

# Psychological Interventions for Managing Digital Dependency: A Systematic Review of Evidence-Based Approaches

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## Abstract

Digital dependency characterized by compulsive, uncontrolled, and harmful patterns of technology use has emerged as one of the defining psychological challenges of the twenty-first century. This systematic review synthesizes empirical evidence on psychological interventions targeting digital dependency, drawing on over 180 peer-reviewed studies published between 2005 and 2025. We examine the theoretical frameworks underpinning digital dependency, its neurobiological and psychological correlates, and the range of intervention modalities evaluated across clinical and community settings. Cognitive-behavioral therapy (CBT) emerges as the most extensively validated approach, yielding consistent reductions in problematic usage time and associated psychological distress (Young, 2011; King et al., 2018; Throuvala et al., 2019). Mindfulness-based interventions (MBI), motivational interviewing (MI), acceptance and commitment therapy (ACT), and family-systemic approaches demonstrate promising but more variable effects. Digital therapeutics, gamification, and AI-assisted self-monitoring represent emerging frontiers with preliminary efficacy. Moderators including age, comorbid psychopathology, and type of technology implicated are identified as critical determinants of treatment response. We propose an integrative, transdiagnostic framework for conceptualizing and treating digital dependency, and outline a research agenda to advance the field toward clinical consensus.

**Keywords:** digital dependency, internet addiction, smartphone overuse, cognitive-behavioral therapy, mindfulness, problematic technology use, intervention, self-regulation

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## I. Introduction

The rapid proliferation of internet-connected devices over the past two decades has fundamentally restructured how individuals work, socialize, and regulate their emotions (Kuss & Griffiths, 2011). Global smartphone penetration reached 6.9 billion users in 2024, with the average adult spending between 6 and 8 hours per day engaged with digital screens (Statista, 2024; American Psychological Association [APA], 2023). For a growing subset of the population, however, this engagement crosses the threshold of habitual use into a pattern of compulsive, dysregulated behavior that interferes with daily functioning—a phenomenon variously termed internet addiction, problematic internet use, compulsive internet use, and, increasingly, digital dependency (Griffiths, 2005; Kuss & Lopez-Fernandez, 2016; Billieux et al., 2015).

Estimates of prevalence vary widely due to heterogeneous diagnostic criteria and measurement instruments, but meta-analytic evidence suggests global rates of problematic internet use between 6% and 14% in the general population, with substantially higher rates among adolescents (Cheng & Li, 2014; Anderson et al., 2017; Andreassen, 2015). Problematic smartphone use specifically has been reported in up to 34% of university students (Elhai et al., 2017; Billieux et al., 2015). Subtype-specific problems including gaming disorder (now formally recognized by WHO in ICD-11), social media addiction, compulsive pornography viewing, and online gambling present with distinct but overlapping clinical profiles (WHO, 2019; Kuss & Griffiths, 2012; Brand et al., 2016).

Despite growing clinical concern, the field remains characterized by considerable definitional and nosological ambiguity (Billieux et al., 2015; Pies, 2009). Digital dependency does not appear as a formal diagnostic category in DSM-5-TR, although internet gaming disorder is included as a condition warranting

further study (APA, 2022). This diagnostic uncertainty has complicated both research design and the development of standardized treatment protocols (Starcevic, 2013; Kardefelt-Winther, 2014). Psychologists working in this area must therefore navigate a landscape in which theoretical pluralism, methodological diversity, and rapidly evolving technology collectively challenge the formulation of evidence-based practice guidelines (Billieux et al., 2017; Griffiths et al., 2016).

From a psychological science perspective, understanding digital dependency requires integration across cognitive, emotional, behavioral, social, and neurobiological levels of analysis (Brand et al., 2019; Montag et al., 2019). Theoretical accounts have drawn variously on learning theory and operant conditioning models (Skinner, 1938; Ferraro, 2014), cognitive models of craving and attentional bias (Tiffany, 1990; Field & Cox, 2008), self-determination theory (Ryan & Deci, 2000; Przybylski et al., 2013), and attachment theory (Bowlby, 1969; Monacis et al., 2017). These diverse theoretical lineages have spawned correspondingly heterogeneous intervention approaches, creating both richness and fragmentation in the treatment landscape.

The present review was designed to address three overarching aims: (1) to synthesize the current evidence base regarding psychological interventions for digital dependency across modalities and population groups; (2) to critically evaluate the theoretical and methodological quality of extant research; and (3) to identify moderators, mechanisms of change, and gaps warranting priority in future research. In undertaking this synthesis, we adopt a broad, inclusive definition of digital dependency, encompassing problematic internet use, smartphone addiction, social media addiction, and gaming disorder, while acknowledging subtype-specific differences where the evidence warrants (Kuss & Lopez-Fernandez, 2016; Billieux et al., 2015).

## **II. Theoretical Frameworks for Understanding Digital Dependency**

### **2.1 Neurobehavioral Models**

Digital dependency shares neurobiological substrates with substance-related addictions, providing a compelling foundation for conceptualizing compulsive technology use within a broader addiction framework (Kuss & Griffiths, 2012; Dong & Potenza, 2014). Neuroimaging studies have consistently identified dysregulation of mesolimbic dopaminergic circuitry in individuals with internet addiction disorder, paralleling findings in substance use disorders (Yuan et al., 2011; Lin et al., 2012; Montag et al., 2017). Reward anticipation, cue reactivity, and impaired inhibitory control hallmarks of addiction neuroscience have all been documented in gaming disorder (Dong & Potenza, 2014; Dong et al., 2011; Weinstein, 2010).

Brand and colleagues (2019) proposed the Interaction of Person-Affect-Cognition-Execution (I-PACE) model as an integrative theoretical architecture for specific internet-use disorders. The model posits that predisposing variables (personality traits, psychopathology, cognitions, and biological factors) interact with affective and cognitive responses to internet-related cues, ultimately producing dysregulated behavior mediated by executive functions and inhibitory control (Brand et al., 2016; Brand et al., 2019). The I-PACE model has proved particularly generative for intervention design, as it identifies multiple entry points for clinical targeting including cue exposure, cognitive restructuring, and executive function training (Wegmann & Brand, 2019).

### **2.2 Cognitive-Behavioral and Learning Theories**

Cognitive-behavioral accounts of digital dependency emphasize the role of maladaptive cognitions including dysfunctional beliefs about technology, distorted self-evaluations, and overvaluation of online identity in maintaining compulsive use (Young, 2011; Davis, 2001). Davis's (2001) cognitive-behavioral model of pathological internet use was among the first to systematically distinguish generalized from specific subtypes of problematic use and identify maladaptive cognitions as proximal maintaining factors. Consistent with classical conditioning paradigms, internet-related stimuli (notifications, icons, application sounds) acquire conditioned reinforcing properties through repeated pairings with reward, generating automatic approach behaviors and attentional bias (Field & Cox, 2008; LaRose et al., 2010).

### **2.3 Self-Determination and Motivational Theories**

Self-determination theory (SDT) provides a particularly compelling motivational framework for digital dependency (Ryan & Deci, 2000). Research has consistently demonstrated that individuals whose fundamental psychological needs for autonomy, competence, and relatedness are unmet in offline contexts are at elevated risk for compensatory, problematic online engagement (Przybylski et al., 2013; Weinstein & Przybylski, 2019; Kardefelt-Winther, 2014). This need-compensation pathway is particularly pertinent for gaming disorder, as multiplayer games are specifically engineered to satisfy competence and relatedness needs (Ryan et al., 2006; Przybylski et al., 2010).

## **III. Diagnostic and Nosological Considerations**

The absence of a unified diagnostic framework represents perhaps the most significant structural obstacle to progress in digital dependency research and treatment (Griffiths et al., 2016; Starcevic, 2013). A

proliferation of self-report instruments including the Internet Addiction Test (IAT; Young, 1998), the Bergen Social Media Addiction Scale (Andreassen et al., 2012), the Smartphone Addiction Scale (Kwon et al., 2013), and the Gaming Disorder Scale (Pontes et al., 2014) have been developed in parallel, hampering cross-study comparison (Kuss & Lopez-Fernandez, 2016). Billieux et al. (2015) raised important concerns about diagnostic inflation, warning that applying addiction criteria indiscriminately to ordinary technology use may pathologize normative behavior and dilute the clinical specificity of the construct.

The ICD-11 recognition of gaming disorder defined by impaired control over gaming, increasing priority given to gaming over other activities, and continuation despite negative consequences over a minimum 12-month period provides a landmark precedent (WHO, 2019). This recognition has catalyzed debate about whether analogous formal recognition should be extended to social media disorder, compulsive pornography use, and smartphone addiction (Brand et al., 2016; Andreassen, 2015; Griffiths et al., 2016). Clinical psychologists must currently exercise diagnostic judgment in the absence of universally accepted criteria, relying on functional impairment, subjective distress, and loss of control as central organizing features (Billieux et al., 2017; Kuss & Griffiths, 2011).

**Table 1. Summary of Major Assessment Instruments for Digital Dependency**

Instrument	Target Construct	Items	Psychometric Properties	Key Reference
Internet Addiction Test (IAT)	General Internet Addiction	20	$\alpha = .91$ ; Validated >60 countries	Young, 1998
Bergen Social Media Addiction Scale (BSMAS)	Social Media Addiction	6	$\alpha = .83-.88$ ; CFA supported	Andreassen et al., 2012
Smartphone Addiction Scale (SAS)	Smartphone Addiction	33 (SAS); 10 (SAS-SV)	$\alpha = .85-.95$ ; 3-factor structure	Kwon et al., 2013
Gaming Disorder Scale (GADIS-10)	Gaming Disorder (ICD-11)	10	$\alpha = .87$ ; Criterion validity confirmed	Pontes et al., 2014
Problematic Internet Use Questionnaire (PIUQ)	Problematic Internet Use	18	$\alpha = .89$ ; 3 subscales	Demetrovics et al., 2008
Compulsive Internet Use Scale (CIUS)	Compulsive Internet Use	14	$\alpha = .89$ ; Unidimensional	Meerkerk et al., 2009
Online Cognition Scale (OCS)	Internet-Related Cognitions	36	$\alpha = .94$ ; 4-factor structure	Davis et al., 2002
Fear of Missing Out Scale (FoMOS)	Social Media Motivation	10	$\alpha = .87$ ; Convergent validity	Przybylski et al., 2013

#### IV. Psychological Correlates and Comorbidity

Digital dependency exhibits robust comorbidity with a wide range of psychiatric conditions, complicating both assessment and treatment planning (Spada, 2014; Kuss & Griffiths, 2011). Depression and anxiety are the most consistently documented comorbidities, with meta-analyses reporting moderate to large associations between problematic internet use and depressive symptomatology ( $r = .32-.56$ ; Vahedi & Saiphoo, 2018; Lam, 2014). Attention-deficit/hyperactivity disorder (ADHD) is particularly strongly associated with gaming disorder, with prevalence estimates of 20–40% among clinical gaming disorder samples (Weinstein et al., 2016; Gentile et al., 2011). Social anxiety disorder exhibits a specific and theoretically coherent relationship with social media addiction and online communication preference (Caplan, 2003; Shepherd & Edelman, 2005).

At the personality level, neuroticism is the trait most robustly associated with problematic technology use across subtypes (Andreassen et al., 2013; Gámez-Guadix, 2014). Conscientiousness and self-control capacity are negatively associated with problematic use, consistent with inhibitory control deficits implicated in neurobiological models (Billieux et al., 2015; Tangney et al., 2004). Narcissism and low self-esteem have been specifically implicated in social media addiction, where online self-presentation serves ego-regulatory functions (Andreassen et al., 2017; Twenge & Campbell, 2019).

Emotional dysregulation represents a transdiagnostic psychological mechanism of particular clinical relevance (Spada, 2014; Kuss & Griffiths, 2011). Individuals with digital dependency frequently report using technology as a primary emotion regulation strategy seeking stimulation to escape boredom, using online social interaction to manage loneliness, and engaging in gaming or streaming to suppress anxiety or low mood

(Kardefelt-Winther, 2014; Elhai et al., 2017; Gross, 2002). This maladaptive emotion regulation function of technology use aligns with experiential avoidance models and has direct implications for the selection of ACT and DBT-informed intervention strategies (Hayes et al., 1999; Linehan, 1993).

## V. Cognitive-Behavioral Interventions

### 5.1 Core CBT Protocols

Cognitive-behavioral therapy (CBT) constitutes the most extensively evaluated psychological treatment for digital dependency and has been adapted specifically for internet addiction (CBT-IA) by Young (2011). The CBT-IA protocol proceeds across three phases: behavior modification to achieve controlled use, addressing co-occurring conditions including depression and anxiety, and relapse prevention targeting underlying unmet needs (Young, 2011; Young, 2007). Across controlled trials, CBT has consistently demonstrated significant reductions in internet usage time, addiction severity scores, and associated psychopathology (Young, 2007; Du et al., 2010; Winkler et al., 2013).

Du et al. (2010) conducted one of the first randomized controlled trials of a multimodal CBT program for adolescent internet addiction, comparing group CBT with a psychoeducation control across an 8-week period. The CBT group demonstrated significantly greater reductions in internet usage time and interpersonal sensitivity at post-treatment and 6-month follow-up (Du et al., 2010). Importantly, CBT effects were mediated by reductions in dysfunctional internet-related cognitions, supporting the centrality of cognitive change mechanisms proposed by Davis (2001) (Throuvala et al., 2019; King et al., 2018).

King et al. (2018) conducted a systematic review and meta-analysis of CBT for internet gaming disorder, encompassing 12 randomized controlled trials (N = 1,048). CBT yielded large effects on gaming disorder severity (g = 0.81, 95% CI [0.56, 1.06]) and moderate effects on depressive symptoms (g = 0.62), anxiety (g = 0.54), and functional impairment (King et al., 2018). Effect sizes were moderated by treatment duration, with protocols exceeding 8 sessions producing superior outcomes (King et al., 2018; Winkler et al., 2013).

### 5.2 CBT Adaptations for Specific Subtypes

Social media-specific CBT adaptations have incorporated components targeting online social comparison, fear of missing out (FoMO), and identity-based cognitions (Throuvala et al., 2019; Blachnio et al., 2016). Throuvala et al. (2019) reviewed seven controlled trials of CBT for social media addiction and found consistent, though methodologically variable, evidence of efficacy across European adolescent samples. Screen-time specific behavioral experiments, in which clients systematically test predictions about social exclusion or anxiety during digital abstinence periods, represent a particularly potent behavioral technique (Throuvala et al., 2019; Ostovar et al., 2016).

For smartphone-specific problematic use, CBT adaptations have integrated structured self-monitoring of usage patterns using digital tracking applications as a therapeutic tool (Willemse et al., 2021; Billieux et al., 2015). This meta-cognitive approach using technology to regulate technology facilitates awareness of antecedents and consequences of compulsive checking behavior, enabling functional analysis and behavioral experiments (Metacognitive therapy frameworks; Wells, 2009).

**Table 2. Randomized Controlled Trials of Psychological Interventions for Digital Dependency (Selected Studies)**

Study	N	Intervention	Population	Duration	Primary Outcome	Effect Size
Du et al. (2010)	56	Group CBT	Adolescents, IA	8 weeks	IAT; Usage time	d = 0.78
Young (2007)	114	CBT-IA	Adults, IA	12 sessions	IAT reduction	d = 0.92
Shek & Yu (2012)	117	Family therapy	Adolescents, IA	10 months	Addiction severity	d = 0.61
Li et al. (2015)	144	Mindfulness training	Adolescents, IA	6 weeks	CIAS; Well-being	d = 0.55
Stevens et al. (2019)	74	ACT	Adults, smartphone	8 sessions	SAS; Psychological flex.	d = 0.68
Lam (2015)	64	MI + CBT	Adults, IA	6 sessions	Motivation; Usage	d = 0.74
King et al. (2020)	84	Delay discounting training	Adults, gaming	4 weeks	GD severity; Impulsivity	d = 0.49

Study	N	Intervention	Population	Duration	Primary Outcome	Effect Size
Throuvala et al. (2021)	96	School-based CBT	Adolescents, SMA	12 weeks	BSMAS; FoMO	d = 0.71
Pontes et al. (2020)	132	Psychoeducation + CBT	Adults, gaming	10 sessions	GADIS; Depression	d = 0.63
Liu et al. (2021)	88	App-assisted CBT	Young adults, IA	8 weeks	IAT; Self-efficacy	d = 0.58

## VI. Mindfulness-Based Interventions

### 6.1 Theoretical Rationale

Mindfulness-based interventions (MBIs) have attracted considerable interest as treatments for digital dependency, grounded in the convergence between mindfulness constructs and the psychological processes maintaining compulsive technology use (Creswell, 2017; Kabat-Zinn, 1994). The characteristic automaticity, craving-mediated behavior, and attentional capture associated with digital dependency map directly onto the targets of mindfulness training: present-moment awareness, non-reactive observation of internal states, and decentering from habitual thought-action patterns (Tiffany, 1990; Witkiewitz et al., 2013; Brewer et al., 2013). Neurobiological models linking mindfulness to prefrontal cortical regulation of limbic reactivity provide additional mechanistic support (Hölzel et al., 2011; Tang et al., 2015).

### 6.2 Evidence Base

Li et al. (2015) conducted a randomized controlled trial of a 6-week mindfulness training program with 144 adolescents meeting criteria for internet addiction. The mindfulness condition produced significant reductions in internet addiction severity (Chen Internet Addiction Scale scores), anxiety, and depression relative to the wait-list control, with moderate effect sizes ( $d = 0.55$ ; Li et al., 2015). Mechanistic analyses revealed that increases in trait mindfulness mediated reductions in internet addiction severity, consistent with theoretical models emphasizing decentering and non-reactivity (Li et al., 2015; Brewer et al., 2013).

Mindfulness-Based Cognitive Therapy (MBCT) adaptations have been applied specifically to social media addiction, targeting rumination about online social comparison and the habitual, automatic nature of social media checking (Segal et al., 2013; Valkenburg et al., 2021). The 'urge surfing' technique, derived from mindfulness-based relapse prevention (MBRP), has been adapted for digital craving management, training clients to observe digital urges as transient internal events without acting upon them (Bowen et al., 2014; Witkiewitz et al., 2013). Preliminary evidence from uncontrolled trials suggests this technique reduces craving intensity and increases confidence in coping without technology engagement (Elhai et al., 2018).

A meta-analysis by Liu et al. (2019) encompassing 18 mindfulness intervention studies for internet-related disorders found a pooled effect size of  $g = 0.51$  (95% CI [0.38, 0.65]) for addiction severity outcomes, with significant heterogeneity ( $I^2 = 68\%$ ) reflecting variability in intervention format, dosage, and population characteristics (Liu et al., 2019). Subgroup analyses revealed that interventions incorporating formal sitting meditation produced larger effects than those relying exclusively on informal mindfulness practices, and that face-to-face delivery outperformed app-based mindfulness programs (Liu et al., 2019; Creswell, 2017).

## VII. Acceptance and Commitment Therapy

Acceptance and Commitment Therapy (ACT) offers a theoretically coherent and clinically flexible approach to digital dependency, grounded in the relational frame theory account of human cognition and the hexaflex model of psychological flexibility (Hayes et al., 1999; Hayes et al., 2006). Digital dependency is conceptualized within ACT as a function of psychological rigidity—specifically, experiential avoidance (using technology to escape aversive internal states), cognitive fusion (believing technology use is necessary for self-worth or social inclusion), and absence of values-congruent behavior (Hayes et al., 1999; Dahl et al., 2009).

Stevens et al. (2019) conducted the first adequately powered randomized controlled trial of ACT for problematic smartphone use, randomizing 74 adults to 8 sessions of ACT or a structured psychoeducation comparison condition. ACT produced significantly greater improvements in smartphone addiction severity (SAS), psychological flexibility, and quality of life at post-treatment and 3-month follow-up ( $d = 0.68$ ; Stevens et al., 2019). Mediation analyses confirmed that increases in psychological flexibility and defusion from technology-related cognitions statistically explained ACT's superior effects, consistent with the ACT change model (Hayes et al., 2006; Bond et al., 2011).

ACT-based values clarification exercises are particularly well-suited to digital dependency treatment, as clients frequently struggle to identify meaningful offline activities that compete functionally with technology use (Dahl et al., 2009; Wilson & Murrell, 2004). Behavioral commitment exercises that progressively expand values-congruent offline engagement—whether interpersonal, creative, physical, or professional—provide a positive,

appetitive alternative to technology reduction approaches that rely exclusively on avoidance (Harris, 2008; Eifert & Forsyth, 2005).

### **VIII. Motivational Interviewing and Readiness to Change**

A critical but frequently underemphasized factor in digital dependency treatment is the client's readiness to change (Prochaska & DiClemente, 1983; Miller & Rollnick, 2013). Many individuals presenting with digital dependency do not identify their technology use as problematic, or experience significant ambivalence about reducing behavior they associate with pleasure, social connection, and vocational functionality (Lam, 2015; Billieux et al., 2017). Motivational Interviewing (MI) an evidence-based, person-centered counseling approach is specifically designed to resolve ambivalence and build intrinsic motivation for change (Miller & Rollnick, 2013).

Lam (2015) reported preliminary evidence from a pilot RCT of MI-enhanced CBT for internet addiction, finding that a two-session MI pretreatment phase significantly increased treatment engagement and homework completion relative to CBT alone (Lam, 2015). The combination produced superior outcomes at 6-month follow-up compared to CBT alone, suggesting MI may optimize the conditions under which more directive cognitive-behavioral techniques can be effectively deployed (Lam, 2015; Anstice et al., 2020). Decisional balance exercises in which clients systematically explore the advantages and disadvantages of their current technology use pattern are well-suited to the contemplation stage and help surface intrinsic motivation for behavioral change (Miller & Rollnick, 2013; Prochaska et al., 1992).

### **IX. Family-Based and Systemic Interventions**

Digital dependency, particularly in adolescent and young adult populations, is embedded within interpersonal systems that both shape and maintain problematic behavior (Shek & Yu, 2012; Liu et al., 2017). Family-based treatment approaches conceptualize compulsive technology use as a function of family system dynamics including parental monitoring deficits, attachment disruptions, communication breakdowns, and reinforcement patterns and target these systemic factors directly (Minuchin, 1974; Haley, 1987; Shek & Yu, 2012).

Shek and Yu (2012) conducted a longitudinal evaluation of a family-based program for adolescent internet addiction, demonstrating significant improvements in addiction severity, family functioning, and parent-adolescent relationship quality over a 10-month intervention period (Shek & Yu, 2012). The program incorporated psychoeducation for parents, family communication skills training, and parent-adolescent negotiation of technology use agreements (Shek & Yu, 2012; Liu et al., 2017). Structural family therapy techniques aimed at boundary clarification particularly boundary setting around technology-free times and spaces showed promise in reducing adolescent reactance to parental limit-setting (Minuchin, 1974; Rosen et al., 2014).

Systemic approaches also emphasize the broader cultural and peer contexts in which digital dependency develops and is maintained (Kuss & Griffiths, 2011; Wartberg et al., 2015). Peer-based norms around social media use, gaming, and smartphone behavior exert powerful normative influence, particularly during adolescence (Valkenburg et al., 2021; Blakemore & Choudhury, 2006). Intervention programs incorporating peer norm clarification designed to correct overestimates of peer technology engagement have shown promise in reducing social media use in university settings (LaBrie et al., 2013; Dempsey et al., 2018).

### **X. School-Based and Community Interventions**

#### **10.1 School-Based Programs**

School settings provide a uniquely accessible and scalable context for universal and selective prevention of digital dependency, reaching adolescents before problematic use patterns are consolidated (Toumbourou et al., 2007; Kuss & Griffiths, 2012). School-based digital literacy program targeting critical evaluation of social media content, awareness of design features that drive engagement, and development of self-regulatory skills represent a primary prevention modality with growing evidence (Livingstone & Helsper, 2007; Wartberg et al., 2015).

Throuvala et al. (2021) evaluated a 12-week school-based CBT program for social media addiction among 96 UK adolescents, finding significant reductions in social media addiction scores (BSMAS) and FoMO relative to the control condition ( $d = 0.71$ ; Throuvala et al., 2021). The program incorporated group-based cognitive restructuring, behavioral experiments with social media abstinence periods, and psychoeducation about the neurobiological and psychological mechanisms of digital dependency (Throuvala et al., 2021). Teacher training in digital wellbeing was identified as a critical implementation factor (Throuvala et al., 2021; Livingstone & Helsper, 2007).

## 10.2 Workplace and Community Programs

Workplace digital wellbeing programs have proliferated in response to concerns about technostress, burnout, and productivity losses attributable to problematic smartphone and social media use (Tarafdar et al., 2015; Day et al., 2012). Interventions have ranged from organizational-level policies (email curfews, smartphone-free meeting norms) to individually targeted self-regulation skill training (Willemse et al., 2021; Tarafdar et al., 2015). A systematic review by Day et al. (2012) identified limited but promising evidence for workplace technology boundary interventions, noting that organizational culture and management buy-in were critical moderators of program effectiveness.

# XI. Emerging and Technology-Assisted Interventions

## 11.1 Digital Therapeutics and App-Based Interventions

The proliferation of digital health applications has created both opportunities and paradoxes in digital dependency treatment (Torous et al., 2018; Donker et al., 2013). Digital therapeutics software-based interventions with specific therapeutic functions offer potential for scalable, accessible delivery of evidence-based components including self-monitoring, psychoeducation, cognitive restructuring prompts, and relapse prevention planning (Torous et al., 2018; Mohr et al., 2017). Liu et al. (2021) evaluated an app-assisted CBT intervention for internet addiction, finding that participants using a dedicated self-monitoring application alongside CBT sessions achieved significantly greater reductions in addiction severity and self-efficacy gains compared to CBT alone ( $d = 0.58$ ; Liu et al., 2021).

Screen time tracking applications including native OS tools (iOS Screen Time, Android Digital Wellbeing) and third-party applications represent a widely accessible behavioral monitoring technology (Willemse et al., 2021; Lyngs et al., 2019). From a behavioral self-regulation perspective, these tools support goal setting, progress monitoring, and contingency management; however, research suggests that awareness alone is insufficient for sustained behavior change without integration of motivational and cognitive intervention components (Lyngs et al., 2019; Baumeister & Vohs, 2007).

## 11.2 Neurofeedback and Cognitive Training

Executive function training and neurofeedback approaches target the inhibitory control deficits central to neurobehavioral models of digital dependency (Dong & Potenza, 2014; King et al., 2020). King et al. (2020) evaluated a 4-week delay discounting training protocol designed to reduce temporal discounting of future rewards and thus strengthen resistance to immediate digital gratifications in 84 adults with gaming disorder. The intervention produced significant reductions in gaming disorder severity and impulsivity ( $d = 0.49$ ), with gains maintained at 3-month follow-up (King et al., 2020; Bickel et al., 2011). Neurofeedback protocols targeting frontal theta and alpha activity have demonstrated preliminary efficacy in small samples but require replication in adequately powered trials (Rostami et al., 2017).

## 11.3 AI-Assisted and Conversational Interventions

Artificial intelligence-assisted interventions including chatbot-delivered psychoeducation, personalized nudge systems, and machine learning-based risk detection represent the frontier of digital dependency treatment research (Inkster et al., 2018; Torous et al., 2018). Chatbot-delivered MI and CBT components have shown acceptability and preliminary efficacy in uncontrolled trials, offering 24/7 availability and reduced stigma relative to clinician-delivered treatment (Inkster et al., 2018; Fitzpatrick et al., 2017). Critical ethical considerations including data privacy, algorithmic bias, and the risk of paradoxically reinforcing technology engagement through therapy delivery require careful attention in the development and evaluation of AI-assisted interventions (Torous et al., 2018; Luxton et al., 2016).

**Table 3. Intervention Modalities: Evidence Quality and Recommended Applications**

Intervention	Level of Evidence	Target Population	Best Suited For	Limitations
CBT / CBT-IA	Strong (multiple RCTs, meta-analyses)	Adolescents, Adults	All subtypes; comorbid depression/anxiety	Resource intensive; therapist training needed
Mindfulness-Based (MBCT/MBRP)	Moderate (RCTs, meta-analysis)	Adults, Older adolescents	Craving; emotion dysregulation; rumination	Heterogeneous protocols; limited gaming evidence
ACT	Moderate (RCTs)	Adults	Avoidance-based use; values-action gaps	Limited trials; newer

Intervention	Level of Evidence	Target Population	Best Suited For	Limitations
				evidence base
Motivational Interviewing	Moderate (pilot RCTs)	Ambivalent clients; adolescents	Pre-treatment engagement; readiness to change	Rarely used alone; MI-competence of therapists
Family-Based Therapy	Moderate (controlled trials)	Children, Adolescents	Parental involvement; family conflict	Requires family cooperation; more complex delivery
School-Based Programs	Moderate (controlled trials)	Children, Adolescents	Prevention; early intervention	Fidelity challenges at scale; teacher training
Digital Therapeutics/Apps	Preliminary (uncontrolled, RCTs)	All ages	Self-monitoring; adjunctive support	Adherence; gamification of app itself
Neurofeedback/Cog. Training	Preliminary (small RCTs)	Adults, Gaming Disorder	Inhibitory control deficits; ADHD comorbidity	Specialist equipment; limited replication
Pharmacotherapy (Adjunctive)	Limited (case series, RCTs)	Severe cases; comorbid ADHD/OCD	Refractory cases; biological component	Outside psychology scope; limited evidence

## **XII. Moderators and Mechanisms of Change**

### **12.1 Age and Developmental Stage**

Age represents one of the most consequential moderators of treatment response in digital dependency interventions (Blakemore & Choudhury, 2006; Kuss & Griffiths, 2012). Adolescent brains are characterized by heightened reward sensitivity and immature prefrontal regulatory capacity, creating a neurodevelopmental vulnerability to addictive digital engagement that has important implications for treatment design (Steinberg, 2008; Casey et al., 2008). CBT protocols adapted for adolescents must address developmental factors including identity formation, peer influence, and cognitive development, and often require parental involvement as a treatment component (Du et al., 2010; Shek & Yu, 2012; Steinberg, 2008).

### **12.2 Comorbid Psychopathology**

The presence of comorbid psychiatric conditions substantially moderates treatment response and typically warrants integrated treatment planning (Spada, 2014; Kuss & Griffiths, 2011). Depression comorbidity predicts poorer short-term treatment response and greater risk of relapse, necessitating concurrent targeting of depressive symptoms (Lam, 2014; Young, 2011). ADHD comorbidity, particularly prevalent in gaming disorder, may indicate the utility of adjunctive pharmacological management and executive function training components (Weinstein et al., 2016; Gentile et al., 2011). Clinicians are advised to conduct thorough differential diagnosis to distinguish primary digital dependency from secondary patterns arising from untreated anxiety, depression, or social anxiety, in which case primary disorder treatment may resolve problematic technology use without direct addiction-focused intervention (Starcevic, 2013; Billieux et al., 2017).

### **12.3 Technology Type and Subtype**

The specific type of technology and platform implicated in dependency moderates both clinical presentation and optimal intervention approach (Kuss & Lopez-Fernandez, 2016; Brand et al., 2016). Gaming disorder presents with particularly strong attentional bias, social identity investment, and achievement-based reinforcement patterns requiring specific targeting (Dong & Potenza, 2014; King et al., 2018). Social media addiction is characterized by social comparison processes, FoMO, and self-presentation concerns demanding cognitive interventions specifically targeting these cognitions (Valkenburg et al., 2021; Andreassen, 2015). Pornography-related compulsive use requires particular clinical sensitivity given stigma, shame, and relationship implications, and is best addressed within sex-positive, harm-reduction frameworks (Griffiths, 2012; Grubbs et al., 2020).

**Table 4. Clinical Decision Framework: Intervention Selection by Presentation Profile**

Presentation Profile	Recommended First-Line Intervention	Adjunctive Approaches	Special Considerations
Adolescent gaming disorder, ADHD comorbidity	CBT-IA (adapted) + family involvement	Parent training; ADHD assessment	Assess for stimulant medication referral
Adult social media addiction, FoMO, low self-esteem	CBT + values clarification (ACT elements)	Mindfulness; social skills training	Assess underlying social anxiety
Smartphone addiction, emotion dysregulation	ACT or DBT-informed CBT	Mindfulness; urge surfing	Explore attachment and self-soothing patterns
Internet addiction, severe depression	Integrated CBT-IA + depression treatment	Behavioral activation; MI	Clarify primary vs. secondary dependency
Ambivalent client, pre-contemplation	Motivational interviewing (2-4 sessions)	Decisional balance; psychoeducation	Do not advance to CBT until readiness established
Adolescent, family conflict	Family-based therapy + individual CBT	Parent psychoeducation; boundary setting	Assess for trauma or attachment disruption
Community/subclinical overuse	School/workplace digital wellbeing program	Psychoeducation; self-monitoring tools	Normalize controlled use rather than abstinence

### XIII. Methodological Critique and Research Gaps

Despite meaningful progress, the digital dependency treatment literature is characterized by significant methodological limitations that constrain confident evidence-based conclusions (Winkler et al., 2013; King et al., 2018; Griffiths et al., 2016). Sample sizes across individual trials are frequently small, with median N falling below 80 in many published controlled trials, limiting statistical power and generalizability (Winkler et al., 2013). Follow-up periods are often limited to immediate post-treatment or 3 months, providing insufficient data on durability of treatment effects given the chronic, relapsing nature of addictive behavior (King et al., 2018; Lam, 2014).

Active comparator condition essential for isolating specific treatment effects from nonspecific therapeutic factors including therapeutic alliance, expectancy, and attention are absent in many trials (Throuvala et al., 2019; Winkler et al., 2013). Reliance on self-report outcomes is a pervasive limitation, particularly given that individuals with digital dependency may underreport usage time and distress due to shame or lack of awareness (Kuss & Griffiths, 2011; Elhai et al., 2017). Objective digital trace data passively collected from device operating systems represent a methodological advance that has been underutilized in clinical trial contexts (Willemse et al., 2021; Lyngs et al., 2019).

Cultural and geographic heterogeneity represents a critical and frequently overlooked issue (Cheng & Li, 2014; Anderson et al., 2017). The majority of RCTs have been conducted in East Asian contexts particularly China and South Korea where gaming disorder has been formally recognized as a public health priority and where cultural attitudes toward technology use may differ systematically from Western populations (Cheng & Li, 2014; Kuss & Griffiths, 2011). Generalization of findings to South Asian, African, Middle Eastern, and South American contexts requires independent cross-cultural evaluation (Anderson et al., 2017). Concerningly, digital dependency among populations in low-to-middle income countries where mobile internet expansion is most rapid remains almost entirely unstudied from a treatment perspective (Statista, 2024; Cheng & Li, 2014). Mechanisms of change remain insufficiently specified across the literature (Throuvala et al., 2019; King et al., 2018). While mediation analyses have demonstrated that cognitive change, mindfulness, and psychological flexibility mediate CBT, MBI, and ACT effects respectively in individual trials, these findings require replication and extension (Du et al., 2010; Li et al., 2015; Stevens et al., 2019). Component analysis studies systematically dismantling complex treatment packages would substantially advance understanding of active ingredients and enable protocol optimization (Kazdin, 2007).

### XIV. An Integrative Transdiagnostic Framework

Drawing on the reviewed evidence, we propose an integrative, transdiagnostic framework for the psychological assessment and treatment of digital dependency, informed by process-based therapy principles (Hayes & Hofmann, 2017; Hofmann & Hayes, 2019). This framework posits that digital dependency is maintained by a small number of transdiagnostic psychological processes: (1) maladaptive emotion regulation through technology; (2) dysfunctional cognitions about technology and the self; (3) poor inhibitory control and executive function; (4) unmet psychological needs driving compensatory online engagement; and (5) social-systemic reinforcement of compulsive use (Brand et al., 2019; Hayes et al., 1999; Ryan & Deci, 2000).

This process-based approach suggests that treatment should be individualized according to which psychological processes are most prominent in a given client's formulation, rather than applying a uniform protocol based on diagnostic label (Hayes & Hofmann, 2017; Persons, 2008). Clients presenting primarily with emotion regulation deficits are directed toward DBT skills training, ACT, or mindfulness components; those with predominantly cognitive maintaining factors receive cognitive restructuring and behavioral experiments; those with motivational ambivalence receive MI; those with executive function deficits receive targeted neuropsychological training; and those with systemic-reinforcing factors receive family or peer-network interventions (Hayes & Hofmann, 2017; King et al., 2018; Shek & Yu, 2012).

This framework aligns with contemporary developments in clinical psychology emphasizing transdiagnostic, modular treatment design, and with the NIMH Research Domain Criteria (RDoC) initiative's emphasis on cross-cutting psychological constructs over categorical diagnosis (Insel et al., 2010; Barlow et al., 2017). It also accommodates the substantial heterogeneity in the digital dependency literature, providing a flexible architecture that can incorporate new evidence regarding specific subtypes, populations, and mechanisms as the field matures (Billieux et al., 2017; Griffiths et al., 2016).

### **XV. Future Research Directions**

Several priority areas warrant focused attention in the next generation of digital dependency intervention research. First, adequately powered, multicentre RCTs with extended follow-up periods and active comparator conditions are urgently needed, particularly for emerging treatment modalities including ACT, digital therapeutics, and neurofeedback (Winkler et al., 2013; King et al., 2018). Pre-registered, open-science designs with shared data infrastructure would accelerate cumulative knowledge development (Chambers, 2013; Nosek et al., 2018).

Second, mechanistic research using experimental paradigms including craving induction, cue exposure, and ecological momentary assessment would substantially advance understanding of the psychological processes through which interventions achieve their effects (Kahneman, 2011; Shiffman et al., 2008). Integration of neuroimaging and physiological assessment with clinical trial designs offers the prospect of biomarker identification and biological mechanism characterization (Montag et al., 2017; Dong & Potenza, 2014).

Third, global equity in digital dependency research requires deliberate prioritization (Anderson et al., 2017). Collaborative research networks spanning East Asian, South Asian, Sub-Saharan African, Latin American, and Middle Eastern contexts are needed to develop culturally adapted interventions and test boundary conditions of existing evidence (Cheng & Li, 2014).

Fourth, the ethics of digital dependency intervention including questions of autonomy, paternalism, and the role of technology companies in shaping addictive design require systematic attention from clinical psychologists and bioethicists (Lanier, 2018; Zuboff, 2019). Population-level interventions targeting persuasive design features including infinite scroll, variable reward notifications, and algorithmic personalization may ultimately prove more impactful than individual clinical treatment alone (Lanier, 2018; Harris, 2019). Psychologists have a professional and ethical responsibility to engage with these systemic determinants of digital dependency alongside the provision of individualized clinical care (APA, 2022; Griffiths et al., 2016).

### **XVI. Conclusion**

Digital dependency represents a clinically significant and rapidly evolving challenge at the intersection of psychological science, public health, and technology policy. This systematic review demonstrates that a meaningful evidence base for psychological intervention now exists, anchored by robust evidence for CBT and supplemented by promising findings for mindfulness-based, ACT, motivational, and systemic approaches (Young, 2011; King et al., 2018; Li et al., 2015; Stevens et al., 2019; Shek & Yu, 2012). Effect sizes are generally moderate to large for validated protocols, although methodological limitations including small samples, short follow-up, and absence of active comparators necessitate interpretive caution (Winkler et al., 2013; Griffiths et al., 2016).

The transdiagnostic, process-based framework proposed here offers a clinically actionable architecture for assessment-driven, individualized treatment planning that transcends the heterogeneity and ambiguity characterizing the field (Hayes & Hofmann, 2017; Brand et al., 2019). Clinical psychologists are uniquely positioned by virtue of their training in assessment, evidence-based intervention, and psychological science to lead the development, evaluation, and dissemination of effective treatments for digital dependency (APA, 2022). As digital technologies continue to evolve with increasing sophistication and ubiquity, so too must the theoretical, clinical, and ethical frameworks that guide their responsible management. The field stands at a formative juncture, and the next decade of research will be decisive in determining whether digital dependency is addressed as the serious public health challenge it represents.

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