Research Paper

The Effectiveness of Acceptance and Commitment Therapy on Anxiety Sensitivity, Aggression, and Online Shopping Addiction in Adolescents

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ABSTRACT

Background: Social media disorder (SMD) is a growing behavioral addiction among adolescents, marked by excessive and uncontrolled use of social media. It is associated with emotional difficulties such as anxiety, aggression, and impulsive behaviors, including online shopping addiction (OSA).

Objectives: This study examined the effectiveness of acceptance and commitment therapy (ACT) in reducing anxiety sensitivity, aggression, and OSA in adolescents with SMD.

Materials & Methods: A randomized controlled clinical trial was conducted using a pretest-posttest design with a control group. Thirty-six adolescents with SMD were purposively recruited from secondary schools in Tehran's District 8 and randomly assigned to an experimental group (n=18) or a control group (n=18). The experimental group received eight weekly 90-minute ACT sessions; the control group received no intervention. Data were collected using the social media disorder scale (SMDS), anxiety sensitivity index-3 (ASI-3), Buss and Perry aggression questionnaire (BPAQ), and online shopping addiction scale (OSAS). Data were analyzed using multivariate analysis of covariance in SPSS software, version 27.

Results: ACT significantly decreased anxiety sensitivity (F=63.67, P=0.001, η^2=0.68), aggression (F=62.66, P=0.001, η^2=0.66), and OSA (F=46.17, P=0.001, η^2=0.59), in adolescents with SMD (P<0.01).

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Conclusion: ACT is an effective intervention for reducing emotional dysregulation and compulsive behaviors among adolescents with SMD. These findings suggest its broader utility in addressing psychological challenges linked to digital overuse in youth populations.

Introduction

Adolescence is a critical developmental period marked by significant cognitive, emotional, and social changes, during which individuals are particularly vulnerable to behavioral disorders [1]. Among these, social media disorder (SMD) has emerged as a growing concern, characterized by excessive and compulsive use of social networking platforms that disrupt daily functioning [2]. To understand SMD, screen time is operationally defined as the total amount of time an adolescent spends actively engaging with electronic devices, specifically the duration on social media platforms, measured in hours per day or week. Recent studies indicate that adolescents with SMD exhibit symptoms similar to other behavioral addictions, including impaired self-regulation, heightened anxiety, and diminished academic performance [3]. Understanding the underlying mechanisms and impacts of SMD in adolescents is essential for developing effective interventions and promoting healthier digital habits during this formative stage [4]. Salari et al. (2025) conducted a meta-analysis of 51 studies (n=35,520) and reported that the pooled global prevalence of social media addiction among university students is 18.4%. The highest prevalence was observed in Asia, reaching 22.8%. These findings highlight social media addiction as a critical public health issue, emphasizing the urgent need for targeted preventive and intervention strategies among student populations [5].

Anxiety sensitivity and SMD are closely interconnected psychological constructs [6, 7]. Anxiety sensitivity refers to the fear of anxiety-related sensations based on the belief that these sensations have harmful physical, social, or cognitive consequences [8]. Individuals with high anxiety sensitivity are more likely to engage in avoidant or compulsive behaviors to manage their anxiety [9]. SMD, characterized by excessive and uncontrollable use of social networking sites, can serve as a maladaptive coping strategy for those with heightened anxiety sensitivity [10]. The compulsive engagement with social media provides temporary relief from anxiety symptoms but may reinforce a cycle of dependence, ultimately exacerbating both anxiety sensitivity and the severity of SMD [11]. Abu Khait et al. [12] found that among 143 university students, Internet addiction, cy-

berchondria, anxiety sensitivity, and hypochondria were moderately to highly correlated. Regression analyses showed cyberchondria predicted 11.5% of variance, while predictors of Internet addiction explained 41.2% of variability. These findings highlight cyberchondria's significant contribution to Internet addiction and underscore the need for targeted mental health interventions for students.

The rapid increase in screen time among adolescents has been linked to heightened emotional sensitivity, frustration, and aggressive behaviors. SMD amplifies these effects by exposing adolescents to constant social comparisons, online conflicts, and cyberbullying [13]. As emotional regulation weakens under these pressures, adolescents may experience elevated levels of anger and aggression, both in digital spaces (such as hostile posts or comments) and in real-world interactions [14]. Moreover, aggressive tendencies can reinforce problematic social media use, as adolescents seek online outlets to express or escalate their emotions, creating a self-perpetuating cycle [15]. Peng et al. [16] found that among 15,977 Chinese adolescents, the prevalence of internet addiction was 16.8% and total aggression was 25.0%. Regression analyses showed that internet addiction significantly predicted total and subtypes of aggression, while only physical aggression, hostility, and indirect aggression predicted internet addiction. Importantly, sex differences emerged, with females showing higher risks of anger and indirect aggression but lower risks of physical and verbal aggression compared to males.

The rise of online shopping addiction (OSA), characterized by compulsive and uncontrollable purchasing behaviors, has been closely tied to patterns seen in SMD, especially among adolescents and young adults [17]. Social media platforms facilitate social interactions and increasingly serve as powerful marketing channels, exposing users to targeted advertisements, influencer promotions, and peer-driven consumption trends [18]. For individuals already prone to SMD, constant exposure to curated product content and social comparison can intensify urges to shop online impulsively, reinforcing addictive shopping behaviors [19]. Moreover, both disorders share underlying mechanisms, such as impaired self-regulation, reward-seeking, and emotional coping through digital means [20]. Suresh & Biswas [21]

found that among 202 millennials in Bangalore, loneliness, depression, low self-esteem, and anxiety increased preference for virtual interactions, fueling compulsive online buying. The study also identified a positive link between Internet addiction and compulsive buying behavior. These insights help marketers strategically target online-focused consumers to boost sales, product alignment, and customer retention.

Many studies have suggested that psychological interventions are highly effective in addressing behavioral addictions, including SMD, particularly among adolescents [22]. As a behavioral addiction, SMD is sustained not only by external factors such as platform design and peer influence but also by internal mechanisms like emotional dysregulation, experiential avoidance, and cognitive fusion [23]. Among the available treatments, acceptance and commitment therapy (ACT) has emerged as a scientifically grounded and promising intervention for reducing the severity of SMD symptoms in youth [24]. Rather than focusing solely on behavioral suppression or screen-time reduction, ACT targets core psychological processes by cultivating psychological flexibility, the capacity to engage with difficult thoughts, feelings, and urges without automatically acting on them [25]. Specifically, ACT helps adolescents recognize and accept uncomfortable internal experiences (such as anxiety, cravings, or social fears) while maintaining a commitment to value-consistent actions [26]. Through evidence-based techniques like mindfulness training, cognitive defusion, and values clarification, adolescents can observe their online urges more objectively and resist compulsive social media use [27].

Emerging clinical evidence indicates that ACT interventions decrease problematic usage patterns and enhance emotional resilience, self-regulation, and overall psychological well-being [28]. As a flexible and adaptable approach, ACT offers a particularly suitable treatment framework for addressing SMD in adolescents, equipping them with lifelong skills to navigate the challenges of the digital environment while promoting healthier engagement and balanced living [29]. Krotter et al. [30] conducted a meta-analysis examining ACT for addictive behaviors, comparing it to active interventions like CBT. The study found that ACT significantly improved treatment completion and short-term abstinence, though long-term effects were comparable to other therapies. Wang & Fang [31] conducted a meta-analysis of RCTs evaluating internet-based ACT (IACT) for adolescent mental health. The results showed small but significant improvements in depression and experiential avoidance, though effects on anxiety, stress, and wel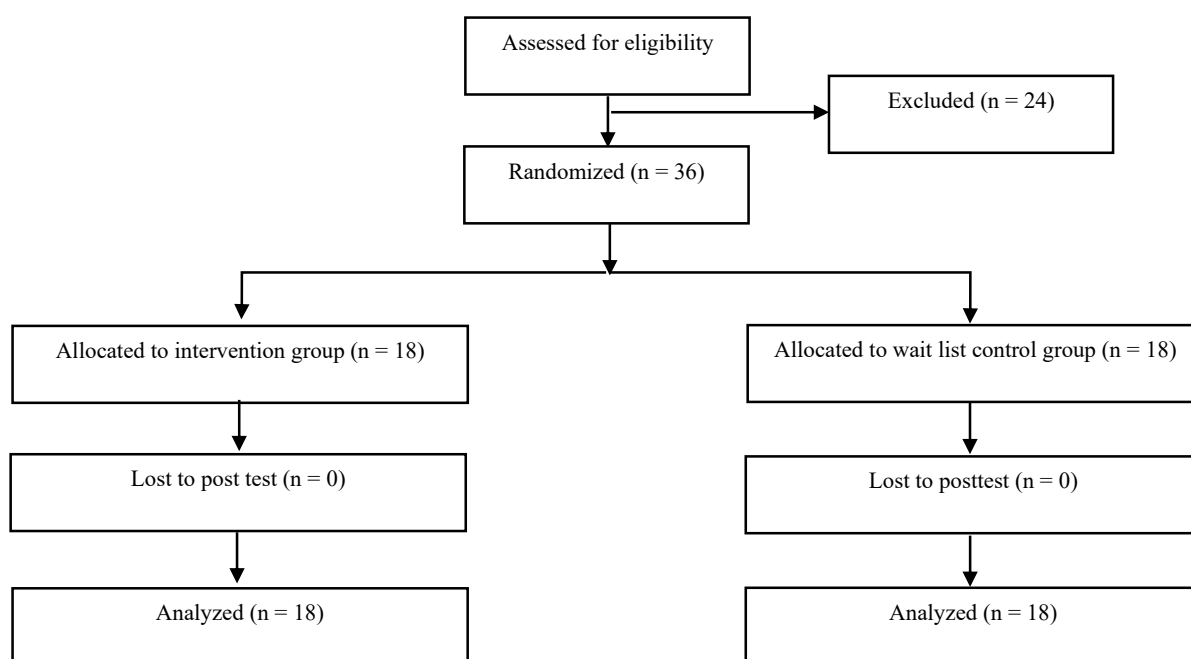l-being were limited. Notably, IACT showed greater therapeutic benefits for targeted (vs universal) adolescent groups, underscoring its selective clinical utility.

The increasing prevalence of SMD among adolescents poses significant challenges to mental health, often manifesting as heightened anxiety sensitivity, increased aggression, and comorbid behavioral addictions such as OSA. These intertwined issues not only impair emotional regulation and social functioning but also contribute to long-term psychological distress if left unaddressed. Given the complexity and severity of SMD and its associated symptoms, it is imperative to identify effective therapeutic interventions that target these multifaceted problems. This study aims to evaluate the effectiveness of ACT in reducing anxiety sensitivity, aggression, and OSA in adolescents with SMD.

Materials and Methods

The research design was a randomized controlled trial, employing a pre-test, post-test format with an experimental and a control group. The target population consisted of adolescents exhibiting symptoms of SMD residing in District 8 of Tehran in the year 2024. Participants were purposively selected from secondary schools in the district. Initial identification was carried out through referrals to school counseling centers for behavioral addiction-related concerns. The social media disorder scale (SMDS) [32] was then administered to these students, and individuals who scored above 80 were considered to meet the criteria for clinically significant SMD symptoms. A total of 36 eligible participants were identified. From this pool, 18 participants were randomly assigned to either the experimental or control group using simple randomization. A random number table (or a computer-generated random sequence) was employed to ensure an unbiased allocation process. The randomization was conducted by an independent researcher not involved in the intervention delivery or outcome assessment, thus maintaining allocation concealment and reducing potential bias.

Sample size determination was guided by prior research and calculated using G*Power software, version 3.1 with parameters set as follows: Effect size=1.25, statistical power $(1-\beta)$=0.97, and significance level (α)=0.05 [33]. Inclusion criteria for participation were: 1) Daily internet use exceeding five hours, 2) Scoring above the clinical threshold for SMD, 3) Age between 15 and 20 years, and 4) Absence of diagnosed psychiatric disorders or current use of psychiatric medication. Exclusion criteria included: 1) Incomplete questionnaire responses, 2) Missing more than two intervention ses-

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Figure 1. The CONSORT flow diagram of the study

sions, or 3) Withdrawal of informed consent at any point during the study.

Study procedure

After selecting participants for both the experimental and control groups, research questionnaires were administered in person as a pre-test to all participants, due to the nature of SMD and to ensure data accuracy. The experimental group subsequently participated in eight weekly 90-minute group sessions of ACT, delivered by a licensed clinical psychologist with specialization in adolescent behavioral disorders. The therapist had received formal training in ACT through certified workshops and had over five years of experience working in clinical settings with youth populations. Throughout the intervention, the therapist received weekly supervision from a senior clinical supervisor to ensure adherence to therapeutic standards and to maintain treatment fidelity. The ACT program followed the manualized treatment protocol developed by Hayes et al. [34], incorporating core ACT components such as cognitive defusion, acceptance, present-moment awareness, values clarification, and committed action (Table 1 and Figure 1). A session-by-session treatment guide was used to ensure consistency and standardization across groups. To minimize the risk of cross-group contamination, participants were explicitly instructed not to share the session content with others. This strategy proved effective, and no participant dropouts occurred. By ethical standards, the control group received the same ACT intervention after post-test data collection.

Measurement tools

The SMDS: Developed by Van Den Eijnden et al. [32], measures the severity of problematic social media use across multiple platforms such as Instagram, Telegram, WhatsApp, Twitter, and Facebook. The scale includes 27 items divided into nine subscales: Preoccupation, tolerance, withdrawal, persistence, escape, problems, deception, displacement, and conflict. Responses are rated on an 8-point likert scale ranging from "never" to "more than 40 times per day," yielding a total score between 0 and 189. The original study reported strong internal consistency, with Cronbach's α values ranging from 0.77 to 0.95 for subscales and 0.96 for the overall scale [32]. A validation study conducted in Iran by Bagheri Sheykhangafshe et al. [35] found Cronbach's α coefficients for subscales ranging from 0.68 to 0.92. In the present study, Cronbach's α values ranged from 0.81 to 0.90, confirming the scale's reliability.

The anxiety sensitivity index-3 (ASI-3): Measures the level of worry related to various symptoms of anxiety [36]. Derived from the revised Anxiety Sensitivity Index, this scale comprises 18 items and evaluates anxiety sensitivity across three dimensions: physical concerns (6 items), cognitive concerns (6 items), and social concerns (6 items). Participants respond on a five-point Likert

Table 1. Summarizes the structured sessions based on ACT [34]

Session	Target	Topic	Expected Behavior Change
1	Introduction to group guidelines and fundamental concepts of ACT	Building rapport among group members and with the therapist, establishing group norms, objectives, and structure, introduction to therapeutic commitments, initial discussions on the principles of act	Learn about ACT
2	Introduction to key therapeutic concepts in ACT, covering notions such as avoidance, cognitive fusion, and psychological acceptance	Assessing clients' problems from the perspective of ACT, extracting experience, avoidance, mixing and values of the individual, making a list of advantages, disadvantages, and problem control practices	Do not try to avoid negative emotions
3	Implement ACT techniques such as separation Cognitive, psychological awareness, self-embodiment	Specify inefficiency, and control negative events using metaphors, cognitive separation training, psychological awareness, and self-visualization	Accepting negative behaviors and emotions
4	Teaching therapy techniques, emotional awareness, and awareness Wisely (metaphor of your victim)	Distinguishing between evaluations and personal experiences, adopting an observational stance towards thoughts without judgment, aiming for enhanced mental flexibility and cultivation of positive emotions.	Pay attention to current experiences and moment-by-moment
5	Instruction and application of therapeutic healing techniques, incorporating mindfulness practices and distress tolerance training	Cultivate present-moment awareness and conceptualize self as an observing entity, instruct techniques for mindful awareness and building tolerance towards anxiety, emphasizing the acceptance of negative emotions.	Embracing negative emotions and thoughts without bias or judgment
6	Instructing therapeutic strategies for identifying and embracing personal values with clarity-facilitating value clarification and delivering emotion regulation techniques	Assisting clients in identifying life values and evaluating their significance, compiling a catalog of hindrances to value actualization, and cultivating positive emotions.	Strive for psychological flexibility
7	Teaching techniques of personal values and practice, Commitment, and increasing interpersonal efficiency	Offering concrete strategies to surmount obstacles, employing metaphors for enhanced understanding, and formulating plans to enact commitment towards values, ultimately cultivating a sense of life purpose and meaning.	Gain psychological flexibility
8	Revisiting and applying taught therapeutic techniques, with a focus on emotion regulation and cultivating meaning in everyday life situations.	Compilation of a progress report regarding value pursuit steps, encouraging clients to elaborate on session outcomes, and encouraging application of taught techniques in real-life scenarios to foster a sense of purpose and elicit positive emotions.	Mitigating negative emotions and thoughts while cultivating psychological flexibility.

scale ranging from 0 ("very little agree") to 4 ("completely agree"), with total scores ranging from 0 to 72. The ASI-3 demonstrates strong psychometric properties, with internal consistency coefficients ranging between 0.76 and 0.86 for physical concerns, 0.79 and 0.91 for cognitive concerns, and 0.73 and 0.86 for social concerns. Additionally, the scale has shown good convergent and divergent validity [36]. In Iran, Cronbach's α coefficients for the physical, cognitive, and social subscales were reported as 0.89, 0.84, and 0.80, respectively [37]. In the present study, the internal consistency for the subscales was also confirmed, with Cronbach's α coefficients ranging from 0.81 to 0.85.

Buss and Perry aggression questionnaire (BPAQ): This questionnaire was developed by Buss and Perry in 1992 to assess levels of aggression [38]. It consists of 29 items rated on a 5-point Likert scale (1=extremely uncharacteristic of me to 5=extremely characteristic of me) and includes four subscales: Physical aggression (9 items), verbal aggression (5 items), anger (7 items), and hostility (8 items). The total possible score ranges from 29 to 145, with higher scores indicating greater levels of aggression. The developers reported test-retest reliability coefficients over a nine-week interval ranging from 0.72 to 0.80 across the four subscales [38]. In Iran [39], Mohammadi reported the internal consistency of the

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Table 2. Demographic information of study participants in the experimental and control groups

Variables		No. (%)		P
		Experimental Group	Control Group	
Screen time (hour)	5-7	9(50.0)	8(44.4)	0.085
	>7	9(50.0)	10(55.6)	
Gender	Girl	10(55.6)	9(50.0)	0.061
	Boy	8(44.4)	9(50.0)	
Age (y)	15-16	4(22.2)	5(27.8)	0.053
	17-18	8(44.4)	9(50.0)	
	19-20	6(33.4)	4(22.2)	

questionnaire's subscales, measured by Cronbach's α, ranging from 0.71 to 0.82. Furthermore, factor analysis confirmed a five-factor structure. In the present study, Cronbach's α values for the subscales ranged from 0.71 to 0.85, with an overall reliability coefficient of 0.85.

online shopping addiction scale (OSAS): Given the lack of a specialized tool for assessing OSA, a questionnaire was developed based on the seven core components of addiction and the Bergen Shopping Addiction Scale [40]. Initially, 27 items were designed and tested across three samples (n=999, 854, and 328). Following data analysis, 18 items with strong psychometric properties were retained. The scale comprises six subscales: salience (items 1–3), tolerance (4–6), mood modification (7–9), withdrawal (10–12), relapse (13–15), and conflict (16–18). Responses are rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree), producing total scores between 18 and 90; higher scores indicate greater OSA severity. The scale demonstrated excellent internal consistency (Cronbach's α=0.90–0.95 overall; 0.74–0.84 across subscales), with item correlations ranging from 0.48 to 0.78, all statistically significant, confirming strong inter-item reliability. Within Iran, the psychometric properties of the OSAS were evaluated in an Iranian sample, yielding a Cronbach's α of 0.93 for the total scale and subscale coefficients ranging from 0.72 to 0.91, demonstrating strong internal consistency [41]. In the present study, the Cronbach's α coefficients for this scale ranged from 0.84 to 0.88, indicating good internal consistency.

Statistical analyses

To analyze the research data, descriptive statistics including Mean±SD, frequency and percent, and bivariate analysis including chi-square, paired t-test, and independent t-test were used based on their assumptions. The Shapiro-Wilk test results were reported to check the normality of the distribution of variables in the two groups. To compare post-test results adjusted for baseline values, multivariate analysis of covariance were used. All analysis was performed with the help of SPSS software, version 27. The significance level was considered at 0.05.

Results

The Mean±SD of the age of the experimental and control groups were 17.86±5.31 and 17.93±5.44, respectively. Demographic data, as displayed in Table 2, highlights no statistically significant differences between the two groups.

The Mean±SD of pre-test, post-test scores of anxiety sensitivity, aggression, and OSA in adolescents with SMD in the experimental and control groups are presented in Table 3. According to Table 3, there was no significant difference in the pre-test score of the experimental and control groups.

The results of the Levin test to examine the homogeneity of variance of dependent variables in groups showed that the variance of anxiety sensitivity (F=2.69, P=0.115), aggression (F=2.02, P=0.185), and OSA (F=1.95, P=0.214) were equal in the groups. The results of the Box test to evaluate the equality of the covariance matrix of dependent variables between the experimental

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Table 3. Descriptive indices of study's variables in the control and experimental groups

| Variables | Group | Mean±SD | | P¥ |
		Pre-test	Post-test	
Social media disorder	Intervention	84.30±5.12	77.42±5.93	0.001
	Control	85.42±6.74	85.96±5.87	0.741
	P£	0.557	0.001	
Anxiety sensitivity	Intervention	36.72±1.84	33.50±2.77	0.001
	Control	36.61±1.94	36.78±1.76	0.861
	P£	0.602	0.001	
Aggression	Intervention	74.45±2.43	70.83±3.02	0.001
	Control	74.33±2.49	74.50±2.31	0.893
	P£	0.689	0.001	
Online shopping addiction	Intervention	42.38±2.47	38.77±2.81	0.001
	Control	42.50±2.41	42.28±2.39	0.892
	P£	0.632	0.001	

¥Reported from within-group comparison, £reported from between-group comparison.

and control groups also showed that the covariance matrix of the dependent variables is equal (Box M= 11.12, F=1.67, P=0.123). Also, the results of the chi-square-Bartlett test to examine the sphericity or significance of the relationship between anxiety sensitivity, aggression, and OSA showed that the relationship between them is significant (χ^2=82.60, df=5, P<0.01).

The homogeneity of regression coefficients was examined through the interaction of dependent variables and independent variables (intervention method) in the pre-test and post-test. The interaction of these pre-tests and post-tests with the independent variable was not significant and indicated the homogeneity of the regression slope. Therefore, all assumptions of multivariate analysis of covariance were met. Table 4 shows the results of multivariate analysis of covariance for comparison between the two groups. The marginal post-test score adjusted for baseline covariates showed that there was a significant difference between the two groups in terms of anxiety sensitivity (F=63.67), aggression (F=62.66), and OSA (F=46.17) at the level of 0.001.

Table 4. Comparison of post-test marginal mean scores between the two groups

Dependent Variables	Group	Marginal Mean	95% CI	F	P	Eta Square
Anxiety sensitivity	Intervention	33.45	32.83-34.05	63.67	<0.001	0.68
	Control	36.83	36.22-34.45			
Aggression	Intervention	70.78	70.06-71.46	62.66	<0.001	0.66
	Control	74.56	73.87-75.24			
Online shopping addiction	Intervention	38.81	38.09-39.54	46.17	<0.001	0.59
	Control	42.24	41.52-42.96			

CI: Confidence interval.

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Discussion

The present study was conducted to evaluate the effectiveness of ACT in reducing anxiety sensitivity, aggression, and OSA among adolescents diagnosed with SMD. The results of this study demonstrated that ACT significantly reduces anxiety sensitivity in adolescents diagnosed with SMD. By fostering psychological flexibility, ACT enables individuals to adopt a mindful, nonjudgmental stance toward anxiety-related sensations and thoughts, perceiving them as transient mental events rather than threats that require immediate avoidance or suppression [30]. This shift mitigates hypervigilance and emotional overreactivity characteristic of anxiety sensitivity, thereby disrupting the maladaptive cycle in which heightened anxiety drives compulsive social media use as a form of temporary relief [22]. Additionally, ACT cultivates acceptance of internal experiences, enhancing adolescents' capacity to endure distressing emotions without resorting to maladaptive coping behaviors [34]. The therapy's emphasis on committed action guided by personally meaningful values redirects adolescents from anxiety-driven avoidance toward engagement in purposeful life domains such as academics, social relationships, and personal growth. This values-oriented approach strengthens emotional regulation and resilience, fostering a sustained reduction in reliance on social media as an emotional crutch [29]. Through its integration of mindfulness, acceptance, and values-based commitment, ACT provides a robust mechanism for attenuating anxiety sensitivity, as reflected in the significant clinical improvements observed post-intervention [25].

Similarly, the findings underscored ACT's substantial efficacy in reducing aggression among adolescents with SMD. Problematic social media use often exacerbates irritability, frustration, and interpersonal conflicts, which can escalate into aggressive behaviors both online and offline. ACT intervenes by promoting cognitive defusion, enabling adolescents to separate themselves from aggressive thoughts and impulses rather than reacting reflexively. This psychological distancing creates a critical space between stimulus and response, facilitating more deliberate and adaptive reactions to provocation [28]. Furthermore, ACT encourages acceptance of aversive emotions such as anger and resentment, reducing emotional tension and impulsivity without suppressing these feelings [22]. Through this process, adolescents develop greater distress tolerance and emotional regulation [27]. Concurrently, ACT supports the identification and commitment to core personal values, such as empathy and cooperation, which foster prosocial behaviors and healthier social interactions [23]. The combined therapeutic elements of mindfulness, acceptance, cognitive defusion, and values clarification contribute to diminished reactive hostility, enhanced emotional intelligence, and improved psychosocial functioning [34].

Finally, the study illuminated ACT's pronounced effectiveness in addressing OSA in adolescents with SMD. OSA often serves as a maladaptive coping strategy to manage negative emotions like stress or boredom, reinforced by the rewarding dopamine-driven sensations of purchasing. ACT enhances mindfulness, increasing adolescents' awareness of compulsive urges and enabling conscious observation without automatic behavioral responses [28]. This awareness interrupts impulsive and habitual buying patterns. Additionally, ACT facilitates a shift from emotion-driven reactivity to intentional, values-aligned decision-making [34]. By helping adolescents clarify and commit to values such as financial responsibility and long-term well-being, ACT cultivates intrinsic motivation and strengthens self-regulation, reducing dependence on online shopping as an emotional escape [24]. The synergistic application of acceptance, mindfulness, and committed action creates a comprehensive therapeutic framework that addresses both the behavioral symptoms and underlying cognitive-emotional drivers of OSA [29], promoting sustainable behavioral change and greater psychological resilience [25].

Despite its promising findings, this study is subject to several limitations. The sample was purposively selected from adolescents referred to school counseling centers within a single urban district, which may limit the generalizability of the results. Such a targeted sampling strategy, while useful for identifying individuals with clinically relevant symptoms, may not represent the broader adolescent population, particularly those from different regions, educational settings, or socio-demographic backgrounds. Additionally, the study relied exclusively on self-report measures, which are inherently vulnerable to various biases, including social desirability, recall errors, and subjective misinterpretation of questionnaire items. These limitations may compromise the accuracy and reliability of the collected data, especially in the context of sensitive issues such as compulsive social media use. Future research should aim to address these limitations by employing larger and more diverse samples, ideally through stratified or randomized sampling techniques to enhance external validity. Incorporating multiple data sources—such as parent, teacher, or clinician reports, as well as behavioral or digital tracking data—would improve methodological rigor and reduce reliance on a single reporting method. Longitudinal designs could further help in understanding the long-term effects of ACT. Exploring the mechanisms through which

ACT reduces problematic digital behaviors and testing its integration with complementary approaches such as digital literacy education or family-based interventions may also enhance its applicability and effectiveness in real-world adolescent settings.

Conclusion

This study elucidates the profound efficacy of ACT as a comprehensive psychotherapeutic intervention for adolescents afflicted with SMD, effectively targeting interconnected psychopathological dimensions such as anxiety sensitivity, aggression, and OSA. ACT disrupts maladaptive reinforcement loops that perpetuate compulsive digital behaviors by fostering psychological flexibility through the synergistic mechanisms of mindfulness, acceptance, cognitive defusion, and values-driven behavioral commitment. This process facilitates enhanced emotional regulation, distress tolerance, and adaptive self-regulation, while promoting alignment with personally meaningful life domains. The findings highlight ACT's capacity to transcend symptomatic relief, positioning it as a transformative framework that cultivates resilience, metacognitive awareness, and intrinsic motivation—critical factors for restoring autonomous control over maladaptive technology use. Given the accelerating integration of digital platforms in adolescent development, these results underscore the imperative for implementing innovative, process-oriented therapeutic models such as ACT to mitigate the burgeoning mental health challenges posed by problematic social media engagement.

Ethical Considerations

Compliance with ethical guidelines

The current study was approved by the Ethics Committee of the University of Guilan, Rasht, Iran (Code: IR.GUILAN.REC.1403.143).

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Authors' contributions

Data analysis and drafting the manuscript: Sara Malek Mohammadi and Mahtab Shah Hosseini; Critical revisions and intellectual input: Narges Asgari Toorzani, Farzin Bagheri Sheykhangafshe and Abbas Ali Hossein Khanzadeh; Study design, data collection, data analysis, manuscript preparation and final approval: All authors.

Conflict of interest

The authors declare no conflicts of interest.

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