	<.001
	Residual	283.39	408	0.69		
	Total	340.20	411			
2	Regression	133.36	4	33.34	65.60	<.001
	Residual	206.84	407	0.51		
	Total	340.20	411			
3	Regression	160.58	5	32.12	72.59	<.001
	Residual	179.63	406	0.44		
	Total	340.20	411			
4	Regression	176.23	6	29.37	72.54	<.001
	Residual	163.98	405	0.40		
	Total	340.20	411			

Table 3 presents the omnibus analysis of variance for each hierarchical regression model and confirms that every stage of the analysis significantly predicted digital emotional dependence. The initial control-variable model was statistically significant, $F(3, 408) = 27.27$, $p < .001$, with a regression sum of squares of 56.81 and a residual sum of squares of 283.39. Following the addition of loneliness, the amount of explained variability increased considerably, with the regression sum of squares increasing to 133.36 and residual variability decreasing to 206.84. The second model was therefore highly significant, $F(4, 407) = 65.60$, $p < .001$. Inclusion of attachment anxiety in Model 3 resulted in a further increase in the regression sum of squares to 160.58 and a reduction in the residual sum of squares to 179.63, $F(5,$

$406) = 72.59$, $p < .001$. In the final model, after perceived social support was also included, the regression component increased to 176.23 while unexplained variability declined to 163.98, producing an overall model of $F(6, 405) = 72.54$, $p < .001$. The residual mean square decreased progressively from 0.69 in the initial model to 0.40 in the final model, further demonstrating that the inclusion of the psychosocial predictors substantially reduced unexplained variability in adolescents' digital emotional dependence. Taken together, the ANOVA findings confirmed that the final set of predictors provided a statistically meaningful improvement over an intercept-only model and that the hierarchical sequence produced increasingly stronger explanatory models.

Table 4*Final Hierarchical Regression Coefficients Predicting Digital Emotional Dependence*

Predictor	B	SE B	β	t	p	95% CI for B	Tolerance	VIF
Constant	2.46	0.39	—	6.31	<.001	[1.69, 3.23]	—	—
Age	0.03	0.03	.05	1.23	.220	[-0.02, 0.08]	.91	1.10
Gender	-0.07	0.06	-.04	-1.14	.255	[-0.20, 0.05]	.94	1.06
Daily social media use	0.14	0.03	.22	5.48	<.001	[0.09, 0.19]	.86	1.16
Loneliness	0.026	0.004	.31	6.50	<.001	[0.018, 0.034]	.61	1.64
Attachment anxiety	0.18	0.03	.25	5.68	<.001	[0.12, 0.24]	.67	1.49
Perceived social support	-0.20	0.03	-.23	-6.13	<.001	[-0.26, -0.13]	.70	1.43

As shown in Table 4, three principal psychosocial predictors remained independently associated with digital emotional dependence after simultaneous adjustment for demographic characteristics and daily social media exposure. Loneliness emerged as the strongest psychosocial predictor in the final model, $\beta = .31$, $B = 0.026$, $SE = 0.004$, $t = 6.50$, $p < .001$, 95% CI [0.018, 0.034]. This coefficient indicated that, holding all other variables constant, every one-point increase in loneliness was associated with an estimated 0.026-point increase in digital emotional dependence. The standardized coefficient further indicated that a one-standard-deviation increase in loneliness corresponded to approximately a 0.31-standard-deviation increase in digital emotional dependence. Attachment anxiety also independently and positively predicted the dependent variable, $\beta = .25$, $B = 0.18$, $SE = 0.03$, $t = 5.68$, $p < .001$, 95% CI [0.12, 0.24], indicating that adolescents characterized by stronger fears of rejection, abandonment, or insufficient interpersonal reassurance tended to demonstrate greater emotional dependence on social media even after loneliness and other predictors were statistically controlled. Perceived social support demonstrated a significant inverse

association with digital emotional dependence, $\beta = -.23$, $B = -0.20$, $SE = 0.03$, $t = -6.13$, $p < .001$, 95% CI [-0.26, -0.13]. Thus, stronger perceptions of available support from family, friends, and significant others were associated with lower levels of emotional dependence on digital interaction. Among the control variables, daily social media use remained a significant positive predictor, $\beta = .22$, $B = 0.14$, $SE = 0.03$, $t = 5.48$, $p < .001$, showing that greater time spent on social media was associated with higher digital emotional dependence independently of the psychosocial predictors. In contrast, age, $\beta = .05$, $p = .220$, and gender, $\beta = -.04$, $p = .255$, did not independently predict digital emotional dependence once the other variables were included in the model. All variance inflation factors were well below conventional thresholds of concern, ranging from 1.06 to 1.64, confirming that the regression estimates were not materially distorted by multicollinearity. Overall, the final model demonstrated that digital emotional dependence was most strongly associated with loneliness, followed by attachment anxiety, lower perceived social support, and greater daily social media use.

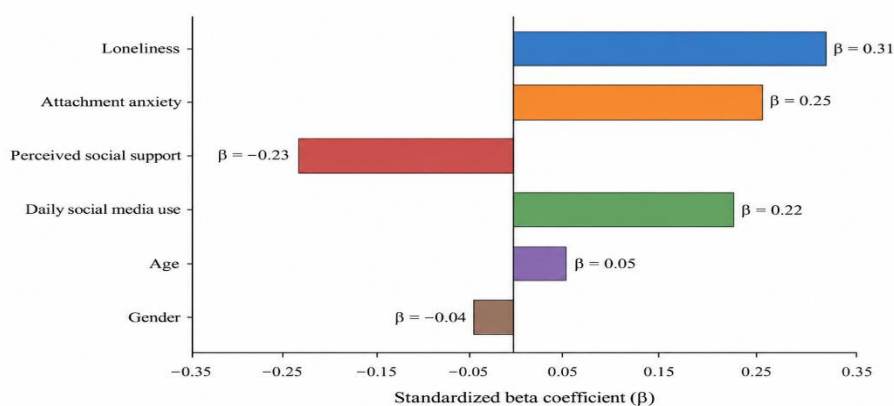
Figure 1*Standardized Regression Coefficients for Predictors of Digital Emotional Dependence in the Final Hierarchical Regression Model*

Figure 1 summarizes the relative standardized contributions of the predictors included in the final hierarchical regression model. The pattern of standardized coefficients showed that loneliness had the largest positive association with digital emotional dependence ($\beta = .31$), followed by attachment anxiety ($\beta = .25$) and daily social media use ($\beta = .22$). Perceived social support showed a substantial negative association ($\beta = -.23$), indicating that greater perceived access to supportive interpersonal relationships functioned in the opposite direction from loneliness and attachment insecurity. By comparison, the standardized effects of age ($\beta = .05$) and gender ($\beta = -.04$) were small and statistically nonsignificant. The figure therefore illustrates that digital emotional dependence among adolescents was associated less with basic demographic characteristics than with the quality of adolescents' subjective interpersonal experiences and patterns of social connection. In particular, greater loneliness and attachment anxiety were associated with greater emotional reliance on digital environments, whereas stronger perceived social support was associated with lower dependence. The simultaneous presence of significant coefficients for loneliness, attachment anxiety, perceived social support, and daily social media use further indicated that these variables contributed distinct explanatory information rather than representing interchangeable indicators of the same underlying phenomenon. The final hierarchical regression model accounted for 51.8% of the variance in digital emotional dependence, demonstrating substantial overall predictive capacity and supporting the proposed role of both vulnerability-related interpersonal factors and supportive social resources in understanding adolescents' emotional dependence on digital communication.

4. Discussion

The present study examined whether loneliness, attachment anxiety, and perceived social support predicted digital emotional dependence among Canadian adolescents after accounting for age, gender, and daily social media use. The findings indicated that the final hierarchical regression model explained 51.8% of the variance in digital emotional dependence, demonstrating that the combination of behavioral exposure and interpersonal-psychological factors provided substantial explanatory power. Daily social media use was a significant positive predictor, whereas age and gender were not significant after the full set of variables was

considered. More importantly, all three focal psychosocial variables contributed significantly and independently to the prediction of digital emotional dependence. Loneliness was the strongest psychosocial predictor, followed by attachment anxiety and perceived social support. Higher loneliness and greater attachment anxiety were associated with stronger digital emotional dependence, whereas greater perceived social support was associated with lower dependence. The hierarchical sequence also showed that loneliness produced the largest increase in explained variance beyond the control variables, attachment anxiety contributed additional explanatory power after loneliness had been considered, and perceived social support further improved the model at the final stage. These results support the view that digital emotional dependence among adolescents cannot be adequately understood as a simple consequence of spending more time online. Rather, it appears to be closely embedded in adolescents' subjective experiences of social disconnection, insecurity within close relationships, and perceived availability of supportive interpersonal resources.

The positive association between loneliness and digital emotional dependence was one of the clearest findings of the study. Adolescents reporting greater loneliness tended to show stronger emotional reliance on digital communication even after adjustment for daily social media use and the other predictors. This result is consistent with a substantial body of evidence connecting loneliness with problematic forms of internet and technology use. Loneliness has previously been identified as a significant predictor of internet addiction among adolescents, suggesting that young people who perceive their offline social world as emotionally insufficient may turn more strongly toward online environments for connection, distraction, and reassurance (Nibal, 2023). Similar findings have emerged from research showing that loneliness can mediate the relationship between adverse interpersonal experiences and problematic internet use. For example, school victimization has been linked to internet addiction through reductions in life satisfaction and increases in loneliness, indicating that digital engagement may function as a compensatory response to social distress (Shi & Wang, 2023). Longitudinal evidence has also demonstrated reciprocal relationships among loneliness, social anxiety, and mobile phone addiction, suggesting that these experiences may reinforce one another over time rather than operate through a purely one-directional pathway (Wu et al., 2024). The current findings therefore extend previous work by showing that loneliness is not merely related to general problematic use

but is specifically associated with the emotional significance that adolescents attach to remaining digitally connected.

The strength of loneliness as a predictor may be explained by the social compensation function of digital environments. Adolescents who feel lonely may experience online spaces as more psychologically rewarding because these environments provide continuous access to peers, opportunities for social monitoring, rapid feedback, and reduced barriers to initiating communication. This interpretation is consistent with recent path-analytic evidence conceptualizing loneliness as a bridge between psychological symptoms and internet addiction, whereby emotionally vulnerable individuals may use online activity as a form of digital escape (Bilgin et al., 2026). Related theoretical work has emphasized emotional dysregulation and social compensation as important mechanisms in adolescent internet addiction, particularly when offline relationships are experienced as inadequate or difficult to access (Qi et al., 2026). The present findings are also consistent with evidence that insecurity may contribute to internet addiction indirectly through loneliness (Dey & Roy, 2025). Such a pattern suggests that loneliness may transform digital engagement from an optional social activity into a psychologically compensatory resource. The association reported here may therefore reflect not simply more frequent platform use, but a deeper emotional dependence on online access for maintaining perceived connectedness and regulating feelings of isolation.

The relationship between loneliness and digital dependence may also be understood as potentially self-reinforcing. Digital communication can temporarily alleviate feelings of social disconnection, but excessive reliance on it may reduce motivation to tolerate solitude, resolve offline relational difficulties, or develop more satisfying face-to-face relationships. Consequently, adolescents may increasingly depend on online reassurance while remaining vulnerable to loneliness when digital contact is interrupted or does not provide the expected emotional response. This interpretation is compatible with work describing the internet-loneliness relationship as complex and potentially bidirectional rather than uniformly beneficial or harmful (Smith & Alheneidi, 2023). Recent longitudinal evidence linking short-form video addiction, loneliness, and social anxiety similarly suggests that repeated digitally mediated coping may become embedded in a broader cycle of social and emotional vulnerability (Zhao et al., 2026). Research on loneliness and gaming addiction further supports the generalizability of this

mechanism across multiple forms of digital behavior (Niazi et al., 2024). In the present study, the fact that loneliness remained the strongest psychosocial predictor after daily social media use was controlled suggests that the subjective quality of adolescents' social experience may be more informative than exposure time alone for understanding why digital environments acquire heightened emotional importance.

Attachment anxiety also emerged as a significant positive predictor of digital emotional dependence. Adolescents who reported stronger concerns about rejection, abandonment, and insufficient responsiveness from important others tended to demonstrate greater emotional reliance on digital interaction. This finding is theoretically coherent because digital communication offers multiple features that may be particularly reinforcing for individuals high in attachment anxiety. Messaging applications, social networking sites, online-status indicators, and notifications allow adolescents to monitor relational availability, seek reassurance rapidly, and maintain a sense of continuous interpersonal access. Such features may reduce uncertainty in the short term while simultaneously strengthening reliance on digital channels for emotional security. The present result is consistent with research showing that attachment styles and loneliness predict maladaptive technology-related interpersonal behavior such as phubbing (Büyüksakar & Çelik, 2024). It also aligns with broader reviews identifying attachment-related insecurity among the psychological vulnerabilities associated with problematic social networking (Fioravanti et al., 2025). The independent effect of attachment anxiety after loneliness had already entered the model is particularly important because it indicates that attachment insecurity contributes to digital emotional dependence through processes that are not reducible to generalized social isolation.

One possible explanation is that attachment-anxious adolescents may be especially sensitive to ambiguous interpersonal cues. Delays in message responses, changes in online behavior, lack of reactions to posts, or signs that peers are interacting without them may be experienced as evidence of rejection or relational instability. Under these conditions, digital platforms may become both a source of reassurance and a source of repeated threat monitoring. The adolescent may therefore check devices more frequently, seek contact more urgently, and experience stronger discomfort when access is unavailable. Although the present study did not assess these mechanisms directly, the findings are compatible with a relational model in which digital

emotional dependence is partly maintained by reassurance-seeking and hypervigilance to social availability. Family-related research provides additional support for this interpretation. Systematic evidence indicates that family processes are strongly connected to adolescent screen-media use and mental-health outcomes (Liu et al., 2024), and parental characteristics have been linked to adolescent internet gaming addiction (Li et al., 2025). Perfectionistic parenting has also been associated with greater risk of internet gaming addiction, suggesting that stressful or controlling relational climates may increase vulnerability to digital coping (Luo & Li, 2025). Moreover, parental technofence may interfere with the quality of parent-adolescent interaction and has been associated with poorer adolescent mental-health and behavioral outcomes (Dixon et al., 2023). These findings support the broader proposition that emotionally insecure relational contexts may encourage stronger reliance on digital environments for reassurance and psychological regulation.

Perceived social support showed a significant negative association with digital emotional dependence, indicating that adolescents who perceived greater availability of emotional and interpersonal support were less likely to rely on digital platforms for emotional security. This result complements the findings for loneliness and attachment anxiety and supports the conceptualization of perceived support as a protective relational resource. Adolescents who believe that family members, friends, and significant others are available when needed may have less reason to use digital interaction as a substitute for unmet emotional needs. They may also be better able to regulate distress through direct interpersonal support rather than through repeated checking, messaging, or online engagement. This interpretation is consistent with research emphasizing that the emotional consequences of social media depend on the broader social context in which use occurs (Bottaro & Faraci, 2022). Research conducted during periods of elevated social disruption has also indicated that perceived psychosocial resources are associated with internet addiction, reinforcing the importance of social support in understanding problematic digital behavior (Suaaree et al., 2022). The protective direction observed in the present study therefore suggests that digital emotional dependence may partly reflect a relative lack of confidence in available offline support networks.

The independent contribution of perceived social support is especially noteworthy because it remained significant after loneliness and attachment anxiety were statistically

controlled. This indicates that perceived support is not simply the inverse of loneliness or attachment insecurity. An adolescent may experience some loneliness or relational anxiety but still believe that meaningful support is ultimately available, and this perception may reduce the need to depend emotionally on digital interaction. Conversely, an adolescent with limited perceived support may rely on online environments as a primary source of validation even in the absence of extreme loneliness. This distinction is important for both theory and intervention because it suggests that risk and protection operate through partially independent pathways. The result is also compatible with broader biopsychosocial approaches to problematic digital behavior, which emphasize that internet- and gaming-related difficulties emerge from the interaction of psychological, social, and behavioral factors rather than from a single cause (Chang et al., 2023). Systematic reviews of adolescent internet addiction during periods of heightened digital exposure have similarly highlighted multiple contributing variables, including emotional stress, family context, social functioning, and coping patterns (Kusnadi & Kaloeti, 2022). The present findings strengthen this multidimensional perspective by demonstrating that vulnerability indicators and protective resources both make unique contributions within the same predictive model.

Daily social media use also remained a significant predictor of digital emotional dependence in the final model. Adolescents who spent more time on social media tended to report greater emotional dependence, even when loneliness, attachment anxiety, and perceived social support were controlled. This result is expected because repeated exposure increases opportunities for reinforcement, habitual checking, interpersonal monitoring, and integration of social media into everyday emotional routines. Similar associations between behavioral engagement and problematic use have been reported across smartphone, internet, social networking, and gaming contexts (Acharya et al., 2023; Munusamy & Ghazali, 2022). Research on adolescent social media addiction has likewise documented that patterns of frequent and dysregulated use can become clinically relevant when they are accompanied by emotional salience and impaired control (Ciacchini et al., 2023). However, the present findings also show that time spent online was not sufficient to explain digital emotional dependence. Even after behavioral exposure was statistically controlled, loneliness, attachment anxiety, and perceived social support remained significant. This distinction supports previous arguments that problematic digital engagement should not

be equated with duration of use alone (Weinstein, 2023). It also corresponds with bibliometric and conceptual work suggesting that social media dependence and broader internet addiction overlap but are not reducible to identical behavioral indices (Dong et al., 2025).

The nonsignificant effects of age and gender in the final model indicate that digital emotional dependence in this sample was better explained by psychosocial characteristics than by basic demographic differences. Although age-related developmental changes and gendered patterns of online communication may influence digital behavior in some contexts, these factors did not independently predict dependence once relational and behavioral variables were included. This finding is consistent with the broader literature showing substantial heterogeneity in the predictors of problematic digital behavior across populations (Kim et al., 2023). Rather than assuming that particular demographic groups are inherently at higher risk, the present results suggest that adolescents' emotional and relational circumstances may be more useful for identifying vulnerability. This conclusion is also consistent with emerging work applying multivariable and predictive approaches to adolescent social functioning, which emphasizes combinations of psychosocial factors rather than isolated demographic indicators (Li, 2026). From a developmental perspective, such an interpretation is valuable because it directs attention toward potentially modifiable interpersonal factors.

5. Conclusion

Taken together, the findings support a relational-compensatory interpretation of digital emotional dependence. Adolescents appear more likely to become emotionally reliant on digital environments when they experience subjective social disconnection, insecurity about the availability of important others, and lower confidence in their support networks. In contrast, perceived interpersonal support may reduce the emotional necessity of remaining digitally connected. This pattern is consistent with contemporary reviews identifying emotional and interpersonal vulnerabilities as central risk factors for problematic social network use (Fioravanti et al., 2025) and with evidence linking digital dependence to broader mental-health concerns (Weinstein, 2023). The results are also clinically relevant because severe loneliness combined with problematic internet use has been discussed in relation to more serious psychological risks, including suicidal ideation

among adolescents (Khatcherian et al., 2022). Although the present study did not assess severe clinical outcomes, the strong predictive role of loneliness highlights the importance of viewing emotionally dependent digital use as a potential marker of broader social and emotional difficulty rather than merely as a behavioral habit.

6. Limitations & Suggestions

Several limitations should be considered when interpreting the findings. First, the cross-sectional design does not permit causal conclusions regarding whether loneliness, attachment anxiety, and lower perceived social support lead to digital emotional dependence or whether emotionally dependent digital use contributes to subsequent interpersonal difficulties. Second, all variables were assessed through self-report measures, creating the possibility of common-method variance, social desirability, inaccurate recall, and subjective response bias. Third, the sample consisted of Canadian secondary-school adolescents who were able to complete English-language questionnaires, which may limit generalizability to adolescents from other cultural, linguistic, educational, or socioeconomic contexts. Fourth, digital emotional dependence was operationalized through the emotional integration component of social media use, and although this approach was conceptually aligned with the study, it may not capture every aspect of dependence across gaming, messaging, streaming, short-form video, and other digital environments. Fifth, daily social media use was estimated by participants rather than obtained from objective device logs. Finally, potentially relevant variables such as depressive symptoms, social anxiety, family functioning, peer victimization, fear of missing out, emotion regulation, sleep quality, and specific platform characteristics were not included in the model.

Future research should employ longitudinal and prospective designs to establish the temporal ordering among loneliness, attachment anxiety, perceived social support, and digital emotional dependence. Cross-lagged panel models would be particularly useful for determining whether these associations are reciprocal and whether digital dependence itself subsequently intensifies loneliness or attachment insecurity. Studies should also integrate objective digital-use indicators derived from device logs with self-report measures of emotional dependence, allowing researchers to distinguish behavioral exposure from psychological reliance more precisely. Replication across different countries, cultural groups, age ranges, and

educational settings would clarify the extent to which the present findings are developmentally and culturally generalizable. Future work could also examine potential mediators and moderators, including social anxiety, depressive symptoms, emotion-regulation difficulties, fear of missing out, parental responsiveness, peer support, cybervictimization, and online social comparison. Person-centered approaches such as latent profile analysis may identify distinct subgroups of adolescents who arrive at digital emotional dependence through different pathways, while longitudinal structural equation modeling and machine-learning approaches may improve risk prediction and help identify combinations of variables that are particularly important for early detection.

From a practical perspective, the findings suggest that prevention and intervention efforts should move beyond strategies that focus only on limiting screen time. Schools, families, counselors, and adolescent mental-health services should consider the emotional and interpersonal functions that digital platforms serve for individual adolescents. Screening for persistent loneliness, attachment-related insecurity, and low perceived support may help identify young people at greater risk of developing emotionally dependent patterns of digital use. School-based programs could strengthen peer connectedness, communication skills, help-seeking confidence, and opportunities for meaningful face-to-face participation, while family-focused interventions could emphasize emotional availability, responsive communication, consistent boundaries, and nonintrusive monitoring of digital behavior. Clinicians working with adolescents who show distress when disconnected from devices should explore whether online engagement is being used to manage fears of rejection, social isolation, or lack of reassurance rather than treating the behavior as a stand-alone technology problem. Interventions that simultaneously strengthen offline relationships, increase perceived support, improve tolerance of interpersonal uncertainty, and develop alternative emotion-regulation strategies may therefore be more effective than restrictive approaches centered exclusively on reducing device access.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this article.

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