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The Effects of Attachment, Temperament, and Self-Esteem on Technology Addiction: A Mediation Model Among Young Adults

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Abstract

Excessive use of technology has become a worldwide problem due to its high prevalence, fast growth rate, and undesirable consequences. However, little is known about underlying psychological mechanisms that maintain excessive use of technology. We investigated the mediating role of self-esteem, novelty seeking, and persistence on the relationship between attachment dimensions and technology addiction among young adults. Data were collected from 727 young adults (females, $N = 478$; 66.3 percent), aged 23.44 ± 3.02 years. Participants completed self-report measures of secure and insecure attachment dimensions, personality, and temperament characteristics (i.e., self-esteem, novelty seeking, and persistence), technology addiction and frequency of technology use (i.e., own technology use, perceived use by peers and parents). The mediation model was tested through a path analysis. The effects of attachment insecurity on technology addiction were partially mediated by the levels of persistence and self-esteem, whereas the effects of attachment security on technology addiction were fully mediated. The effects remained robust even after controlling for the frequency of technology use. The model was gender and age invariant, suggesting that the mediation worked in a similar way for both men and women and across ages. Findings suggest that attachment dimensions exert not only a direct but also an indirect effect on technology addiction through self-esteem and persistence. Such findings may help to develop psychosocial interventions that are sensitive to young adults' attachment, personality, and temperament characteristics.

Keywords: attachment, temperament, personality, technology addiction, frequency of technology use

Introduction

To DATE, 59.5 percent of the world population use the Internet and 92.6 percent access cyberspace from mobile devices.[1] Despite being useful and sometimes indispensable tools, excessive use of information technologies[2] can become problematic and turn into "technology addiction," a form of

behavioral addiction characterized by a person's inability to self-regulate the use of technology (including Internet, Smartphone, or Social Media).[3]

Several studies have examined the association between attachment dimensions and technology addiction.[4,5] Attachment refers to internalized mental representations of self and others that develop from repeated early interactions

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between an infant and his∖her caregivers.[6] Bonds with attachment figures shape a set of cognitive-affective schemas that are used for emotion regulation and that affect future relationships with friends and romantic partners.[7,8] Securely attached individuals tend to have a greater sense of worth and positive expectations of others, which lead to greater psychological well-being.[9] In contrast, individuals with an insecure attachment tend to be at higher risk of developing internalizing and/or externalizing problems and lower well-being.[5,10]

Existing literature supports the predictive role of secure and insecure attachment in technology addiction. The research suggests that in comparison with securely attached individuals, young adults with greater insecure attachment are more inclined to use technologies to compensate for their attachment needs.[11] Of note, a recent study from our research group found that insecure attachment dimensions were indirectly related to technology addiction through a range of risk factors, including psychological distress, impulsivity, and alexithymia.[5]

Temperament characteristics, such as novelty seeking (the tendency to seek out new experiences, thrills, and excitement), and lack of persistence (difficulties in maintaining attention and directing behaviors toward an objective despite frustration and fatigue) seem to increase vulnerability to developing addiction to technology.[12,13] Previous studies indicated that the type of attachment has no effect on how temperament develops because temperament is considered a trait, that is, it remains relatively stable throughout life.[14] However, other studies indicate that the way in which attachment security or insecurity is expressed partially reflects aspects of temperament.[15] For instance, factors related to social context, such as the type of attachment, may predict the expression of temperament characteristics.[16]

TABLE 1. SAMPLE DEMOGRAPHICS (N = 727)

Variable(s)	n	%
Education		
Middle school diploma	80	11.0
High school diploma	255	35.1
Bachelor's degree	297	40.9
Master's degree	70	9.6
Postgraduate level	25	3.4
Socioeconomic status		
Low	67	9.3
Average	310	42.8
High	347	47.9
Relationship status		
Single	342	48.5
Engaged	53	7.6
Married	310	43.9

Research also indicates that self-esteem, an evaluation of self-concept, is one the most significant determinant of technology addiction. Self-esteem is also related to attachment dimensions.[17,18] For example, a recent meta-analysis[17] found that securely attached children develop a positive and worthy concept of the self, whereas children with an insecure attachment are more prone to excessively use technologies to express themselves without fears of being judged.

Despite the growing number of studies on the topic, only very few studies investigated the mechanisms underlying technology addiction among young adults. This study tests a model in which the effects of attachment insecurity on technology addiction is partially explained by temperament factors and self-esteem. We hypothesized that lower secure and higher insecure attachment will be associated with higher levels of technology addiction, and that these
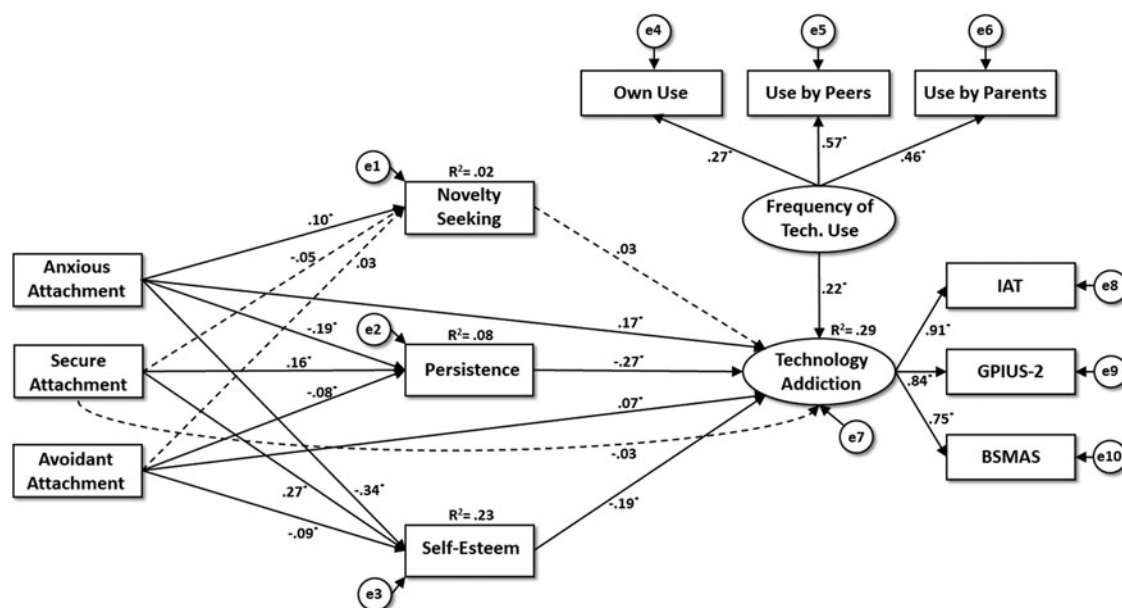

FIG. 1. Standardized regression paths of the proposed mediation model, where the association between attachment dimensions and technology addiction is mediated by personality factors and self-esteem, while controlling for the (perceived) frequency of technology of use.
Note. * = The path is significant ($p < .05$). Dashed lines indicate non-significant paths. The covariance between Persistence and Self-Esteem is modelled but not shown for ease of interpretation.

relationships will be mediated by lower levels of self-esteem and persistence and higher levels of novelty seeking. In the model, we controlled for the frequency of one's own, parents', and peers' use of technology.

Methods

Participants and procedure

Between November 2020 and April 2021, a total of 727 young adults (females $N = 478$, 66.3 percent; mean age 23.44 ± 3.02 years) volunteered for this cross-sectional study. Additional descriptives of the sample are reported in Table 1. Inclusion criteria were age between 18 and 30 years and being a native Italian speaker.

Questionnaires were administered through an anonymous web-based survey disseminated among students attending University of Bergamo, and through online in-class test administration of students registered at high schools in the city of Rome. The study was conducted in accordance with ethical standards and approved by the local ethics committee (University of Bergamo; Record n. 10, 15/03/2021). All participants provided informed consent before participation.

Measures

Attachment dimensions. The Experiences in Close Relationships-12 (ECR-12)[19,20] is a 12-item self-report measure of avoidant (6 items) and anxious (6 items) attachment to romantic partners (total mean scores range: 1–7). The Short-Form Inventory of Parent and Peer Attachment (S-IPPA)[21,22] is a self-report measure of attachment to parents and peers. For the purposes of this study, we selected the dimension of secure attachment to peers, composed of 12 items (total scores range: 12–60).

Technology addiction. Three scales indicated the technology addiction latent factor. The Internet Addiction Test (IAT)[23,24] is a 20-item self-report questionnaire that assesses the degree of preoccupation, compulsive use, behavioral problems, emotional changes, and impact on life related to Internet usage (total scores range: 20–100). The Generalized Problematic Internet Use Scale 2 (GPIUS2)[25,26] is a 15-item self-report measure of five constructs problematic Internet use: preference for online social interaction, mood regulation, cognitive preoccupation, compulsive Internet use, and negative outcomes (total mean scores range: 1–8).

The Bergen Social Media Addiction Scale (BSMAS)[27,28] is a 6-item self-report measure that assesses six core addiction elements (salience, mood modification, tolerance, withdrawal, conflict, and relapse)[29,30] related to the experience of using social media for the past year (total scores range: 6–30).

Mediators. Three mediators were used in the model. We used the Novelty Seeking and the Persistence scales derived from 26 items of the Temperament Character Inventory-Revised (TCI-R)[29,30] (total scores range: 26–130). Also, the Rosenberg Self-Esteem Scale (RSES)[31,32] is a 10-item self-report questionnaire that assess the global self-esteem and self-worth (total scores range: 10–40).

Frequency of technology use. We estimated a latent control variable from participants' ratings of the frequency of

TABLE 2. MEANS, STANDARD DEVIATIONS, CRONBACH'S ALPHAS, AND ZERO-ORDER CORRELATIONS FOR ALL THE PSYCHOSOCIAL AND CONTEXTUAL VARIABLES EXAMINED IN THE STUDY, IN OUR SAMPLE OF LATE ADOLESCENTS AND EMERGING ADULTS ($N = 721$)

Variable(s)	Mean (SD)	α	1	2	3	4	5	6	7	8	9	10	11
1. IAT	39.77 (10.76)	0.91	╱										
2. GPIUS2	2.44 (1.12)	0.91	0.77**	╱									
3. BSMAS	14.04 (4.56)	0.79	0.69**	0.61**	╱								
4. ECR-12 anxiety	4.44 (1.30)	0.82	0.24**	0.27**	0.32**	╱							
5. ECR-12 avoidance	2.31 (1.15)	0.90	0.16**	0.11**	0.05	0.08	╱						
6. S-IPPA peer	46.00 (7.47)	0.87	−0.18**	−0.18**	−0.05	−0.12**	−0.23**	╱					
7. RSES	44.19 (5.65)	0.90	−0.33**	−0.35**	−0.29**	−0.38**	−0.17**	0.33**	╱				
8. TCI novelty seeking	23.92 (5.43)	0.77	0.08*	0.06	0.07	0.11**	0.05	−0.07	−0.004	╱			
9. TCI persistence	56.85 (9.87)	0.89	−0.33**	−0.35**	−0.29**	−0.21**	−0.14**	0.20**	0.41**	−0.08*	╱		
10. Tech use—own	1.81 (0.64)	╱	0.07	0.05	0.04	−0.08	−0.04	0.05	0.07	−0.02	0.11**	╱	
11. Tech use—peers	2.98 (0.38)	╱	0.10**	0.08*	0.08*	0.03	−0.02	0.01	−0.07	0.07	0.05	0.17**	╱
12. Tech use—parents	2.29 (0.45)	╱	0.09*	0.14**	0.11**	0.05	−0.02	0.02	−0.07	0.02	0.03	0.08*	0.27**

*Correlation is significant at the 0.05 level; **Correlation is significant at the 0.01 level. Scores were the sum of items for the variables: IAT, BSMAS, S-IPPA peer, RSES, TCI novelty seeking, and TCI persistence. Score were the average of items for the variables: GPIUS2, ECR-12 anxiety, ECR-12 avoidance, tech use—own, tech use—peers, and tech use—parents.
IAT, Internet Addiction Test; GPIUS2, Generalized Problematic Internet Use Scale; BSMAS, Bergen Social Media Addiction Scale; ECR-12, Experiences in Close Relationships-12 (Anxiety and Avoidance subscales); S-IPPA peer, Inventory of Parent and Peer Attachment (peer subscale); RSES, Rosenberg Self-Esteem Scale; TCI, Temperament Character Inventory; Tech use, (perceived) frequency of technology use. α, Cronbach's alpha.

their own, peers', and parents' use of different technologies during the previous 7 days. Each rating was on a Likert-type scale (i.e., "*During the previous seven days, how often did you use the following devices*": smartphones, laptops, computers, tablets, smartwatches, smart speakers, and consoles) (total mean scores range: 1 = "*Never*" to 6 = "*Daily*").

Statistical analysis

We tested the hypothesized mediation model by using path analyses with both observed and latent variables (see Fig. 1 for a graphical depiction of the model). Parameter estimates were computed using a maximum likelihood estimation method, whereas an optimal model fit was evaluated using the following criteria: a root-mean-squared error of approximation (RMSEA) of .05 or less, an upper RMSEA's 90% confidence interval (CI) bound of 0.08 or less, a comparative fit index (CFI) and a Tucker–Lewis index (TLI) of 0.95 or more, and a standardized root mean squared residual (SRMR) of 0.05 or less. The magnitude of all direct paths was interpreted according to guidelines (≥ 0.10, small; ≥ 0.30 medium; ≥ 0.50 large).[33]

The standardized indirect (i.e., mediated) effects and their standard errors were computed using a bootstrap procedure, saving parameter estimates drawn from 10,000 bootstrap samples. If the 95% CI of these estimates do not include zero, then the indirect effect is statistically significant at the 0.05 level.[34] We reported the proportion mediated (P_M, or the ratio between the standardized indirect effect by the standardized total effect) as a measure of effect size for each indirect effect.[35]

Furthermore, we tested for the age- (with the sample split around the median age of 23 years) and gender-invariance of the model through multigroup path analyses.[34] Analyses were performed using Analysis of Moment Structures (AMOS) and Statistical Package for Social Sciences (SPSS) version 26.0.

Results

Data were screened to test for violations of statistical assumptions. We brought into range 5 univariate outliers.[36] All non-normally distributed variables were transformed. Finally, we identified a total of 6 multivariate outliers that were removed from the analyses.[36] Means and standard deviations, Cronbach's alphas (which were all in a good range) and zero-order correlations among all variables of interest of are reported in Table 2. The measurement model provided a good fit to the data, χ^2 (8) = 10.870, $p = 0.209$; RMSEA = 0.022 (90% CI: 0–0.052); CFI = 0.99; TLI = 0.99; SRMR = 0.021.

The mediation model with a modeled covariance between persistence and self-esteem ($r = 0.32$, $p < 0.001$) had a good fit to the data: χ^2 (37) = 104.820, $p < 0.001$; RMSEA = 0.050 (90% CI: 0.039–0.062); CFI = 0.96; TLI = 0.93; SRMR = 0.033. As shown in Figure 1, we found that only insecure attachment dimensions had significant positive direct associations with technology addiction with trivial to small effects. Attachment Anxiety was significantly associated with novelty seeking, with small effects.

All attachment dimensions had significant direct associations on both persistence and self-esteem. Effect sizes were trivial to small except for that of Attachment Anxiety on self-esteem, which was medium. Both persistence and self-esteem were significantly associated with lower technology addiction with small effects. Finally, we found that the frequency of technology use was associated with a greater technology addiction with small effects. All other direct paths were not significant. All standardized betas and p values are reported in Table 3.

TABLE 3. REGRESSION WEIGHTS, STANDARD ERRORS, z-VALUES, P VALUES, AND STANDARDIZED BETAS FOR ALL DIRECT PATHS OF OUR MEDIATION MODEL ($N = 721$)

Predictor(s)	Predicted variable(s)	Regression weight	SE	z-value	p	Standardized β
ECR-12 anxiety	RSES	−0.052	0.005	−10.341	<0.001	−0.340
ECR-12 avoidance	RSES	−0.080	0.031	−2.543	0.011	−0.085
S-IPPA peer	RSES	0.251	0.031	8.024	<0.001	0.270
ECR-12 anxiety	TCI novelty seeking	0.048	0.017	2.748	0.006	0.102
ECR-12 avoidance	TCI novelty seeking	0.085	0.109	0.779	0.436	0.030
S-IPPA peer	TCI novelty seeking	−0.155	0.109	−1.427	0.154	−0.054
ECR-12 anxiety	TCI persistence	−0.084	0.016	−5.206	<0.001	−0.187
ECR-12 avoidance	TCI persistence	−0.232	0.101	−2.289	0.022	−0.084
S-IPPA peer	TCI persistence	0.445	0.101	4.418	<0.001	0.163
ECR-12 anxiety	Technology addiction	0.013	0.003	4.394	<0.001	0.165
ECR-12 avoidance	Technology addiction	0.037	0.018	2.091	0.036	0.074
S-IPPA peer	Technology addiction	−0.017	0.018	−0.913	0.361	−0.034
RSES	Technology addiction	−0.099	0.022	−4.483	<0.001	−0.185
TCI novelty seeking	Technology addiction	0.005	0.006	0.905	0.366	0.031
TCI persistence	Technology addiction	−0.048	0.007	−7.072	<0.001	−0.268
Frequency of technology use	Technology addiction	0.920	0.284	3.234	0.001	0.224
Technology addiction	IAT	1				0.909
Technology addiction	GPIUS2	1.543	0.057	27.081	<0.001	0.843
Technology addiction	BSMAS	1.792	0.077	23.414	<0.001	0.750
Frequency of technology use	Own	1				0.270
Frequency of technology use	Perceived by peers	8.393	2.262	3.710	<0.001	0.569
Frequency of technology use	Perceived by parents	8.032	2.005	4.006	<0.001	0.457

SE, standard error.

Regarding the indirect effects, we found that persistence and self-esteem were significant mediators of the association between attachment insecurity and technology addiction, with trivial to small effects. Interestingly, the effect of attachment security was fully mediated, whereas those of attachment insecurity were partially mediated. The indirect paths are reported in the note of Figure 1. The mediation model explained up to 29.1 percent of the variance in technology addiction, and this effect was substantial.

Furthermore, our model was age and gender invariant. Descriptive statistics, fit indices, regression weights, and indirect paths for all the multigroup models are reported among the Supplementary Tables S1–S4. A *post hoc* power analysis indicated that our study was adequately powered.[33]

Discussion

This study examined the relationship between attachment dimensions and technology addiction with the mediating effects of self-esteem, novelty seeking, and persistence among Italian young adults. The effects of attachment insecurity on technology addiction were partially mediated by lower levels of persistence and self-esteem, whereas the effects of attachment security on technology addiction were fully mediated by higher persistence and self-esteem. Also, frequency of technology use was positively associated with technology addiction, suggesting that higher technology use increases the probability of developing an addiction to technology.

Of note, the model was gender and age invariant, suggesting that the mediation worked in a similar way for both men and women and across age. These findings extend our understanding of the roles of attachment, personality, and temperament characteristics to help explain technology addiction. Higher levels of insecure attachment may lead to difficulties in maintaining attention toward an objective and to lower evaluations of the self, which may in turn lead to technology addiction. In contrast, individuals with a higher secure attachment may develop better capacities to persist despite fatigue or frustration and to have higher evaluations of the self, and these may reduce the occurrence of technology overuse.

This study comes with several limitations. First, as we relied solely on self-report scales, our data may be biased, and it would be useful to replicate our findings using multiple informant ratings. Another limitation is the generalizability of the present findings from the Italian population to other cultural contexts. Further cross-cultural studies are needed to extend our findings. Third, the cross-sectional nature of our data limits us in drawing conclusions regarding causality. Longitudinal studies are needed to advance this line of work. Finally, not all potential confounding factors were measured in the analysis. Factors such as the presence of mental health disorders among the participants, or the possible mental health impacts of the COVID-19 pandemic, were not assessed in this study.

Despite these limitations, the results of this study increase our understanding of the potential mechanisms underlying technology addiction. Knowledge regarding attachment dimensions, personality, and temperament characteristics can lead to the development of different treatments or education models to address technology addiction.[37] The findings of our study may help to reduce harm caused by technology-related addiction through informing psychosocial interventions that are sensitive to young adults' attachment dimensions, personality, and temperament characteristics.

Authors' Contributions

C.R. and A.B. designed the study, conducted the data analysis, and led the article preparation. A.C. and G.A.T participated in the conception and review of the statistical analysis. G.L.C. provided feedback on article drafts with a focus on theoretical implications. V.C., A.F., and S.C. assisted with measure development and article preparation. A.G., B.P., and C.Z. provided conceptual inputs at various stages of study design. All authors contributed substantively to the interpretation of the data and the findings.

Supplementary Material

Supplementary Table S1
Supplementary Table S2
Supplementary Table S3
Supplementary Table S4

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